Flint Creek Power Plant

Notice of Intent to Comply With the Site-Specific Alternative to Initiation of Closure

CCR Unit – Primary Bottom Ash Pond

As required by 40 CFR 257.103(f)(1)(ix)(A), this is a notification that on November 30, 2020 Flint Creek Power Plant (Flint Creek Plant) submitted a site-specific alternative to initiation of closure due to development of alternative capacity infeasible to US EPA. The submission has been placed in Flint Creek Plant’s operating record and posted to the CCR Rule Compliance Data and Information website.

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY

American Electric Power
1 Riverside Plaza
Columbus, OH 43215
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November 30, 2020

Submitted Electronically via Email

Mr. Andrew R. Wheeler, EPA Administrator
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Mail Code 5304-P
Washington, DC 20460

RE: Southwestern Electric Power Company
Flint Creek Power Plant Alternative Closure Demonstration

Dear Administrator Wheeler,

Southwestern Electric Power Company (SWEPCO) Flint Creek Power Plant (Flint Creek Plant), hereby submits this request to the U.S. Environmental Protection Agency (EPA) for approval of a site-specific alternative deadline to initiate closure pursuant to 40 C.F.R. § 257.103(f)(1) for the Primary Bottom Ash Pond located at the Flint Creek Plant near Gentry, Arkansas. Flint Creek Plant is requesting an extension pursuant to 40 C.F.R. § 257.103(f)(1) to allow the Primary Bottom Ash Pond to continue to receive CCR and non-CCR wastestreams after April 11, 2021, such that retrofits can be completed. Enclosed is a demonstration prepared by American Electric Power and Burns & McDonnell that addresses all of the criteria in 40 C.F.R. § 257.103(f)(1)(i)-(iii) and contains the documentation required by 40 C.F.R. § 257.103(f)(1)(iv). As allowed by the agency, in lieu of hard copies of these documents, electronic files were submitted to Kirsten Hillyer, Frank Behan, and Richard Huggins via email. A separate cover letter and confidential copy of Appendix C is being submitted in hard copy by overnight mail. If you have any questions regarding this submittal, please contact me at 614-716-2281 or damiller@aep.com.

Sincerely,

David A. Miller

David A. Miller, P.E.
Director, Land Environment & Remediation Services
Environmental Services Division

Attachments

cc: Kirsten Hillyer – USEPA
Frank Behan – USEPA
Richard Huggins – USEPA

Southwestern Electric Power Company

Flint Creek Plant

SOUTHWESTERN ELECTRIC POWER COMPANY℠
An AEP Company
BOUNDLESS ENERGY℠

Demonstration Request to Develop Alternative Disposal Capacity for the Primary Bottom Ash Pond

Prepared by:

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and

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Submitted

11/30/2020

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Professional Engineer's Certification

I certify, as a Professional Engineer in the State of Arkansas, that the information in this document was assembled under my direct supervisory control and is accurate as of the date of my signature. This report is not intended or represented to be suitable for reuse without the specific verification or adaptation by the engineer.

DAVID ANTHONY MILLER

Printed Name of Registered Professional Engineer

DAVID ANTHONY MILLER
No. 15296

David Anthony Miller

Signature

15296	ARKANSAS	11.30.2020
Registration No.	**Registration State**	**Date**

INTRODUCTION

American Electric Power Service Corporation (AEP) as agent for its affiliate Southwestern Electric Power Company (SWEPCO), an owner and operator of the Flint Creek Power Plant, seeks EPA approval under 40 CFR 257.103(f)(1) - *"Development of Alternate Capacity Infeasible"* for a coal combustion residuals (CCR) surface impoundment located at the Flint Creek Plant to continue to receive CCR and/or non-CCR wastestreams beyond April 11, 2021. This document will demonstrate that the CCR and/or non-CCR wastestreams must continue to be managed in the CCR surface impoundment because no alternative disposal capacity is available on or off-site and it is technically infeasible to complete the measures necessary to provide alternative disposal capacity either on-site or off-site by April 11, 2021. As discussed in more detail below, AEP has elected to convert to dry bottom ash handling at Flint Creek Plant, close the existing bottom ash pond by removal and convert the pond to treat non-CCR wastestreams. Sluicing of CCR is scheduled to cease no later than November 30, 2022. Removal of CCR from the Primary Bottom Ash Pond (PBAP) will proceed in a phased manner. Receipt of non-CCR wastestreams will be controlled so that removal of CCR materials from the PBAP can be conducted in phases. CCR removal will be completed by February 28, 2023. The area of the former pond will be repurposed as the non-CCR wastewater pond (WWP).

OVERVIEW OF FLINT CREEK PLANT AND AFFECTED CCR UNITS

The Flint Creek Plant, located at 21797 Swepco Plant Rd., Gentry, AR 72734, consists of one coal-fired unit with a total capacity of 528 megawatts that was put in service in 1978. CCR units currently include an active surface impoundment known as the Primary Bottom Ash Pond (PBAP) and a 40-acre landfill. Bottom ash and economizer ash are sluiced to the PBAP from the generating unit. The PBAP does not meet either the aquifer separation distance or the liner requirements of the CCR rule and must close. AEP has elected to convert to dry ash handling at Flint Creek Plant, and the plant does not currently have an existing alternate pond that meets the requirements of the CCR rule. Considerable modifications to plant equipment, facilities, and processes will be necessary before the plant can cease placing CCR and non-CCR wastestreams into the PBAP to accommodate the CCR and non-CCR wastestreams in order to continue operations.

Flint Creek's PBAP is shown on Figure 1, which provides a depiction of the overall layout of the plant site and CCR units. The PBAP is used primarily for the settling and storage of bottom ash, and is a CCR surface impoundment, but also receives non-CCR wastestreams. Bottom ash within the PBAP is periodically excavated/dredged for disposal or beneficial use. Flow from the PBAP discharges over a control structure with stop logs into the Clearwater Pond. The Clearwater Pond is not a CCR unit. Flow from the Clearwater Pond discharges over a weir (NPDES Outfall 101) into the plant's cooling lake, known as Little Flint Creek Reservoir (or locally as SWEPCO Lake).

At maximum capacity, the PBAP has a surface area of approximately 42.8 acres and a storage capacity of 484.1 acre-ft. The dam impounding the PBAP is a cross-valley dam approximately 820 feet in length with earthen embankments having interior and exterior slopes of approximately 3 horizontal to 1 vertical (3H:1V) and a crest width of 12 feet. The crest elevation on the dam is 1155 ft. and the recent normal pond elevation is approximately 1144 ft.

Groundwater at the unit has been monitored in accordance with a detection monitoring program, following the requirements of 40 CFR 257.94 in the CCR rule, to the present time since there have been no statistically significant increases over background values for any constituent at any monitoring well in the unit's groundwater monitoring network. Following the requirements of 40 CFR 257.94, groundwater samples from each monitoring well are analyzed for all parameters in appendix III of the CCR rule. Analysis results for each constituent at each monitoring well are compared to background according to statistical procedures and performance standards specified in 40 CFR 257.93(f) and 40 CFR 257.93(g).

SATISFACTION OF THE CRITERIA IN 40 CFR §257.101(f)(1) FOR THE BAP CCR Unit

WORK PLAN

To demonstrate that the criteria in 40 C.F.R. § 257.103(f)(1)(i) and (ii) have been met, the following is a workplan, consisting of the elements required by § 257.103(f)(1)(iv)(A). Specifically, this workplan documents that there is no alternative capacity available on or off-site for each of the CCR and/or non-CCR wastestreams that are managed in the PBAP and discusses the options considered for obtaining alternative disposal capacity. As discussed in more detail below, AEP has elected to convert to dry bottom ash handling at Flint Creek Plant. The workplan provides a detailed schedule for the conversion project, including a narrative description of the schedule and an update on the progress already made toward obtaining the alternative capacity. In addition, the narrative includes an analysis of the site-specific conditions that led to the decision to convert to dry handling and an analysis of the adverse impact to plant operations if Flint Creek Plant were no longer able to use the PBAP.

Section One - Narrative Description of How Alternative Capacity will be Developed

From the regulatory text § 257.103(f)(1)(iv)(A)(1)

> *(1) A written narrative discussing the options considered both on and off-site to obtain alternative capacity for each CCR and/or non-CCR wastestreams, the technical infeasibility of obtaining alternative capacity prior to April 11, 2021, and the option selected and justification for the alternative capacity selected. The narrative must also include all of the following:*
>
> *(i) An in-depth analysis of the site and any site-specific conditions that led to the decision to select the alternative capacity being developed;*
> *(ii) An analysis of the adverse impact to plant operations if the CCR surface impoundment in question were to no longer be available for use; and*
> *(iii) A detailed explanation and justification for the amount of time being requested and how it is the fastest technically feasible time to complete the development of the alternative capacity;*

Existing On and Off-site Disposal Capacity Evaluation

Flint Creek plant does not currently have an existing alternate pond that meets the aquifer separation or liner requirements of EPA's CCR regulation. Considerable modifications to plant equipment, facilities, and processes will be necessary before Flint Creek Plant can cease placing CCR wastestreams into the PBAP and remove the CCR materials so the pond can be converted and the non-CCR wastestreams continue to be placed in the repurposed wastewater treatment pond. Likewise, considerable modifications and new equipment would be necessary to transport CCR and non-CCR wastestreams to an off-site disposal facility, if one were available. Currently, no known off-site facilities are available that are capable of processing the wastestreams generated by the Flint Creek Plant.

CCR Wastestreams:

The PBAP receives approximately 0.42 million gallons a day (MGD) of sluiced water containing economizer and bottom ash.

Relative to off-site disposal capacity; the sheer volume which will need to be handled on a daily basis makes this impractical. 0.42 MGD of bottom ash sluice flows equates to approximately 56 trucks holding 7,500 gallons each per day to haul off and dispose of the flows. This operation would need to take place 24 hours a day and 7 days a week while the unit is operating. There are currently no facilities to collect and load this wastestream into tankers for transport, and construction of such facilities to manage these flows on a temporary basis would interfere with the activities needed to comply with the new requirements of both the CCR and ELG rules. The increase in traffic associated with such an operation on the plant site poses significant safety risks and is impossible to achieve. The most likely facility type capable of managing industrial wastewaters are publicly-owned or private treatment works, underground injection wells, or publicly available waste management facilities capable of solidifying liquid wastes for disposal in a landfill. Given the volume and characteristics of the CCR wastestream, increases in permitted capacity or other modifications to the permitted pretreatment programs of a public or private wastewater treatment facility would likely be required to manage this flow, if one were available.

AEP evaluated each CCR wastestream placed in the PBAP at the Flint Creek Plant. For the reasons discussed above, and in Table 1 below, the following CCR wastestreams must continue to be placed in the PBAP due to lack of alternative capacity both on and off-site.

Table 1: Flint Creek Plant CCR Wastestreams

CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Bottom Ash	420,000	Bottom ash is currently sluiced to the PBAP, where it is either collected for beneficial reuse or remains for disposal.	Bottom ash wastestream cannot be removed from PBAP until new dry bottom ash system (DBAH) is installed allowing ash to be collected and transported to the onsite landfill or for beneficial reuse. This wastestream will be eliminated no later than November 30, 2022.
Economizer Ash	Included with Bottom Ash flows	Sluiced to the existing PBAP with bottom ash	Like bottom ash, economizer ash is only produced when the boiler is operational, and no alternate system is available for collection of economizer ash. Economizer ash wastestream cannot be removed from PBAP until new economizer ash system is installed allowing ash to be collected and transported to the onsite landfill. This wastestream will be eliminated no later than November 30, 2022.

CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Pyrites (non-CCR but handled with CCR wastestreams)	Included with Bottom Ash flows	Sluiced to the existing PBAP using the existing bottom ash pumps and piping.	Like both bottom ash and economizer ash, pyrites are only produced when the boiler is operational, and no alternate system is available for collection of pyrites. Pyrites material will be sluiced to the existing bottom ash hopper and comingled with bottom ash before being dewatered and transported to the onsite landfill. This wastestream will be eliminated no later than November 30, 2022.

Non-CCR Wastestreams:

Approximately 8 MGD of various non-CCR wastestreams are sent to the PBAP on average. These wastewater streams include coal pile runoff, hydrovactor system discharges, ecology pit discharges, boiler blowdown, demineralizer sump, plant drains and sumps, treated ash landfill leachate, contact and non-contact storm water runoff as well as contact storm water runoff from and through the ash landfill, and City of Gentry sewage treatment effluent. Additional stormwater flows originate from an area in excess of 1100 acres and are introduced into the PBAP via gravity from multiple locations. These flows are mostly attributed to rainfall events which are unpredictable and can vary drastically. Off-site disposal of these flows is impractical as a significant storm event could generate in excess of 50 million gallons from these wastestreams.

Relative to off-site disposal capacity and similar to bottom ash; the sheer volume which would need to be handled on a daily basis makes this impractical. 8 MGD would require approximately 1060 trucks per day holding 7,500 gallons each to haul off and dispose of the water collected. This operation would need to take place 24 hours a day and 7 days a week. There are currently no facilities to collect and load these wastestreams into tankers for transport, and construction of such facilities to manage these flows on a temporary basis would interfere with the activities needed to comply with the new requirements of both the CCR and ELG rules. The increase in traffic associated with such an operation on the plant site poses significant safety risks and is impossible to achieve. The most likely facility type capable of managing industrial wastewaters are publicly-owned or private treatment works, underground injection wells, or publicly available waste management facilities capable of solidifying liquid wastes for disposal in a landfill. Given the volume and characteristics of the non-CCR wastestreams, increases in permitted capacity or other modifications to the permitted pretreatment programs of a public or private wastewater treatment facility would likely be required to manage this flow, if one were available. Furthermore, the 8 MGD flow rate is an average flow rate. Several of the non-CCR wastestreams (coal pile runoff, landfill runoff, etc.) are mostly a result of rain events which are not predictable and could result in daily flows that nearly double the 8 MGD average flowrate.

AEP evaluated each non-CCR wastestream placed in the PBAP at Flint Creek Plant. For the reasons discussed above, and in Table 2 below, each of the following non-CCR wastestreams must continue to be placed in the PBAP due to lack of alternative capacity both on and off-site.

Table 2: Flint Creek Plant non-CCR Wastestreams

Non-CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
Hydrovactor Flows	2,030,000	Pumped to the existing PBAP, using the existing bottom ash pumps and piping	These non-CCR wastestreams are piped to the PBAP which provides treatment (primarily solids settling and pH adjustment if necessary) to allow them to meet the NPDES discharge limits at the plant outfall and no on-site alternative capacity exists for treatment until the repurposed WWP is completed. Off-site disposal of these flows is not practical as noted previously. These wastestreams will continue to be directed to the repurposed WWP.
Ecology Pit flows	5,160,000	Collects flow from multiple sources including plant drains, coolers and sumps pumped to the PBAP	
Coal Pile Reclaim Hopper & Rail Car Dump Sumps	220,000	Flows to the existing PBAP	
Demineralizer, Boiler Blowdown, and Lab Drains	40,000	Flows to the existing PBAP	
Coal Pile Runoff	Intermittent (50,000 avg)	Flows to the existing PBAP	These non-CCR wastestreams and stormwater flows gravity feed into the PBAP from surrounding areas and require the PBAP to provide treatment (primarily solids settling) to allow them to meet the NPDES discharge limits at the plant outfall. No on-site alternative capacity exists for treatment of these flows. Even if there was alternative capacity available on site, it would not be practical to redirect these flows based on the volume, multiple locations where they enter the pond, available area and site elevations. These flows originate from an area in excess of 1100 acres and are introduced into the PBAP via gravity from multiple locations. These flows are mostly attributed to rainfall events which are unpredictable and can vary drastically. Redirection of these flows would require construction of a channel in excess of 40 feet deep and would need to be routed to the east and south of the PBAP through land not owned by the Flint Creek Plant. Even if a channel could physically be constructed to redirect the flows, substantial permitting and land ownership issues exist that would make it infeasible
Ash Landfill Runoff	Intermittent (70,000 avg)		
Contact stormwater runoff	Intermittent		
Non-contact stormwater runoff	Intermittent		
City of Gentry Sewage Effluent	451,000		

Non-CCR Wastestream	Average Flow (gpd)	Current Configuration	AEP Notes
			to complete the effort prior to the February 28, 2023 requested extension date. Off-site disposal of these flows is impractical as discussed previously. These wastestreams and stormwater flows will continue to flow to the PBAP throughout the closure of the pond and will continue to be directed through the WWP once it is repurposed in February 2023.

i) Alternatives for Disposal Capacity

In order to comply with the CCR rule AEP performed an evaluation of alternative disposal capacity options at Flint Creek Plant for both CCR and non-CCR wastestreams in 2017 and 2018. The evaluation determined the feasibility of each option to achieve compliance requirements. Feasible options were evaluated by balancing the technology, performance, schedule duration, other risk factors, and considered potential ELG compliance alternatives.

The options considered for alternative disposal capacity of the wastestreams currently routed to the PBAP are summarized in Table 3 below.

Table 3: Alternatives for Disposal Capacity

Alternative Capacity Technology	Estimated Implementation Time (Months)	Feasible at Flint Creek?	Selected?	AEP Notes
Conversion to dry handling	25	Yes	Yes	Adequate space is available at the site to install equipment necessary for a dry bottom ash conversion. This alternate has a similar compliance schedule to the other alternates considered and allows for compliance with ELG rules.
New CCR surface impoundment	38 to 72	No	No	A new impoundment alone would not provide compliance with the ELG rules. This option was not pursued further based on the required schedule to install the new impoundment. Past AEP projects experienced a range from 38-72 months (siting, permitting, engineering and design, and construction of the new impoundment) before waste could be placed in a new impoundment.

Alternative Capacity Technology	Estimated Implementation Time (Months)	Feasible at Flint Creek?	Selected?	AEP Notes
Retrofit a portion of CCR surface impoundment	31.5	Yes	No	Retrofitting a portion of the pond alone will not bring the facility into compliance with the ELG rule without additional water recycle systems that have an uncertain impact on the plant water balance; the dry ash handling systems have a similar compliance schedule.
Repurpose the CCR surface impoundment to a wastewater pond for non-CCR wastestreams	30	Yes	Yes	This alternative was selected for the Flint Creek Plant since the existing PBAP currently handles the existing non-CCR wastestreams and provides the treatment capacity required to comply with the facility's NPDES permit. This pond will be closed by removal and converted to wastewater pond for non- CCR wastestreams.
Multiple technology system	25 to 30	Yes	Yes	This alternative was selected for the Flint Creek Plant since the existing PBAP provides the capacity to receive the non-CCR wastestreams and provides operational flexibility once bottom ash sluice streams are eliminated to allow for adequate treatment area and facilitation of solids settling. Dry handling of the bottom ash (25 months) and repurposing the PBAP to receive non-CCR wastestreams (30 months) will provide the necessary compliance needs on the fastest feasible schedule for the site balancing both CCR and ELG rule requirements. Chemical treatment systems will be added for non-CCR wastestreams, if necessary.
Off-site disposal	N/A	No	No	As EPA explained in the preamble of the 2015 rule, it is not possible for sites that sluice CCR material to an impoundment to eliminate the impoundment and dispose of the material offsite. See 80 Fed. Reg. 21,301, 21,423 (Apr. 17, 2015) It is infeasible to provide offsite treatment of the large volume of non-CCR and CCR wastestreams currently routed to the PBAP as discussed earlier. Even if it was feasible to transport the large volume of wastestreams offsite, no off-site facilities have been identified that are capable of handling these materials at the flows generated by the facility.

Alternative Capacity Technology	Estimated Implementation Time (Months)	Feasible at Flint Creek?	Selected?	AEP Notes
Temporary treatment system	Not defined (see AEP Notes)	No	No	The total volume of wastewater managed by the PBAP is too large to be managed onsite in temporary tanks. If tanks were used for treatment of just CCR sluice water defined in Table 1 onsite and if 24 hours would provide sufficient residence time for the settling of the fine solids in these wastestreams, approximately 50 frac tanks (21,000 gallons each) would be required to store and treat the bottom ash transport water. The number of tanks required was estimated by taking the total sluice flow (420,000 gallons) divided by the frac tank capacity (21,000 gallons) and doubling it to account for the 24 hours settling time requirement which resulted in 40 frac tanks. A 25% margin was added to this value to allow for frac tanks being removed and replaced for solids removal and solids accumulation in the tanks which resulted in a total of 50 tanks being required. These tanks would require significant amounts of interconnecting piping to route flows to all the tanks and direct the flow to the final discharge point. Furthermore, approximately 5 of these frac tanks would need to be removed and replaced each day for solids removal. Treated water from the tank-based system would need to be discharged to the Clearwater pond which would require revisions to the NPDES discharge permit. This type of system is not proven for CCR management in the industry. Even if enough volume was available, rerouting non-CCR flows to a temporary treatment system is impractical as described in Table 2. For these reasons, AEP has chosen to devote resources to completion of the selected project scope rather than further development of temporary solutions.

Based on the decision to convert to a dry ash handling system at Flint Creek Plant, AEP evaluated potential options for compliance with both the CCR and ELG rules as noted in the Table 4 below.

Table 4: Alternatives Considered for CCR Wastestreams

System	Technology	Practicability or Feasibility for Flint Creek
Bottom Ash	Under boiler Drag Chain Conveyor System	Feasible
Bottom Ash	Remote Drag Chain Conveyor System	Feasible. Challenging to add remote pumps and power supply for recirculation not required with other options. Risk associated with managing plant water balance.
Bottom Ash	Dry Belt/Tray Conveying System	Feasible
Bottom Ash	Pneumatic Conveying System	Feasible
Bottom Ash	Vibratory Conveying System	Not Practicable; frequent labor intensive maintenance is required and no longer industry standard practice for bottom ash (replaced by remote conveyors for similar costs)
Bottom Ash	Remote Settling Basins	Not Practicable; frequent labor intensive maintenance is required and both water balance and safety concerns. Challenging to add remote pumps and power supply for recirculation that is not required with other options.
Bottom Ash	Remote Dewatering Bins	Not Practicable; frequent labor intensive maintenance is required and no longer industry standard practice for bottom ash (option replaced by remote conveyors for similar costs)

Timeframe for delivering dry ash handling alternatives were determined to be equivalent and not a factor in the final selection.

Based on the evaluation of alternative disposal options, AEP selected the following options for compliance at Flint Creek Plant:

- Converting from wet bottom ash and economizer ash systems to a Dry Bottom Ash Handling (DBAH) system using a traditional under-boiler drag chain conveyor (UBDC) for the bottom ash system and dry flight conveyors for the economizer ash system.
- Closure of the PBAP by CCR material removal.
- Repurposing the closed PBAP to a non-CCR wastewater pond.

This alternative and strategy can be implemented in the least or equal amount of time of the alternatives and accommodates the unique site features, quantity of wastestreams and the lack of off-site disposal facilities. This alternative complies with both the CCR and ELG rules at Flint Creek Plant.

AEP contracted with Burns & McDonnell (B&M) to provide engineering, design, and procurement services for the selected alternative disposal option. The conceptual design stage of the projects has been completed and includes the following scope:

- Dry Ash Handling Systems
  - Removal of the current bottom ash hoppers, crushers, and jet pumps
  - Installation of new UBDC and associated equipment to collect and dewater bottom ash, economizer ash, and pyrites from the unit.

  - Installation of dry flight conveyors to transport economizer ash from the economizer hoppers on the unit to the UBDC.
  - Rerouting the wet pyrite sluicing system to the UBDC.
  - Installation of a new concrete ash bunker to collect and temporarily store CCR material from the UBDC.
  - Installation of a sump at the new ash bunker to collect contact stormwater or excess quench water and return to UBDC.
  - CCR material from ash bunker will be either sold for beneficial reuse or hauled to onsite landfill for disposal.

- Pond Closure by Removal and construction of new Coal Pile Runoff Pond (CPRP)
  - Serpentine diversion channel will be installed within the current PBAP footprint to allow for CCR wastestreams to be rerouted to facilitate the CCR material removal and pond closure and repurposing steps below.
  - CCR material from the PBAP to be removed via mechanical excavation and dredging. All CCR material will either be sold for beneficial reuse or hauled to the onsite landfill for disposal.
  - Following the removal of CCR material, the existing PBAP will be repurposed as the Wastewater Pond (WWP) and will receive low volume wastewater and coal pile runoff flows from the plant along with stormwater runoff from the surrounding area. The WWP will continue to discharge to the Clearwater Pond (a non-CCR unit) before ultimately discharging to SWEPCO Lake through NPDES Outfall #101. Repurposing the PBAP allows the WWP to be used for non-CCR wastestreams immediately following closure of the PBAP by removal of CCR and does not require additional time to construct a new pond.
  - A tank-based chemical treatment system will be designed and installed to treat the influent to the Wastewater Pond and Coal Pile Runoff Ponds as needed to ensure compliance with plant discharge requirements.

Appendix A includes a site plan showing the existing and future configurations of the site after construction of the new coal pile run off pond and removal of CCR material from the PBAP. The water balance is also included in Appendix B.

ii) Impact to Plant Operations if Alternative Capacity Not Obtained

If the Flint Creek Plant were required to immediately cease the placement of CCR and non-CCR wastestreams into the PBAP, which is necessary for handling more than 8.4 MGD of CCR and non-CCR wastestreams, and initiate closure, AEP would have to temporarily or permanently cease power production at the Flint Creek Plant. Idling or closure of the Flint Creek Plant would stop the production of CCR wastestreams and some non-CCR wastestreams, but would not eliminate the need for handling other non-CCR wastestreams, such as the storm water runoff from the coal pile and landfill, as well as low volume wastewater from various water collection sumps from around the plant. The PBAP is integral in receiving and treating these flows (settling solids and pH adjustment) as required to meet the NPDES discharge limits. Therefore, the need for uninterrupted non-CCR wastestream capacity in the PBAP will be necessary for a significant amount of time until alternate capacity from the new WWP is available. Put simply, the PBAP will be unable to immediately cease operation even if the Flint Creek Plant immediately discontinued the combustion of coal and production of CCR wastestreams.

SWEPCO owns and operates three coal-fired generating facilities within northwest Arkansas and Eastern Texas that are seeking additional time to provide alternative disposal capacity or cease combusting coal. Together, these facilities have a maximum generating capacity of over 2,000 MW. All of these facilities operate within the Southwest Power Pool Regional Transmission Organization (SPP). Because of their close geographic proximity, simultaneous immediate closure of a significant portion of this capacity would compromise SWEPCO's ability to meet electrical demand and capacity obligations of the SPP, would destabilize portions of the electricity grid and, therefore, would not be in the public interest. One facility will retire in 2023, one will be converted to satisfy both the ELG and CCR requirements, and the third will cease combusting coal in 2028. The requested extensions will allow for an orderly transition of generating resources, provide time to initiate transmission mitigation plans to avoid compromising the reliability of the grid, and maintain SWEPCO's ability to provide affordable electricity to customers.

iii) Justification for Time Needed to Complete Development of Alternative Capacity Approach

The schedule for developing alternative disposal capacity is described in more detail in Section 3. As the schedule shows, AEP has already undertaken significant planning and implementation steps towards ceasing the receipt of CCR and non-CCR wastestreams within the PBAP. Finalization of both the CCR and ELG rules was critical to AEP's ability to fully evaluate the options to provide alternate capacity for the CCR and non-CCR wastestreams. The schedule represents the fastest technically feasible timeframe for compliance at Flint Creek Plant, driven primarily by the need for a major outage to allow for removal of the current sluicing equipment and installation of the new UBDC equipment. Flint Creek Plant serves the Southwest Power Pool (SPP) which manages the grid to provide electricity to Arkansas, Oklahoma and east Texas. Outages are planned many years in advance with the SPP to effectively manage the generation capacity of the SPP service area. The SPP does not typically allow Flint Creek Plant much flexibility to adjust these outages or perform them in the non-shoulder months (summer and winter) due to the limited generating capacity during these peak electricity usage times and resulting potential impacts to grid stability. The sequencing and final tie-ins associated with this work as described in the work plan in Section 3 further elaborates on the complexities associated with this option. The unit must be converted to dry ash handling in order to cease receipt of CCR wastestreams in the current configuration. The dry ash handling conversion will be worked in parallel with the pond closure and tank based chemical treatment scope to achieve compliance as soon as possible. The total project duration of approximately 36 months from the date AEP initiated conceptual design (December 2019) until the date that CCR sluicing is ceased (November 30, 2022) is comparable to the average dry ash conversion timeline identified by EPA in the final Part A rule (33.8 months). Moreover, as a result of AEP performing work in parallel, the pond closure activities are planned to be completed by February 28, 2023 as shown on the schedule.

Section Two – Visual Timeline Depicting the Steps Necessary to Obtain Alternative Capacity

From the regulatory text § 257.103(f)(1)(iv)(A)(2)

> *(2) A detailed schedule of the fastest technically feasible time to complete the measures necessary for alternative capacity to be available including a visual timeline representation. The visual timeline must clearly show all of the following:*
>
> *(i) How each phase and the steps within that phase interact with or are dependent on each other and the other phases;*
> *(ii) All of the steps and phases that can be completed concurrently;*

> *(iii) The total time needed to obtain the alternative capacity and how long each phase and step within each phase will take; and*
> *(iv) At a minimum, the following phases: engineering and design, contractor selection, equipment fabrication and delivery, construction, and start up and implementation.*

Appendix C contains a timeline that illustrates all relevant phases and details the steps necessary for implementation of obtaining Alternative Capacity.

Section Three – Narrative of the Schedule and Timeline to Obtain Alternative Capacity

From the regulatory text § 257.103(f)(1)(iv)(A)(3)

> *(3) A narrative discussion of the schedule and visual timeline representation, which must discuss all of the following:*
>
> *(i) Why the length of time for each phase and step is needed and a discussion of the tasks that occur during the specific step;*
> *(ii) Why each phase and step shown on the chart must happen in the order it is occurring;*
> *(iii) The tasks that occur during each of the steps within the phase; and*
> *(iv) Anticipated worker schedules; and*

The schedule for this project is generally broken down into three major scopes of work that must occur to ensure efficiency and compliance with environmental permits: Dry Bottom Ash Handling (DBAH) System installation (includes the UBDC, and economizer ash, and pyrites handling equipment), PBAP Closure/Repurpose and Coal Pile Runoff Pond Construction. The construction work schedule during non-unit outage periods is planned for a single shift fifty hours per week with spot overtime as needed to maintain schedule and also attract and retain quality craft labor.

Dry Ash Handling Systems

Engineering, Design and Procurement (November 2020 – May 2022)

The conceptual design of the new DBAH System has been completed. Equipment procurement for the DBAH System to support this project is underway with a forecasted contract award date of November 2020 and delivery date of the major equipment by May 2022. AEP has allowed 18 months total lead time in the schedule to have the equipment on site in time for the necessary pre-outage construction period. Initial DBAH System design submittals will be provided by the DBAH OEM starting 4 weeks after award and will continue for several months until delivery of equipment. Equipment fabrication will start after the approval of the initial design submittals. The balance of plant (BOP) Electrical, Mechanical, and Structural Engineering and detailed design will start in November 2020 and is scheduled to be completed eight months later by June 2021. While Instrument & Controls (I&C) Engineering will start concurrently with the BOB engineering in November 2020, the completion will be 13 months later by December 2021. The BOP Civil Engineering will start by February 2021, after receipt of submittals from the DBAH OEM, and is scheduled to be complete in four months, by the first of June 2021.

Contractor Selection (July 2021 – January 2022)

The construction bid packages for site preparation and foundations, mechanical construction and electrical construction are planned to be developed in parallel with the detailed design efforts and will be issued for bid by July 2021 and awarded to the selected construction contractors by

January 2022. This 6 month timeframe is typical for AEP's normal process for awarding major construction contracts.

Construction (March 2022 – December 2022)

Construction is planned to start with civil work in March 2022 and will proceed with completing non-outage related work. The schedule for non-unit outage related work is based on similar projects that have been completed and includes the work described in this section. The civil work will include underground utility relocations, excavation and subgrade preparation for the ash bunker footings and foundation installation. Once the footings and foundation are poured, the bunker walls will be formed and poured. The civil work is planned to take a total of three months completing in June 2022. The structural/mechanical (S/M) contractor will mobilize to site in May 2022 to begin above ground utility installation/relocation, equipment installation and structural steel installation inside the unit. The ash bunker sump pumps will be set and piping ran back to the ash hopper pit sump. Balance of plant piping such as service water, instrument air, plant air, and other systems will be installed. Modification and demolition of existing equipment and structural steel that can be achieved ahead of the unit tie-in outage, including reinforcing of the existing boiler structural steel to accommodate the new DBAH equipment loads, will be performed prior to the start of the unit outage. The S/M work is planned to take a total of 7 months of construction will be complete in December 2022.

The electrical/instrumentation and controls contractor (EIC) will mobilize to site in July 2022 and begin above ground utility relocations and installation. Relocation and installation of conduit and cable tray for both power and control cabling will be completed for the new equipment mentioned above. New electrical equipment will be set including motor control centers and distributed control system cabinets. Once the conduit and cable tray runs are completed, the power and control cabling will be pulled, tested and terminated to the greatest extent possible. A majority of the power feeds and control cables for the DBAH equipment will need to be rolled up and staged at the ash hopper pit to be completed once the DBAH equipment is erected during the tie-in outage. The EIC work is planned to take a total of 5 months of construction and will be complete in December 2022.

As discussed earlier, the primary activity impacting the project schedule critical path is the outage time required for installation of the DBAH System. Although as much work as possible will be performed while the unit is operating as described above, a significant portion of the work to complete the DBAH System installation requires a unit outage. The unit outage to install and tie in the new DBAH equipment is planned for Fall 2022. Due to equipment lead times and steps required to contract for construction, it is not feasible to conduct the DBAH System installation in unit outages occurring before Fall 2022.

The work that is scheduled to take place during the unit outages includes removing the existing boiler hoppers and existing ash sluicing equipment, installing the new bottom ash, economizer ash and pyrites handling equipment, completing structural steel modifications, and piping and electrical ties. Once the unit starts the outage, both the S/M and EIC contractors will work two shifts, sixty hours per week to complete the outage related activities.

Startup and Implementation

Startup and commissioning of the system is planned to start sometime during the unit outage and is expected to be completed shortly after the unit is brought back online for the new equipment bottom ash, economizer ash and pyrites handling equipment. The tuning period will take 3 months and extend through December 2022.

Sluicing of CCR to the PBAP will cease by November 30, 2022.

Primary Ash Pond Closure/ Coal Pile Runoff Pond Construction

Engineering and Design (September 2020 – May 2021)

The conceptual design of the PBAP pond closure / repurpose and the CPRP has been completed. Civil and Mechanical Engineering and detailed design of the CPRP and closure / repurposing activities for the PBAP began in September 2020 and will be completed by early March and early May 2021, respectively, taking six and eight months in duration. Necessary Structural and Electrical Engineering and design started in October 2020 and will take six and seven months, respectively, and will be complete in April and May 2021. A geotechnical investigation is being performed to verify CCR material depths at certain locations and provide information to support the design and construction efforts. The investigation is planned to be completed in 2020.

Permitting (December 2020 – August 2022)

Permitting efforts necessary for the project will start a month after the start of engineering in December 2020 and are planned to continue through early 2022 with receipts of the permits expected by August 2022.

Contractor Selection (May 2021 – November 2021)

Construction bid packages are planned to be developed in parallel with the detailed design efforts and will be issued for bid beginning in May 2021. Six months have been allowed for bidding, selection and award of construction contracts to the selected contractors in accordance with AEP's typical process.

Construction (November 2021 – February 2023)

The closure of the PBAP and construction of the new CPRP requires specific sequencing in order to complete the work while continuing to meet the NPDES discharge permit requirements throughout construction. Final completion of the pond closure and repurposing activities is dependent upon installation of the DBAH equipment and ceasing CCR flows to the PBAP. However, steps have been included in the project plan to allow for parallel activities to complete the work as much as possible as shown on the schedule in Appendix C and further described in this section.

The ponded area of the PBAP is approximately 30 acres of the 43 acre impoundment. The pond is located at the low point of a drainage area that is approximately 1,100 acres in size. The continuous flows from stormwater runoff create a difficult environment for removing CCR material from the pond. The means and methods of excavating or removing the material from the pond and hauled to the onsite landfill will be decided by the construction contractor with approval by the engineer and AEP. CCR material removal will require both mechanical excavation and dredging. The removal of ash will be verified by visual evaluation of sediment samples collected after the removal process. Once all CCR material is removed, the contractor will remove an additional one foot of material to confirm removal of CCR material. An engineer will independently certify the removal of CCR material.

The pond construction and closure work will be performed in stages. The stages are shown in the schedule in Appendix C and timeframes are based on the estimated volumes of CCR material to be removed as well as the estimated earthwork and concrete required for the CPRP construction. These durations are based on an average work schedule of five days per week / ten hours per day and do not take into account delays from periods with significant rain events greater than average or normal for the area. These timeframes have been validated by proposals received from construction contractors.

The mobilization of the final pond construction and closure contractor is planned to start in November 2021. Once the contractor mobilizes to begin closing the PBAP, the contractor will work to complete early site preparation activities including mobilization, installing erosion control, preparing laydown and construction office areas, lowering the pond water level (remove the free water from the impoundment), and installing a temporary serpentine channel to reroute PBAP flows away from the closure work area during construction. Conceptually, the serpentine channel is planned to be routed in the northwest corner of the pond along the edge of the current waterline. The site preparation activities are expected to take approximately three months completing January 2022. At the completion of this phase, CCR and all piped non-CCR flows will no longer be directed to the PBAP area outside of the serpentine channel area of the pond which will greatly limit the pond area receiving CCR flows. Gravity fed non-CCR flows as defined in Table 2 will continue to be directed through the PBAP throughout the construction and cleaning efforts.

Dredging of the PBAP and construction of the CPRP are planned to start in December 2021. Based on estimated volumes of material to be removed (approx. 550,000 CY), the duration of the dredging and excavation is estimated to be 11 months utilizing actual removal rates achieved from similar projects; this work will be complete in November 2022. Dredging of the pond is planned to start in the northeast portion of the pond and work downstream towards the dam and pond outfall. Dredging will occur over all open water areas of the pond up to the edge of the serpentine channel installed during the site preparation activities. Mechanical excavation of the dry areas of the PBAP will be performed concurrently with the dredging and will also be completed in November 2022. The mechanical excavation will primarily take place between the serpentine channel and the limits of the PBAP in the northwest corner of the pond where CCR material is currently above the pond waterline.

Once the CCR sluicing from the operating unit ceases and non-CCR flows are directed to the cleaned portion of the pond, the remaining residual CCR will be removed from the serpentine channel area within the pond. At the completion of the CCR material removal, the temporary construction facilities, laydown areas, and erosion controls will be removed, and these areas will be restored to their pre-construction conditions. Removal of CCR material from the PBAP will be completed by February 28, 2023. At that time, the cleaned PBAP will be repurposed as the WWP and will continue to receive non-CCR wastestream flows during the future operation of the plant.

The closure by removal will be certified by an engineer and the records will be posted in the operating record and on the AEP CCR website as appropriate. The closure by removal will be considered to be complete once all CCR material is removed and certified.

Section Four – Narrative of the Steps Already Taken to Initiate Closure and Develop Alternative Capacity

From the regulatory text § 257.103(f)(1)(iv)(A)(4)

> *(4) A narrative discussion of the progress the owner or operator has made to obtain alternative capacity for the CCR and/or non-CCR wastestreams. The narrative must discuss all the steps taken, starting from when the owner or operator initiated the design phase up to the steps occurring when the demonstration is being compiled. It must discuss where the facility currently is on the timeline and the efforts that are currently being undertaken to develop alternative capacity.*

As described in Section 1 and as shown in Appendix C, AEP has made considerable progress at the time of this request towards creating alternative disposal capacity for the CCR and non-CCR wastestreams at the Flint Creek Plant that are currently discharged in the PBAP. The following major activities have been completed or are in process:

- Conceptual design for all aspects of the project required to achieve the alternate disposal capacity has been completed and detailed design has commenced.
- DBAH equipment has been specified, procurement has commenced, and equipment delivery scheduled.
- Contractors have been engaged to discuss closure plan for the PBAP and identify expected construction timeframes.
- Geotechnical investigations required to support the work have been started and are expected to be completed in 2020.
- AEP currently has a contract in place to remove CCR material from the PBAP for beneficial reuse. This work is planned to continue to allow for additional material to be removed prior to the mobilization of the final pond construction and closure contractor.

NARRATIVE STRATEGY FOR COMPLIANCE WITH ALL REQUIREMENTS OF 40 CRF 257 SUBPART D

From the regulatory text 40 CFR § 257.103(f)(1)(iv)

(B) To demonstrate that the criteria in paragraph (f)(1)(iii) of this section have been met, the owner or operator must submit all of the following:

> *(1) A certification signed by the owner or operator that the facility is in compliance with all of the requirements of this subpart;*
>
> I hereby certify that, based on my inquiry of those persons who are immediately responsible for compliance with environmental regulations for the Flint Creek Plant, the facility is in compliance with all of the requirements contained in 40 CFR 257 Subpart D – *Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments.*
>
> X David A. Miller
>
> David A. Miller, P.E., Director
> Land Environment and Remediation Services

The Flint Creek Plant is maintaining compliance with all requirements of Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. Reports documenting compliance with the rule's provisions, such as location restriction, design criteria, operating criteria, and groundwater monitoring are posted to the AEP public CCR Rule Compliance Data and Information Internet site at the following link: http://www.aep.com/about/codeofconduct/ccrrule/.

40 CFR § 257.103(f)(1)(iv)(B)(2) Visual representation of hydrogeologic information at and around the CCR unit(s) that supports the design, construction and installation of the groundwater monitoring system. This includes all of the following:

(i) Map(s) of groundwater monitoring well locations in relation to the CCR unit(s);
(ii) Well construction diagrams and drilling logs for all groundwater monitoring wells; and
(iii) Maps that characterize the direction of groundwater flow accounting for seasonal variations;

Groundwater monitoring at the Flint Creek Plant is accomplished using a PE-certified groundwater monitoring networks. The PBAP network is composed of three upgradient and three downgradient monitoring wells. The wells monitor the upper part of the Boone Formation, which is the uppermost usable aquifer at the site. The LF network is composed of six upgradient and five downgradient monitoring wells. The complete Groundwater Monitoring Network Design (GWMN) Reports are provided in Appendix D and include the following:

- The map showing the location of the monitoring wells relative to the CCR units is presented on Figure 3 of the GWNM report (see **Appendix D**).
- The associated boring logs and well construction diagrams are provided in *Appendix 1* of the GWMN report (see **Appendix D**).
- Groundwater flow direction maps of monitoring events completed in the autumn, winter, spring, and summer, to show seasonal changes, are provided on Figures 2 through 5 for the PBAP and Figures 6 – 9 for the Landfill.

40 CFR § 257.103(f)(1)(iv)(B)(3) Constituent concentrations, summarized in table form, at each groundwater monitoring well monitored during each sampling event;

The most recent Groundwater Monitoring and Corrective Action Reports summarizes Appendix III and IV constituent concentrations at each groundwater monitoring well monitored during each sampling event as Table 1 (see **Appendix E**).

40 CFR § 257.103(f)(1)(iv)(B)(4) A description of site hydrogeology including stratigraphic cross-sections;

Regionally, the site is located in northwest Arkansas in the Springfield Plateau of the Ozark Plateaus Province. The Ozark Plateaus Province covers northern Arkansas and consists of sedimentary rock strata which have undergone massive uplift and which remain relatively horizontal with only minor deformation. Stream erosion has removed much of the original surface rock and typically dissected the area into hills and low mountains.

Locally, the site is underlain by the Boone Formation which consists primarily of limestone and chert of Lower Mississippian age. In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as a residual soil overburden. The Boone Formation, in this area, consists of a highly weathered cherty limestone with red to brown clay seams. The thickness of residuum varies from 30 to 50 feet, and the limestone and chert content also varies in lateral extent. The chert is typically the remnant of weathering after the limestone is removed by dissolution in surface and groundwater.

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered. Perched groundwater is occasionally present within the upper unconsolidated soils;

however, this perched zone appears discontinuous across the site. Groundwater can occur in both the unconsolidated soils and within the limestone.

Two sets of site cross sections are provided in Appendix D of the Groundwater Monitoring Network Design Reports as follows:

- Cross sections showing the seasonal high groundwater level and CCR units bottom are located in plan view on Figure 4 and presented on Figures 5 and 6;
- Cross sections showing the lithology, soil composition, and reservoir elevation at the CCR units are presented in *Appendix 2*.

40 CFR § 257.103(f)(1)(iv)(B)(5) Any corrective measures assessment conducted as required at § 257.96;

The PBAP is expected to remain in detection monitoring until closure by removal is complete. The LF is expected to remain in assessment monitoring. The Flint Creek Pant CCR units will transition to an assessment of corrective measures and selection of a remedy following requirements in 40 CFR 257.96 and 40 CFR 257.97 and a corrective action program following requirements in 40 CFR 257.98, if necessary.

40 CFR § 257.103(f)(1)(iv)(B)(6) Any progress reports on corrective action remedy selection and design and the report of final remedy selection required at § 257.97(a);

The Flint Creek CCR units have not entered Assessment of Corrective Measures, therefore no progress reports on remedy selection and design and a report of final remedy selection have been required or prepared.

40 CFR § 257.103(f)(1)(iv)(B)(7) The most recent structural stability assessment required at § 257.73(d); and

The most recent structural stability assessment required by § 257.73(d) for the PBAP is included in Appendix F. This report will be updated every 5 years as required by the CCR rule.

40 CFR § 257.103(f)(1)(iv)(B)(8) The most recent safety factor assessment required at § 257.73(e).

The recent safety factor assessment required by § 257.73(e) for the PBAP is included in Appendix G. This report will be updated every 5 years as required by the CCR rule.

CONCLUSION

As set forth and allowed by 40 CFR 257.103 – *Alternate Closure Requirements* and specifically 40 CFR 257.103(f)(1) – *Site Specific Alternate to Initiation of Closure Deadline,* the Flint Creek Plant qualifies for the site specific alternate time frame provisions for continuing to receive CCR and non-CCR wastestreams and initiate closure of the CCR surface impoundment. Based upon the information submitted SWEPCO seeks to establish a site-specific compliance deadline to continue to receive CCR wastestreams in the PBAP until November 30, 2022 while the generating unit is converted to dry ash handling. Non-CCR wastestreams will continue to be directed through the PBAP throughout the construction and cleaning efforts. Removal of all CCR material and repurposing of the PBAP for continued treatment of non-CCR wastestreams will be completed no later than February 28, 2023.

Figures

PRELIMINARY - NOT FOR CONSTRUCTION

Figure 1

- - - - LIMITS OF CCR UNIT

no.	date	by	ckd	description	no.	date	by	ckd	description
A	06/22/20	KTM	MDB	ISSUED FOR EXTENSION REQUEST					

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
Burns & McDonnell Engineering Company, Inc.
Firm License No. 17

designed M. BLEYTHING
detailed J. RIDDER

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY℠
CCR / ELG COMPLIANCE PROJECT
FLINT CREEK POWER PLANT
BENTON COUNTY, ARKANSAS

CCR UNIT LOCATION MAP
project 120796
contract
drawing **SK - C504** — rev. **A**
sheet of sheets
file 120796SK-C504.DGN

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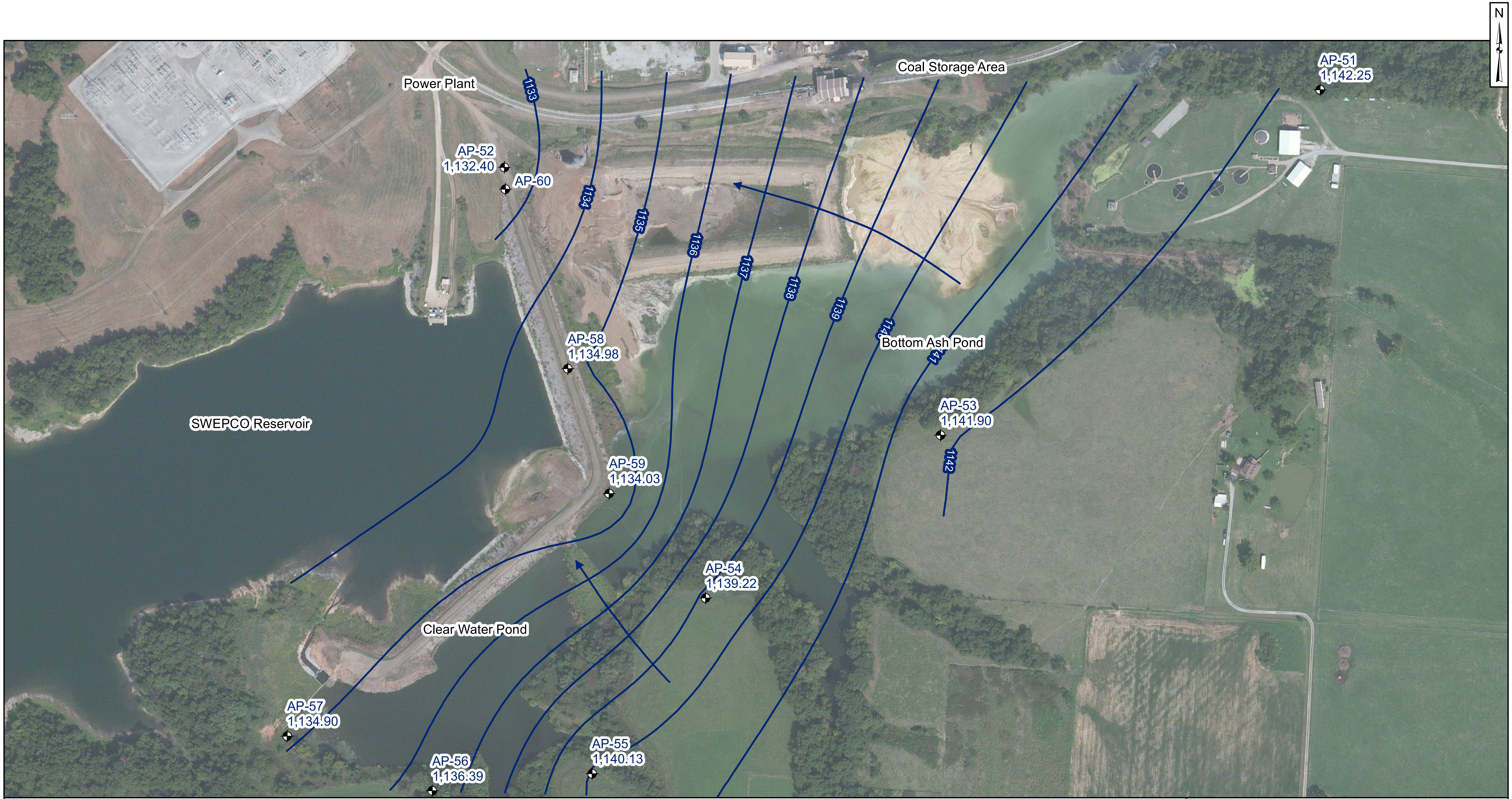
11/16/2020



Legend

- Monitoring Wells
- Groundwater Contour Elevation
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on November 8, 2016) provided by AEP.
- AP-52 was abandoned December 6, 2016.
- AP-60 was installed January 9, 2017.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

Potentiometric Surface Map
Uppermost Aquifer - November 2016

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

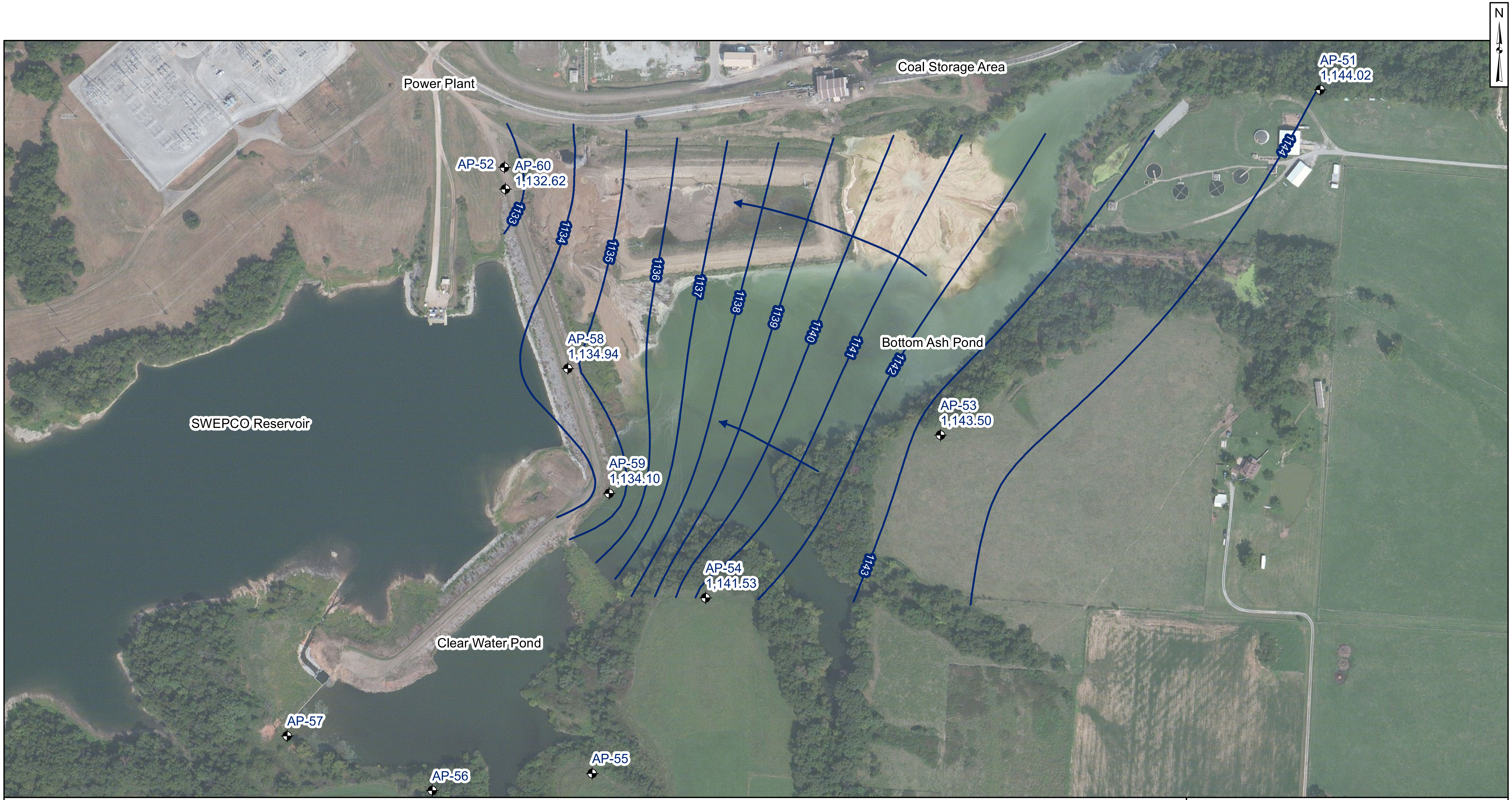
Geosyntec
consultants

Columbus, Ohio

2017/12/21

Figure
2

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\AEP-Flint Creek_GW_BAP_Nov 2016.mxd. ARevezzo. 12/21/2017. CHA8423/01/08.



Legend

⯐ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on January 24, 2017) provided by AEP.
- AP-52 was abandoned December 6, 2016.
- AP-60 was installed January 9, 2017.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - January 2017

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

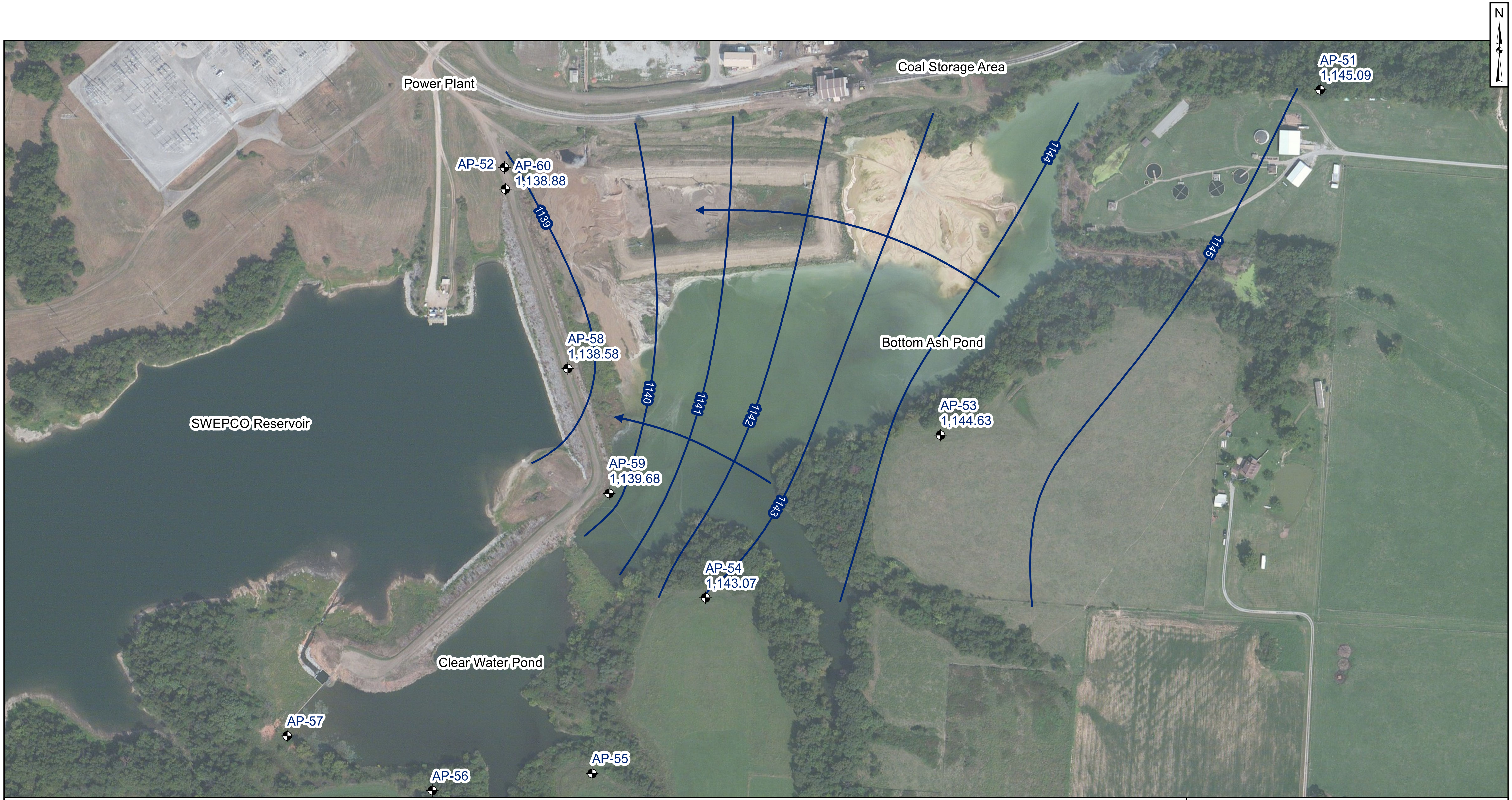
Columbus, Ohio

2017/12/21

Figure

3

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\AEP-Flint Creek_GW_BAP_Jan 2017.mxd. ARevezzo. 12/21/2017. CHA8423/01/08.



Legend

- ⊕ Monitoring Wells
- ― Groundwater Contour Elevation
- → Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on May 16, 2017) provided by AEP.
- AP-52 was abandoned December 6, 2016.
- AP-60 was installed January 9, 2017.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - May 2017

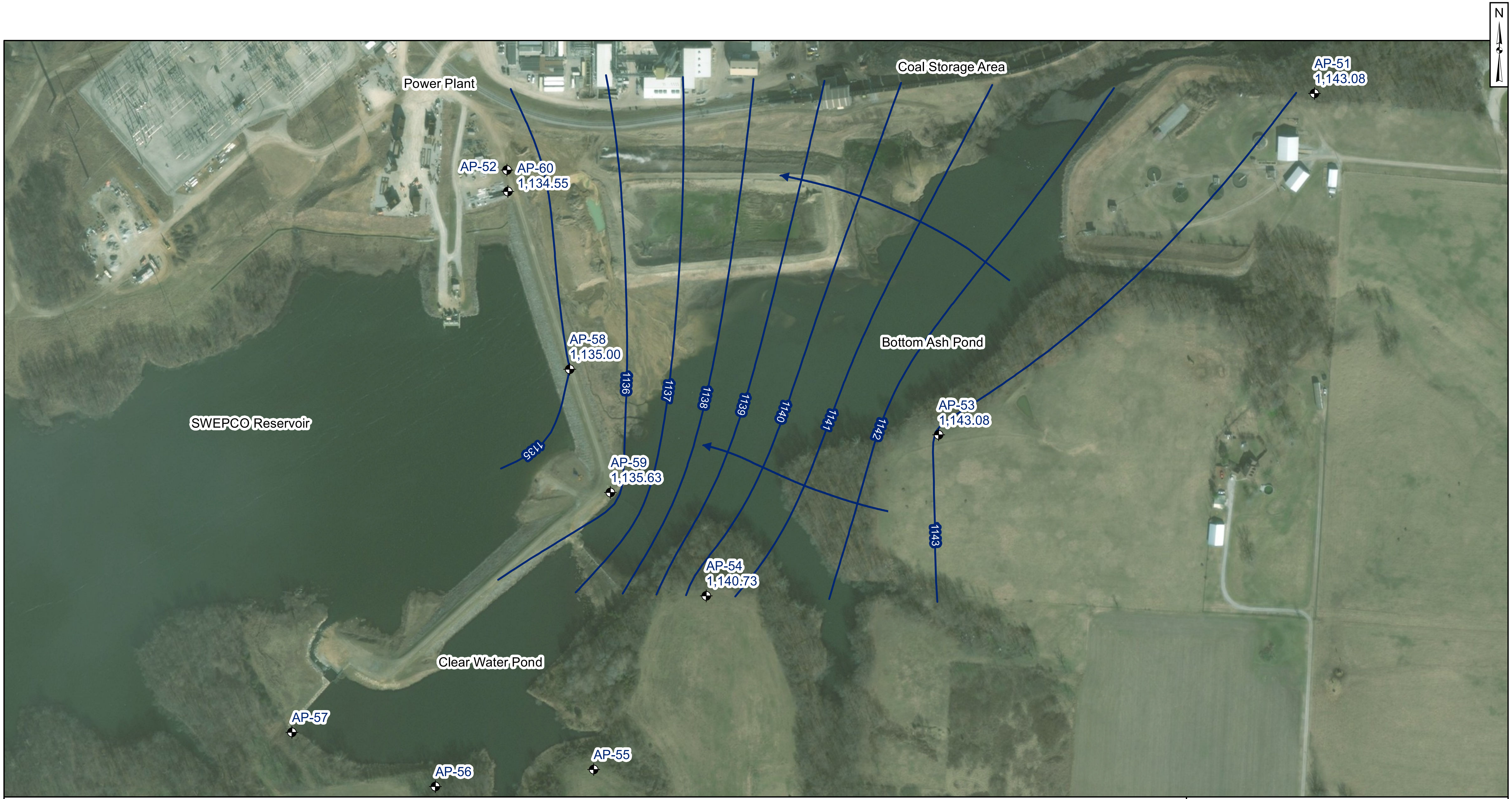
AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2017/12/21

Figure
4

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\AEP-Flint Creek_GW_BAP_May 2017.mxd. ARevezzo. 12/21/2017. CHA8423/01/08.



Legend

- ⯐ Monitoring Wells
- ― Groundwater Contour Elevation
- → Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on August 29, 2017) provided by AEP.
- AP-52 was abandoned December 6, 2016.
- AP-60 was installed January 9, 2017.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - August 2017

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio
2018/01/26

Figure
5

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\AEP-Flint Creek_GW_BAP_Aug 2017.mxd. ARevezzo. 1/26/2018. CHA8423/01/08.

Monitoring Wells
- Shallow
- Intermediate
- Deep

Groundwater Elevation Contour
- Shallow
- Shallow, Inferred
- Shallow Flow Direction
- Intermediate
- Intermediate, Inferred
- Intermediate Flow Direction
- Deep
- Deep Flow Direction

Notes
- Monitoring well coordinates and water level data (collected on November 8, 2016) provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Locations of NE-5D, NE-7R, and NE-9 are approximate.
- Groundwater elevation units are feet above mean sea level.
* Inconsistant/anamolous reading; B-13 not utilized to generate contours.

200 100 0 200
Feet

Potentiometric Surface Map
November 2016

AEP Flint Creek Plant - Landfill
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio | 2017/12/22

Figure
6

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\Landfill\AEP-Flint Creek_GW_Landfill_Nov 2016.mxd. ARevezzo. 12/22/2017. CHA8423/01/08.

Monitoring Wells
- 🟢 Shallow
- 🔵 Intermediate
- ⊕ Deep

Groundwater Elevation Contour
- ― Deep
- → Deep Flow Direction

Notes
- Monitoring well coordinates and water level data (collected on January 24, 2016) provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Locations of NE-5D, NE-7R, and NE-9 are approximate.
- Groundwater elevation units are feet above mean sea level.

Potentiometric Surface Map
January 2017

AEP Flint Creek Plant - Landfill
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio
2017/12/26

Figure
7

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\Landfill\AEP-Flint Creek_GW_Landfill_Jan 2017.mxd. ARevezzo. 12/26/2017. CHA8423/01/08.

Monitoring Wells
- 🟩 Shallow
- 🟦 Intermediate
- ◆ Deep

Groundwater Elevation Contour
- ── Deep
- ⟶ Deep Flow Direction

Notes
- Monitoring well coordinates and water level data (collected on May 16, 2016) provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Locations of NE-5D, NE-7R, and NE-9 are approximate.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
May 2017

AEP Flint Creek Plant - Landfill
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio
2017/12/26

Figure
8

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\Landfill\AEP-Flint Creek_GW_Landfill_May 2017.mxd. ARevezzo. 12/26/2017. CHA8423/01/08.

Monitoring Wells
- ⊕ Shallow
- ⊕ Intermediate
- ⊕ Deep

Groundwater Elevation Contour
- ― Deep
- → Deep Flow Direction

Notes

- Monitoring well coordinates and water level data (collected on August 29, 2017) provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Locations of NE-5D, NE-7R, and NE-9 are approximate.
- Groundwater elevation units are feet above mean sea level.

Potentiometric Surface Map
August 2017

AEP Flint Creek Plant - Landfill
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio
2018/01/26

Figure
9

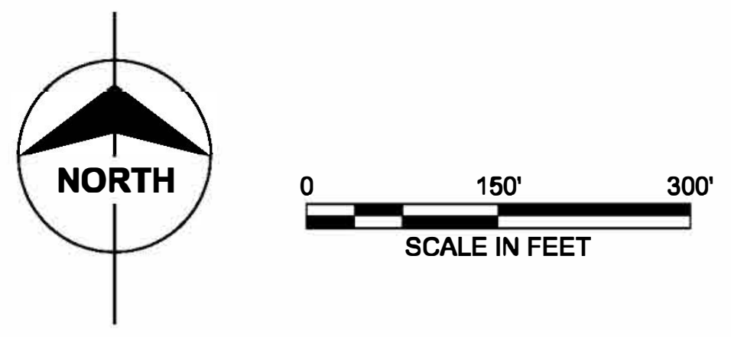
P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\Landfill\AEP-Flint Creek_GW_Landfill_August 2017.mxd. ARevezzo. 1/26/2018. CHA8423/01/08.

Appendix A

Existing and Future Pond Configurations

LEGEND

▨ CLOSED CCR POND
EXISTING FLOW PATH
NEW FLOW PATH
WATERSHED BOUNDARY
CULVERT



PRELIMINARY - NOT FOR CONSTRUCTION

no.	date	by	ckd	description
C	10/13/20	MDB	RNO	ISSUED FOR EPA EXTENSION
B	05/22/20	MDB	RNO	ISSUED FOR EPA EXTENSION
A	03/11/20	MDB	RNO	ISSUED FOR CDRM

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BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
Burns & McDonnell Engineering Company, Inc.
Firm License No. 17

designed K. MORES
detailed J. RIDDER

AMERICAN ELECTRIC POWER
BOUNDLESS ENERGY
CCR / ELG COMPLIANCE PROJECT
FLINT CREEK POWER PLANT
BENTON COUNTY, ARKANSAS

Existing and Future Bottom Ash Pond Configuration

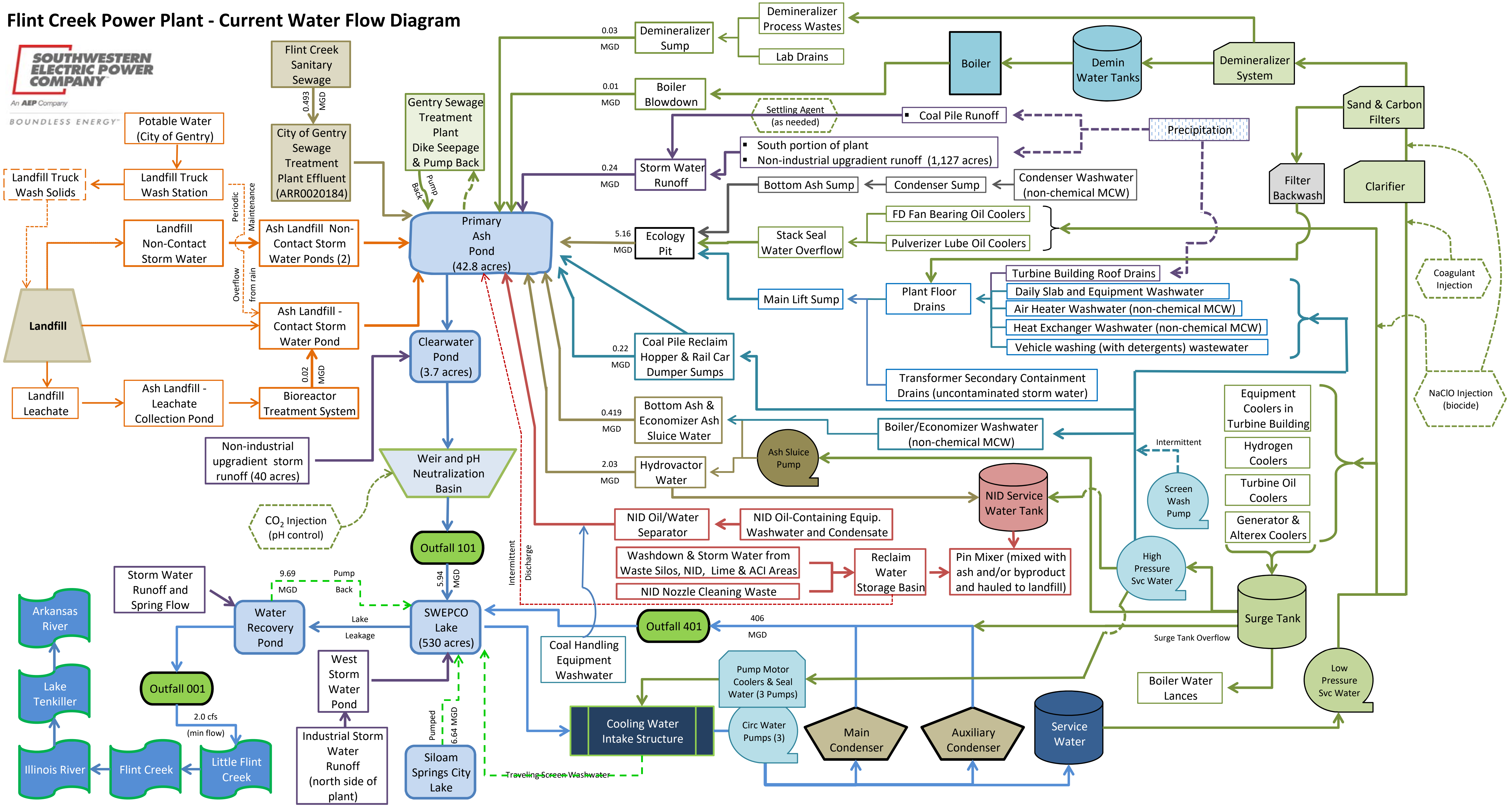
project 120796
contract
drawing SK - C002 — rev. C
sheet of sheets
file 120796SK-C002.DGN

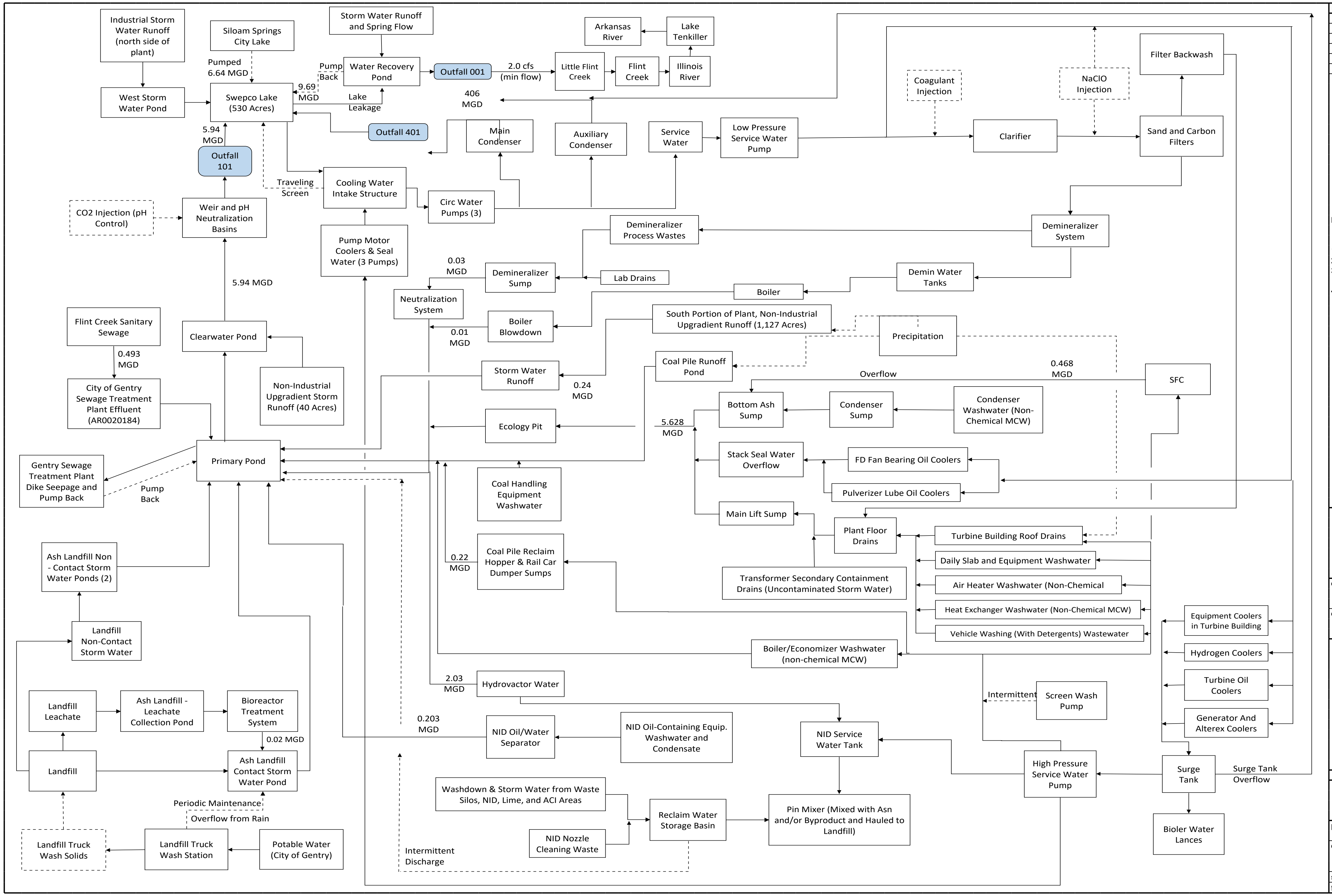
10/13/2020

Appendix B

Existing and Future Water Balances

Flint Creek Power Plant - Current Water Flow Diagram





no.	date	by	ckd	description
A	3/11/20	SJT	BDH	Issued for CDRM
B	5/7/20	SJT	BDH	Issued for PDR
C	5/21/20	SJT	BDH	LVWWP Removed

NOTES:

1. Flows are shown in million gallons per day (MGD).
2. Flows are based on average daily conditions.
3. Precipitation flows not included.

4. Balance based off of Flint Creek ELG Report and adjusted for CCR removal from ponds.

PRELIMINARY

BURNS McDONNELL

date 3/11/2020	detailed G. Rapp
designed S. Tewell	checked B. Hansen

AMERICAN ELECTRIC POWER

AEP - Flint Creek Power Plant

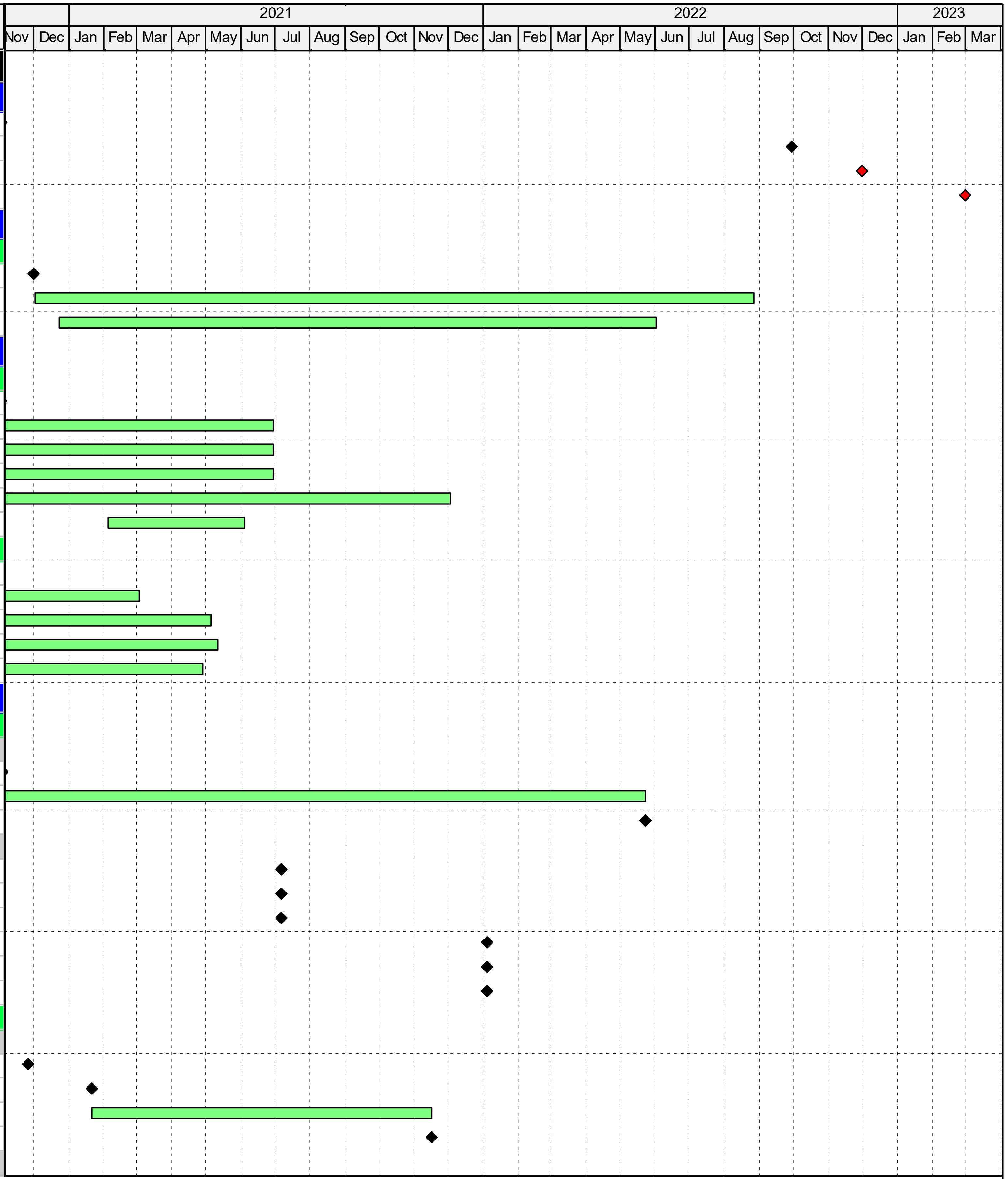
Future Water Mass Balance

project 102796
contract
drawing **WMB-01** ---
rev. **C**
sheet 1 of 1 sheets
file

Appendix C

Site-Specific Schedule to Obtain Alternative Capacity

#	Activity Name	Duration (Months)	Start	Finish
1	**AEP CCR/ELG Extension Schedule - Flint Creek**	29		
2	**Project Milestones**	27		
3	AEP Release Engineer and OEM to Complete Detailed Design for CCR/ELG Compliance	0		Nov-20
4	Initial Operation of Coal Pile Runoff Pond	0		Sep-22
5	Cease sluicing CCR from Unit 1	0		30-Nov-22
6	Completion of all pond closure	0		28-Feb-23
7	**Permitting**	21		
8	**Pond Closure and New Pond Construction**	21		
9	Submit Extension Letter	0		Nov-20
10	Prepare, Submit and Receive Application for CCR permit	21	Dec-20	Aug-22
11	Prepare, Submit and Receive NPDES Permit Amendment	17	Dec-20	Jun-22
12	**Engineering**	15		
13	**Bottom Ash Conversion**	13		
14	Engineer Commences Detailed Design for CCR/ELG Compliance Project	0	Nov-20	
15	Structural Engineering	8	Nov-20	Jun-21
16	Mechanical Engineering	8	Nov-20	Jun-21
17	Electrical Engineering	8	Nov-20	Jun-21
18	I&C Engineering	13	Nov-20	Dec-21
19	Civil Engineering	4	Feb-21	Jun-21
20	**Pond Closure and New Pond Construction**	8		
21	Engineer Commences Detailed Design for CCR/ELG Compliance Project	0	Sep-20	
22	Civil Engineering	6	Sep-20	Mar-21
23	Mechanical Engineering	8	Sep-20	May-21
24	Electrical Engineering	7	Oct-20	May-21
25	Structural Engineering	6	Oct-20	Apr-21
26	**Procurement**	20		
27	**Bottom Ash Conversion**	18		
28	**Equipment**	18		
29	AEP Award Ash Handling Equipment Contract	0		Nov-20
30	Fabricate/Deliver Ash Handling Equipment	18	Nov-20	May-22
31	Ash Handling Equipment Delivered	0		May-22
32	**Subcontracts**	6		
33	AEP Bid Civil Contract	0		Jul-21
34	AEP Bid Structural / Mechanical Construction Contract	0		Jul-21
35	AEP Bid Electrical / Instrument & Controls Construction Contract	0		Jul-21
36	AEP Award Civil Contract	0		Jan-22
37	AEP Award Structural / Mechanical Construction Contract	0		Jan-22
38	AEP Award Electrical / Instrument & Controls Construction Contract	0		Jan-22
39	**Pond Closure and New Pond Construction**	14		
40	**Equipment**	11		
41	AEP Bid Chemical Feed System Equipment Contract	0		Nov-20
42	AEP Award Chemical Feed System Equipment Contract	0		Jan-21
43	Fabricate/Deliver Chemical Feed System Equipment	10	Jan-21	Nov-21
44	Chemical Feed System Equipment Delivered	0		Nov-21
45	**Subcontracts**	13		



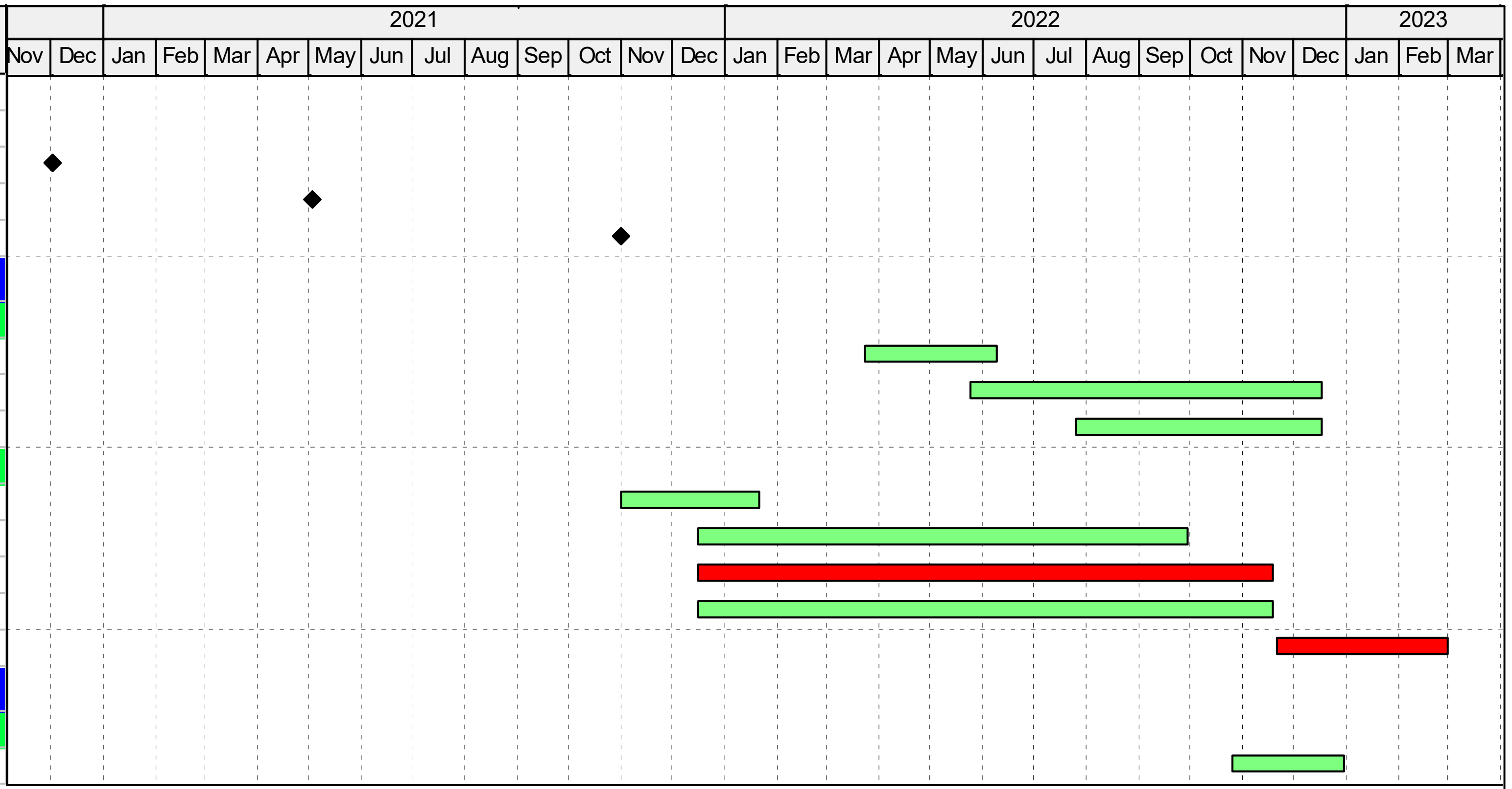
🟩	Remaining Level of Effort	🟥	Critical Remaining Work
🟦	Actual Level of Effort	◆	Milestone
🟦	Actual Work	◆	Critical Milestone
🟩	Remaining Work		

AEP - Flint Creek
Schedule Extension
CCR/ELG
Full Schedule

Data Date: 10-Sep-20
Run Date: 23-Nov-20
Page: 1 of 2

CURRENT PROJECT ID:
PREVIOUS PROJECT ID:
TARGET PROJECT ID:

#	Activity Name	Duration (Months)	Start	Finish
46	Issued for Bid Geotechnical Investigation	0		Jul-20
47	Award Geotechnical Investigation	0		Aug-20
48	Receive Final Report Geotechnical Investigation	0		Dec-20
49	Issued for Bid Pond Construction Documents	0		May-21
50	AEP Award Civil Pond Construction Contract	0		Nov-21
51	**Construction**	16		
52	**Bottom Ash Conversion**	9		
53	Civil Construction - Unit 1	3	Mar-22	Jun-22
54	Structural / Mechanical Construction - Unit 1	7	May-22	Dec-22
55	Electrical / Instrument & Controls Construction - Unit 1	5	Jul-22	Dec-22
56	**Pond Closure and New Pond Construction**	16		
57	Site Preparation for Dredge (Installation of Serpentine Division Channel)	3	Nov-21	Jan-22
58	Coal Pile Runoff Pond Construction	9	Dec-21	Sep-22
59	Dredge Primary Ash Pond	11	Dec-21	Nov-22
60	Mechanical Excavation of Dry Ash	11	Dec-21	Nov-22
61	Closure In Place and Final CCR Clean-up & Close out	3	Nov-22	Feb-23
62	**Startup/Commissioning**	3		
63	**Bottom Ash Conversion**	3		
64	Start-up & Commissioning - Unit 1	3	Oct-22	Dec-22



🟩 Remaining Level of Effort
🟦 Actual Level of Effort
🟦 Actual Work
🟩 Remaining Work
🟥 Critical Remaining Work
◆ Milestone
◆ Critical Milestone

AEP - Flint Creek
Schedule Extension
CCR/ELG
Full Schedule

Data Date: 10-Sep-20
Run Date: 23-Nov-20
Page: 2 of 2

CURRENT PROJECT ID:
PREVIOUS PROJECT ID:
TARGET PROJECT ID:

Appendix D

Groundwater Monitoring Network Design Reports

for

Flint Creek Plant's

Primary Bottom Ash Pond

and

Landfill

Report 1 - Groundwater Monitoring Network for CCR Compliance

SWEPCO - Flint Creek Primary Bottom Ash Pond
Permit No. 0273-S3N-R2
AFIN: 04-00107

October 2017
Project No. 35157124

AEP SOUTHWESTERN ELECTRIC POWER COMPANY
A unit of American Electric Power

Prepared for:
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Prepared by:
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Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

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Appendix

1.0 Objective

The purpose of this Groundwater Monitoring Network Report (GWMNR) is to demonstrate adequacy and compliance of the existing monitoring well network with EPA Coal Combustion Residuals (CCR) regulations at the Southwestern Electric Power Company (SWEPCO) – Flint Creek Primary Bottom Ash Pond (Permit No. 0273-S3N-R2).

2.0 Background Information

2.1 Facility Description

The SWEPCO facility consists of an approximately 42.8-acre Primary Bottom Ash Pond along with a 40-acre permitted Class 3N Landfill and various support facilities including entrance roads, leachate and contact water storage ponds, vehicle/equipment facilities, groundwater monitoring facilities, and storm water control systems. The site is located in portions of Section 8, Township 18 North, and Range 33 West in Benton County, Arkansas (**FIGURE 1 & 2**).

2.2 Description of CCR Unit

2.2.1 Embankment Configuration

The Primary Bottom Ash Pond (**See FIGURE 3**) was constructed from 1974 to 1978. The site is situated on a topographically level feature, with a slight slope from northeast to southwest. The surface elevation of the study site is 1100 to 1160 feet above mean sea level (msl). Little Flint Creek enters the subject site along the western portion of the property and flows into the reservoir. The ash pond is divided into two impoundments in series, the Primary Bottom Ash Pond and the Clear Water Pond (non-CCR). The Primary Bottom Ash Pond berm is 820-foot long, the clear water pond is 750-foot long. Surface water runoff from the site is expected to move to the southwest along Little Flint Creek. The Primary Bottom Ash Pond embankment is approximately 45 feet deep and the clear water pond embankment is approximately 35 feet deep with a berm crest height of 1155 feet-msl for both. (**Golder Associates Inc., Inspection of the Ash Ponds at Little Flint Creek, November 2015**)[1]

The fill material in the containment berm consists primarily of stiff to very stiff lean clay (CL) or fat clay (CH) with gravel and medium dense clayey gravel (GC) or clayey sand (SC) with gravel overlying native soils which consist primarily of weathered limestone with layers of stiff to hard lean clay (CL) with gravel. The limestone encountered typically consisted of solid layers less than 14 inches thick. The Rock Quality Designation (RQD) of the cores is less than 25%. (**ETTL Engineers and Consultants Inc., Slope Stability Report, Revised August 2010**)[2]

2.2.2 Area/Volume

The Primary Ash Pond is approximately 42.8 acres and Clear Water Pond is approximately 3.7 acres. (**Dewberry & Davis LLC, Coal Combustion Residue Impoundment Round 9 – Dam Assessment Report, December 2011**)[3]

2.2.3 Construction and Operational History

The Primary Bottom Ash Pond was constructed from 1974 to1978. It is used for the management of bottom ash from the coal combustion operations on site. The primary ash pond is approximately 45 feet deep and the clear water pond is approximately 35 feet deep with a berm crest height of 1155 feet-msl for both. The embankment was constructed with 3:1 slopes.

There were no signs of sloughing or slope instability. The crests of both embankments are in good conditions with no obvious depressions in the crest. The riprap on the downstream slope of the Primary pond appears to be in fair conditions, but it is in poor condition along the Secondary Pond due to significant vegetation growth. Two animal burrows were identified on the Primary Pond slope. Sapling trees, 1 to 2-inches in diameter, have established near the shoreline of the Primary Pond embankment, and clusters of 2 to 3-inche diameter trees have established on the slope of the Secondary Pond embankment. No seeps, signs of sloughing, or signs of slope instability were observed. (**Golder Associates Inc., Inspection of the Ash Ponds at Little Flint Creek, November 2015**)[1]

In 2010 a slope stability analysis was conducted on the embankment of the Primary Bottom Ash Pond by ETTL Engineers & Consultants Inc. (ETTL). According to a slope stability analysis performed by ETTL, the site coefficients determined for site class C contained in the IBC, parameters as listed below are recommended by the Code:

Site Coefficients:	Fa = 1.60
	Fv = 2.40
Maximum Earthquake Spectral Response Acceleration Parameters:	SMS = 0.217*
	SM1 = 0.139
Design Spectral Response Acceleration Parameters:	SDS = 0.144
	SD1 = 0.093

*Note: Acceleration used for seismic evaluation.

The minimum factor of safety under static conditions was 1.9, and under seismic conditions was 1.3 (**ETTL Engineers & Consultants Inc., Slope Stability Analysis, August 2010**)[2].

2.2.4 Surface Water Control

Surface Water is controlled by stormwater diversion berms, reinforced letdowns, perimeter ditches (with permanent erosion control matting where necessary), and culverts. A small portion of run-off from the final cover from a southeast portion of the Landfill will flow to the Primary Ash Pond (**Major Modification, Appendix N-I, March 2014 – Rev. 2, Page PN-26, ADEQ Doc ID #65699**)[4].

<u>Discharge</u>

SWEPCO is authorized to discharge through Outfall 101 from ash ponds (bottom ash discharge, low volume wastewater, and stormwater runoff, including coal pile runoff from a facility, treated municipal wastewater from the City of Gentry, and spring water/stormwater) from facility located as follows: approximately 3 miles southwest of Gentry in Benton County, Arkansas to receiving waters named:

Outfall 001: Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.
Outfalls 101 and 401: SWEPCO Reservoir, thence to Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.

The outfalls are located at the following coordinates (NAD 27):

Outfall 001: Latitude: 36° 14' 0.366"; **Longitude:** 94° 33' 05.944"
Outfall 101: Latitude: 36° 14' 59.38"; **Longitude:** 94°31' 34.90"
Outfall 401: Latitude: 36° 15' 29.17"; **Longitude:** 94°31' 33.80"

Discharge shall be in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

2.3 Previous Investigations – Geotechnical, Groundwater and Other Environmental

- Golder Associates Inc., Inspection of the Ash Ponds at Little Flint Creek, May 2015
- Dewberry & Davis, LLC, Dam Assessment Report, December 2011
- ETTL Engineers & Consultants Inc., Existing Ash Storage Ponds Embankment Investigations(Revision 2), August 2010.

2.4 Hydrogeologic Setting

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered.

Perched groundwater is occasionally present within the upper unconsolidated soils; however, this perched zone appears discontinuous across the site. Groundwater can occur in both the unconsolidated soils and within the limestone. (**Terracon Well Installation Report, August 2011, pg. 7**)[5]

In the area of the Flint Creek Power Plant, water wells supply rural domestic households. According to state water well records, water wells are typically drilled through the Boone Formation and Chattanooga Shale into the underlying Ordovician age dolomites, due to the low yield of the upper Boone Formation. In general, the total depth of the water wells is approximately 500 feet below ground surface. The water wells are usually cased to allow water production from both the Boone Formation and the Ordovician dolomites. Yields generally range from 2 to 30 gallons per minute (gpm). Some wells within the area have been completed only within the Boone Formation at a typical depth of approximately 200 feet below ground surface. Yields from these wells generally range from 2 to 10 gpm with some wells yielding up to 100 gpm. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[6]

2.4.1 Climate

The Arkansas River Basin lies in a semi-humid region characterized by long summers, relatively short winters, and a wide range of temperatures. Extremes in air temperatures may vary from winter lows around 0°F, usually caused by Canadian air masses to summer highs above 100°F. Extreme temperatures may occur for short periods of time at any location within the study area. The growing season averages 244 days per year.

The average pan evaporation is about 54.9 inches for the Arkansas River Basin. Lake evaporation averages about 69 percent of the class A pan evaporation.

Precipitation is well distributed throughout the year with the driest periods occurring during the late summer and early fall. Mean annual precipitation in the study area ranges from less than 40 inches per year to greater than 52 inches per year (**Arkansas State Water Plan, Arkansas River Basin, pg. 3**)[7].

2.4.2 Regional and Local Geologic Setting

The Site is located in northwest Arkansas in the Springfield Plateau of the Ozark Plateau's Province. The Ozark Plateaus Province covers northern Arkansas and consists of sedimentary rock strata which have undergone massive uplift and which remain relatively horizontal with only minor deformation. Stream erosion has removed much of the original surface rock and typically dissected the area into hills and low mountains. Elevations typically range from 1200 to 1400 feet above mean sea level. Extensive relatively flat areas occur in Benton County (**USCS, Soil Survey of Benton County, Arkansas, January 1977**)[8]. The Site is underlain by the Boone Formation which consists primarily of limestone and chert of Lower Mississippian age. In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as a residual soil overburden. The Boone Formation, in this area, consists of a highly weathered cherty limestone with red to brown clay seams. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[6]

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered. (**FIGURES 4 & 5**)

In the vicinity of the study area, the stratigraphy consists of a weathered residuum of the Boone Formation, overlying the cherty limestone of the Boone Formation (Mississippian). The Boone Formation lies conformably atop the St. Joe Member (Mississippian) and together comprises one hydrostatic unit known as the Boone-St. Joe Aquifer. Unconformably underlying the Boone-St. Joe is the Chattanooga Shale (Devonian), which acts as the upper confining layer of the Sylamore, Clifty, and Everton Aquifers.

In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as residual soil overburden. The Boone residuum is characterized by red (iron-rich) clay, weathered limestone and chert. The thickness of residuum varies from 30 to 50 feet, and the limestone and chert content also varies in lateral extent. The chert is typically the remnant of weathering after the limestone is removed by dissolution in surface and groundwater.

The Boone Formation is a gray, crinoidal limestone abundantly interbedded with gray, black and blue chert. It is massive, well cemented and has a thickness of approximately 280 feet in northwest Arkansas. It is nearly pure calcium carbonate which is soluble, and therefore underground drainage channels, sinkholes, caves and fissures can occur.

The underlying St. Joe Member is typically a light-gray, mud-supported Crinozoan-Bryozoan crystalline limestone, and is easily recognized by its lack of chert. In Northern Arkansas, the formation exhibits a thickness of between 6 to 84 feet, with an average of thickness of 45 feet.

The underlying Chattanooga Shale is a black, fissile and carbonaceous rock with abundant pyrite. It thickens (up to 70 feet) westward and acts as a barrier to vertical groundwater flow (**Nature and Extent Groundwater Monitoring Well Installation Report, Terracon. August 2011**)[9].

2.4.3 Surface Water/Groundwater Interactions

Based on water level elevations, groundwater flow across the pond is to the west. Currently there is not enough data to determine if there is surface water to groundwater communication.

2.4.4 Water Users

A spring and well survey was conducted on November 11, 1991. The area within one-quarter mile of the Site was searched for springs, flowing streams, lakes, ponds, and water wells. **FIGURE 7** includes the results of the survey. A more recent search of an Arkansas USGS water well database provided additional wells

The closest water well was located approximately 1995 feet from the landfill boundary. No springs were located during the spring and well survey. When questioned, plant personnel knew of no springs within the survey area. All streams within the survey area are intermittent and were dry at the time of the survey.

Three large ponds are present within the survey area. The pond located in the SW 1/4 of the NW1/4 of Section 9 contains little water and is used for farming purposes. The plant's bottom ash storage pond is located in the SW1/4 of the NE1/4 of Section 9. The third pond is in the northern portion of the SE1/4 of the SE1/4 of Section 5. Two smaller ponds are also present in the SW1/4 of the SER of Section 5, and in the NW1/4 of the NE1/4 of Section 8. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21**)[10]

3.0 Certified Groundwater Monitoring Network

3.1 Hydrostratigraphic Units

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Flint Creek is currently monitored by up-gradient wells AP-51, AP-53, and AP-54 and down-gradient wells AP-58, AP-59 and AP-60. The wells monitor the upper part of the Boone Formation. Horizontal monitoring well locations relative to the CCR Unit are provided in **FIGURE 3**. Vertical positioning of monitoring wells is shown in **TABLE 2 – WELL CONSTRUCTION DETAILS**.

3.1.2 Overall Flow Conditions

Based on water level elevations from the March 2016 sampling event groundwater flow across the Primary Bottom Ash Pond is to the west. (**FIGURE 6**)

3.2 Uppermost Useable Aquifer

3.2.1 CCR Rule Definition

"Aquifer" means a geologic formation, group of formations or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

"Uppermost Aquifer" means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.

Common Definition

"Aquifer" is a geologic formation(s) that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs. Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people's uses. (USGS, Water Science Glossary of Terms)

3.2.2 Identified Onsite Hydrostratigraphic Unit

3.2.2.1 Relative Position to CCR Unit

Based on water level elevations from the March 2016 sampling event groundwater flow across the pond is to the west (**FIGURE 6**). The current groundwater monitoring network consists of up gradient wells AP-51, AP-53, and AP-54 and down gradient wells AP-58, AP-59 and AP-60.

3.2.2.2 Water Quality

Rural domestic household water wells installed in the upper Boone-St. Joe Formation typically do not yield large quantities of water. Wells within the area completed only within the Boone Formation are installed at a typical depth of approximately 200 feet below ground surface. Yields from these wells generally range from 2 to 10 gpm with some wells yielding up to 100 gpm. The underlying Roubidoux Formation and Gunter Sandstone are the most regionally significant water bearing units in this area, and the units are typically encountered at depths of greater than 1,200 feet below land surface.

Wells in the Roubidoux Formation yield an average of less than 150 gal/min, but can yield up to 450 gal/min. Well yields from the Gunter average more than 200 gal/min, with local yields up to 500 gal/min. The depth to water in the Gunter Sandstone ranges from approximately 27 to 465 feet below land surface in the study area, and the depth to water in the Roubidoux Formation ranges from approximately 90 to 200 feet below land surface. Year-to-year water-level fluctuations are due primarily to temporal variations in pumpage and do not represent long-term trends.

Analyses of samples from wells tapping subsurface rock units show that water in these units is a moderately hard to very hard, calcium and magnesium carbonate water. The quality of water from these units is well within the established drinking water standards with the exception of high iron and nitrate concentrations in a few isolated Benton County wells. The subsurface rock units will yield fresh water in Benton and Washington Counties, but the water becomes mineralized and is unusable to the south (**Arkansas State Water Plan, Arkansas River Basin, pg. 121**)[11]

3.2.3.3 Users/Receptors

A spring and well survey was conducted on November 11, 1991. The area within one-quarter mile of the Site was searched for springs, flowing streams, lakes, ponds, and water wells. **FIGURE 7** includes the results of the survey. A more recent search of an Arkansas USGS water well database provided additional wells

The closest water well was located approximately 1995 feet from the Primary Bottom Ash Pond boundary. No springs were located during the spring and well survey. When questioned, plant personnel knew of no springs within the survey area. All streams within the survey area are intermittent and were dry at the time of the survey.

Three large ponds are present within the survey area. The pond located in the SW 1/4 of the NW1/4 of Section 9 contains little water and is used for farming purposes. The plant's bottom ash storage pond is located in the SW1/4 of the NE1/4 of Section 9. The third pond is in the northern portion of the SE1/4 of the SE1/4 of Section 5. Two smaller ponds are also present in the SW1/4 of the SER of Section 5, and in the NW1/4 of the NE1/4 of Section 8. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21**)[10]

3.3 Existing Monitoring Network

3.3.1 Overview

The current groundwater monitoring network at the Flint Creek Primary Bottom Ash Pond consists of 6 groundwater monitoring wells (AP-51, AP-53, AP-54, AP-58, AP-59 and AP-60). The groundwater monitoring network was previously evaluated to determine compliance with the new CCR requirements. Based upon the review AEP installed 3 new downgradient groundwater monitoring wells. Wells AP-58 and AP-59 were installed on February 4, 2016. In December, 2016 well AP-52 was decommissioned and replaced with well AP-60. With the installation of the 3 new wells the current groundwater monitoring network at the Primary Bottom Ash Pond complies with the new CCR requirements.

3.3.1.1 Well Construction Summary Table

Please refer to **TABLE 2** for construction details of the groundwater monitoring wells.

3.3.1.2 Depth Ranges and Hydrostratigraphic units monitored

Please refer to **TABLE 1** for groundwater elevation data taken from the groundwater monitoring system.

3.3.1.3 Position in Terms of Flow Directions and Distance from Waste Boundary

Based on water level elevations from the March 2016 sampling event groundwater flow across the pond is to the west (**FIGURE 6**). The groundwater monitoring network consists of up gradient wells AP-51, AP-53, and AP-54 and down gradient wells AP-58, AP-59 and AP-60.

3.3.1.4 Uppermost Useable Aquifer

The groundwater monitoring network at the Flint Creek Primary Bottom Ash Pond is installed to monitor the uppermost aquifer at the facility. The uppermost usable aquifer at the site is the Mississippian age Boone Formation.

3.3.1.5 Insufficient Definition of Background Water Quality

Background water quality data will need to be reestablished according to the new requirements set by 40 CFR 257 using Appendix III and IV Constituents for groundwater monitoring at CCR units. Background concentrations need to be established by October 17, 2017 in accordance with §257.90.

Appendix III to Part 257—Constituents for Detection Monitoring

Common Name[1]
Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common Name[1]
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 and 228 combined

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

3.3.1.6 Key Down-gradient Directions

Groundwater flow at the Primary Bottom Ash Pond is to the west and is currently monitored by monitoring wells AP-58, AP-59 and AP-60. (**See FIGURE 6**)

3.3.1.7 Key Users/Receptors Not Protected

Key users/receptors are protected with the recently installed monitoring wells that reduce the spacing between the down-gradient wells.

4.0 Certification

The monitoring wells currently installed are adequate to monitor the uppermost aquifer as required by §257.91.

4.1 Limitations

The findings and conclusions resulting from this investigation are based upon information derived from the on-site activities and other services performed under the scope of work as described in this report; such information is subject to change over time if additional information is obtained. Please note that Terracon does not warrant the work of laboratories, regulatory agencies or other third parties supplying information used in the preparation of the report.

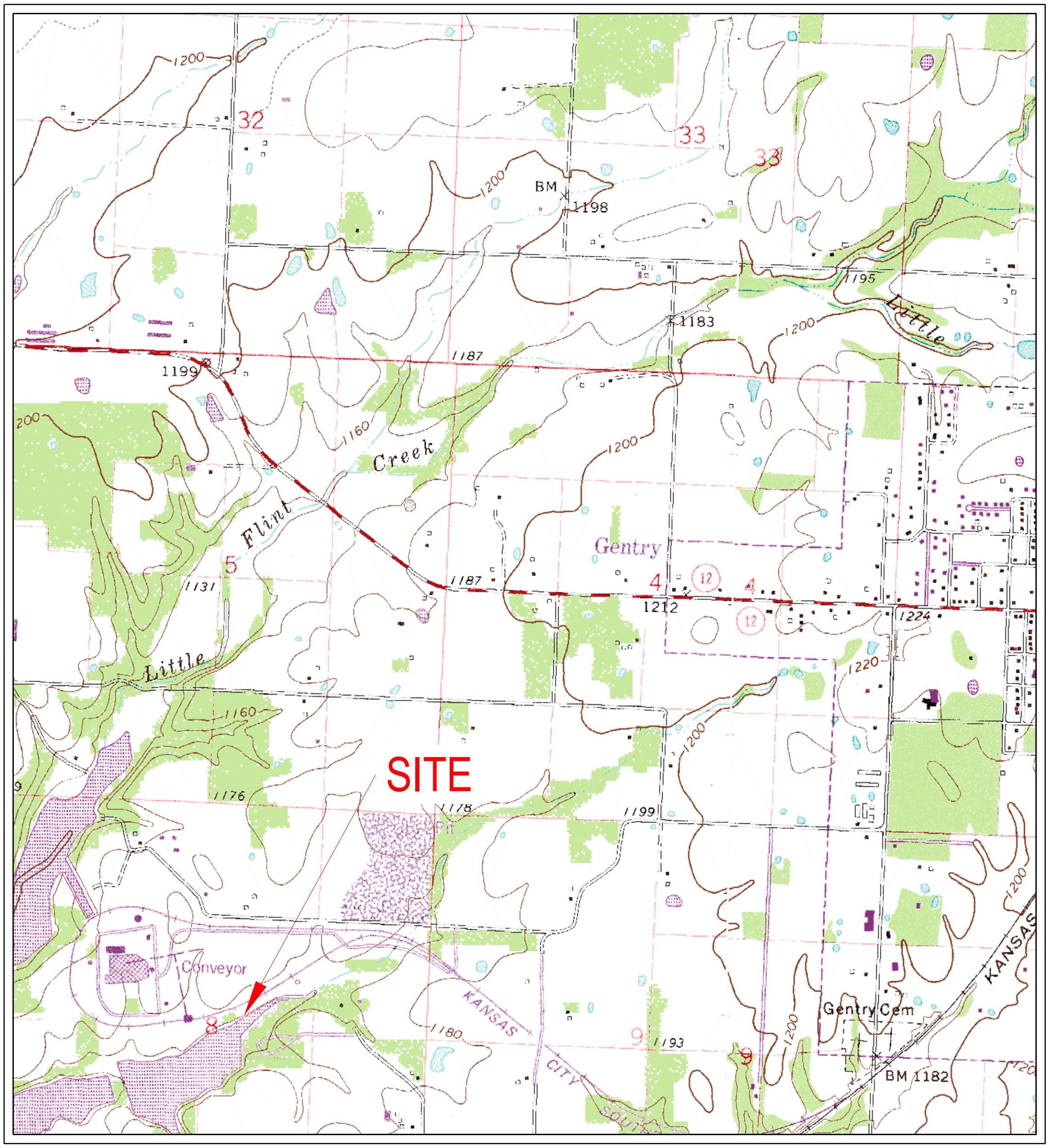
4.2 PE Certification

Name:	Date: 10/17/17	STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. 9199 DAVID C. McCORMICK Stamp
Company: Terracon COA #223	Expiration Date: 12/31/17	

Bibliography

1 Golder Associates Inc., Inspection of the Ash Ponds at Little Flint Creek, November 2015
2 ETTL Engineers and Consultants Inc., Slope Stability Report, Revised August 2010
3 Dewberry & Davis LLC, Coal Combustion Residue Impoundment Round 9 – Dam Assessment Report, December 2011
4 Major Modification, Appendix N-I, March 2014 - Rev2, page N-I, ADEQ Doc ID# 65699
5 Terracon Well Installation Report, August 2011, pg. 7
6 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20
7 Arkansas State Water Plan, Arkansas River Basin, pg. 3
8 USCS, Soil Survey of Benton County, Arkansas, January 1977
9 Nature and Extent Groundwater Monitoring Well Installation Report, Terracon. August 2011
10 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21
11 Arkansas State Water Plan, Arkansas River Basin, pg. 121

UNITED STATES — DEPARTMENT OF THE INTERIOR — GEOLOGICAL SURVEY



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FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

N

CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

CHEROKEE CITY
QUADRANGLE
1982
7.5 MINUTE SERIES (TOPOGRAPHIC)

Project Mngr:	DCM
Drawn By:	TLB
Checked By:	DCM
Approved By:	DCM

Project No.	216-001-35157124
Scale:	AS SHOWN
File No.	001
Date:	10-17-17

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SITE LOCATION MAP
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

FIG. No.
1

FIGURE 2

DESIGNED BY:	TLB
DRAWN BY:	TLB
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	002
SHEET NO.:	2 OF 7

PLANT AND CCR UNIT LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

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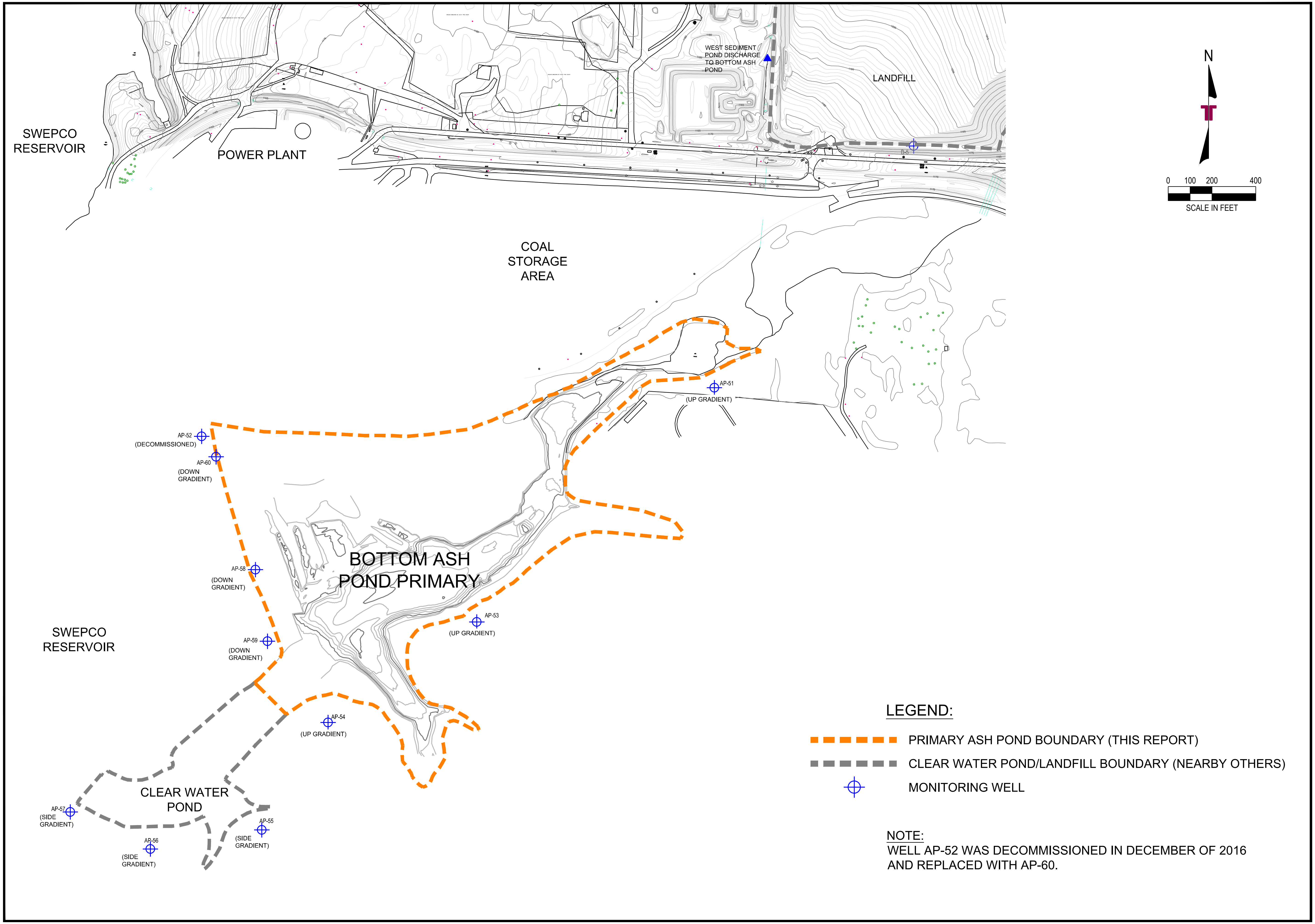
REV.	DATE	BY	DESCRIPTION



LEGEND:

🟧	PRIMARY ASH POND BOUNDARY (THIS REPORT)
⬜	CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
⊕	MONITORING WELL

NOTE:
WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

FIGURE 3

DESIGNED BY:	TLB
DRAWN BY:	TLB
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	003
SHEET NO.:	3 OF 7

CCR UNIT AND WELL LOCATIONS

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

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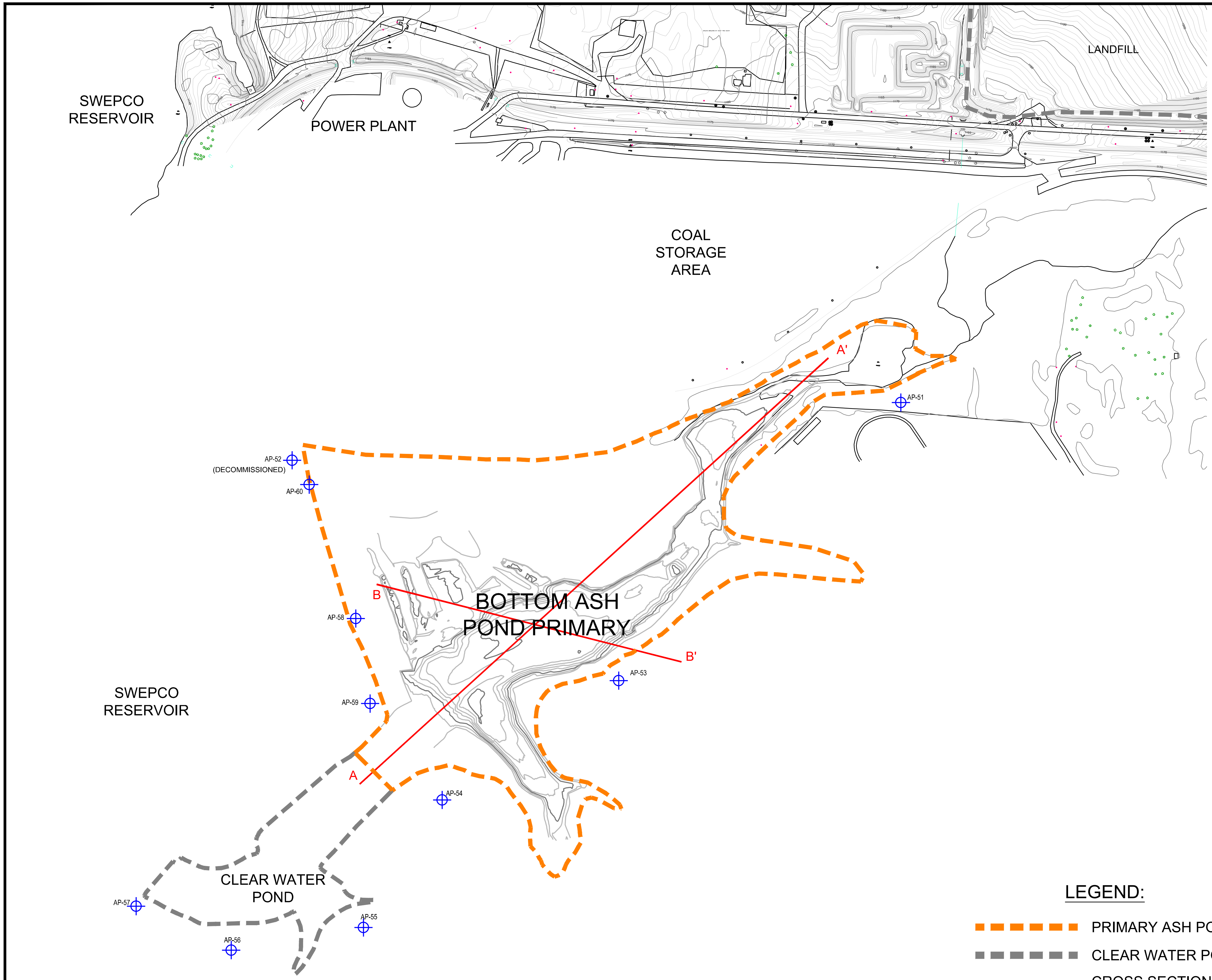
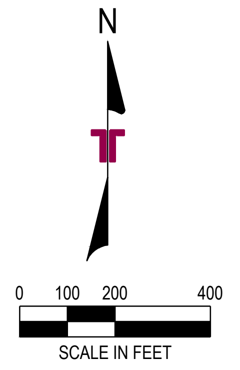
REV.	DATE	BY	DESCRIPTION





NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER 2016 AND REPLACED WITH AP-60.

LEGEND:

▬ ▬ ▬	PRIMARY ASH POND BOUNDARY (THIS REPORT)
▬ ▬ ▬	CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
──	CROSS SECTION LOCATION
⌖	MONITORING WELL

FIGURE 4

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	004
SHEET NO.:	4 OF 7

CROSS SECTION LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

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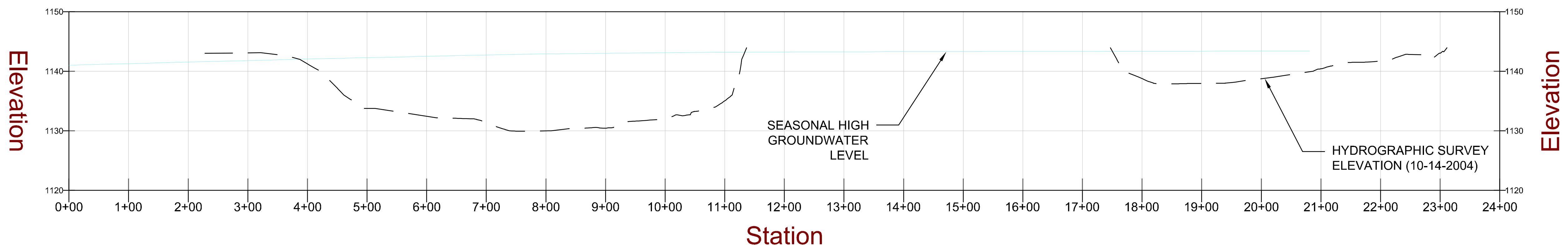
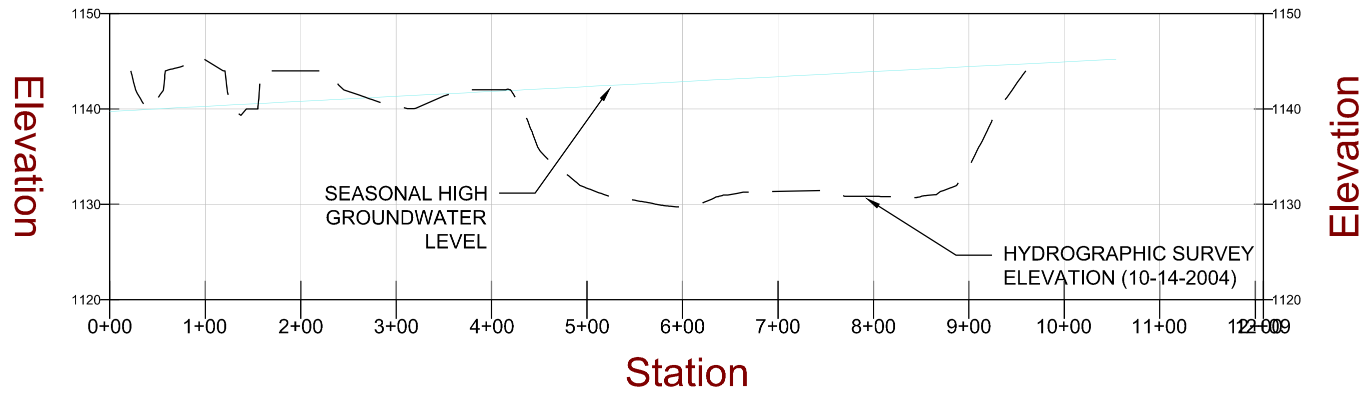
REV.	DATE	BY	DESCRIPTION

SECTION A-A'



SECTION B-B'



NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15,2016.

FIGURE 5

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	005
SHEET NO.:	5 OF 7

CROSS SECTIONS
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

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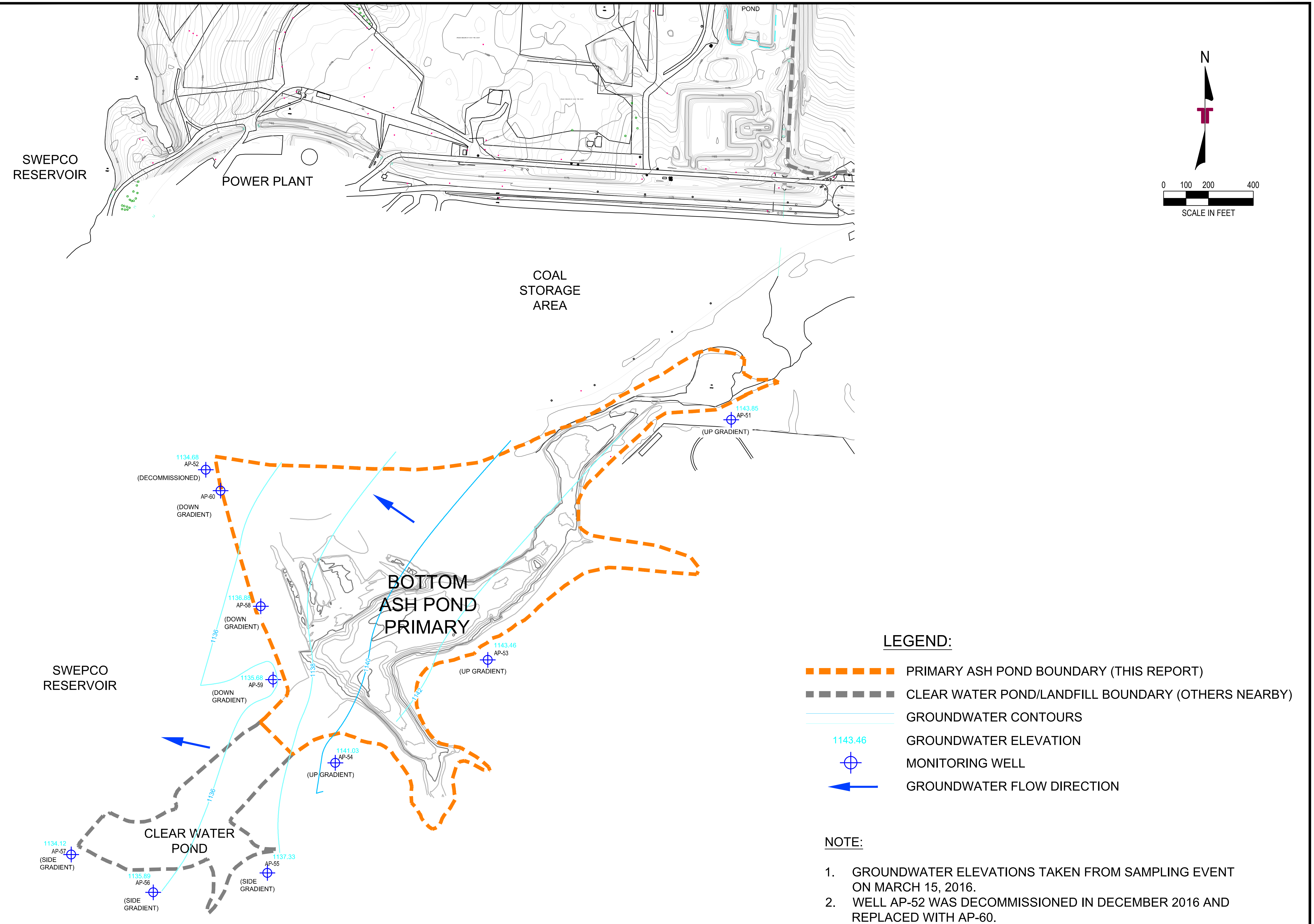
REV.	DATE	BY	DESCRIPTION



NOTE:

1. GROUNDWATER ELEVATIONS TAKEN FROM SAMPLING EVENT ON MARCH 15, 2016.
2. WELL AP-52 WAS DECOMMISSIONED IN DECEMBER 2016 AND REPLACED WITH AP-60.

REV.	DATE	BY	DESCRIPTION

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POTENTIOMETRIC SURFACE MAP - UPPERMOST AQUIFER

GROUNDWATER MONITORING NETWORK EVALUATION

AMERICAN ELECTRIC POWER

SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

FIGURE 6

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	006
SHEET NO.:	6 OF 7

FIGURE 7

DESIGNED BY: TLB
DRAWN BY: TLB
APPVD. BY: DCM
SCALE: SEE BARSCALE
DATE: 10-17-2017
JOB NO. 216-001-35157124
ACAD NO. 009
SHEET NO.: 7 OF 7

NEAREST DOMESTIC WELL LOCATION

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTOM ASH POND
GENTRY ARKANSAS

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REV.	DATE	BY	DESCRIPTION

TABLE 1
AEP – Flint Creek
Primary Bottom Ash Pond
Groundwater Elevations (FMSL)

Well	AP-51	AP-52	AP-53	AP-54	AP-55	AP-56	AP-57	AP-58	AP-59	AP-60
Date										
7/20/2011	1144.38	1134.59	1145.13	1142.71	1139.16	1136.90	1134.72			
10/26/2011	1143.72	1131.70	1142.57	1140.03	1136.80	1133.71	1131.37			
1/24/2012	1144.41	1134.85	1145.28	1141.57	1139.01	1136.53	1134.95			
4/25/2012	1144.23	1137.08	1142.88	1140.79	1138.74	1087.86	1137.24			
7/31/2012	1143.60	1133.35	1143.19	1140.75	1136.59	1134.94	1133.27			
10/24/2012	1142.56	1131.67	1141.35	1137.99	1135.18	1132.36	1130.20			
1/29/2013	1141.08	(dry)	1139.86	1136.43	1133.83	1130.78	1129.74			
4/23/2013	1145.20	1136.01	1143.28	1141.11	1140.83	1139.10	1136.30			
8/13/2013	1143.67	1133.40	1143.29	1140.59	1138.25	1137.03	1135.92			
10/21/2013	1143.48	1134.74	1144.49	1142.07	1137.29	1135.89	1134.96			
1/29/2014	1144.12	1134.68	1143.69	1141.30	1138.76	1137.30	1135.80			
4/30/2014	1142.45	1135.04	1140.98	1137.81	1135.77	1135.72	1135.25			
7/23/2014	1144.04	1134.64	1143.57	1140.99	1138.56	1137.23	1135.71			
10/16/2014	1143.87	(dry)	1144.42	1142.71	1142.13	1138.36	1135.32			
1/20/2015	1143.45	(dry)	1144.19	1142.82	1141.87	1137.80	1134.75			
4/28/2015	1144.27	(dry)	1142.73	1140.23	1138.55	1137.23	1136.50			
7/22/2015	1145.15	1138.77	1143.23	1140.90	1139.87	1138.75	1137.35			
10/20/2015	1140.13	(dry	1143.70	1141.39	1136.91	1135.73	1133.83			
3/15/2016	1143.85	1134.68	1143.46	1141.03	1137.33	1135.89	1134.12	1136.88	1135.68	
Seasonal High	1145.20	1138.77	1145.28	1142.82	1142.13	1139.10	1137.35	1136.88	1135.68	-

Note: AP-52 was decommissioned in December, 2016 and replaced with AP-60.

TABLE 2

AEP - FLINT CREEK

Primary Bottom Ash Pond

MONITORING WELL CONSTRUCTION DETAILS

Well Number	Latitude	Longitude	Ground Surface Elevation	Top of Casing Elevation	Borehole Depth ft.bls	Date Installed	Screen Material	Well Diameter inches	Top of Screen Depth ft. bls	Top of Screen Elevation ft. msl	Bottom of Screen Depth ft. bls	Bottom of Screen Elevation ft. msl
AP-51	36° 15' 15.04552"	94° 31' 00.57349"	1160.10	1163.23	35	6/12/2011	PVC	2	17	1143.10	32.4	1130.83
AP-52	36° 15' 12.25697"	94° 31' 29.06821"	1155.90	1158.89	26	6/13/2011	PVC	2	9.2	1146.70	24.6	1134.29
AP-53	36° 15' 04.97559"	94° 31' 13.55592"	1156.40	1159.34	30	6/12/2011	PVC	2	13.8	1142.60	29.05	1130.29
AP-54	36° 15' 00.19114"	94° 31' 31.64012"	1164.70	1167.71	31.5	6/11/2011	PVC	2	14.6	1150.10	30	1137.71
AP-55	36° 14' 55.13143"	94° 31' 25.45525"	1153.80	1156.86	26.5	6/9/2011	PVC	2	8.75	1145.05	24.15	1132.71
AP-56	36° 14' 54.52789"	94° 31' 31.04075"	1155.60	1158.77	36	6/8/2011	PVC	2	19.5	1136.10	34.9	1123.87
AP-57	36° 14' 55.97604"	94° 31' 36.16662"	1154.10	1157.31	25	6/8/2011	PVC	2	9.6	1144.50	25	1132.31
AP-58	36° 15' 06.5928"	94° 31' 26.6690"	1155.02	1154.65	69	2/16/2016	PVC	2	58.45	1096.57	68.85	1085.80
AP-59	36° 15' 06.7003"	94° 31' 26.7060"	1151.83	1155.14	30	2/4/2016	PVC	2	19.89	1131.94	30.29	1124.85
AP-60	36° 15' 11.6378"	94° 31' 29.0189"	1154.01	1156.93	48.5	12/8/2016	PVC	2	38.15	1115.86	48.45	1108.48

Note: AP-52 was decommissioned in December, 2016 and replaced with AP-60.

APPENDIX 1

Boring & Monitoring Well Installation Logs

Boring Logs

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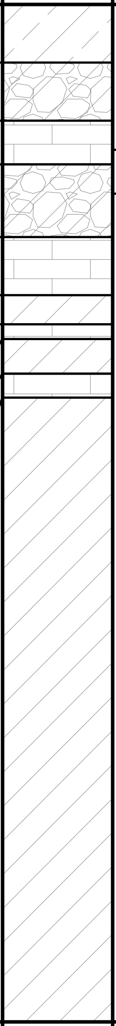
FIELD BORING LOG

BORING NO.: AP-51 PAGE: 1 of 1
TOTAL DEPTH: 35 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK
PROJECT: ASH POND WELLS
JOB NO.: 216-001-35117108-008
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS
DRILLER: GARRY MOYERS
DATE DRILLED: 6/12/11
RIG TYPE: ATV
DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY
SAMPLING METHOD: SPLIT SPOON

N: 708,641.27 E: 1,257,949.01 G.S. ELEV. 1,160.10

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 2' SILTY GRAVEL brown with boulders					
	2' - 4' GRAVELLY CLAY reddish brown					
5	4' - 5.5' CHERTY LIMESTONE white		1	2"		
	5.5' - 8' GRAVELLY CLAY reddish brown			LOGGED BY CUTTINGS		
	8' - 10' LIMESTONE gray					Refusal at 8' bgs (Started air rotary at 8')
10	10' - 11' CLAY reddish brown					
	11' - 11.5' LIMESTONE gray					
	11.5' - 13' CLAY reddish brown					
	13' - 13.5' LIMESTONE gray					
15	13.5' - 35' CLAY reddish brown with intermittent gray limestone layers, limestone layers are approximately 0.6' to 1' thick					
20	Moist at 21'					
25						
30						
35	Total Depth of Boring at 35' bgs					Stopped at 35' for 1 hr. Water recharged to 17.8' bgs
40						



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FIELD BORING LOG

BORING NO.: AP-52 PAGE: 1 of 1
TOTAL DEPTH: 26 FEET BELOW GROUND SURFACE (BGS)
CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK
PROJECT: ASH POND WELLS
JOB NO.: 216-001-35117108-009
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS
DRILLER: GARRY MOYERS
DATE DRILLED: 6/13/11
RIG TYPE: ATV
DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY
SAMPLING METHOD: SPLIT SPOON

N: 708,419.12 E: 1,255,608.60 G.S. ELEV. 1,155.90

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 2' GRAVELLY CLAY reddish brown					
	2' - 4.5' CLAY reddish brown					
5	4.5' - 8' CHERTY LIMESTONE white and gray with small (~ 3") intermittent reddish brown and white heavily weathered limestone		1	0		
10	8' - 13' LIMESTONE reddish brown, very heavily weathered with cherty limestone layers (<3" thick)		2			Water observed at 10' bgs while drilling
15	13' - 16' LIMESTONE gray, hard					Refusal at 13.5' bgs (Started air rotary at 13.5')
	16' - 18' LIMESTONE heavily weathered					
20	18' - 20.5' Void, wet					Void at 18' - 20.5'
25	20.5' - 26' LIMESTONE gray					
	Total Depth of Boring at 26' bgs					Allowed boring to sit open for 1 hr. at 26'. Water recharged to 17' bgs
30						
35						
40						

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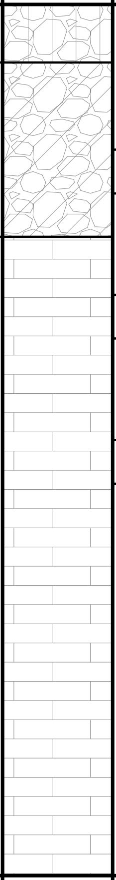
FIELD BORING LOG

BORING NO.: AP-53 PAGE: 1 of 1
TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK	PROJECT: ASH POND WELLS
JOB NO.: 216-001-35117108-010	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS	DRILLER: GARRY MOYERS
DATE DRILLED: 6/9/11	RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY
SAMPLING METHOD: SPLIT SPOON

N: 707,650.49 E: 1,256,859.93 G.S. ELEV. 1,156.40

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 3' SILTY GRAVEL cobble size gravel					
	3' - 8' GRAVELLY CLAY reddish brown					
5			1			
	8' - 10.5' LIMESTONE reddish brown, heavily weathered, soft drilling, moist					
10	10.5' - 11' CHERTY LIMESTONE gray		2	4"		
	11' - 30' LIMESTONE reddish brown, very heavily weathered with thin (<5") layers of cherty limestone					
15			3	10"		Water observed at 14.5' bgs while drilling
20						
25						Allowed boring to sit open overnight at 30' bgs. water at 12.2' bgs on 6/10/11
30	Total Depth of Boring at 30' bgs					
35						
40						

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FIELD BORING LOG

BORING NO.: AP-54 PAGE: 1 of 1
TOTAL DEPTH: 31.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK
PROJECT: ASH POND WELLS
JOB NO.: 216-001-35117108-011
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS
DRILLER: GARRY MOYERS
DATE DRILLED: 6/9/11
RIG TYPE: ATV
DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY
SAMPLING METHOD: SPLIT SPOON

N: 707,183.78 E: 1,256,185.57 G.S. ELEV. 1,164.70

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 3' GRAVELLY CLAY reddish brown 3' - 10.5' GRAVELLY CLAY reddish brown, more clay					
5			1	13"		
10	10.5' - 11' LIMESTONE gray 11' - 12' SILTY CLAY tan and gray, very hard 12' - 12.5' LIMESTONE white		2	4"		
15	12.5' - 26' LIMESTONE reddish brown, heavily weathered with intermittent (<4" thick) hard cherty limestone layers		3	15"		
20			4	2"		Water observed at 20.5' bgs while drilling
25	26' - 27' LIMESTONE 27' - 28.5' LIMESTONE heavily weathered, soft drilling 28.5' - 31.5' LIMESTONE					Allowed boring to sit open for 30 min. at 25' water recharged to 22.5' bgs Refusal at 26' bgs Boring sat open at 26' for 15 min. water recharged to 23.2' bgs
30	intermittent hard and soft beds, cherty Total Depth of Boring at 31.5' bgs					6-11-11 water at 21' bgs
35						
40						

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FIELD BORING LOG

BORING NO.: AP-55 PAGE: 1 of 1

TOTAL DEPTH: 26.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK

PROJECT: ASH POND WELLS

JOB NO.: 216-001-35117108-012

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: JODY ADAMS

DRILLER: GARRY MOYERS

DATE DRILLED: 6/9/11

RIG TYPE: ATV

DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY

SAMPLING METHOD: SPLIT SPOON

N: 706,680.30 E: 1,255,860.06 G.S. ELEV. 1,153.80

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 4' SILTY GRAVEL gray					
5	4' - 7' GRAVELLY CLAY reddish brown		1	8"		
10	7' - 12.5' CLAY reddish brown with black mottles		2	18"		
15 20	12.5' - 14' LIMESTONE weathered 14' - 22' LIMESTONE weathered, alternating and reddish brown gravelly clay, wet		3 4	15" 18"		
25	22' - 26.5' GRAVELLY CLAY reddish brown		5	18"		
30 35 40	Total Depth of Boring at 26.5' bgs					Allowed boring to sit open for 45 min. at 26.5' bgs water recharged to 12.8' bgs.

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FIELD BORING LOG

BORING NO.: AP-56 PAGE: 1 of 1
TOTAL DEPTH: 36 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK
PROJECT: ASH POND WELLS
JOB NO.: 216-001-35117108-013
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS
DRILLER: GARRY MOYERS
DATE DRILLED: 6/8/11
RIG TYPE: ATV
DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY
SAMPLING METHOD: SPLIT SPOON

N: 706,631.02 E: 1,255,401.11 G.S. ELEV. 1,155.60

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 18' GRAVELLY CLAY reddish brown					
5			1	15"		
10			2	2"		
15			3	10"		
	18' - 24' CLAY tan and gray, some silt, firm					
20			4	18"		
	24' - 24.5' Rock					
25	24.5' - 31' CLAY tan, gray and reddish brown, mottled, firm, wet		5	18"		
30						Allowed boring to sit open for 20 min. at 30' bgs water recharged to 29' bgs.
	31' - 36' LIMESTONE weathered with interbedded clay, wet					
35						
	Total Depth of Boring at 36' bgs					Allowed boring to sit open for 1 hr. at 36' bgs water recharged to 27.2' bgs.
40						

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FIELD BORING LOG

BORING NO.: AP-57 PAGE: 1 of 1
TOTAL DEPTH: 25 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK
PROJECT: ASH POND WELLS
JOB NO.: 216-001-35117108-014
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS
DRILLER: GARRY MOYERS
DATE DRILLED: 6/8/11
RIG TYPE: ATV
DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY
SAMPLING METHOD: SPLIT SPOON

N: 706,788.18 E: 1,254,985.13 G.S. ELEV. 1,154.10

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 2' GRAVELLY CLAY brown 2' - 3.5' GRAVELLY CLAY reddish brown	▒				
	3.5' - 9.5' SILTY CLAY reddish brown	▨				
5			1	13"		
10	9.5' - 25' LIMESTONE bedrock	▦	2			Refusal at 10' bgs Started air rotary at 10'
15						
20						
	(void at 23'-23.5') (fractured limestone at 24'-25')					
25	Total Depth of Boring at 25' bgs					Allowed boring to sit open for 20 min. at 25' bgs water recharged to 15' bgs.
30						
35						
40						

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FIELD BORING LOG

BORING NO.: AP-58 PAGE: 1 of 2
TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER
PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-002
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER
DRILLER: GARY MOYERS
DATE DRILLED: 2/16/2016
RIG TYPE: CME 75 BUGGY
DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-15' SILTY CLAY - FILL brown and red, poor sample return	▦	
5		▦	
10		▦	
15	15'-56' SILTY CLAY red, moist zones at 30' - 40' and 45' - 50'	▨	
20		▨	
25		▨	
30		▨	

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FIELD BORING LOG

BORING NO.: AP-58
PAGE: 2 of 2
TOTAL DEPTH: 69 FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
	15'-56' <u>SILTY CLAY</u> red, moist zones at 30' - 40' and 45' - 50'	▨	
40		▨	
45		▨	
50		▨	
55		▨	
	56'-69' <u>LIMESTONE</u> gray, crystalline	▦	56' - 59' bgs logged by cuttings
60		▦	
65		▦	
	Total Depth of Boring at 69' bgs		
70			
75			

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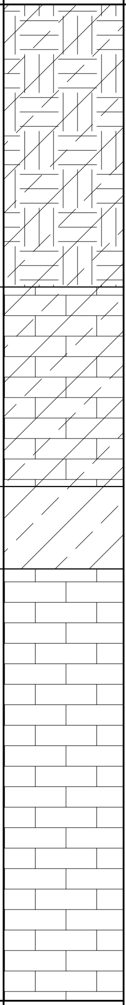
FIELD BORING LOG

BORING NO.: AP-59 PAGE: 1 of 1
TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER
PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-001
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER
DRILLER: GARY MOYERS
DATE DRILLED: 2/3/2016
RIG TYPE: CME 75 BUGGY
DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A



Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-8.5' SILTY CLAY - FILL red and brown		
5			
10	8.5'-14.5' LIMESTONE and SILTY CLAY hard while drilling		
15	14.5'-17' SILTY CLAY red		
	17'-30' LIMESTONE light gray, crystalline, thin fracture/void at 22' bgs		Moisture at top of rock at 17' bgs
20			
	▽		Water at 22' bgs 17' - 30' Logged by cuttings
25			
30	Total Depth of Boring at 30' bgs		

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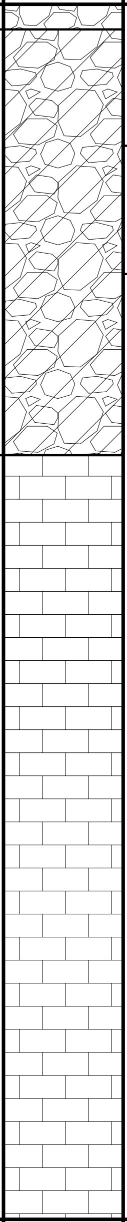
FIELD BORING LOG

BORING NO.: AP-60
PAGE: 1 of 1
TOTAL DEPTH: 48.5 FEET BELOW GROUND SURFACE (BGS)
CLIENT: AMERICAN ELECTRIC POWER
PROJECT: FLINT CREEK - GENTRY, AR.
JOB NO.: 216-001-35167278-001
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS
DRILLER: DOMENIC TORANO
DATE DRILLED: 12/6/2016
RIG TYPE: TRUCK MOUNTED CME-55
DRILLING METHOD: HOLLOW STEM AUGER/AIR ROTARY
SAMPLING METHOD: SPLIT SPOON/CUTTINGS

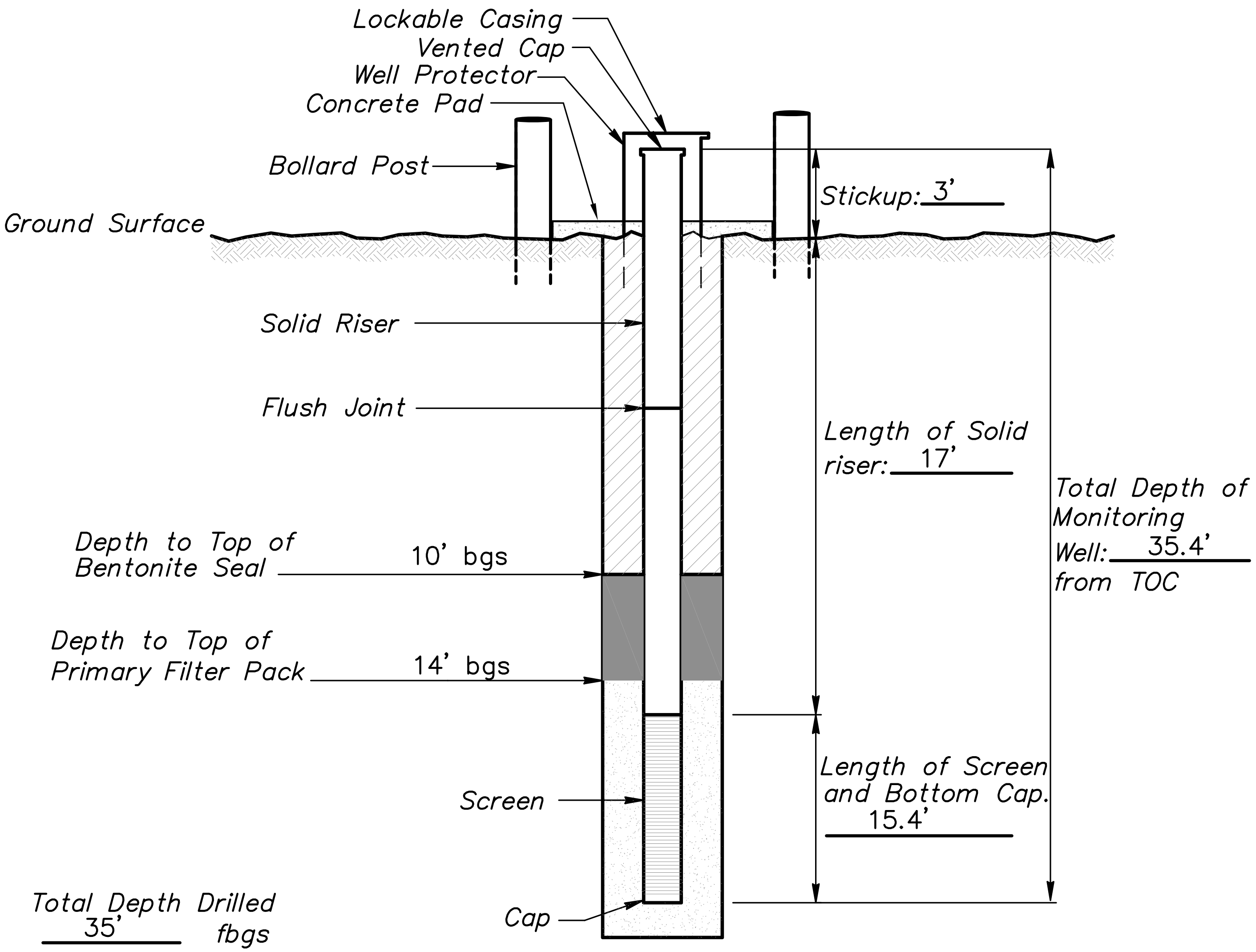
N: 708325.63 E: 1255674.34 TOC: 1156.93

Depth BGS	Sample Interval	DESCRIPTION	Litho. Symbol	Sample Interval	Comments
0		0'-1' Gravel			
		1'-4' CLAY brown, gravelly			Hand auger from 1'-2' bgs at AEP request.
5		4'-18' CLAY reddish brown, gravelly with intermittent chert layers		5'-6.5' SS	
10				10'-11.5' SS	
15					
20		18'-23.5' LIMESTONE interbedded and weathered with reddish brown clay, moist			
25		23.5'-40' LIMESTONE intermittent weathered layers			Auger refusal at 23.5' bgs. Started air rotary
30					
35					
40		40'-46' LIMESTONE			Paused drilling at 38' bgs for 20 minutes to observe for water. Water came up to 36' bgs but is still believed to be perched water from the top of bedrock.
45		46'-46.5' LIMESTONE weathered, wet ▽			Wet at 46' bgs
		46.5'-48.5' LIMESTONE			
50		Total Depth of Boring at 48.5' bgs			

Monitoring Well Installation Logs

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – ASH POND WELLS
Well Number AP–51
Job Number 35117108
Installation Date 6/12/2011
Location GENTRY, AR.
Datum Elevation 1,163.23
Surface Elevation 1,160.10
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010"
Riser Diameter & Material 2" PVC
Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND
Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER, AIR ROTARY
Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 17'

Total Depth of Monitoring Well: 35.4' from TOC

Depth to Top of Bentonite Seal 10' bgs

Depth to Top of Primary Filter Pack 14' bgs

Length of Screen and Bottom Cap. 15.4'

Total Depth Drilled 35' fbgs

▨ Bentonite Grout

■ Bentonite Plug

☐ Granular Backfill

(Not to Scale)

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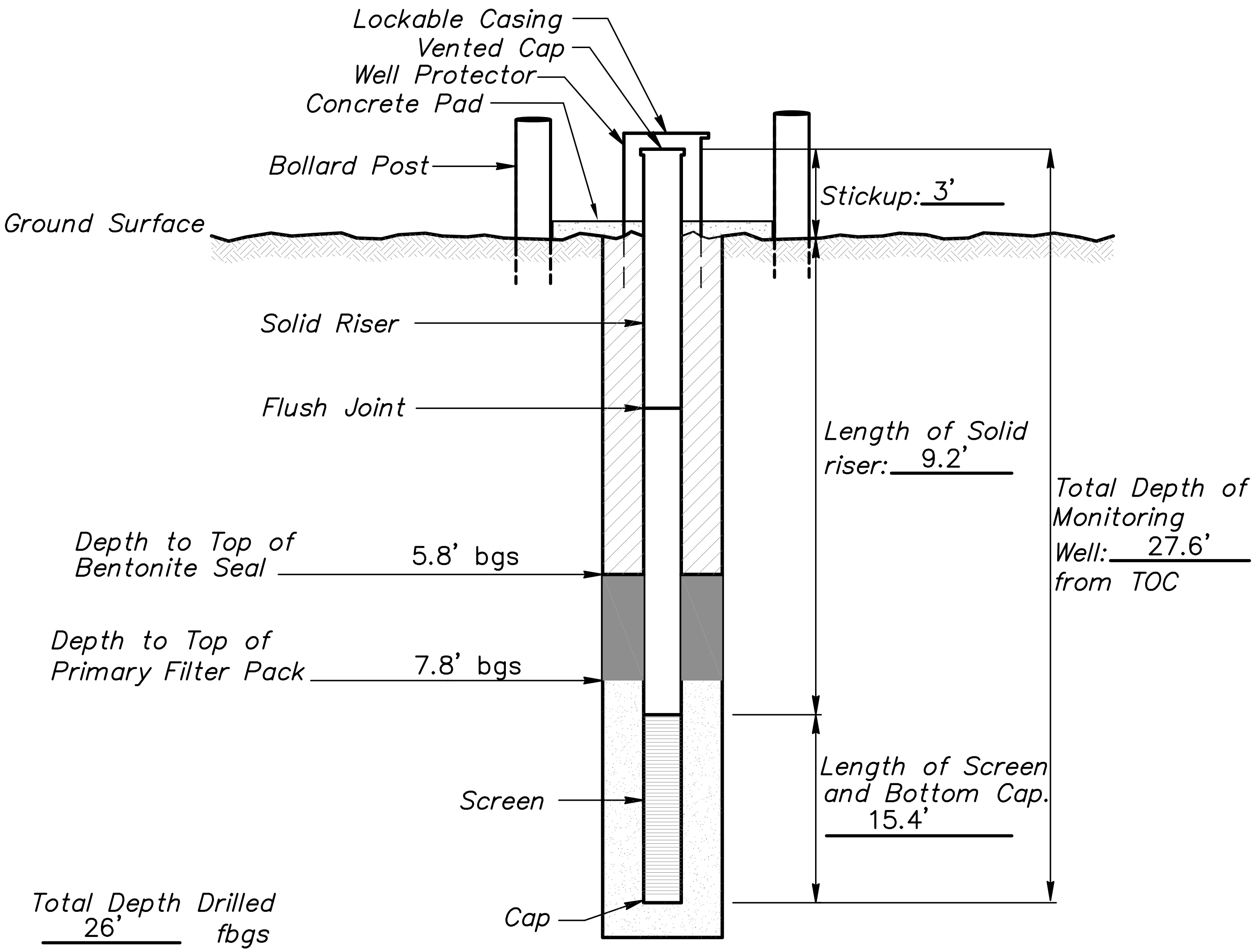
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: AP–51
DRAWING NUMBER: 021 **CHECKED BY:** QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – ASH POND WELLS
Well Number AP–52
Job Number 35117108
Installation Date 6/13/2011
Location GENTRY, AR.
Datum Elevation 1,158.89
Surface Elevation 1,155.90
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010"
Riser Diameter & Material 2" PVC
Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND
Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER, AIR ROTARY
Drilling Contractor ANDERSON ENGINEERING



▨ Bentonite Grout

■ Bentonite Plug

░ Granular Backfill

(Not to Scale)

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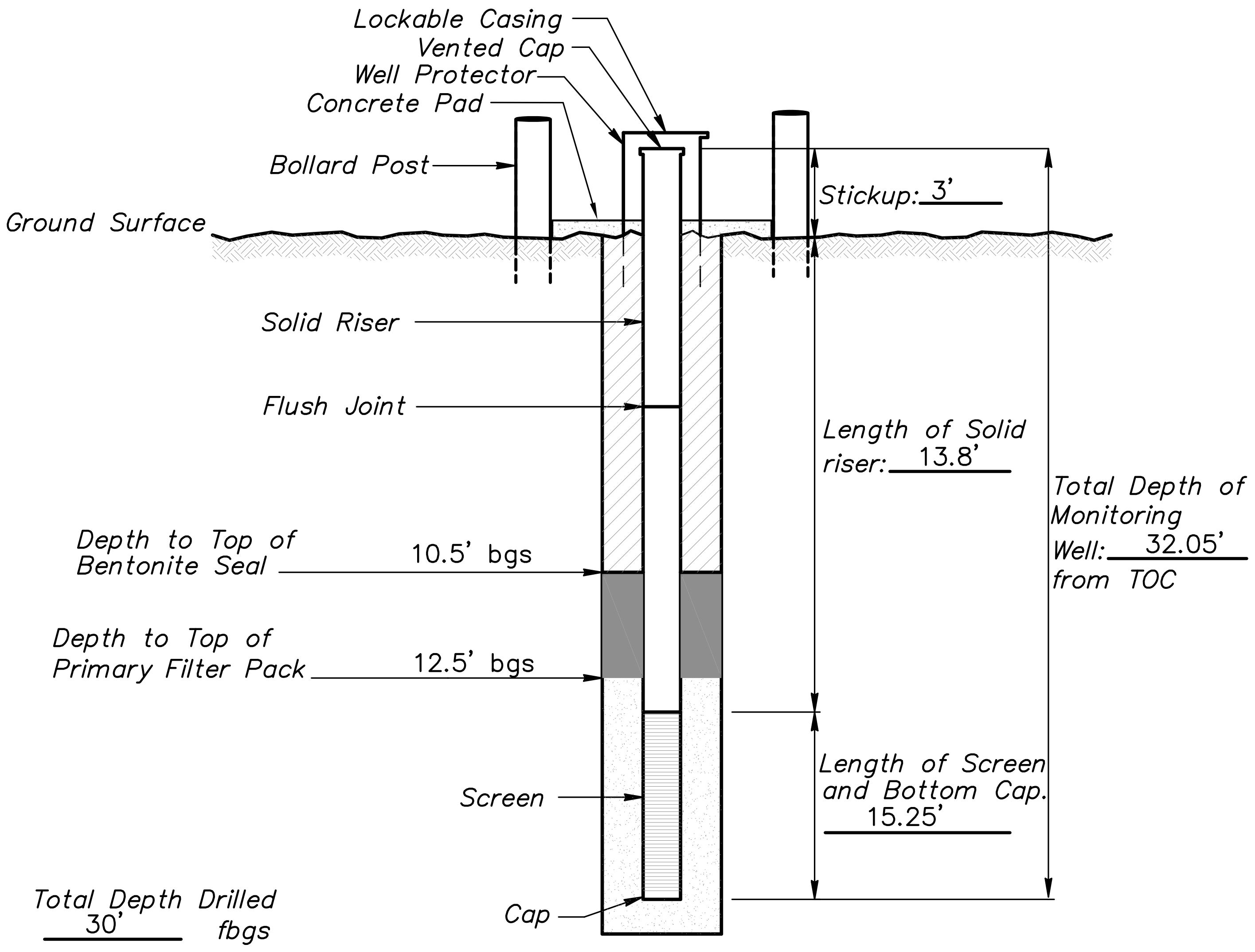
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: AP–52
DRAWING NUMBER: 022
CHECKED BY: QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – ASH POND WELLS Well Number AP–53
Job Number 35117108 Installation Date 6/12/2011 Location GENTRY, AR.
Datum Elevation 1,159.34 Surface Elevation 1,156.40
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 13.8'

Total Depth of Monitoring Well: 32.05' *from TOC*

Depth to Top of Bentonite Seal 10.5' bgs

Depth to Top of Primary Filter Pack 12.5' bgs

Length of Screen and Bottom Cap. 15.25'

Total Depth Drilled 30' *fbgs*

▨ Bentonite Grout

■ Bentonite Plug

☐ Granular Backfill

(Not to Scale)

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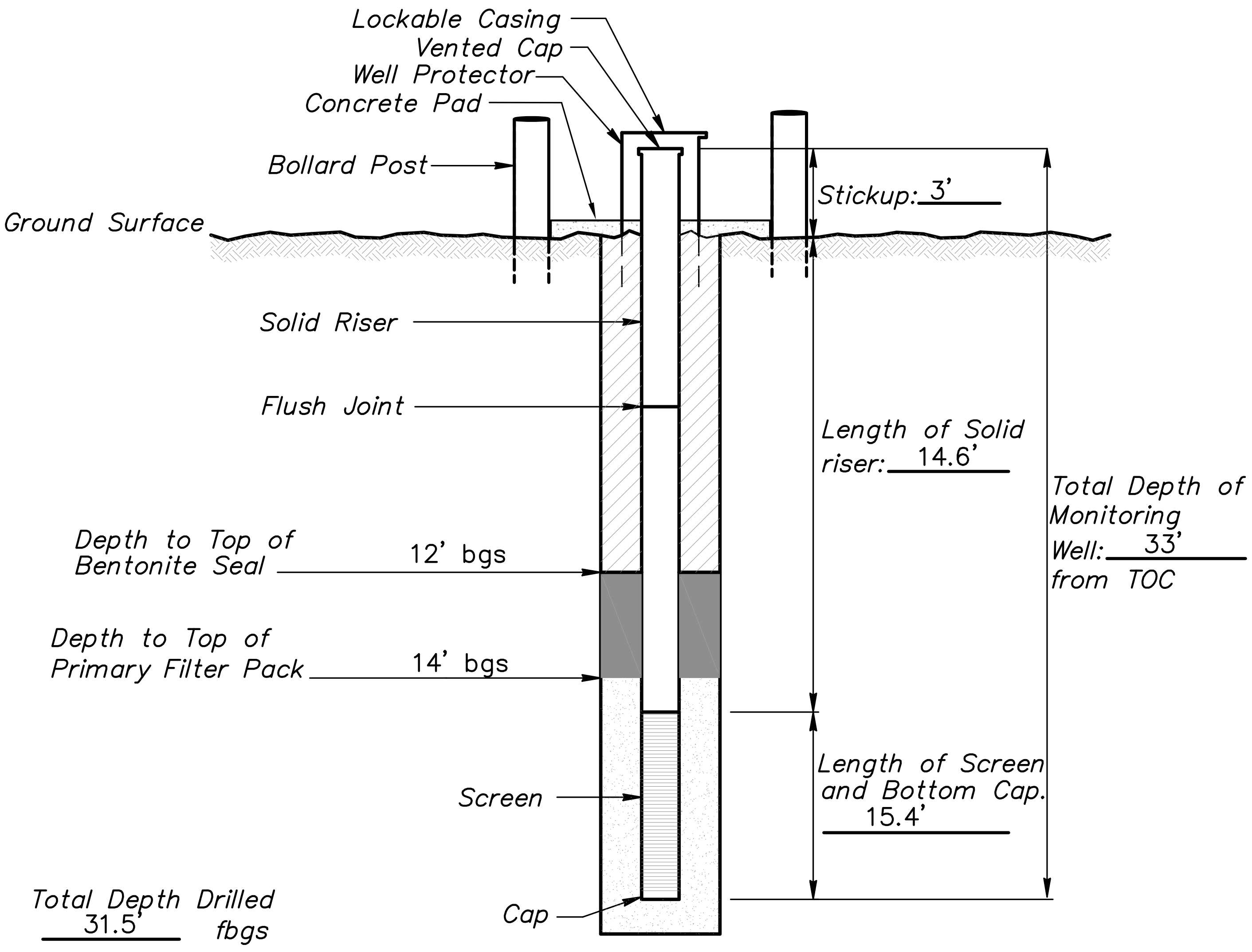
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: AP–53
DRAWING NUMBER: 023 **CHECKED BY:** QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – ASH POND WELLS Well Number AP–54
Job Number 35117108 Installation Date 6/11/2011 Location GENTRY, AR.
Datum Elevation 1,167.71 Surface Elevation 1,164.70
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER, AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



▨ Bentonite Grout

■ Bentonite Plug

░ Granular Backfill

(Not to Scale)

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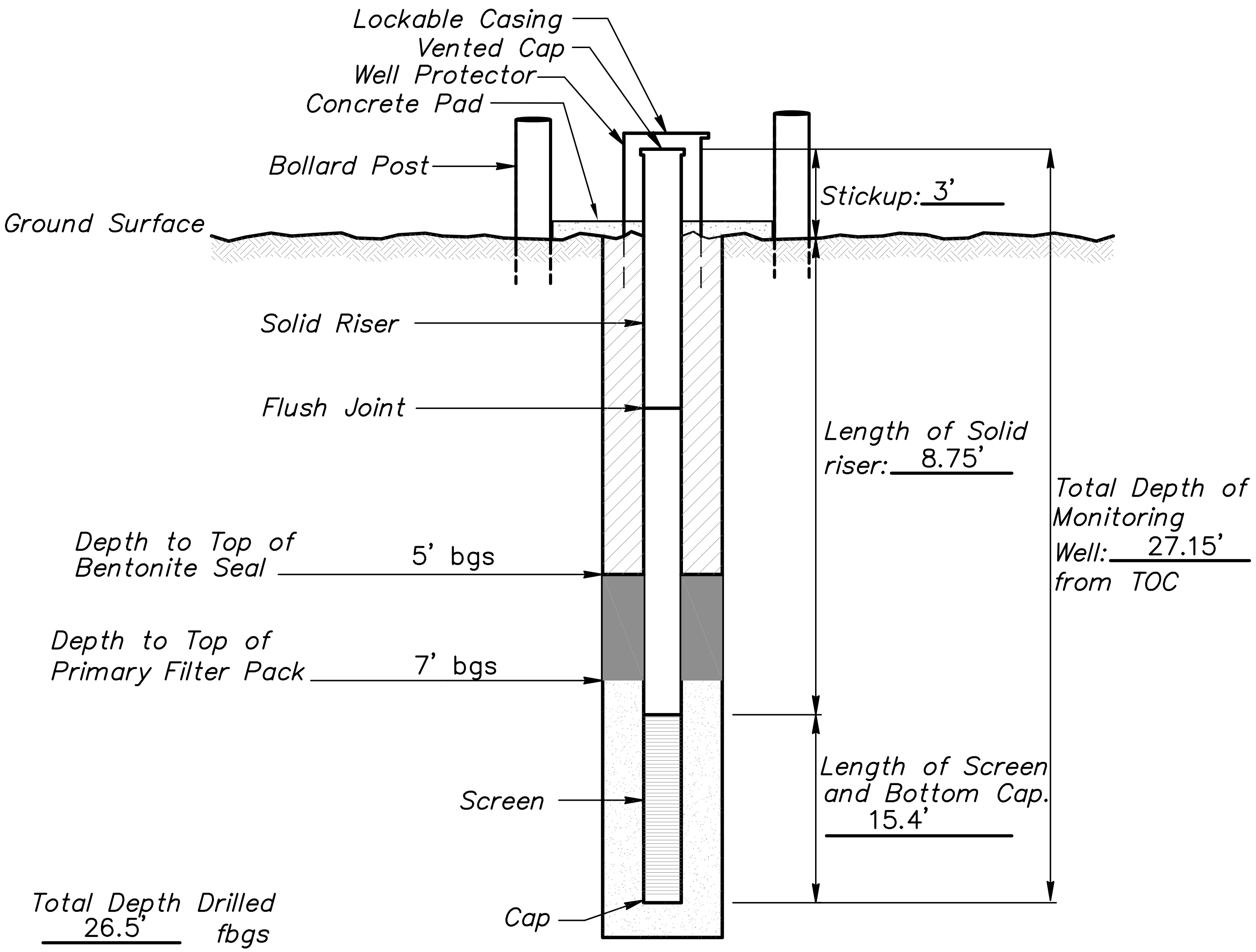
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: AP–54
DRAWING NUMBER: 024 **CHECKED BY:** QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – ASH POND WELLS
Well Number AP–55
Job Number 35117108
Installation Date 6/9/2011
Location GENTRY, AR.
Datum Elevation 1,156.86
Surface Elevation 1,153.80
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010"
Riser Diameter & Material 2" PVC
Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND
Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER
Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 8.75'

Total Depth of Monitoring Well: 27.15' *from TOC*

Depth to Top of Bentonite Seal 5' bgs

Depth to Top of Primary Filter Pack 7' bgs

Length of Screen and Bottom Cap. 15.4'

Total Depth Drilled 26.5' *fbgs*

▨ Bentonite Grout

■ Bentonite Plug

□ Granular Backfill

(Not to Scale)

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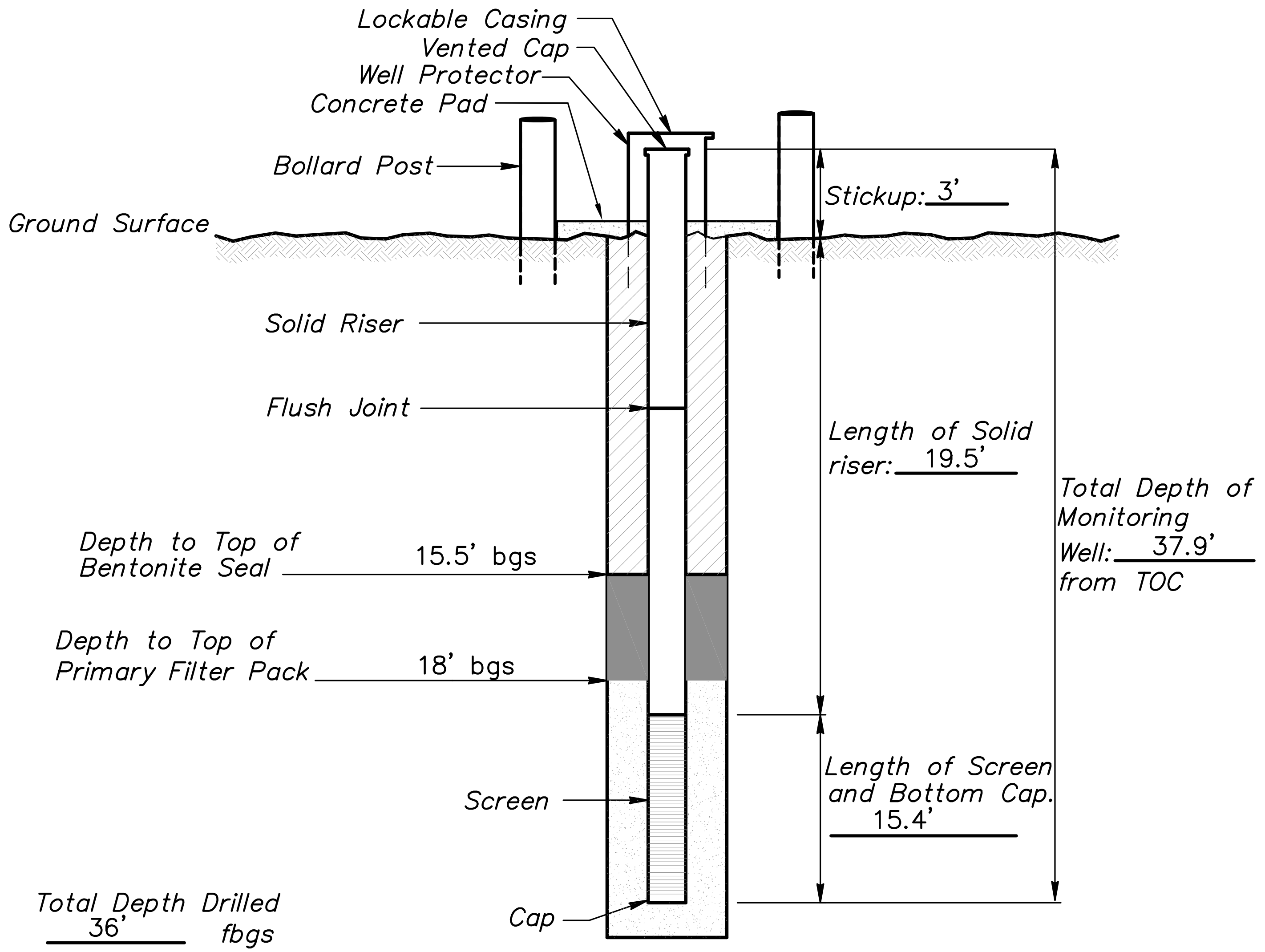
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: AP–55
DRAWING NUMBER: 025
CHECKED BY: QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – ASH POND WELLS Well Number AP–56
Job Number 35117108 Installation Date 6/8/2011 Location GENTRY, AR.
Datum Elevation 1,158.77 Surface Elevation 1,155.60
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



▨ Bentonite Grout

■ Bentonite Plug

░ Granular Backfill

(Not to Scale)

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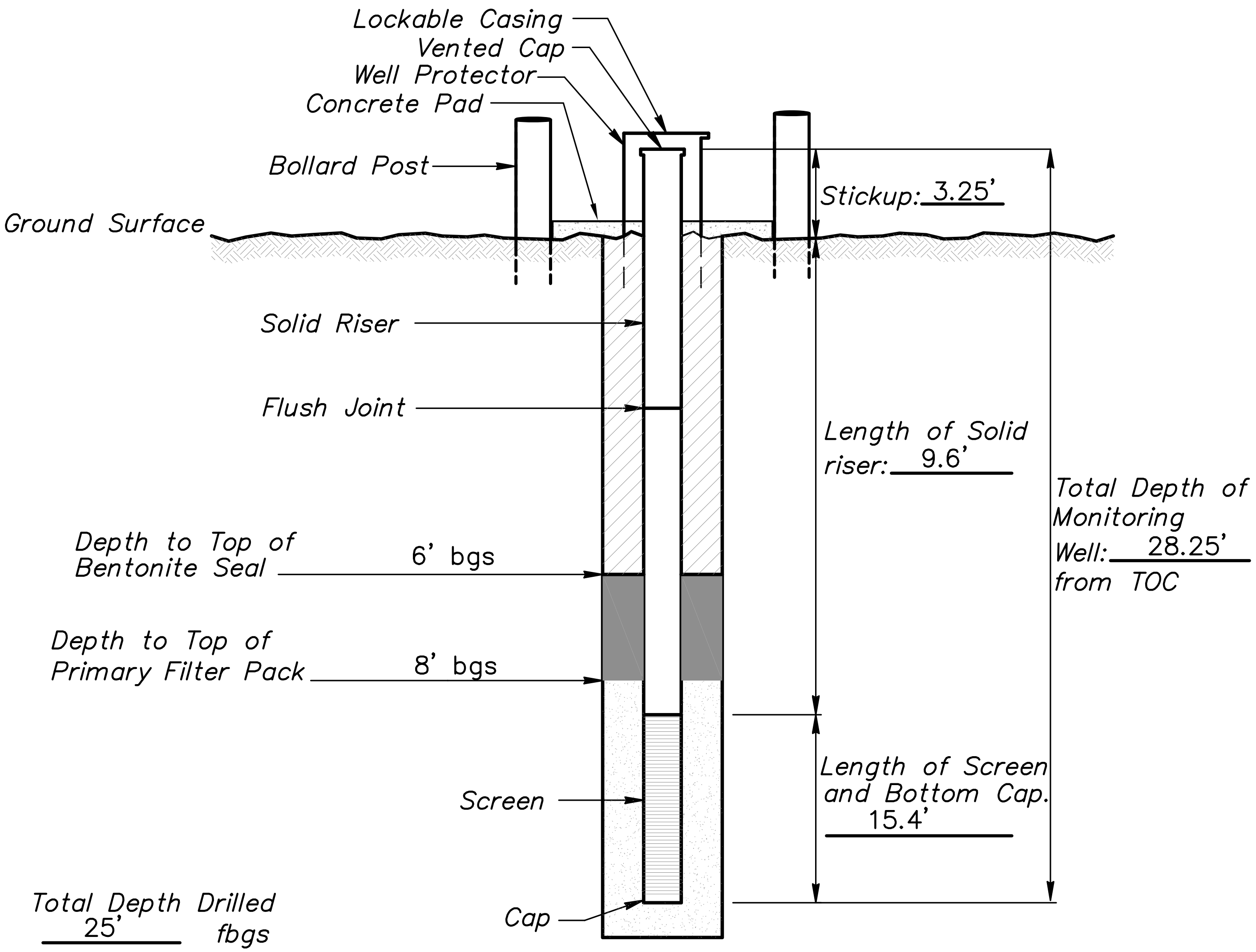
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: AP–56
DRAWING NUMBER: 026 **CHECKED BY:** QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – ASH POND WELLS Well Number AP–57
Job Number 35117108 Installation Date 6/8/2011 Location GENTRY, AR.
Datum Elevation 1,157.31 Surface Elevation 1,154.10
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



Stickup: 3.25'

Length of Solid riser: 9.6'

Total Depth of Monitoring Well: 28.25' from TOC

Depth to Top of Bentonite Seal 6' bgs

Depth to Top of Primary Filter Pack 8' bgs

Length of Screen and Bottom Cap. 15.4'

Total Depth Drilled 25' fbgs

▨ Bentonite Grout

■ Bentonite Plug

░ Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: AP–57
DRAWING NUMBER: 027 **CHECKED BY:** QEB

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number AP–58

Job Number 35157182 Installation Date 2/16/2016 Location AEP–FLINT CREEK –GENTRY, AR.

Datum Elevation NA Surface Elevation NA

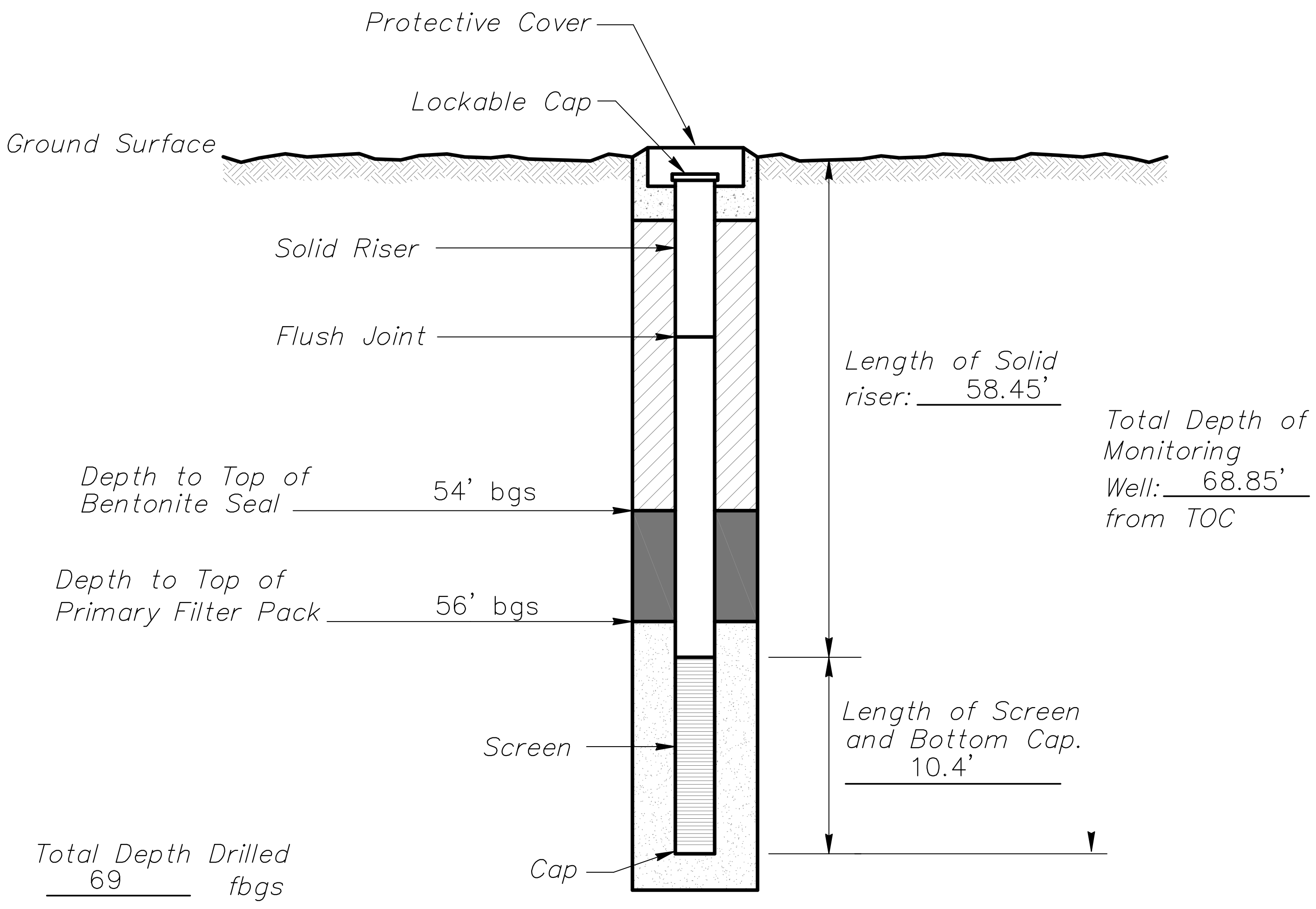
Datum for Water Level Measurement T.O.C.

Screen Diameter & Material 2" PVC Slot Size 0.010

Riser Diameter & Material 2" PVC Borehole Diameter 8"

Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER

Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

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MONITORING WELL INSTALLATION RECORD

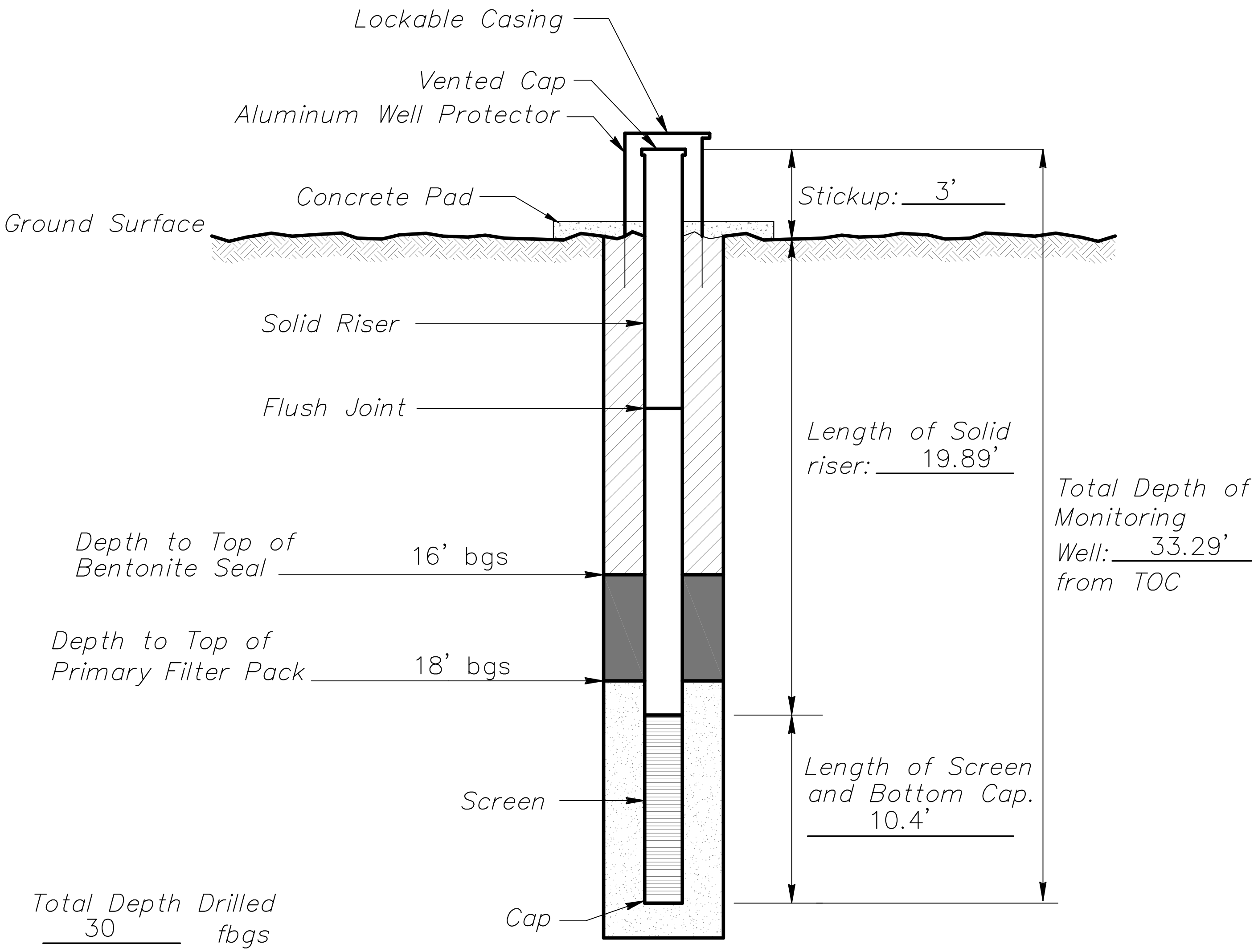
PROJECT NUMBER: 216–001–35157182

WELL NUMBER: AP–58

DRAWING NUMBER: 006 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION
Well Number AP–59
Job Number 35157182
Installation Date 2/4/2016
Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA
Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010
Riser Diameter & Material 2" PVC
Borehole Diameter 8"
Granular Backfill Material 16–30 SAND
Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 19.89'

Total Depth of Monitoring Well: 33.29' *from TOC*

Depth to Top of Bentonite Seal 16' bgs

Depth to Top of Primary Filter Pack 18' bgs

Length of Screen and Bottom Cap. 10.4'

Total Depth Drilled 30 *fbgs*

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

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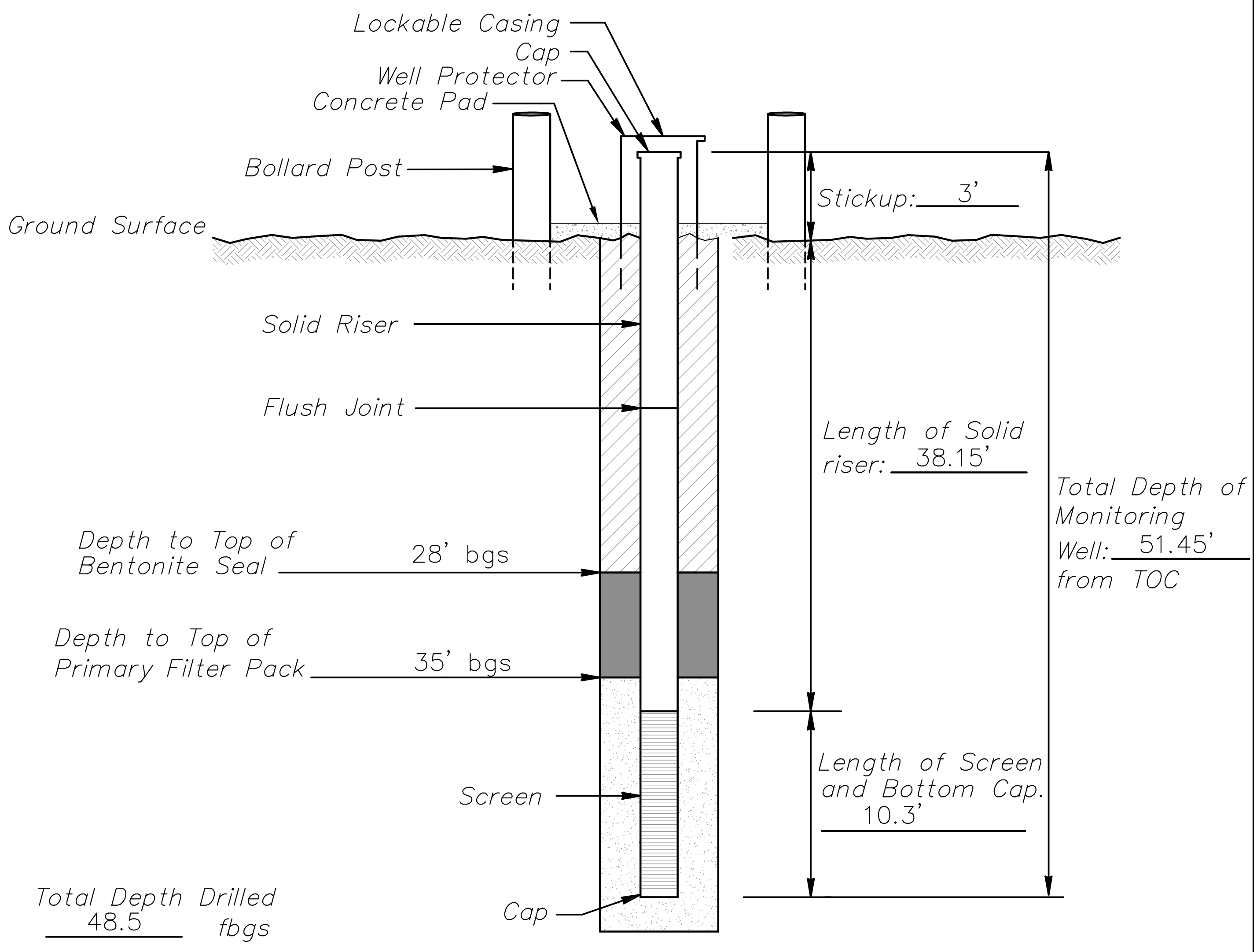
MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216–001–35157182
WELL NUMBER: AP–59
DRAWING NUMBER: 005
CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP – FLINT CREEK WELL INSTALLATION Well Number AP–60
Job Number 35167278 Installation Date 1/9/2017 Location AEP–FLINT CREEK–GENTRY, AR.
Datum Elevation 1156.93 Surface Elevation 1154.01
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER/AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'
Length of Solid riser: 38.15'
Total Depth of Monitoring Well: 51.45' from TOC
Depth to Top of Bentonite Seal 28' bgs
Depth to Top of Primary Filter Pack 35' bgs
Length of Screen and Bottom Cap. 10.3'
Total Depth Drilled 48.5 fbgs

▨ Cement/Bentonite Grout
■ Bentonite Plug
░ Granular Backfill

(Not to Scale)

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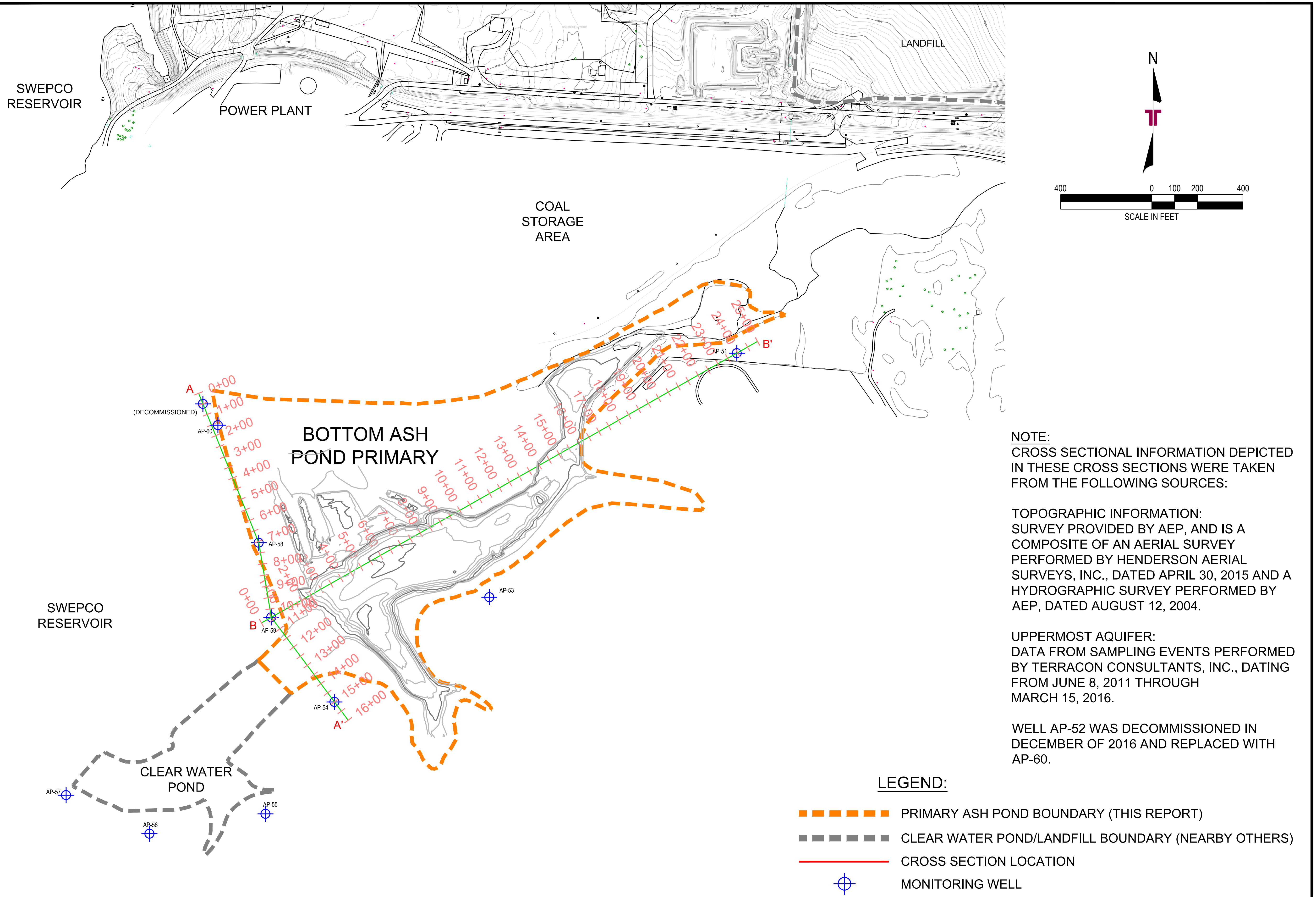
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35167278
WELL NUMBER: AP–60
DRAWING NUMBER: 002 CHECKED BY: JBA

APPENDIX 2

Geologic Cross Sections



NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS A COMPOSITE OF AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015 AND A HYDROGRAPHIC SURVEY PERFORMED BY AEP, DATED AUGUST 12, 2004.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY TERRACON CONSULTANTS, INC., DATING FROM JUNE 8, 2011 THROUGH MARCH 15, 2016.

WELL AP-52 WAS DECOMMISSIONED IN DECEMBER OF 2016 AND REPLACED WITH AP-60.

LEGEND:

▬ ▬ ▬	PRIMARY ASH POND BOUNDARY (THIS REPORT)
▬ ▬ ▬	CLEAR WATER POND/LANDFILL BOUNDARY (NEARBY OTHERS)
▬	CROSS SECTION LOCATION
⊕	MONITORING WELL

SHEET 1

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	1 OF 2

CROSS SECTION LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

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BRYANT, AR 72022
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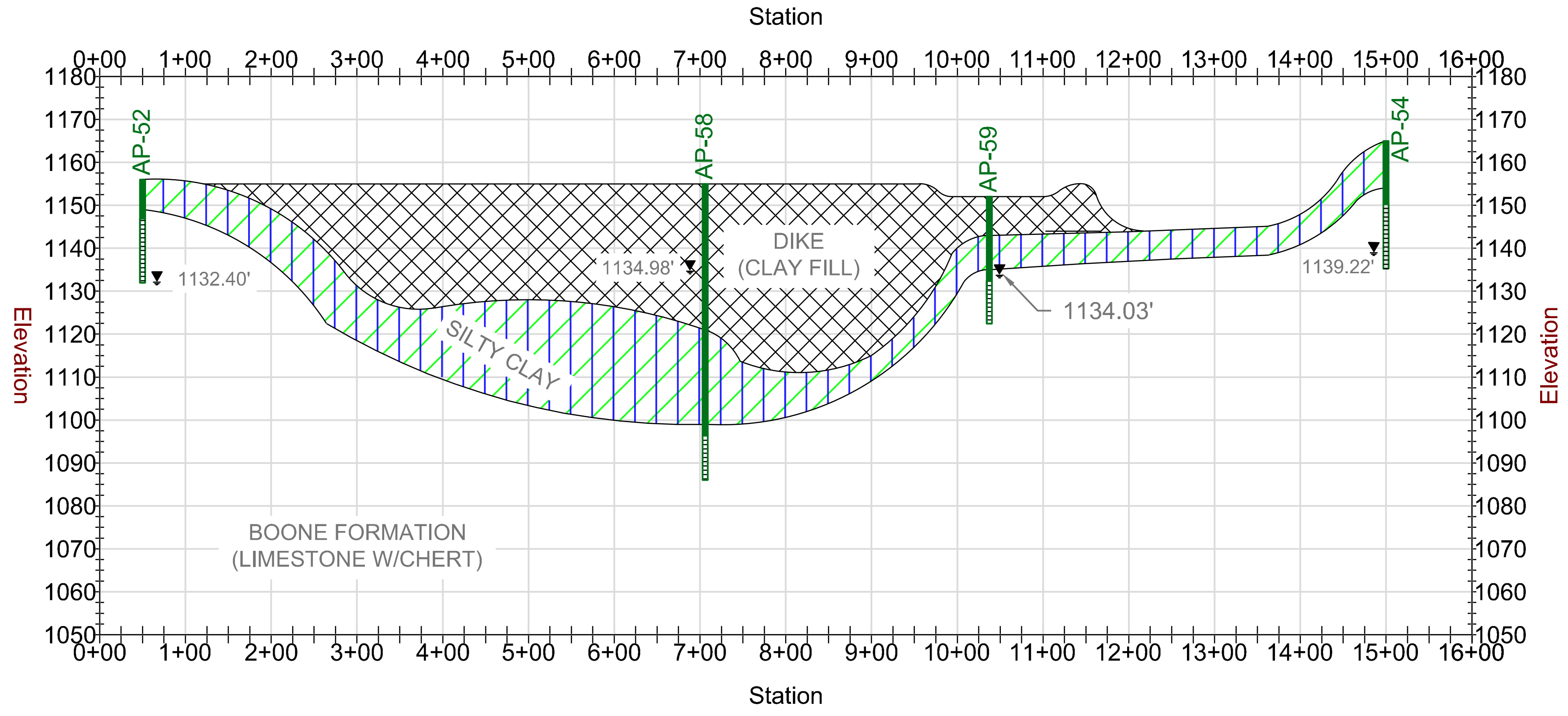
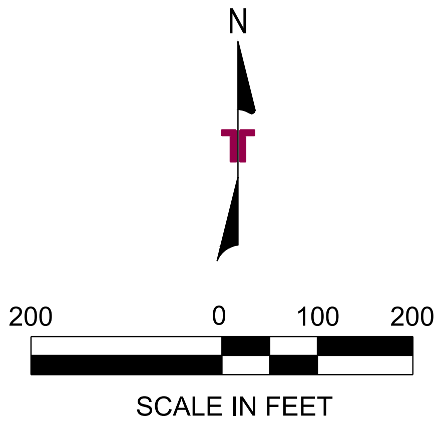
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

ALIGN- A-A'



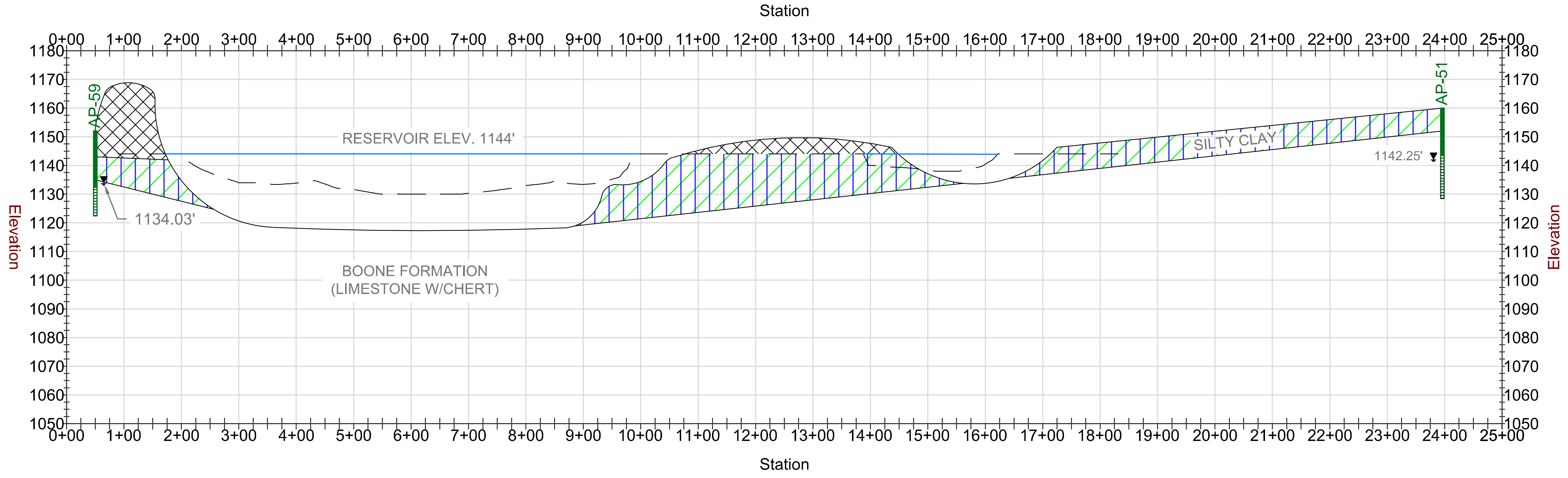


LEGEND:

▨ DIKE
(CLAY FILL)

▨ SILTY
CLAY

ALIGN- B-B'



SHEET 2

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	10-17-2017
JOB NO.	216-001-35157124
ACAD NO.	001
SHEET NO.:	2 OF 2

CROSS SECTION A-A' & B-B'

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT BOTTPONDOM ASH
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

Report 1 - Groundwater Monitoring Network for CCR Compliance

SWEPCO - Flint Creek Class 3N Landfill
Permit No. 0273-S3N-R2
AFIN: 04-00107

August 2016
Project No. 35157124

AEP SOUTHWESTERN ELECTRIC POWER COMPANY
A unit of American Electric Power

Prepared for:
SWEPCO – Flint Creek Power Plant
P.O. Box 21106
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Appendix

1.0 Objective

The purpose of this Groundwater Monitoring Network Report (GWMNR) is to demonstrate adequacy and compliance of the existing monitoring well network with EPA Coal Combustion Residuals (CCR) regulations at the Southwestern Electric Power Company (SWEPCO) – Flint Creek Class 3N Landfill (Permit No. 0273-S3N-R2).

2.0 Background Information

2.1 Facility Location Description

The SWEPCO facility consists of an approximately 40-acre permitted Class 3N Landfill and various support facilities including entrance roads, leachate and contact water storage ponds, bottom ash ponds, vehicle/equipment facilities, groundwater monitoring facilities, and storm water control systems. The site is located in portions of Section 8, Township 18 North, and Range 33 West in Benton County, Arkansas (**FIGURE 1 & 2**).

2.2 Description of CCR Unit

2.2.1 Embankment Configuration

The landfill location is shown on **FIGURE 3**. The underlying limestone was described as light gray, hard with weathered/fractured zones. The facility is currently performing improvements to the landfill. The landfill embankments are being constructed with 3:1 interior slopes. The outside embankment slopes vary from approximately 4:1 to 2:1. A geosynthetic intermediate liner and collection system are currently being installed above existing wastes in the landfill. The remaining portions of the landfill are receiving final cover which includes a flexible membrane liner. After completion of the improvements the entire landfill will be covered with a flexible membrane liner (**SWEPCO, "Ash Landfill Major Modification – Construction Drawings", Flint Creek, Dated April 2011**)[1].

2.2.2 Area/Volume

SWEPCO currently own, operate, and maintain a Class 3N landfill facility located in Gentry, Arkansas. The Class 3N landfill is operated under the authority of the ADEQ Permit No. 0273-S3N-R2 issued on December 20, 2014. The landfill is permitted for approximately 2,854,000 Cubic Yards on 40 Acres of disposal area.

2.2.3 Construction and Operational History

The Flint Creek Power Plant was constructed from 1974 to 1978, and power production and fly ash disposal began in 1978. Ash was first disposed of in the east half on the landfill. The fly ash is removed from the fly ash storage silo and transported to the landfill in trucks. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 12**)[2]

As part of the permitting process, several soil borings were advanced to characterize the soil beneath the landfill. Five of the borings were converted to monitoring wells (B-01B to B-05). Monitoring wells B-01B, B-02, B-04, and B-05 are located at approximately the midpoint on each side of the landfill. Well B-05 is on the southern side and is an up gradient well. Monitoring well B-03, located in the center of the landfill was used during the initial hydrogeological site characterization and subsequently plugged and abandoned in February, 1993. The well's location in the middle of the active fill area necessitated its closure.

An additional monitoring well, B-06, was added in 2001. Well B-06 is located just north of the northwest corner of the landfill.

Three additional wells, B-07A, B-07C, and B-08, were added in May 2007. B-07A and B-07C were added north of the northern edge of the landfill. Monitoring well B-07A is set in competent bedrock at 100 feet below ground surface (bgs). Monitoring well B-07C is set on top of bedrock at 35.5 feet bgs and does not contain a sufficient amount of groundwater for the collection of a sample. Usually there is less than 0.5 feet of water in the well. Monitoring well B-07C was decommissioned and plugged in February 2016 and is not used for the preparation of the potentiometric surface map. Monitoring well B-08 was sited to the west of the southwest corner of the landfill. B-08 was set at 50 feet bgs which is above the bedrock. Monitoring well B-08 was inadvertently damaged on October 20, 2012, by a D-10 bulldozer and therefore plugged in December 2012.

An additional monitoring well, NE-8, was added in June 2011 as part of Nature and Extent Well installations. In November 2015 the well was renamed B-09 and added to the groundwater monitoring network wells.

Two additional wells, B-10 and B-11, were added on the west side of the landfill in November 2015. B-10 was installed adjacent to previously plugged well B-08 to serve as a replacement.

Two additional wells, B-12 and B-13, were added in February 2016. B-12 is located just north of the northeast corner of the landfill and B-13 is at the southeast corner. The 2 wells were added to bring the groundwater monitoring network into compliance with CCR requirements.

Leachate has been collected since April, 2010, using a leachate collection system located inside the landfill berm in the southeast corner of the landfill. The leachate is sampled for laboratory analysis at the same time as the groundwater monitoring wells and its sample identification is SW-1.

2.2.4 Surface Water Control

The drainage channels (perimeter ditches, letdowns, and terrace ditches) and culverts are designed to collect and convey stormwater run-off from the 10-year/24-hour storm event (design storm event), in accordance with the requirements of Reg.22.517(b), Reg.22.518, and Reg.22.527 from the Arkansas Department of Environmental Quality Solid Waste Management Rules.

Surface Water will be controlled by stormwater diversion berms, reinforced letdowns, perimeter ditches (with permanent erosion control matting where necessary), and culverts. The majority of the flow from the Landfill flows to two dedicated sediment ponds (the North Sediment Pond and the West Sediment Pond). The discharge points from the North and West Sediment ponds are shown on **FIGURE 2**. A small portion of run-off from a southeast portion of the Landfill will flow to the Primary Ash Pond (**Major Modification, Appendix N-I, March 2014 – Rev. 2, Page PN-26, ADEQ Doc ID #65699**)[3].

Discharge

SWEPCO is authorized to discharge once-through condenser cooling water through Outfall 401 and combined wastewater through Outfall 101 from ash ponds (bottom ash discharge, low volume wastewater, and stormwater runoff, including coal pile runoff from a facility, treated municipal wastewater from the City of Gentry, and spring water/stormwater) from facility located as follows: approximately 3 miles southwest of Gentry in Benton County, Arkansas to receiving waters named:

Outfall 001: Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.
Outfalls 101 and 401: SWEPCO Reservoir, thence to Little Flint Creek, thence to Flint Creek in Segment 3J of the Arkansas River Basin.

The outfalls are located at the following coordinates (NAD 27):

Outfall 001: Latitude: 36° 14' 0.366"; **Longitude:** 94° 33' 05.944"
Outfall 101: Latitude: 36° 14' 59.38"; **Longitude:** 94°31' 34.90"
Outfall 401: Latitude: 36° 15' 29.17"; **Longitude:** 94°31' 33.80"

Discharge shall be in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

2.3 Previous Investigations

Geotechnical

- Hull & Associates Inc., Permit Modification Application, March 2014, Section 3, Page PN-7
- Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Section 2, pg. 2-1

Groundwater and Other Environmental

- Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Section 4. Page 4-1

2.4 Hydrogeologic Setting

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered.

Perched groundwater is occasionally present within the upper unconsolidated soils; however, this perched zone appears discontinuous across the site. Groundwater can occur in both the unconsolidated soils and within the limestone. (**Terracon Well Installation Report, August 2011, pg. 7**)[4]

In the area of the Flint Creek Power Plant, water wells supply rural domestic households. According to state water well records, water wells are typically drilled through the Boone Formation and Chattanooga Shale into the underlying Ordovician age dolomites, due to the low yield of the upper Boone Formation. In general, the total depth of the water wells is approximately 500 feet below ground surface. The water wells are usually cased to allow water production from both the Boone Formation and the Ordovician dolomites. Yields generally range from 2 to 30 gallons per minute (gpm). Some wells within the area have been completed only within the Boone Formation at a typical depth of approximately 200 feet below ground surface. Yields from these wells generally range from 2 to 10 gpm with some wells yielding up to 100 gpm. (**Burns & McDonnel Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[5]

2.4.1 Climate

The Arkansas River Basin lies in a semi-humid region characterized by long summers, relatively short winters, and a wide range of temperatures. Extremes in air temperatures may vary from winter lows around 0°F, usually caused by Canadian air masses to summer highs above 100°F.

Extreme temperatures may occur for short periods of time at any location within the study area. The growing season averages 244 days per year.

The average pan evaporation is about 54.9 inches for the Arkansas River Basin. Lake evaporation averages about 69 percent of the class A pan evaporation.

Precipitation is well distributed throughout the year with the driest periods occurring during the late summer and early fall. Mean annual precipitation in the study area ranges from less than 40 inches per year to greater than 52 inches per year (**Arkansas State Water Plan, Arkansas River Basin, pg. 3**)[6].

2.4.2 Regional and Local Geologic Setting

The Site is located in northwest Arkansas in the Springfield Plateau of the Ozark Plateau's Province. The Ozark Plateaus Province covers northern Arkansas and consists of sedimentary rock strata which have undergone massive uplift and which remain relatively horizontal with only minor deformation. Stream erosion has removed much of the original surface rock and typically dissected the area into hills and low mountains. Elevations typically range from 1200 to 1400 feet above mean sea level. Extensive relatively flat areas occur in Benton County (**USCS, Soil Survey of Benton County, Arkansas, January 1977**)[7]. The Site is underlain by the Boone Formation which consists primarily of limestone and chert of Lower Mississippian age. In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as a residual soil overburden. The Boone Formation, in this area, consists of a highly weathered cherty limestone with red to brown clay seams. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20**)[5]

Groundwater occurs at various depths and the presence of water appears to be related to a number of factors, including site lithology, rock type and thickness, and number of fractures encountered. (**FIGURES 4 & 5**)

In the vicinity of the study area, the stratigraphy consists of a weathered residuum of the Boone Formation, overlying the cherty limestone of the Boone Formation (Mississippian). The Boone Formation lies conformably atop the St. Joe Member (Mississippian) and together comprise one hydrostatic unit known as the Boone-St. Joe Aquifer. Unconformably underlying the Boone-St. Joe is the Chattanooga Shale (Devonian), which acts as the upper confining layer of the Sylamore, Clifty, and Everton Aquifers.

In-situ weathering has reduced the limestone, leaving chert and limestone gravel mixed with clay as residual soil overburden. The Boone residuum is characterized by red (iron-rich) clay, weathered limestone and chert. The thickness of residuum varies from 30 to 50 feet, and the limestone and chert content also varies in lateral extent. The chert is typically the remnant of weathering after the limestone is removed by dissolution in surface and groundwater.

The Boone Formation is a gray, crinoidal limestone abundantly interbedded with gray, black and blue chert. It is massive, well cemented and has a thickness of approximately 280 feet in northwest Arkansas. It is nearly pure calcium carbonate which is soluble, and therefore underground drainage channels, sinkholes, caves and fissures can occur.

The underlying St. Joe Member is typically a light-gray, mud-supported Crinozoan-Bryozoan crystalline limestone, and is easily recognized by its lack of chert. In Northern Arkansas, the formation exhibits a thickness of between 6 to 84 feet, with an average of thickness of 45 feet.

The underlying Chattanooga Shale is a black, fissile and carbonaceous rock with abundant pyrite. It thickens (up to 70 feet) westward and acts as a barrier to vertical groundwater flow (**Nature and Extent Groundwater Monitoring Well Installation Report, Terracon. August 2011**)[8].

2.4.3 Surface Water/Groundwater Interactions

Based on water level elevations, groundwater flow across the Landfill is to the west. Currently there is not enough data to determine if there is surface water to groundwater communication near the Landfill.

2.4.4 Water Users

A spring and well survey was conducted on November 11, 1991. The area within one-quarter mile of the Site was searched for springs, flowing streams, lakes, ponds, and water wells. **FIGURE 7** includes the results of the survey. A more recent search of an Arkansas USGS water well database provided additional wells.

The closest water well was located approximately 1457 feet from the landfill boundary. No springs were located during the spring and well survey. When questioned, plant personnel knew of no springs within the survey area. All streams within the survey area are intermittent and were dry at the time of the survey.

Three large ponds are present within the survey area. The pond located in the SW 1/4 of the NW1/4 of Section 9 contains little water and is used for farming purposes. The plant's bottom ash storage pond is located in the SW1/4 of the NE1/4 of Section 9. The third pond is in the northern portion of the SE1/4 of the SE1/4 of Section 5. Two smaller ponds are also present in the SW1/4 of the SER of Section 5, and in the NW1/4 of the NE1/4 of Section 8. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21**)[9]

3.0 Certified Groundwater Monitoring Network

3.1 Hydrostratigraphic Units

3.1.1 Horizontal and Vertical Position Relative to CCR Unit

Flint Creek is monitored by up-gradient wells B-4, B-12 and B-13 side-gradient wells B-1B, B-7C, and B-5, and down-gradient wells B-2, B-6, B-9, B-10, and B-11. The wells monitor the upper part of the Boone Formation. Horizontal monitoring well locations relative to the CCR Unit are provided in **FIGURE 3**. Vertical positioning of monitoring wells is shown in **TABLE 2 – WELL CONSTRUCTION DETAILS**.

3.1.2 Overall Flow Conditions

Based on water level elevations from the March 2016 Sampling Event, groundwater flow is to the west across the landfill (**FIGURE 6**).

3.2 Uppermost Useable Aquifer

3.2.1 CCR Rule Definition

"Aquifer" means a geologic formation, group of formations or portion of a formation capable of yielding usable quantities of groundwater to wells or springs.

"Uppermost Aquifer" means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season.

Common Definition

"Aquifer" is a geologic formation(s) that is water bearing. A geological formation or structure that stores and/or transmits water, such as to wells and springs. Use of the term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply for people's uses. (USGS, Water Science Glossary of Terms)

3.2.2 Identified Onsite Hydrostratigraphic Unit

<u>3.2.2.1 Relative Position to CCR Unit</u>

Based on water level elevations from the March 2016 Sampling Event, groundwater flow is to the west across the landfill (**FIGURE 6**). The groundwater monitoring network consist of up gradient wells, B-4, B-12 and B-13 side gradient wells B1-B, B5, B7-A, and down gradient wells B2, B6, B-9, B10, and B11.

3.2.3.2 Water Quality

Rural domestic household water wells installed in the upper Boone-St. Joe Formation typically do not yield large quantities of water. Wells within the area completed only within the Boone Formation are installed at a typical depth of approximately 200 feet below ground surface. Yields from these wells generally range from 2 to 10 gpm with some wells yielding up to 100 gpm. The underlying Roubidoux Formation and Gunter Sandstone are the most regionally significant water bearing units in this area, and the units are typically encountered at depths of greater than 1,200 feet below land surface.

Wells in the Roubidoux Formation yield an average of less than 150 gal/min, but can yield up to 450 gal/min. Well yields from the Gunter average more than 200 gal/min, with local yields up to 500 gal/min. The depth to water in the Gunter Sandstone ranges from approximately 27 to 465 feet below land surface in the study area, and the depth to water in the Roubidoux Formation ranges from approximately 90 to 200 feet below land surface. Year-to-year water-level fluctuations are due primarily to temporal variations in pumpage and do not represent long-term trends.

Analyses of samples from wells tapping subsurface rock units show that water in these units is a moderately hard to very hard, calcium and magnesium carbonate water. The quality of water from these units is well within the established drinking water standards with the exception of high iron and nitrate concentrations in a few isolated Benton County wells. The subsurface rock units will yield fresh water in Benton and Washington Counties, but the water becomes mineralized and is unusable to the south (**Arkansas State Water Plan, Arkansas River Basin, pg. 121**)[10]

3.2.3.3 Users/Receptors

A spring and well survey was conducted on November 11, 1991. The area within one-quarter mile of the Site was searched for springs, flowing streams, lakes, ponds, and water wells. **FIGURE 7** includes the results of the survey. A more recent search of an Arkansas USGS water well database provided additional wells.

The closest water well was located approximately 1457 feet from the landfill boundary. No springs were located during the spring and well survey. When questioned, plant personnel knew of no springs within the survey area. All streams within the survey area are intermittent and were dry at the time of the survey.

Three large ponds are present within the survey area. The pond located in the SW 1/4 of the NW1/4 of Section 9 contains little water and is used for farming purposes. The plant's bottom ash storage pond is located in the SW1/4 of the NE1/4 of Section 9. The third pond is in the northern portion of the SE1/4 of the SE1/4 of Section 5. Two smaller ponds are also present in the SW1/4 of the SER of Section 5, and in the NW1/4 of the NE1/4 of Section 8. (**Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21**)[9]

3.3 Review of Existing Monitoring Network

3.3.1 Overview

The current groundwater monitoring system at the Flint Creek Class 3N Landfill consists of 11 groundwater monitoring wells (B-1B, B-2, B-4, B-5, B-6, B-7A, B-9, B-10, B-11, B-12 and B-13). The groundwater monitoring network was evaluated to determine compliance with the new CCR requirements. In February 2016 AEP installed up gradient monitoring wells B-12 and B-13 to comply with the new CCR requirements. The groundwater monitoring network complies with the CCR requirments.

3.3.1.1 Well Construction Summary Table

Please refer to **TABLE 2** for construction details of the groundwater monitoring wells.

3.3.1.2 Depth Ranges and Hydrostratigraphic units monitored

Please refer to **TABLE 1** for groundwater elevation data taken from the groundwater monitoring system.

3.3.1.3 Position in Terms of Flow Directions and Distance from Waste Boundary

Based on water level elevations, groundwater flow is to the west across the landfill (March 2016 Sampling Event). (**FIGURE 6**) The groundwater monitoring network consist of up gradient wells, B-4, B-12 and B-13 side gradient wells B1-B, B5, B7-A, and down gradient wells B2, B6, B-9, B10, and B11.

3.3.1.4 Uppermost Useable Aquifer

The groundwater monitoring network at the Flint Creek Class 3N Landfill is installed to monitor the uppermost aquifer at the facility. The uppermost usable aquifer at the site is the Mississippian age Boone Formation. Groundwater flow is to the west and north.

3.3.1.5 Insufficient Definition of Background Water Quality

Background water quality data will need to be reestablished according to the new requirements set by 40 CFR 257 using Appendix III and IV Constituents for groundwater monitoring at CCR units. Background concentrations need to be established by October 17, 2017 in accordance with §257.90.

Appendix III to Part 257—Constituents for Detection Monitoring

Common Name[1]
Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common Name[1]
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226 and 228 combined

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

3.3.1.6 Key Downgradient Directions

Groundwater flow at the facility is to the west and is currently monitored by 5 groundwater monitoring wells located down-gradient of the landfill: B-2, B-6, B-9, B-10, and B-11. (**See FIGURE 6**).

3.3.1.7 Key Users/Receptors Not Protected

Key users/receptors are protected with the recently installed monitoring wells that reduce the spacing between the down-gradient wells.

4.0 Certification

The monitoring wells currently installed are adequate to monitor the uppermost aquifer as required by §257.91.

4.1 Limitations

The findings and conclusions resulting from this investigation are based upon information derived from the on-site activities and other services performed under the scope of work as described in this report; such information is subject to change over time if additional information is obtained. Please note that Terracon does not warrant the work of laboratories, regulatory agencies or other third parties supplying information used in the preparation of the report.

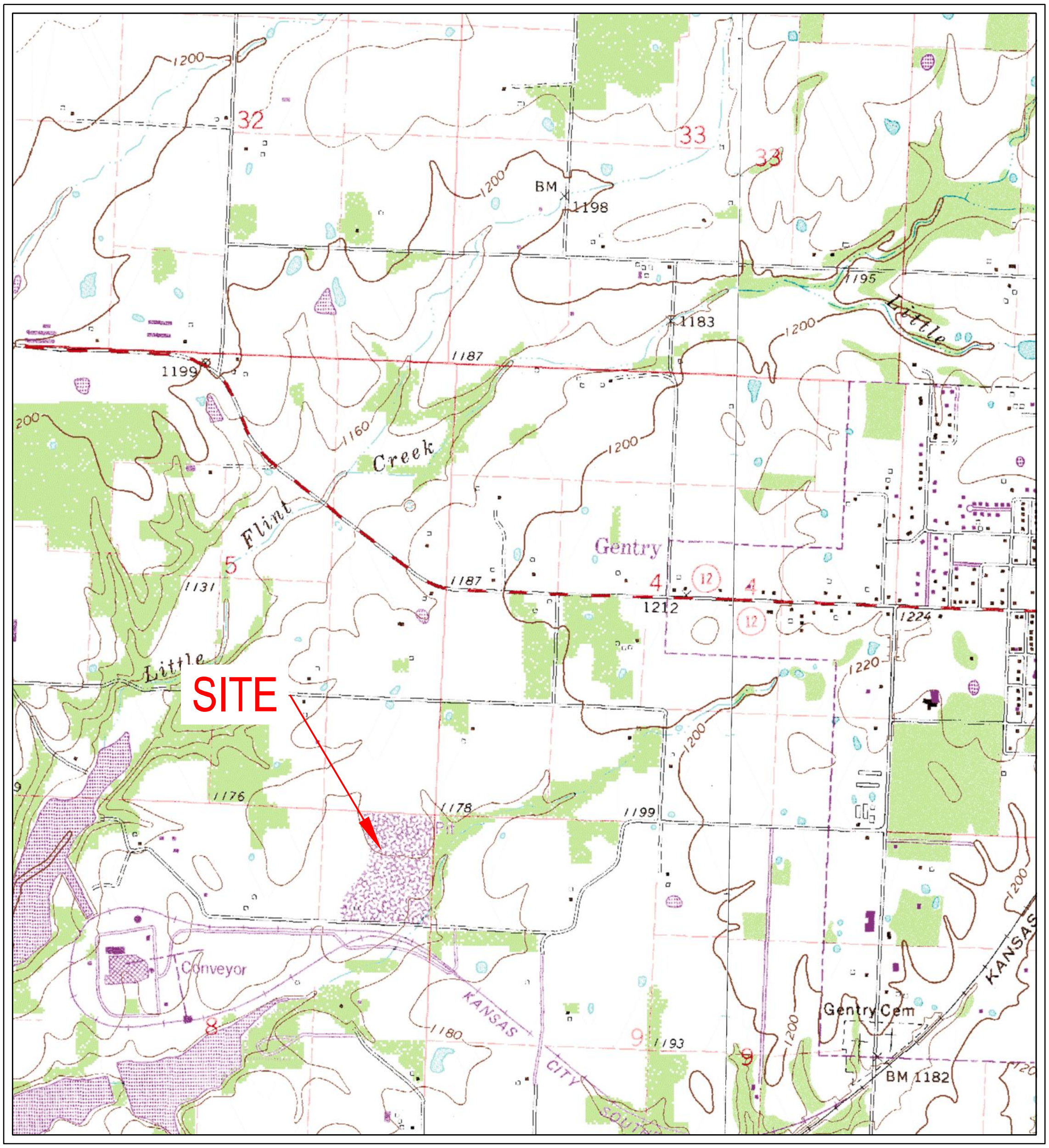
4.2 PE Certification

Name:	Date: 8/5/16	STATE OF ARKANSAS REGISTERED PROFESSIONAL ENGINEER No. 9199 DAVID C. McCORMICK Stamp
Company: Terracon COA #223	Expiration Date: 12/31/17	

Bibliography

1 SWEPCO, “Ash Landfill Major Modification – Construction Drawings”, Flint Creek, Dated April 2011
2 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 12
3 Major Modification, Appendix N-I, March 2014, page PN-26, ADEQ Doc ID# 65699
4 Terracon Well Installation Report, August 2011, pg.7
5 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 20
6 Arkansas State Water Plan, Arkansas River Basin, pg. 3
7 USCS, Soil Survey of Benton County, Arkansas, January 1977
8 Nature and Extent Groundwater Monitoring Well Installation Report, Terracon, August 2011
9 Burns & McDonnell Engineers-Architects-Consultants, Hydrogeologic Site Characterization, February 1992, Page 21
10 Arkansas State Water Plan, Arkansas River Basin, pg. 121

UNITED STATES — DEPARTMENT OF THE INTERIOR — GEOLOGICAL SURVEY



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MILES

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CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

CHEROKEE CITY
QUADRANGLE
1982
7.5 MINUTE SERIES (TOPOGRAPHIC)

N

Project Mngr:	DCM
Drawn By:	JDW
Checked By:	DCM
Approved By:	DCM
Project No.	216-001-35157124
Scale:	AS SHOWN
File No.	LF/001
Date:	10-15-15

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SITE LOCATION MAP
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT LANDFILL
GENTRY ARKANSAS

FIG. No.
1

FIGURE 2

DESIGNED BY: JDW
DRAWN BY: JDW
APPVD. BY: DCM
SCALE: SEE BARSCALE
DATE: 4-14-2016
JOB NO. 216-001-35157124
ACAD NO. LF/002
SHEET NO.: 2 OF 7

PLANT AND CCR UNIT LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

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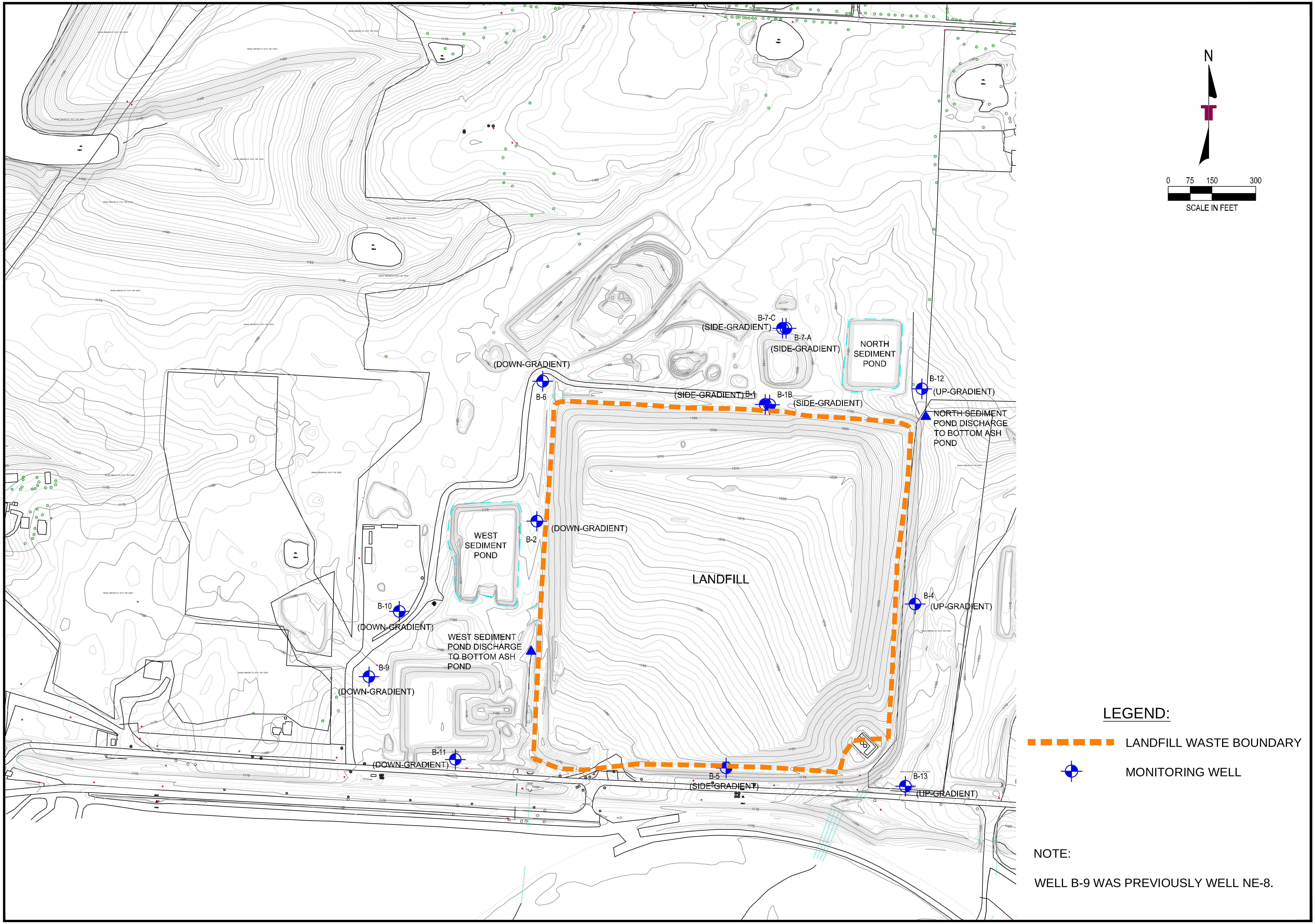
REV.	DATE	BY	DESCRIPTION



LEGEND:

▬ ▬ ▬	LANDFILL WASTE BOUNDARY
⊕	MONITORING WELL

NOTE:

WELL B-9 WAS PREVIOUSLY WELL NE-8.

REV.	DATE	BY	DESCRIPTION

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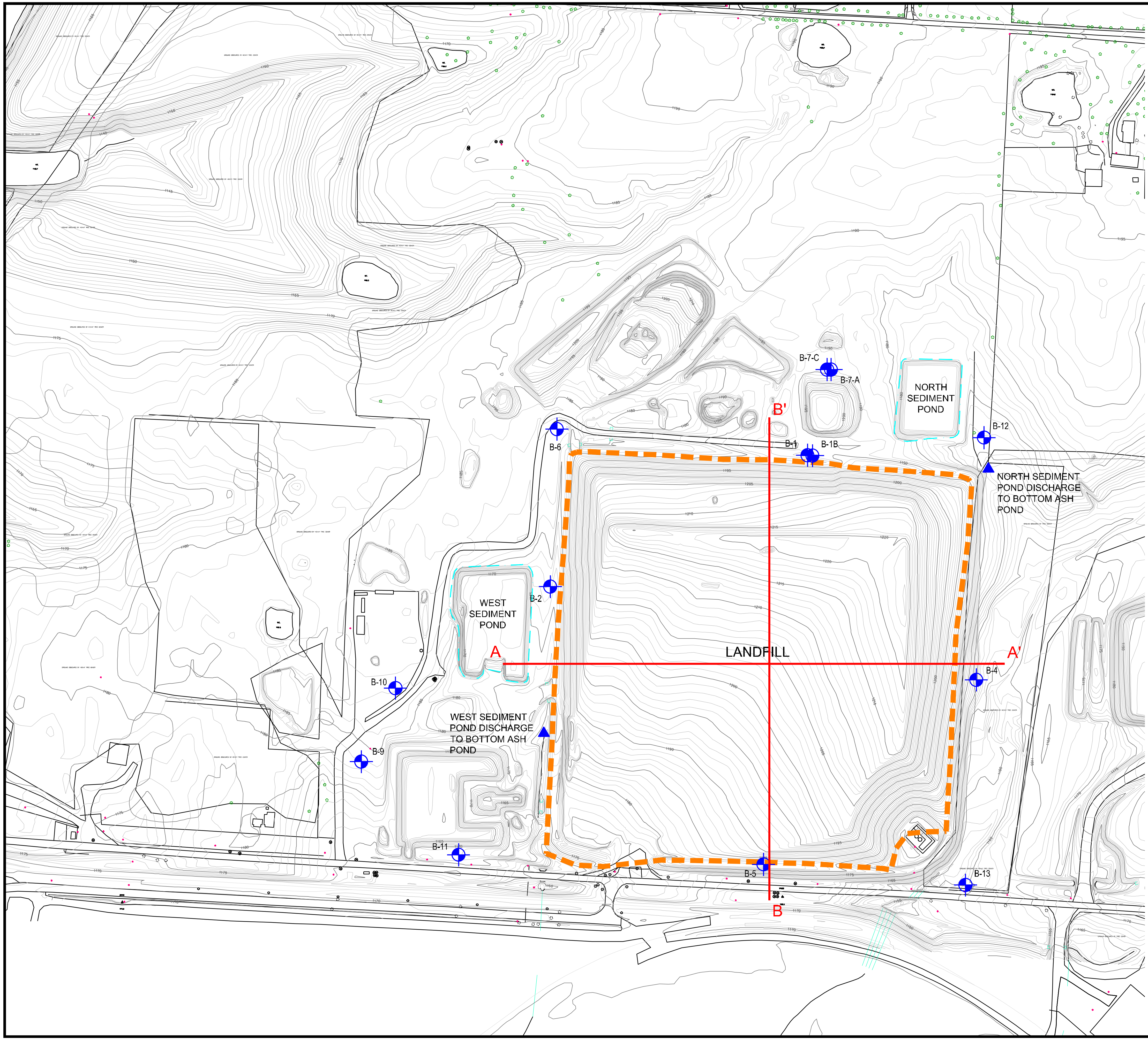
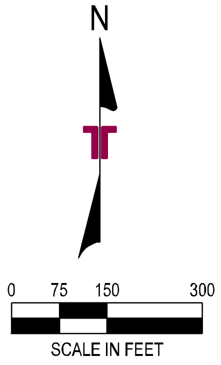
CCR UNIT AND WELL LOCATIONS

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEK POWER PLANT LANDFILL
GENTRY ARKANSAS

FIGURE 3

DESIGNED BY:	JDW
DRAWN BY:	JDW
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	216-001-35157124
ACAD NO.	LF/003
SHEET NO.:	3 OF 7





NOTE:

CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015.

BOTTOM GRADING INFORMATION:
B-1B - B-5 WELL INSTALLATION LOGS PERFORMED BY BURNS & McDONNELL, DATING NOVEMBER 25, 1991 THROUGH MARCH 1, 1993.
B-6 WELL INSTALLATION LOG PERFORMED BY ANDERSON ENGINEERING, DATED OCTOBER 8, 2001.
B-7A & B-8 WELL INSTALLATION LOG PERFORMED BY TERRACON CONSULTANTS, INC., DATING MAY 16, 2007 & MAY 17, 2007.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY AMERICAN ELECTRIC POWER, DATING FROM NOVEMBER 1, 1994 THROUGH MARCH 15, 2016.

LEGEND:

- ▬ ▬ ▬ LANDFILL WASTE BOUNDARY
- ━━━ CROSS SECTION LOCATION
- ⊕ MONITORING WELL

CROSS SECTION LOCATION MAP

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

FIGURE 4

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	216-001-35157124
ACAD NO.	LF/004
SHEET NO.:	4 OF 7

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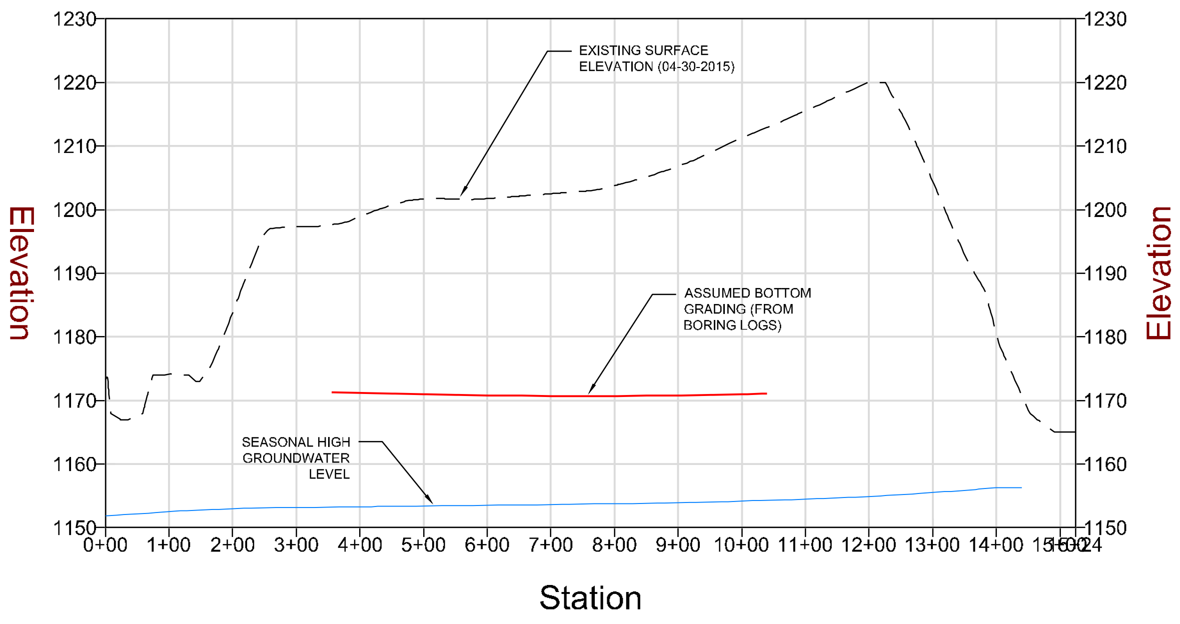
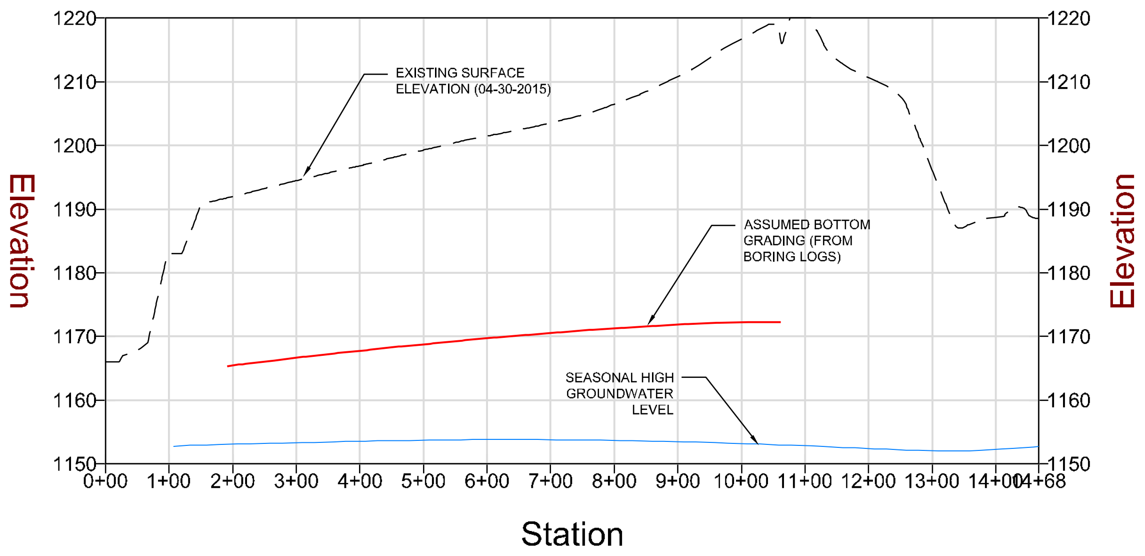
REV.	DATE	BY	DESCRIPTION

SECTION A-A'



SECTION B-B'



NOTE:
CROSS SECTIONAL INFORMATION DEPICTED IN THESE CROSS SECTIONS WERE TAKEN FROM THE FOLLOWING SOURCES:

TOPOGRAPHIC INFORMATION:
SURVEY PROVIDED BY AEP, AND IS AN AERIAL SURVEY PERFORMED BY HENDERSON AERIAL SURVEYS, INC., DATED APRIL 30, 2015.

BOTTOM GRADING INFORMATION:
B-1B - B-5 WELL INSTALLATION LOGS PERFORMED BY BURNS & McDONNELL, DATING NOVEMBER 25, 1991 THROUGH MARCH 1, 1993.
B-6 WELL INSTALLATION LOG PERFORMED BY ANDERSON ENGINEERING, DATED OCTOBER 8, 2001.
B-7A & B-8 WELL INSTALLATION LOG PERFORMED BY TERRACON CONSULTANTS, INC., DATING MAY 16, 2007 & MAY 17, 2007.

UPPERMOST AQUIFER:
DATA FROM SAMPLING EVENTS PERFORMED BY AMERICAN ELECTRIC POWER, DATING FROM NOVEMBER 1, 1994 THROUGH MARCH 15, 2016.

FIGURE 5

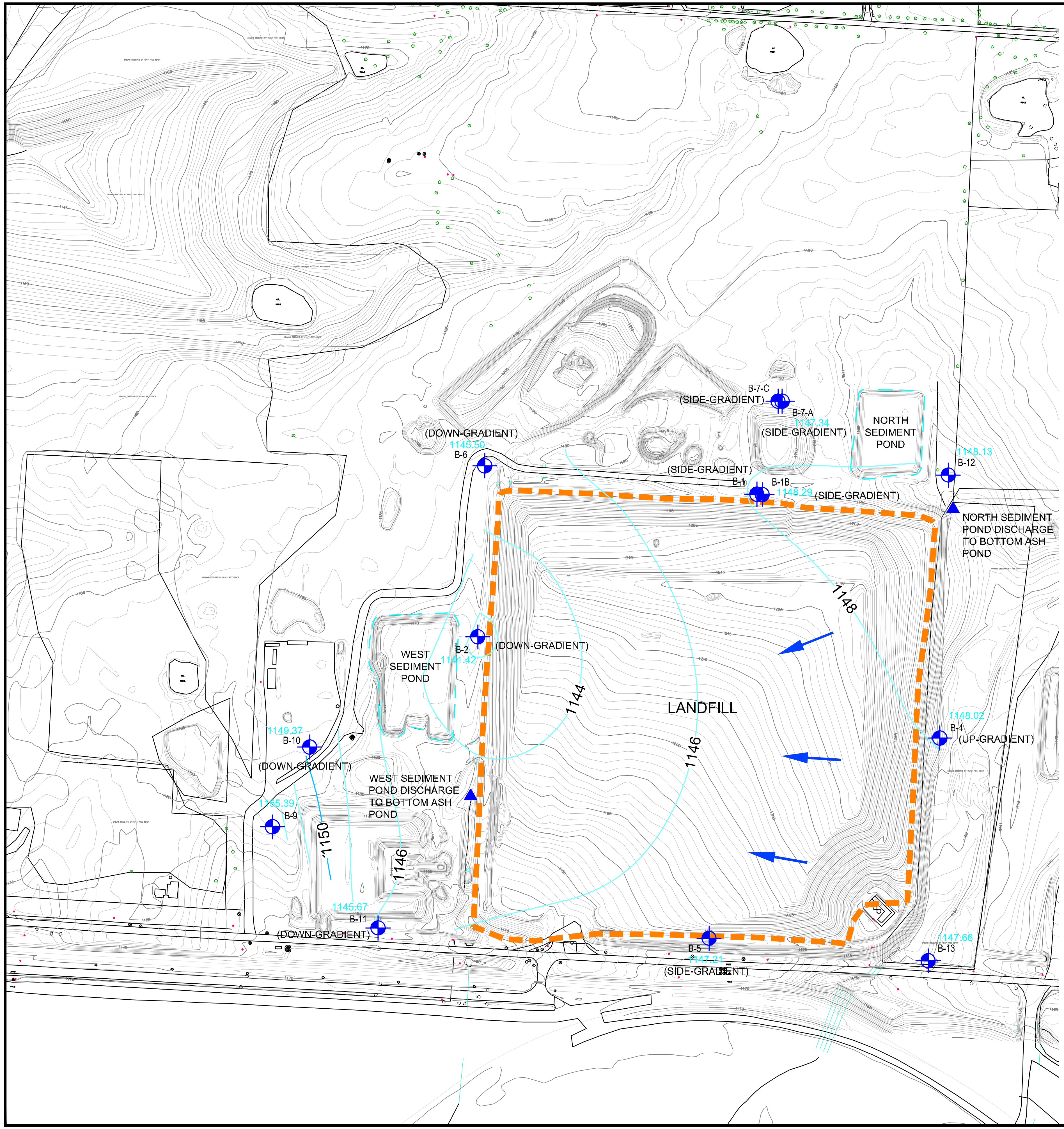
DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	4-14-2016
JOB NO.	216-001-35157124
ACAD NO.	LF/005
SHEET NO.:	5 OF 7

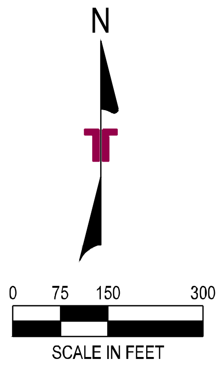
CROSS SECTIONS

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION





LEGEND:

▬ ▬ ▬	LANDFILL WASTE BOUNDARY
───	GROUNDWATER CONTOUR (IDX.)
───	GROUNDWATER CONTOUR (INT.)
←	GROUNDWATER FLOW DIRECTION
1147.66	GROUNDWATER LEVEL
⊕	MONITORING WELL

NOTE:

1. GROUNDWATER ELEVATIONS TAKEN FROM SAMPLING EVENT ON MARCH 15, 2016.

REV.	DATE	BY	DESCRIPTION

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

POTENTIOMETRIC SURFACE MAP - UPPERMOST AQUIFER
GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

FIGURE 6

DESIGNED BY:	TLB
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	04/14/2016
JOB NO.	216-001-35157124
ACAD NO.	LF/006
SHEET NO.:	6 OF 7

FIGURE 7

DESIGNED BY: JDW
DRAWN BY: JDW
APPVD. BY: DCM
SCALE: SEE BARSCALE
DATE: 4-14-2016
JOB NO. 216-001-35157124
ACAD NO. LF/008
SHEET NO.: 7 OF 7

NEAREST DOMESTIC WELL LOCATION

GROUNDWATER MONITORING NETWORK EVALUATION
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

TABLE 1 - Landfill Wells
AEP – Flint Creek
Class 3N Landfill
Groundwater Elevations (FMSL)

Well	B-1B	B-2	B-4	B-5	B-6	B-7A	B-8	B-9	B-10	B-11	B-12	B-13
Date												
11/1/1994	1136.36	1135.22	1136.70	1137.53								
4/27/1995	1144.40	1147.24	1148.62	1147.29								
11/3/1995	1138.12	1137.71	1137.11	1138.79								
5/7/1996	1137.94	1137.77	1138.21	1138.96								
11/7/1996	1135.72	1142.14	1147.28	1141.58								
5/1/1997	1145.86	1144.76	1145.45	1146.15								
12/9/1997	1140.96	1142.40	1144.41	1142.58								
5/28/1998												
11/18/1998	1141.95	1142.93	1143.55	1144.45								
5/12/1999	1147.91	1149.13	1150.53	1150.36								
11/10/1999	1138.18	1138.39	1138.70	1139.39								
5/10/2000	1138.54	1139.74	1142.03	1139.98								
11/21/2000	1141.76	1142.67	1143.30	1144.04								
5/16/2001	1142.22	1141.77	1142.18	1142.90								
11/14/2001	1138.94	1138.90	1139.18	1140.36	1137.73							
5/22/2002	1145.47	1146.60	1147.79	1147.34	1145.38							
11/19/2002	1139.02	1140.34	1140.60	1140.41	1139.34							
5/20/2003	1141.98	1144.86	1147.27	1143.72	1144.09							
11/19/2003	1137.35	1138.21	1139.16	1138.84	1137.47							
5/11/2004	1151.26	1152.99	1154.03	1152.90	1151.85							
11/16/2004	1142.87	1143.88	1144.25	1144.84	1142.72							
5/25/2005	1142.22	1142.28	1143.00	1143.02	1141.16							
8/17/2005	1140.84	1141.69	1142.28	1142.19	1140.71							
11/30/2005	1139.00	1139.52	1139.68	1140.17	1134.49							
2/15/2006	1137.43	1137.87	1138.02	1138.58	1136.87							
5/17/2006	1141.19	1142.77	1143.23	1143.27	1141.55							
8/24/2006	1139.80	1141.15	1141.71	1141.19	1140.24							
12/7/2006	1141.49	1143.74	1144.50	1143.70	1142.62							
2/20/2007	1147.28	1148.15	1149.01	1149.09	1146.98							
5/23/2007	1143.35	1144.34	1144.76	1145.15	1143.15	1143.24	1144.28					
8/22/2007	1141.04	1141.88	1142.08	1142.40	1140.82	1141.32	1141.93					
1/23/2008				1147.28								
5/14/2008	1150.64	1150.15	1150.61	1151.00	1148.90	1151.29	1149.62					
10/8/2008	1148.33	1148.48	1148.94	1149.35	1147.28	1148.51	1148.19					
1/7/2009		1144.64										
4/14/2009	1148.31	1150.36	1152.18	1150.22	1149.59	1148.18	1149.85					
7/29/2009	1145.69	1145.77	1146.07	1146.63	1144.66	1146.21						
8/21/2009												
10/28/2009	1149.07	1152.29	1154.20	1152.35	1151.21	1148.65	1151.74					
1/27/2010	1144.64	1145.90	1146.69	1145.75	1144.93	1145.10	1145.68					
5/18/2010	1146.76	1147.76	1149.38	1148.24	1146.93	1147.24	1147.45					
8/25/2010	1144.18	1144.80	1145.00	1144.91	1143.74	1144.60	1144.80					
11/30/2010	1141.62	1142.27	1142.57	1143.04	1141.33	1142.21	1142.30					
2/24/2011	1142.81	1144.86	1145.00	1145.12	1143.81	1153.48	1144.98					
5/25/2011	1149.84	1154.68	1156.89	1152.07	1154.14	1150.77	1151.07					
7/20/2011	1145.83	1145.85	1146.10	1146.59	1144.78	1146.46	1145.91	1152.77				
10/26/2011	1144.35	1145.40	1145.49	1146.03	1144.23	1144.54	1145.59	1153.02				
1/24/2012	1145.75	1146.02	1146.30	1146.72	1144.90	1146.07	1146.03	1158.63				
4/25/2012	1146.88	1146.67	1147.08	1147.66	1145.47	1147.56	1146.71	1153.85				
7/31/2012	1143.69	1144.37	1144.49	1144.79	1143.36	1144.11	1144.44	1151.94				
10/24/2012	1142.76	1143.57	1143.67	1144.12	1142.58	1143.19	plugged	1151.94				
1/29/2013	1141	1141.52	1141.58	1142.16	1140.53	1141.93		1151.5				
4/23/2013	1148.99	1151.21	1152.51	1150.86	1150.37	1148.4		1156.7				
8/8/2013	1145.09	1146.17	1146.3	1146.95	1144.18	1145.68		1154.32				
10/21/2013	1143.89	1144.73	1144.86	1145.51	1143.83	1144.38		1152.69				
1/29/2014	1145.83	1146.16	1146.69	1146.93	1145.04	1146.28		1154.99				
4/30/2014	1143.02	1143.97	1144.35	1144.71	1142.45	1143.53		1155.35				
7/23/2014	1145.35	1146.31	1147.16	1146.54	1144.89	1146.45		1154.91				
10/16/2014	1145.83	1148.97	1151.46	1149.61	1148.8	1145.6		1156.49				
1/20/2015	1145.75	1147.13	1147.51	1147.66	1145.92	1146.62		1155.21				
4/28/2015	1147.25	1147.75	1151.24	1148.49	1148.19	1146.07		1155.9				
7/22/2015	1151.29	1152.61	1153.59	1151.97	1151.4	1152.14		1156.14				
10/20/2015	1143.53	1144.05	1151.31	1143.66	1142.97	1144.16		1152.49				
3/15/2016	1148.29	1141.42	1148.02	1147.21	1145.5	1147.34		1155.39	1149.37	1145.67	1148.13	1147.66
Seasonal High	1151.29	1154.68	1156.89	1152.90	1154.14	1153.48	1151.74	1158.63	1149.37	1145.67	1148.13	1147.66

B-3 is not in use as a monitoring well.

B-9 was renamed from well NE-8, groundwater elevation data previous to 3/15/2016 was taken from NE-8.

TABLE 2

AEP - FLINT CREEK

CLASS 3N LANDFILL

MONITORING WELL/PIEZOMETER CONSTRUCTION DETAILS

Well Number	Latitude	Longitude	Ground Surface Elevation	Top of Casing Elevation	Borehole Depth ft.bls	Date Installed	Screen Material	Well Diameter inches	Top of Screen Depth ft. bls	Top of Screen Elevation ft. msl	Bottom of Screen Depth ft. bls	Bottom of Screen Elevation ft. msl
B-1B	36° 15' 38.508"	94° 30' 48.390"	1189.04	1191.64	72.2	3/1/1993	PVC	2	59.6	1129.44	69.6	1122.04
B-2	36º 15’ 34.367”	94º 30’ 57.987”	1176.60	1179.36	45	11/25/1991	PVC	2	35	1141.60	45	1134.36
B-4	36º 15’ 31.890”	94º 30’ 42.096”	1166.80	1169.09	34	11/26/1991	PVC	2	24	1142.80	34	1135.09
B-5	36º 15’ 26.182”	94º 30’ 49.814”	1183.40	1185.54	60	12/6/1991	PVC	2	50	1133.40	60	1125.54
B-6	36º 15’ 39.110”	94º 30’ 57.890”	1181.20	1184.19	59.75	11/13/1991	PVC	2	48.2	1133.00	59.75	1124.44
B-7A	36º 15’ 41.108”	94º 30’ 47.780”	1194.89	1191.89	100	5/17/2007	PVC	2	80	1114.89	100.5	1091.39
B-9	36° 15' 29.95958"	94° 31' 04.83356"	1179.10	1182.13	38.5	6/8/2011	PVC	2	22.85	1156.25	38.25	1143.88
B-10	36° 15' 31.4844"	94° 31' 04.4162"	1181.78	1184.98	51	11/12/2015	PVC	2	40.85	1140.93	51.15	1133.83
B-11	36º 15’ 26.5230”	94º 31’ 01.9179”	1171.59	1174.53	32.5	11/12/2015	PVC	2	22.02	1149.57	32.32	1142.21
B-12	36° 15' 39.4681"	94° 30' 42.8205"	1177.48	1180.26	49	2/10/2016	PVC	2	38.27	1139.21	48.67	1131.59
B-13	36º 15’ 26.0006”	94º 30’ 43.0819”	1159.54	1162.61	38	2/9/2016	PVC	2	27.16	1132.38	37.56	1125.05

APPENDIX 1

Boring & Monitoring Well Installation Logs

Boring Logs

Drilling Log

Project Name SWEPCO			Boring Number B-1B
Project No. 92-388-1			Page 1 of 5
Ground Elevation	Location		Total Footage 75 ft.

Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. Of Samples	No. Core Boxes	Depth to Water	Date Measured
AIR ROTARY	5 5/8"	35	40	0	0	See Remarks	See Remarks

Drilling Co. LAYNE WESTERN

Driller (s) FLOYD CHILCUTT / JAMES MUTIE

Drilling Rig. K-30 SPEEDSTAR

Type of Penetration Test NONE

Date 2/26/93

To 3/2/93

Field Observer (s) C. Wood

Depth	Description	Class.	Blow Count	Recov.		Sample or Box No.	Remarks
	SILT, CLAYEY, TRACE FINE GRAVEL, DAMP, TRACE PLASTICITY, 10R 4/6	CL					START @ 0805 2/26/93 LOGGED FROM CUTTINGS
1							
2	CLAY, SILTY, SOME MEDIUM SAND, TRACE FINE TO MEDIUM GRAVEL, TRACE PLASTICITY, STIFF DAMP, 10R 4/6	CL					
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

Drilling Log, continued

Boring No. B-1B

Project Name SWEPCO

Page 2 of 5

Project No. 92-388-1

Date 2/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
15	CLAY, SILTY, WITH GRAVEL AND COBBLES, POORLY GRADED, CLAY TRACE PLASTICITY, STIFF, 2,5YR, 4/6, DAMP	CL					
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Drilling Log, continued

Boring No. B-1B
Project Name SWEPCO
Page 3 of 5
Project No. 92-388-1
Date 7/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
	CLAY, SILTY, WITH GRAVEL & COBBLES, POORLY GRADED, CLAY: TRACE PLASTICITY, STIFF, DAMP, 2.5YR 4/6	CL					
32							
33							
34							
35	LIMESTONE, FINELY CRYSTALLINE, MICRITIC, WEATHERED MOD. STRONG, MED. DK GREY N4	LS					
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							

Drilling Log, Continued

Boring No. B-1B

Project Name SWEPCO

Page 4 of 5

Project No. 92-388-1

Date 2/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
	LIMESTONE, FINELY CRYSTALLINE, MICRITIC, FRESH MED. DK GREY N4, STRONG	LS					
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							1253
59							- WATER OBSERVED 3/1/93
60							
61							
62							
63							
64							
65							

Drilling Log, continued

Boring No. B-1B

Project Name SWEPCO

Page 5 of 5

Project No. 92-388-1

Date 2/26/93

Depth	Description	Class.	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
	LIMESTONE, FINELY CRYSTALLINE, MICRITIC, FRESH STRONG, MED. DK, GREY N4	LS					
66							
67							
68							
69							
70							
71							
72							
73							
74							NO WATER OBSERVED 2/26/93
75	T.D. 75'						T.D. @ 1225 2/26/93
76							1327 3/1/93 BEGIN WELL CONSTRUCTION. SET 9.98' SCH 40 0.10 SLOTTED SCREEN @ 73.20', AND 64.70 SCH 40 RISER PIPE. FILTER PACK TO 56.2 FT BGS. BENTONITE SEAL TO 51.03 FT BGS. BENTONITE ENVIROPLUG GROUT TO 3.2 FT BGS. SURFACE COMPLETIO 3/2/93
77							
78							
79							
80							
81							
82							

Drilling Log

Project Name	Boring No.
SWEPCO	B-2

Project No. 91-339-4

Page 1 of 3

Ground Elevation 1176.6'

Location N 710591.2 E 258212.0

Total Footage 45'

Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
HSA	8"	45'	-0-	2	-0-	SEE REMARKS	

Drilling Co. LAYNE WESTERN

Driller (s) T. ATHERTON, BUDDY

Drilling Rig. CME-75

Type of Penetration Test STANDARD PENETRATION TEST

Date 11-24-91 To 11-25-91

Field Observer (s) GLENN SCHERER

Depth	Description	Class.	Blow Count	Recov.		Sample or Box No.	Remarks
	SILTY CLAY, MODERATE BROWN 5YR 3/4, DAMP, MEDIUM PLASTIC, MEDIUM	CL					BEGAN AT 4:15pm
1					1		
2	CLAY, GRAVEL, MODERATE BROWN 5YR 3/4, MOIST, LOW PLASTIC, STIFF		12/13/23	18"/18"	2		
3		CL			3	SS-1	4:25pm TFS=4.5
4					4		
5	CLAYEY GRAVEL, SILT, MODERATE BROWN 5YR 3/4, DAMP, NON PLASTIC, SOFT				5		
6		GC			6		
7					7		
8	LIMESTONE GRAVEL, DARK YELLOWISH ORANGE, clayey		11/40/36	18"/18"	8	SS-2	4:42pm TFS=2.4
9		GC			9		
10					10		
11					11		
12	CLAYEY GRAVEL, MODERATE BROWN 5YR 3/4 DAMP, NONPLASTIC, FIRM	GC			12		
13	CLAY, DARK YELLOWISH ORANGE, DAMP MEDIUM PLASTIC, FIRM	CL	5/11/13	18"/18"	13	SS-3	5:00pm TFS=3.2
14					14		

Drilling Log, continued

	Boring No. B-2
Project Name SWEPCO	Page 2 of 3
Project No. 91-339-4	Date 45'

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
	CLAY, DARK YELLOWISH ORANGE, DAMP MEDIUM PLASTIC, FIRM						
15		CL			15		
16					16		
17					17		5:15 pm
18			4/31/56	6"/18"	18	SS-4	TFS = 1.5
19	LIMESTONE GRAVEL, CLAY, SILT, LIGHT BROWN 5 YR 5/6, DRY, LOOSE, NONPLASTIC	GC			19		QUIT FOR THE DAY RESTART 11/25/91 AT 7:25 AM
20	LIMESTONE, GRAY, SEAMS of CLAY, RED, MOIST, MEDIUM PLASTIC, SOFT				20		
21		LS			21		
22					22		7:30 AM
23			25/53/50 @.25'	6"/18"	23	SS-5	
24					24		
25					25		
26					26		
27					27		
28			4/4/9	14"/18"	28	SS-6	BECOMING MOIST
29					29		
30					30		
31					31		

Drilling Log, continued

Boring No. B-2

Project Name SWEPCO

Page 3 of 3

Project No. 91-339-4

Date 11-25-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
	LIMESTONE, GRAY, SEAMS of CLAY, RED MOIST, MEDIUM PLASTIC, SOFT, LIMESTONE HIGHLY WEATHERED AND WEAK						
32					32		
33		LS	12/25/19	14"/18"	33	SS-7	8:30 AM
34					34		
35					35		
36					36		
37					37		
38			11/15/9	12"/18"	38	SS-8	8:45 AM TFS = 0.25 BECOMES WET
39					39		
40					40		
41	SAME AS ABOVE				41		
42					42		
43			21/16/18	12"/18"	43	SS-9	
44					44		
45					45		TD = 45' AT 9:35 AM AUGER REFUSAL Place monitoring well 11/25/91 @ 1:20P

Drilling Log

Project Name SWEPCO

Boring No. B-3

Project No. 91-339-4

Page 1 of 4

Ground Elevation 1191.5

Location N710416.6 E259114.4

Total Footage 59 1/2'

Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
SSA/HSA	12"/8"	59 1/2	-0-	5	-0-	SEE REMARKS	

Drilling Co. LAYNE-WESTERN

Driller (s) T. ATHERTON, BUDDY

Drilling Rig. CME-75

Type of Penetration Test NONE

Date 12-23-91

To 12-5-91

Field Observer (s) G. SCHERER

Depth	Description	Class.	Blow Count	Recov.		Sample or Box No.	Remarks
	FLY ASH						BEGAN AT 8:15 AM using 12" SSA
1					1		
2					2		
3					3		
4					4		
5					5		RIG BROKE DOWN RESTART AT 10:30 AM
6					6		
7					7		
8					8		
9					9		
10					10		
11					11		
12					12		
13					13		
14					14		

Drilling Log, continued

Boring No. B-3

Project Name SWEPCO

Page 2 of 4

Project No. 91-339-4

Date 11-23-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
15					15		11:20AM
16					16		
17					17		
18					18		
19					19		
20					20		11:40AM
21	CLAY, GRAVEL, RED, MOIST, HIGH PLASTIC, MEDIUM	CH			21		
22					22		
23					23		FINISH 12" BORING BEGAN AUGERING 8" 12-5-91 AT 10:30AM
24					24		
25	CLAY, YELLOWISH BROWN, MOIST, MEDIUM PLASTIC, MEDIUM	CL			25		
26					26		11:00AM ATTEMPTED SHELBY TUBE FAILED
27					27		
28					28	SHELBY TUBE	11:15AM GOOD SHELBY TUBE
29				1.5/2.0'	29		
30					30		
31					31		BEGAN HITTING ROCK

Drilling Log, continued

	Boring No. B-3
Project Name SWEPCO	Page 3 of 4
Project No. 91-339-4	Date 12-5-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
32	CLAY, SANDY, SOME FINE GRAVEL, MODERATE REDDISH BROWN, MOIST, LOW PLASTIC, LOOSE	CL			32		
33					33		1:30 pm
34			20/17/50@ .3	10"/18"	34	SS-1	TOOK SAMPLE B-3/SS-1
35	GRAVEL WITH CLAY LAYERS, REDDISH BROWN	GC			35		
36					36		
37					37		
38					38		
39	LIMESTONE, HIGHLY WEATHERED, FRAGMENTED WITH SOME CLAY, REDDISH BROWN, MOIST, FIRM	LS	50 @ .25'	.25/1.5	39	SS-2	
40					40		
41					41		
42					42		
43					43		
44			50@ .2'	0/18"	44	SS-3	
45					45		
46					46		
47	CLAY with LIMESTONE, MODERATE REDDISH BROWN, WET, FIRM	CL			47		
48					48		

Drilling Log, continued

	Boring No. B-3
Project Name SWEPCO	Page 4 of 4
Project No. 91-339-4	Date 12-5-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
48	LIMESTONE, HIGHLY WEATHERED, FRAGMENTED WITH CLAY, MOIST, BECOMING WET, FIRM, NON-PLASTIC	LS	18/50 for .2'	6"/18"	48	SS-4	3:30pm
49					49		
50					50		
51					51		
52					52		
53	CHERTY LIMESTONE, GREY, HIGHLY WEATHERED, CLAYEY, CLAY IS MODERATE REDDISH BROWN, MOIST TO WET, FIRM, MEDIUM PLASTIC	LS	38/60/18	12"/18"	53		3:50pm
54					54	SS-5	
55					55		
56					56		▼ 56.5' BGS MEASURED THROUGH AUGERS 4:05pm
57					57		
58					58		
59					59		
60					60		4:10 pm AUGER REFUSAL, TOTAL DEPTH = 59.5' 12/6/91 9:10A Monitoring Well Set.

Drilling Log

Project Name SWEPCO			**Boring No.** B-4
Project No. 91-339-4			**Page** 1 **of** 3
Ground Elevation 1166.8'	**Location** N 710307.6 E 259506.3		**Total Footage** 34.0'

Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
HSA	8"	34.0'	-0-	2	—	SEE REMARKS	

Drilling Co. LAYNE-WESTERN

Driller (s) T. ATHERTON / BUDDY

Drilling Rig. CME-75

Type of Penetration Test STANDARD PENETRATION

Date 11-26-91 **To** 11-26-91

Field Observer (s) GLENN SCHERER

Depth	Description	Class.	Blow Count	Recov.		Sample or Box No.	Remarks
	CLAY, GRAVEL, DARK MODERATE BROWN 5YR 3/4 DAMP, MEDIUM, MEDIUM PLASTIC	CL					BEGAN DRILLING AT 7:13Am
1					1		
2					2		7:30Am TSF = 1.5
3					3	SS-1	
	GRAVEL, SOME CLAY, GRAVEL IS CHERTY LIMESTONE GRAY, CLAY IS DARK MODERATE BROWN 5YR 3/4 DAMP, MEDIUM, MEDIUM PLASTIC	GC					
4					4		
5					5		
6					6		
7					7		
8			50 for .2'	0"/18"	8	SS-2	
9					9		
10					10		
11	CLAY, BROWN 5YR 3/4, DAMP, MEDIUM, MEDIUM PLASTIC	CL			11		
12					12		9:15Am
13					13	SS-3	
14					14		

Drilling Log, continued

Boring No.	B-4
Project Name SWEPCO	Page 2 of 3
Project No. 91-339-4	Date 11-26-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
14	CLAY, SOME GRAVEL, SAND, LIGHT YELLOWISH BROWN, MOIST, MEDIUM, LOW PLASTIC	CL			14		
15					15		
16					16		
17					17		9:45AM
18			5/20/36	12"/18"	18	SS-4	
19					19		
20	ALTERNATING LAYERS of LIMESTONE AND CLAY — LIMESTONE IS CHERTY, GRAY, — CLAY IS SANDY, LIGHT BROWN, WET, LOW PLASTICITY	LS/CL			20		
21					21		
22					22		9:58 Am TSF = 0.1
23				19"/18"	23	SS-5	
24					24		
25					25		
26	LIMESTONE, GREY; EXTREMELY WEATHERED, WEAK, WET & CLAYEY, CLAY IS LIGHT BROWN, LOW PLASTICITY	LS			26		
27					27		10:10 Am TSF = 0
28			4/22/90	6"/18"	28	SS-6	▼ MEASURED INSIDE AUGERS 28.0'
29					29		
30					30		
31					31		

051281

Burns & McDonnell
ENGINEERS - ARCHITECTS - CONSULTANTS

Form TS-GT-2-2

Drilling Log, continued

Boring No. B-4

Project Name SWEPCO

Page 3 of 3

Project No. 91-339-4

Date 11-26-91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
31	LIMESTONE, BUFF, EXTREMELY WEATHERED, WEAK, FRAGMENTED, CLAYEY, CLAY IS LIGHT BROWN, WET, LOW PLASTICITY.	LS			31		
32					32		10:20AM
33			50 for .4'	2"/18"	33	SS-7	
34					34		AUGER REFUSAL AT 10:30AM 34.0' place monitoring well - 11/26/91.

Drilling Log

Project Name SWEPCO						Boring No. B-5	
Project No. 91-339-4						Page 1 of 5	
Ground Elevation 1183.4'		Location N709746.8 E258859.7'				Total Footage 70	
Drilling Type	Hole Size	Overburden Footage	Bedrock Footage	No. of Samples	No. Core Boxes	Depth To Water	Date Measured
HSA & Rotary Wash	8"	24'	46'	5	0	See Remarks	—

Drilling Co. Layne-Western Co. - Kansas City, KS

Driller (s) Tom Atherton, Buddy

Drilling Rig. CME 75

Type of Penetration Test Standard Split Spoon

Date 11/16/91 To 11/20/91

Field Observer (s) Martha Hildebrandt

Depth	Description	Class.	Blow Count	Recov.		Sample or Box No.	Remarks
0	FLY ASH				0		start at 7:40A
	CLAY, silty, grey-brown, moist, medium plasticity, soft	CH					
1	CLAY, silty, red-brown, moist, medium- to high-plasticity, stiff with GRAVEL, chert, white, rounded, poorly sorted. (Fill for berm)	CH			1		
2					2		
3			12/7/18	15"/18"	3	SS-1	7:55P 4.0 tsf (?)
4					4		
5					5		
6					6		dark organic layer at 6.4'
7	CLAY, silty, brownish grey, gravelly, moist, trace plasticity, medium consistency (fill for berm).	CL			7		
8			9/9/14	14"/18"	8	SS-2	8:10A 3.25 tsf
9					9		
10					10		
11					11		
12					12		
13	CLAY, silty, red intermixed with brownish-grey medium plasticity, stiff with GRAVEL (20%) chert, angular, poorly sorted (fill for berm)	CL	6/9/20	11"/18"	13	SS-3	8:20A 2.75 tsf
14					14		

Drilling Log, continued

Boring No. B-5

Project Name SNEPCO

Page 2 of 5

Project No. 91-339-4

Date 11/16/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
M					M		
15					15		
16					16		
17	CLAY, silty, yellow-brown, moist, medium-to high-plasticity, stiff with GRAVEL (40%) chert, white, angular, poorly sorted.	CL	59/50 @ 4"		17		← "Undisturbed" soil augering hard and with more gravel.
18				10"/10"	18	SS-4	8:30A
19					19		
20					20		
21					21		
22					22		
23	CLAY, silty, gravelly, reddish yellow-brown, moist, high plasticity, tough, very stiff	CH	4/12/50 @ 1"	12"/13"	23	SS-5	8:55A
24	LIMESTONE, grey, moderately to highly weathered, moderately strong with Chert occurring in sporatic 3" layers. CLAY	LS			24		Auger Rufusal @ 24.0' 1:00 P - Begin Rotary Wash. Broke off bit at ~25'. Had to abandon hole. 11/18/91 - Off set 6 feet West. Rotary Wash to 25'. 11/19/91 - Rotary Wash down ward
25					25		
26					26		
27					27		
28					28		
29					29		
30					30		
31					31		

Drilling Log, continued

	Boring No. B-5
Project Name SWEPCO	Page 3 of 5
Project No. 91-339-4	Date 11/19/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
31					31		
32					32		
33					33		
34					34		
35	As above but with more clay.	LS			35		
36					36		
37					37		
38					38		
39					39		
40					40		1:00 P ← Remove rods & bail well down. Wait 30 minutes. WL does not change.
41	LIMESTONE, buff, moderately weathered, moderately strong, microcrystalline, Clay & Chert beds but fewer than above.	LS			41		
42					42		
43					43		
44					44		
45					45		
46					46		
47					47		
48					48		

Drilling Log, continued

	Boring No. B-5
Project Name SWEPCO	Page 4 of 5
Project No. 91-339-4	Date 11/19/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
48					48		
49					49		
50					50		1:45P Boring advanced to 50', Pull rods. Bail well down. 2:45P TD 50' WL 42.0' 3:00P WL-47.1'
51					51		
52	As above with more clay. Little chert.	LS			52		
53					53		
54					54		
55					55		
56					56		
57					57		
58					58		
59					59		
60	CLAY, red, high plasticity with LIMESTONE buff, weathered	CH/LS			60		4:00P Boring at 60' 5:00P Well bailed down WL 55.5' TD 56' 11/20/91 7:00A WL 55.8' TD 56' 10:35 Begin Rotary Wash at 60'
61					61		
62					62		
63					63		
64					64		
65					65		11:10A

Drilling Log, continued

Boring No. B-5

Project Name SWEPCO

Page 5 of 5

Project No. 91-339-4

Date 11/20/91

Depth	Description	Log or Class	Blow Count	Core Recov. & Loss		Box or Sample No.	Remarks
65					65		
66	LIMESTONE, light grey, slightly weathered, strong, massive, cherty.	LS			66		11:20A Drilling harder advancing slowly
67					67		Advancing 1"/5 minutes
68					68		← 1:45P
69					69		
70	Total 70.0				70		Finish at 4:00 12/6/91 Place monitoring well
71					71		
72					72		
73					73		
74					74		
75					75		
76					76		
77					77		
78					78		
79					79		
80					80		
81					81		
82					82		

1/7

FLC 10/8/01 1:27 pm B-6

Gary Moyer & Rodney Phillips - Anderson

Lat. 36 15 40 N
Long. 094 30 589W } B-6

MW B-6

8¼" HSA

CL 0-5' tan sl cl

GC 5-10' } 7½ hitting rock bring up nodules
reddish sl cl w/ chert pebbles

GC 10-15' more of same until 12½
then less chert

GC 15'-20' changed color to light brown at
15' (more clay content) <u>more chert</u>

CL 20-25' tan slightly moist clay w silt

CL 25 to 30' 22 ft changed to yellow sl clay
no Chert

GC 30 to 35' more of same to 33' - 33 to 35
light brown w chert sl clay

35 to 40' same as above

40 to 45' same as above GW water yet

next page

FLC
10/8/01

GC 45'-50' same as above
LS 50-55' same a above but easier drilling
?55' LS 55-60' same as above
LS 60' TD
drill stem wet at 55' 卌|||| @ 2:45pm
D to W 45' (approx 1" above gs. measuring pt.
4 1/2 50lbs bag of sand to 2'
above screen Unimin Corp. (see bag)
1/4" bentonite pellets 3° all in water
~~¾ of a~~ 1 bucket (5gal) PDS Co
Polymer Drilling Systems
El Dorado Ark.

Note: Water level measurements made with
a tape base on sound & feel
pulled Casing @ 4:40pm
moved to B7 @ 4:47pm
B7 – 36°15'40"N ; 094°31'02"W (@4:48pm)
0-5' reddish brown silty w chert
5-10' 7 1/2' turns more red and
sl clay w chert

LOG OF WELL NO. B-7-A

CLIENT
AEP-Swepco

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT
Monitoring Well Installation

Boring Location: N = 711249.14 E = 1259063.79
T.O.C. Elevation = 1191.89
Drilling Method: 8.25 O.D. HOLLOW STEM AUGER
6" Air Rotary

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS		
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
2	**SILTY LEAN CLAY** dark brown									
8	**LEAN TO FAT CLAY**, gravely orangish brown with chert and limestone gravel, limestone is subangular and heavily weathered	5								
12	**LEAN TO FAT CLAY**, gravely medium brown chert and limestone gravel, limestone is subangular and heavily weathered	10								
15	**LEAN TO FAT CLAY** medium to dark brown with angular chert gravel	15								
20	**LEAN TO FAT CLAY** light brown to tan with angular chert gravel	20								
26	**SILTY LEAN CLAY** orangish brown, moist with intermittent chert and limestone beds	25								
32	**LEAN TO FAT CLAY** orange, silty	30								
36	**LEAN TO FAT CLAY** orangish brown with intermittent chert beds, moist -Auger refusal-started drilling at 36 feet with air rotary (6"dia.)	35								
	LIMESTONE gray, unweathered, dry	40 45								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 48.13 bgs	▼
WL	▼	▼
WL	Logged by drill cuttings	

Terracon

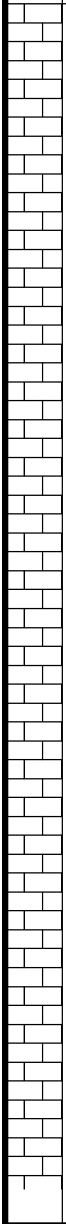
BORING STARTED			5-15-07
BORING COMPLETED			5-16-07
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

LOG OF WELL NO. B-7-A

CLIENT
AEP-Swepco

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT
Monitoring Well Installation



GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf	
	LIMESTONE gray, unweathered, dry - Stabilized groundwater level at 48.13' ∇	50 55 60 65 70 75 80 85 90									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 48.13 bgs	▼
WL	▼	▼
WL	Logged by drill cuttings	

Terracon

BORING STARTED			5-15-07
BORING COMPLETED			5-16-07
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

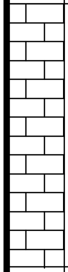
LOG OF WELL NO. B-7-A

Page 3 of 3

CLIENT **AEP-Swepco**

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT **Monitoring Well Installation**

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS			
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	
	**LIMESTONE** gray, unweathered, dry	95									
	100	100									
	BOTTOM OF BORING AT 100 FEET										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 48.13 bgs	▼
WL	▼	▼
WL	Logged by drill cuttings	

Terracon

BORING STARTED			5-15-07
BORING COMPLETED			5-16-07
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

LOG OF WELL NO. B-8

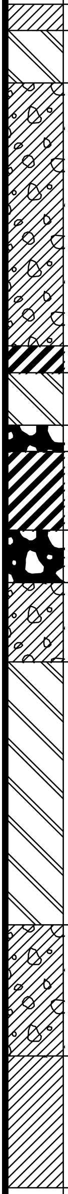
Page 1 of 2

CLIENT
AEP-Swepco

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT
Monitoring Well Installation

Boring Location: N = 709769.92 E = 1257934.80
T.O.C. Elevation = 1174.19
Drilling Method: 8.25 O.D. HOLLOW STEM AUGER



GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, in.	SAMPLES SPT - N BLOWS / ft.	TESTS WATER CONTENT, %	TESTS DRY UNIT WT pcf	TESTS UNCONFINED STRENGTH, psf
1	**LEAN CLAY** brown									
3	**LEAN TO FAT CLAY**, gravelly brown clay with subangular weathered limestone gravel									
	LEAN CLAY, gravelly red, silty with subangular limestone and angular chert gravel	5								
13		10								
14	**FAT CLAY** medium brown									
16	**LEAN TO FAT CLAY** medium brown	15								
17	**BEDDED CHERT**									
	FAT CLAY, gravelly									
20	**BEDDED CHERT**	20								
22	**LEAN CLAY**, gravelly red with chert and limestone gravel, moist									
25	**LEAN TO FAT CLAY** red with chert and limestone beds - Stabilized groundwater level at 29.49' ∇	25								
		30								
35	**LEAN CLAY**, gravelly ▼ medium brown clay with weathered limestone gravel, wet	35								
40	**LEAN CLAY** medium brown, saturated	40								
45		45								

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft				
WL	∇ 29.49	bgs	▼ 36	bgs
WL	∇		▼	
WL	Logged by drill cuttings			

Terracon

BORING STARTED			5-16-07
BORING COMPLETED			5-16-07
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

LOG OF WELL NO. B-8

CLIENT
AEP-Swepco

SITE **Flint Creek Power Plant**
Gentry, Arkansas

PROJECT
Monitoring Well Installation

GRAPHIC LOG		DEPTH, ft.	USCS SYMBOL	SAMPLES				TESTS			
				NUMBER	TYPE	RECOVERY, in.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	
▨	**FAT CLAY**, gravelly red with weathered limestone gravel 50	50									
	BOTTOM OF BORING AT 50 FEET										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 29.49 bgs	▼ 36 bgs
WL	▼	▼
WL	Logged by drill cuttings	

BORING STARTED			5-16-07
BORING COMPLETED			5-16-07
RIG	Strata Star 25	FOREMAN	JBA
APPROVED	JBA	JOB #	35077067

Consulting Engineers and Scientists
25809 Interstate-30 BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: NE-8 PAGE: 1 of 1
TOTAL DEPTH: 38.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER - FLINT CREEK
PROJECT: NATURE AND EXTENT WELLS
JOB NO.: 216-001-35117108-007
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: JODY ADAMS
DRILLER: GARRY MOYERS
DATE DRILLED: 6/8/11
RIG TYPE: ATV
DRILLING METHOD: HOLLOW STEM AUGER, AIR ROTARY
SAMPLING METHOD: SPLIT SPOON

N: 710,056.77 E: 1,257,636.17 G.S. ELEV. 1,179.10

Depth BGS	DESCRIPTION	Litho. Symbol	Run #	% Recovery	RQD	Remarks
0	0' - 2' SILTY CLAY brown, more silt than clay					
	2' - 9' GRAVELLY CLAY reddish brown					
5			1	8"		
10	9' - 13' SILTY CLAY tan, gray and reddish brown with gravel, mottled		2	18"		
	13' - 19' SILTY CLAY tan and gray, mottled					
15	Moist at 15.5'		3			
20	19' - 20' LIMESTONE weathered					Refusal at 20' bgs (Started air rotary at 20')
	20' - 38.5' LIMESTONE bedrock limestone consists of alternating hard and soft beds soft drilling from 28'-29' but still limestone					
25						
30	moist at 31'					Allowed boring to sit open for 30 min. at 30' & was dry.
35						Allowed boring to sit open for 1 hr. & 20 min. at 35' water is at 28' bgs
40	Total Depth of Boring at 38.5' bgs					

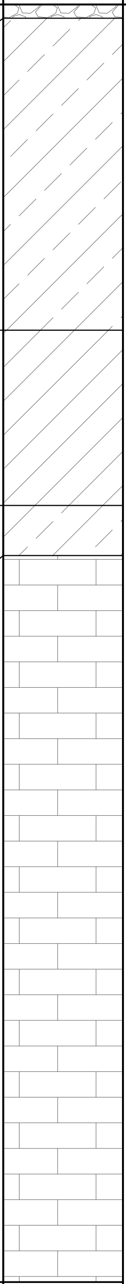
Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: B-10 PAGE: 1 of 1
TOTAL DEPTH: 51 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER
PROJECT: AEP-Flint Creek Monitoring Well Installation
JOB NO.: 216-001-35157178-001
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER
DRILLER: GARY MOYERS
DATE DRILLED: 11/10/2015 & 11/11/2015
RIG TYPE: TRUCK MOUNTED CME 75
DRILLING METHOD: HOLLOW STEM AUGER & AIR ROTARY
SAMPLING METHOD: SPLIT SPOON & CUTTINGS

N: N/A E: N/A TOC: N/A



Depth BGS	Sample Interval	DESCRIPTION	Litho. Symbol	Comments
0		0"-8" Gravel and Fill		
		8"-13' SILTY CLAY red with chert and limestone gravel		
5				
10				
15		13'-20' CLAY red and gray, mottled, fat with some chert gravel		
20		20'-22' SILTY CLAY with weathered chert and limestone fragments		
		22'-51' LIMESTONE crystalline and consistent		
25				
30				
35				Dry after 14 hours at 36' bgs
40				
45				Clear water after 3 hours at 46' bgs
50				Few inches of water after 3 hours at 51' bgs
		Total Depth of Boring at 51' bgs		Approx. 3' of water after 14 hours at 51' bgs

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

BORING NO.: B-11 PAGE: 1 of 1
TOTAL DEPTH: 32.5 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER
PROJECT: AEP-Flint Creek Monitoring Well Installation
JOB NO.: 216-001-35157178-002
DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: MERRICK ROTENBERRY
DRILLER: GARY MOYERS
DATE DRILLED: 11/11/2015
RIG TYPE: TRUCK MOUNTED CME 75
DRILLING METHOD: HOLLOW STEM AUGER
SAMPLING METHOD: SPLIT SPOON AND CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-15' SILTY CLAY red with chert and limestone gravel	▨	
5		▨	
10		▨	
15	15'-16.5' CLAY brown and red, fat with some chert gravel	▨	
	16.5'-32.5' SILTY CLAY red with weathered chert and limestone fragments	▨	
20		▨	
25		▨	Moist from 24.5'-26.5' bgs
		▨	Water encountered between 28'-29' bgs
30		▨	
	Total Depth of Boring at 32.5' bgs		

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FIELD BORING LOG

BORING NO.: B-12 PAGE: 1 of 2
TOTAL DEPTH: 49 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-003	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/10/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
			Flush - mounted boring
0	0'-8' SILTY CLAY dark brown, stiff	▨	
5		▨	
	8'-20' SILTY CLAY some chert and limestone gravel increasing with depth	▨	
10		▨	
15		▨	
20	20'-39' LIMESTONE heavily weathered with gray clay and chert gravel	▦	
25		▦	
30		▦	Wet at 32' bgs

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FIELD BORING LOG

BORING NO.: B-12 PAGE: 2 of 2

TOTAL DEPTH: 49 FEET BELOW GROUND SURFACE (BGS)

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
40	39'-49' <u>LIMESTONE</u> light gray with chert	▨	39' - 49' bgs logged by cuttings
45		▨	
50	Total Depth of Boring at 49' bgs		
55			
60			
65			
70			
75			

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FIELD BORING LOG

BORING NO.: B-13

PAGE: 1 of 1

TOTAL DEPTH: 38 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER

PROJECT: FLINT CREEK - CCR WELL INSTALLATION

JOB NO.: 216-001-35157182-004

DRILLING CO.: ANDERSON ENGINEERING

LOGGED BY: ADAM HOOPER

DRILLER: GARY MOYERS

DATE DRILLED: 2/9/2016

RIG TYPE: CME 75 BUGGY

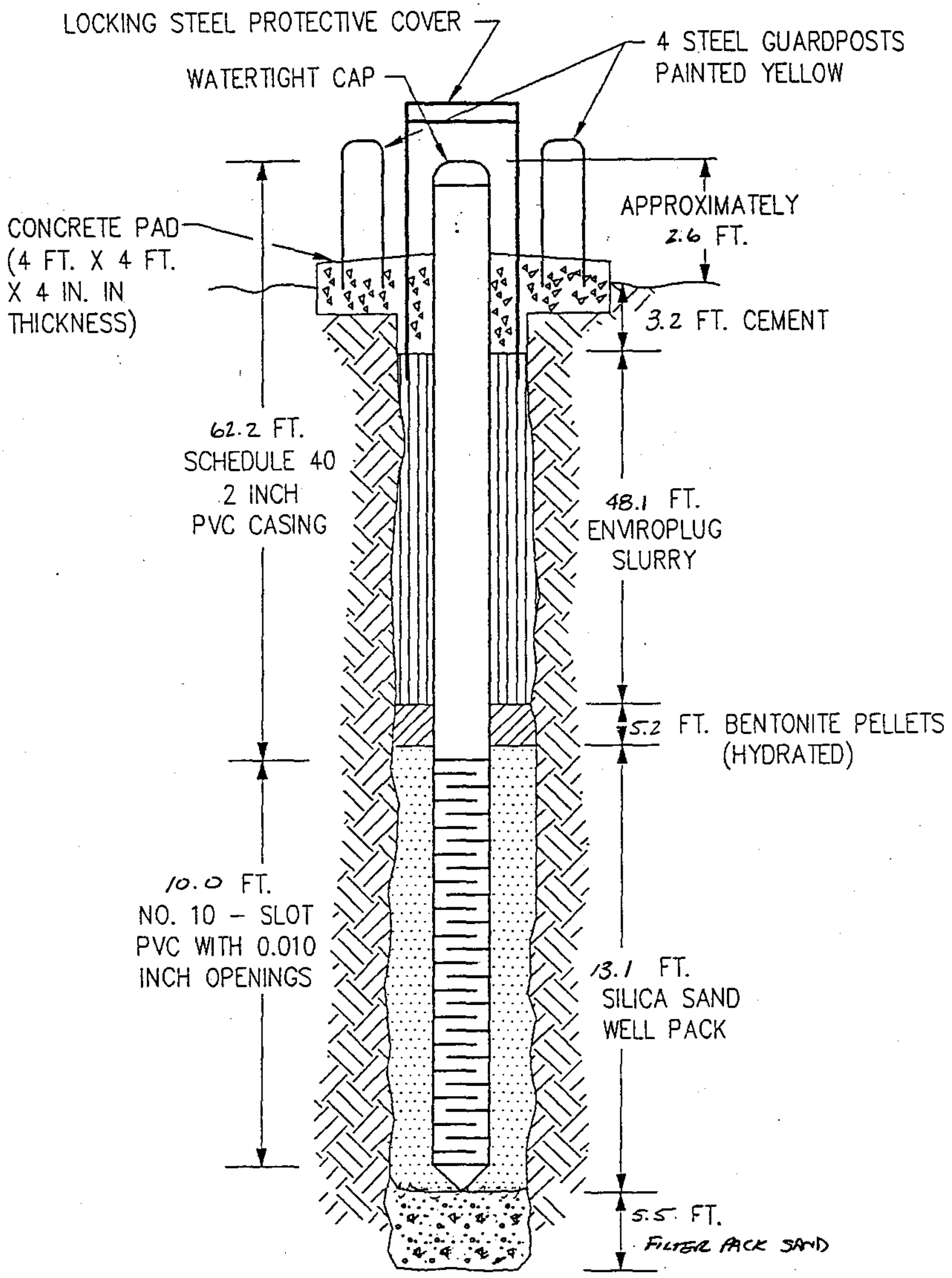
DRILLING METHOD: HOLLOW STEM AUGER/AIR ROTARY

SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: NA E: NA G.S. ELEV. NA

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-38' SILTY CLAY red with chert gravel	▨	
5		▨	
10		▨	
15		▨	Wet at 14' bgs
20		▨	
25		▨	
30		▨	
35	Top of limestone bedrock	▨	
	Total Depth of Boring at 38' bgs		
40			

Monitoring Well Installation Logs



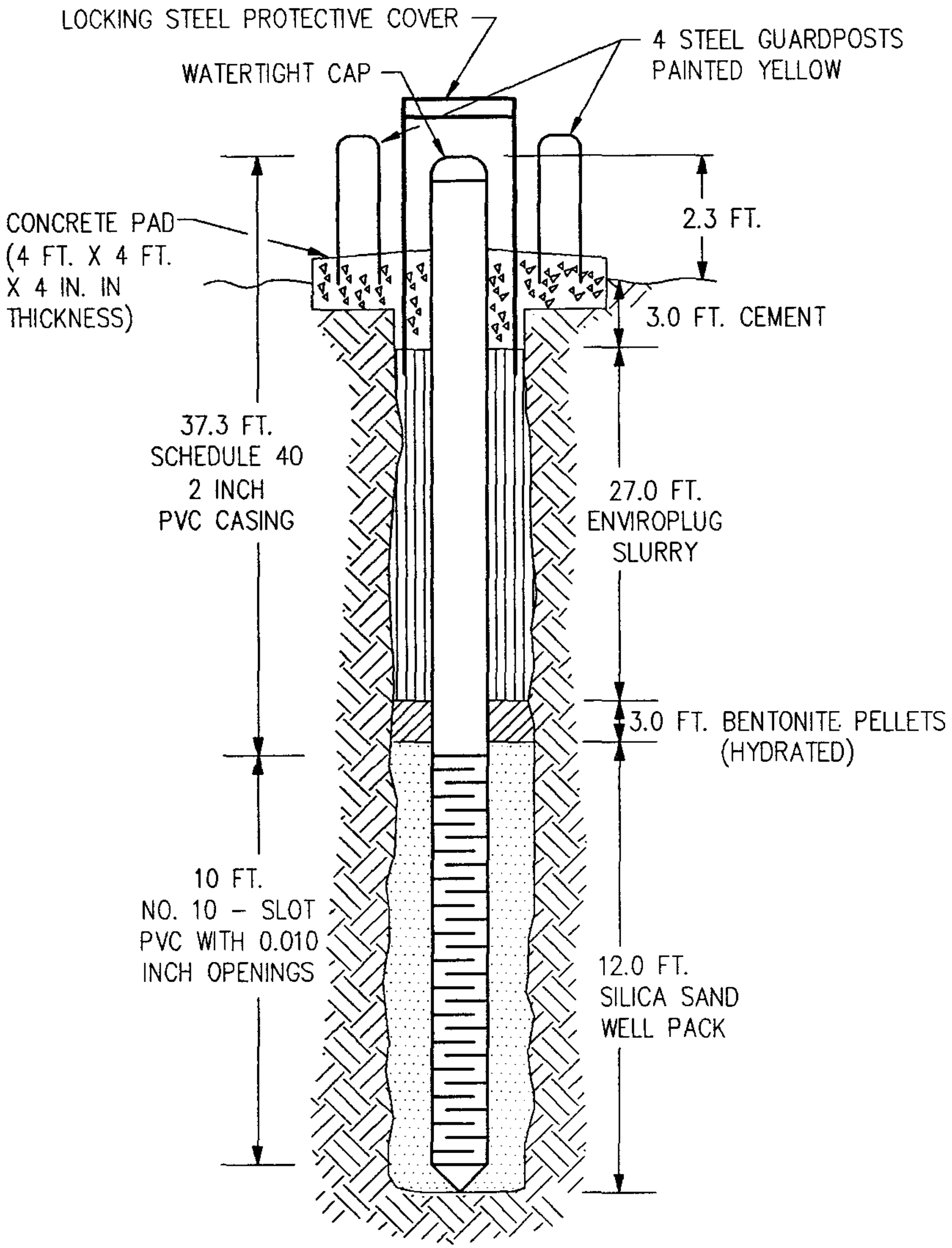
TOP OF PIPE ELEVATION
GROUND SURFACE ELEVATION
TOTAL DEPTH OF PIEZOMETER 72.20

NOT TO SCALE DATE INSTALLED 3/1/93

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-1B
MONITORING WELL CONSTRUCTION DIAGRAM

SWEFC013.DWG 01-08-1992 14:13 KBL



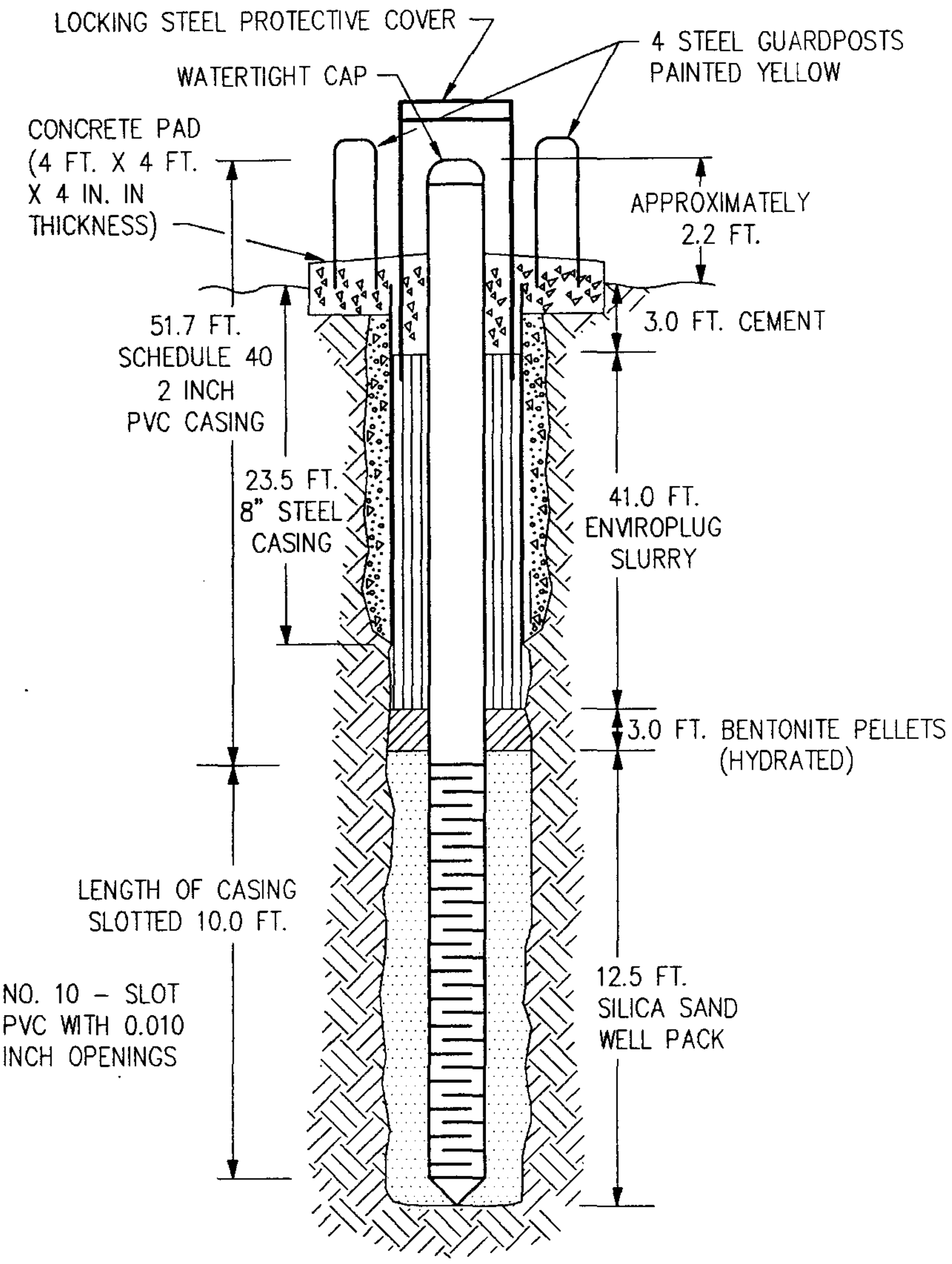
TOP OF PIPE ELEVATION 1178.93'
GROUND SURFACE ELEVATION 1176.6'
TOTAL DEPTH OF PIEZOMETER 45.0'

NOT TO SCALE DATE INSTALLED 11-25-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-2
MONITORING WELL CONSTRUCTION DIAGRAM

SWEPC010.DWG 01-08-1992 11:45 KBL



TOP OF PIPE ELEVATION 1193.72'
GROUND SURFACE ELEVATION 1191.5'
TOTAL DEPTH OF PIEZOMETER 59.5'

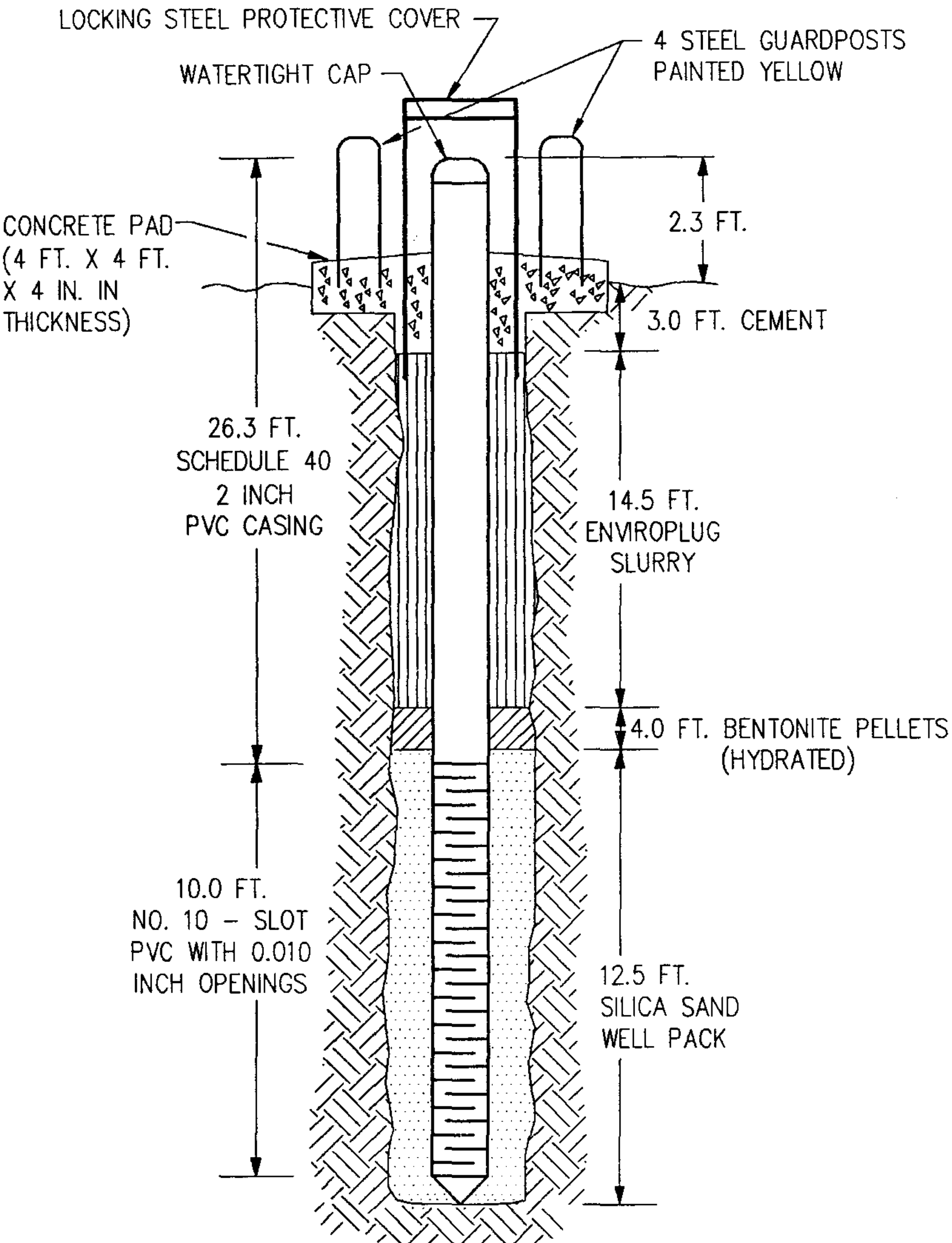
NOT TO SCALE DATE INSTALLED 12-6-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-3

MONITORING WELL CONSTRUCTION DIAGRAM

SWEPCO11.DWG 01-27-1992 14:21 KBL



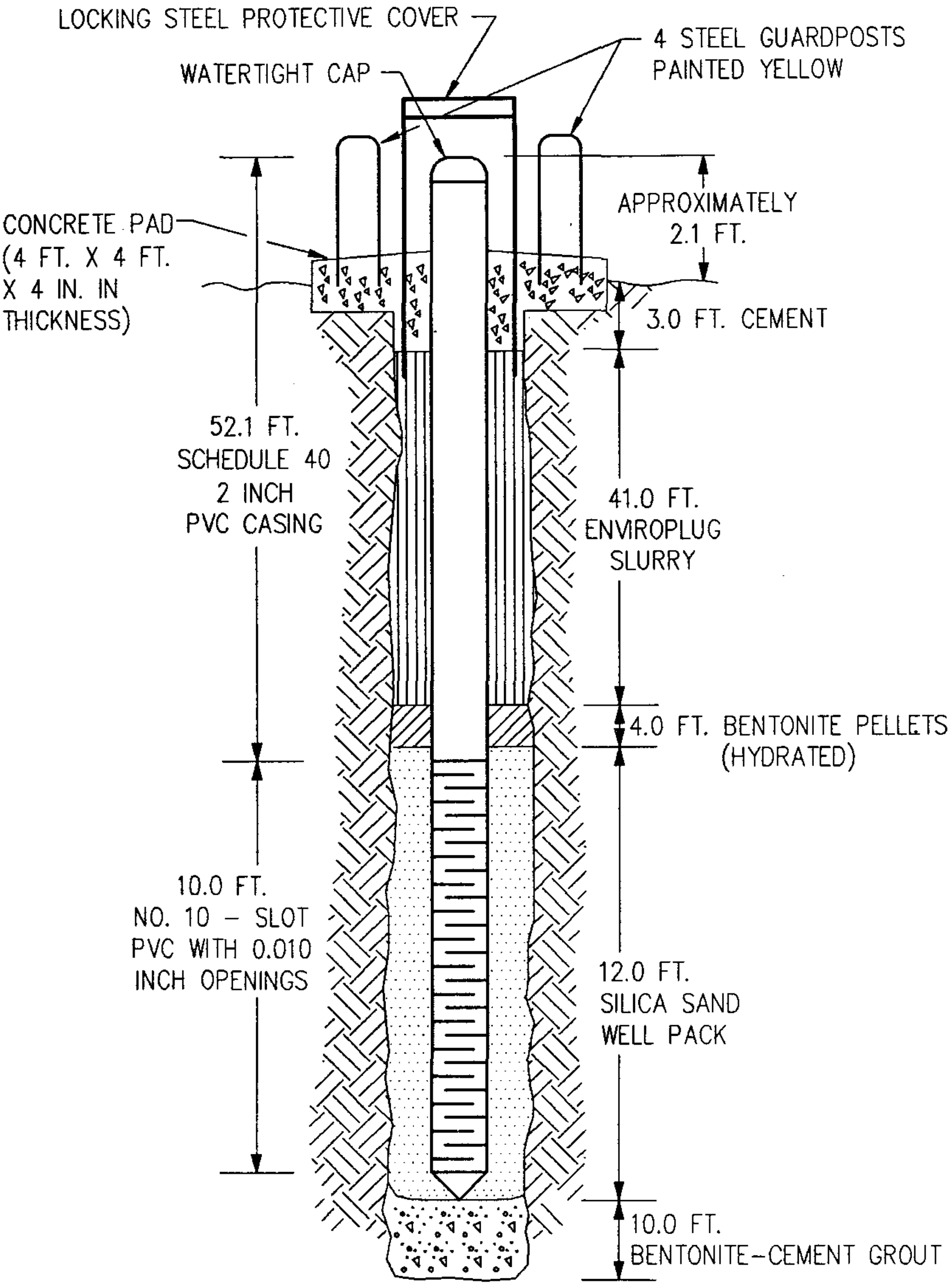
TOP OF PIPE ELEVATION 1169.09'
GROUND SURFACE ELEVATION 1166.8'
TOTAL DEPTH OF PIEZOMETER 34.0'

NOT TO SCALE DATE INSTALLED 11-26-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-4
MONITORING WELL CONSTRUCTION DIAGRAM

SWEPC012.DWG 01-08-1992 14:21 KBL



TOP OF PIPE ELEVATION 1185.54'
GROUND SURFACE ELEVATION 1183.4'
TOTAL DEPTH OF PIEZOMETER 60.0'

NOT TO SCALE DATE INSTALLED 12-6-91

Burns & McDonnell
ENGINEERS-ARCHITECTS-CONSULTANTS
Kansas City, Missouri

B-5

MONITORING WELL CONSTRUCTION DIAGRAM

SWEPC013.DWG 01-08-1992 14:13 KBL

Date:	# of Pages: /
To: Curtis Carter	From: Scott Anderson
Co:	Co: ANDERSON ENGINEERING CONSULTANTS, INC.
Phone:	Phone: 501/455-4545
Fax #:	Fax #: 501/455-4552

STATE OF ARKA
REPORT ON WATER WELL CONSTRUCT

A

1 Contractor Name & Number: ANDERSON ENGR. C# 1121

2 Driller Name & Number: GARRY MOYERS D# 2396

3 Pump Installer Name & Number: P#

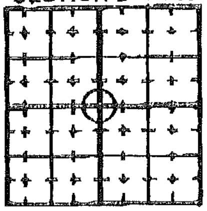
4 Date Well Completed: 10/8/01 New Well ☒ Replace or Work-over ☐

5 COUNTY	6 FRACTION	7 SECTION	8 TOWNSHIP	9 RANGE
BENTON	¼ of ¼ of			

LONGITUDE 11 N 36 ° 15 ' 18 "

LATITUDE 11 W 95 ° 31 ' 28 "

10 LOCATE WITH 'X' IN SECTION BELOW



B 1 DESCRIPTION OF FORMATION: DEPTHS IN FEET

	FROM	TO
RED CLAY W/LS FRAG	0	58.5
WITH GREY LIMESTONE		60
ATTACH ADDITIONAL SHEETS IF NECESSARY		

2 TOTAL DEPTH OF WELL 60 ft

3 DEPTHS TO WATER PRODUCING FORMATIONS. 50

4 STATIC WATER LEVEL 52 Ft below land surface

5 YIELD N/A gallons per ☐ min ☐ hr

6 DIAMETER OF BORE HOLE 8.25 IN

C PUMP REPORT

1 TYPE PUMP: SUBMERSIBLE ☐ TURBINE ☐ JET ☐

2 SETTING DEPTH: FEET

3 BRAND NAME AND SERIAL NUMBERS:

4 RATED CAPACITY gallons per minute

5 TYPE LUBRICATION

6 DROP PIPE OR COLUMN PIPE SIZE

7 WIRE SIZE

8 PRESSURE TANK . . . SIZE, MAKE, MODEL

9 DATE OF INSTALLATION OR REPAIR

10 Is there an abandoned water well on the property?

D 1 LAND OWNER OR OTHER CONTACT PERSON:

NAME FLINT CREEK POWER PLANT

STREET ADDRESS Hwy 12 & 59

CITY GENTRY Ark.

2 CASING FROM 0.0 TO 50.0 W/ 2" "ID

FROM TO W/ "ID

TYPE CASING: PVC 40

3 SCREEN

TYPE: PVC 40 DIA 2" SLOT/GA .010"

SET FROM 50.0 FT TO 60.0 FT

TYPE: DIA SLOT/GA

SET FROM FT TO FT

4 GRAVEL PACK FROM 48 FT TO 60 FT

5 BACK FILLED WITH: MED. PLUG

FROM 3 FT TO 45 FT

6 SEALED WITH: 0.25" PELLETS

FROM 45 FT TO 48 FT

FROM FT TO FT

7 DISINFECTED WITH: N/A

8 USE OF WELL:

DOMESTIC	☐	COMMERCIAL	☐
IRRIGATION	☐	MONITOR	☑
LIVESTOCK/POULTRY	☐	TEST WELL	☐
OIL/GAS SUPPLY	☐	SEMI-PUBLIC	☐
PUBLIC SUPPLY	☐	OTHER	

(A/C HEATPUMP TYPE WELLS)

SOURCE	☐	RETURN	☐
CLOSED LOOP	☐		

9 (For A/C only) Will system also be used for purposes other than Heating or Air Conditioning?

If yes, name use: yes ☐ no ☐

10 (For A/C open-loop only) Into what medium is water returned?

11 REMARKS

WELL NO. W-8b

12 SIGNED Garry Moyers DATE 10/16/01

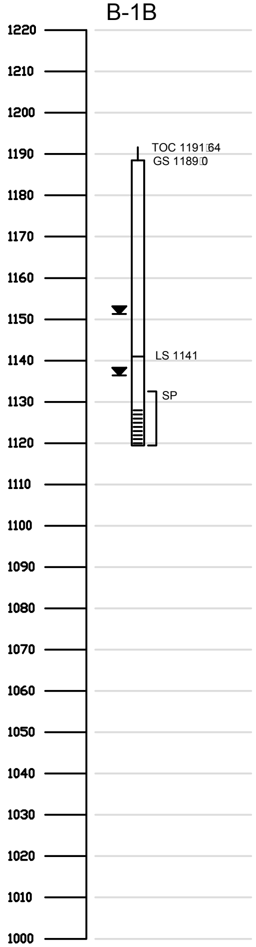
AWD 7 JAN 89
ACI 5946

Arkansas Water Well Construction Commission, 101 East Capitol, Suite 350, Little Rock, AR 72201

COMMISSION COPY

Hydraulic conductivity
(from slug test)
K = 1.18x10-6 cm/sec

B-1B

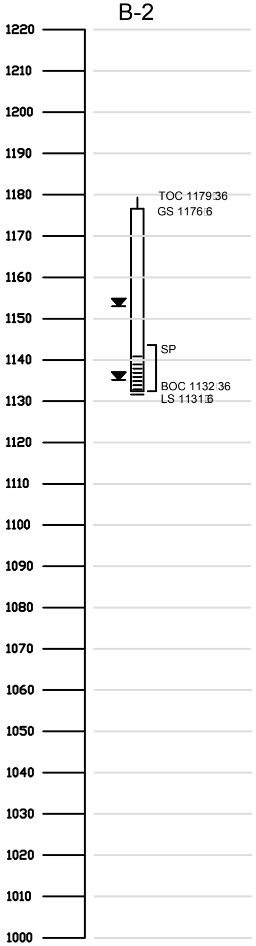


▼ Range of observed potentiometric groundwater elevations in monitoring well
▼

TOC - Top of Casing
GS - Ground Surface
LS - Top of Boone Limestone
BOC - Bottom of Casing
SP - Sand Pack elevations

Hydraulic conductivity
(from slug test)
K = 17.31x10-3 cm/sec

B-2

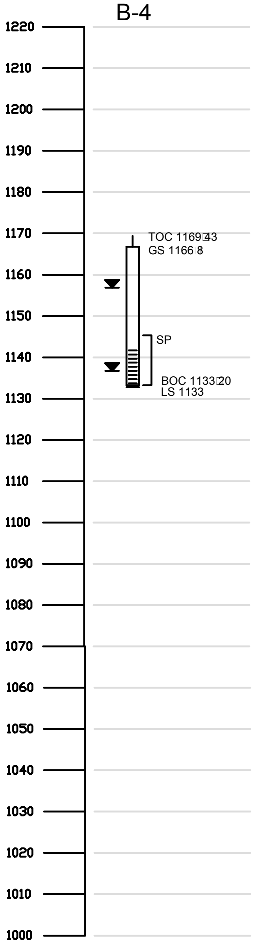


▼ Range of observed potentiometric groundwater elevations in monitoring well
▼

TOC - Top of Casing
GS - Ground Surface
LS - Top of Boone Limestone
BOC - Bottom of Casing
SP - Sand Pack elevations

Hydraulic conductivity
(from slug test)
K = 4.02x10-3 cm/sec

B-4

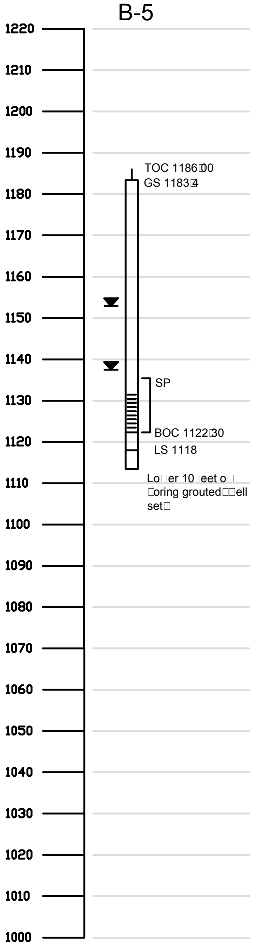


▼ Range of observed potentiometric groundwater elevations in monitoring well
▼

TOC - Top of Casing
GS - Ground Surface
LS - Top of Boone Limestone
BOC - Bottom of Casing
SP - Sand Pack elevations

Hydraulic conductivity
(from slug test)
K = 9.64x10-5 cm/sec

B-5

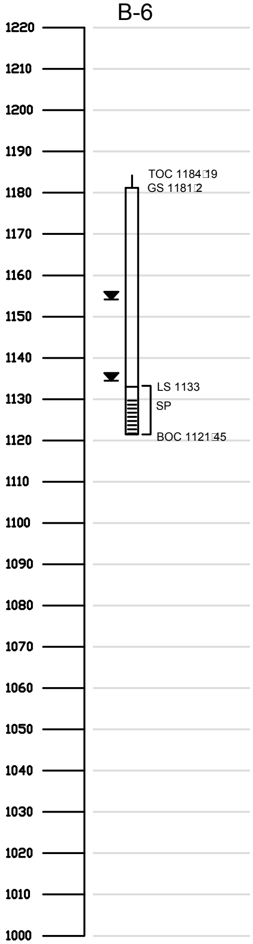


▼ Range of observed potentiometric groundwater elevations in monitoring well
▼

TOC - Top of Casing
GS - Ground Surface
LS - Top of Boone Limestone
BOC - Bottom of Casing
SP - Sand Pack elevations

Hydraulic conductivity
(from slug test)
K = 5.59x10-3 cm/sec

B-6

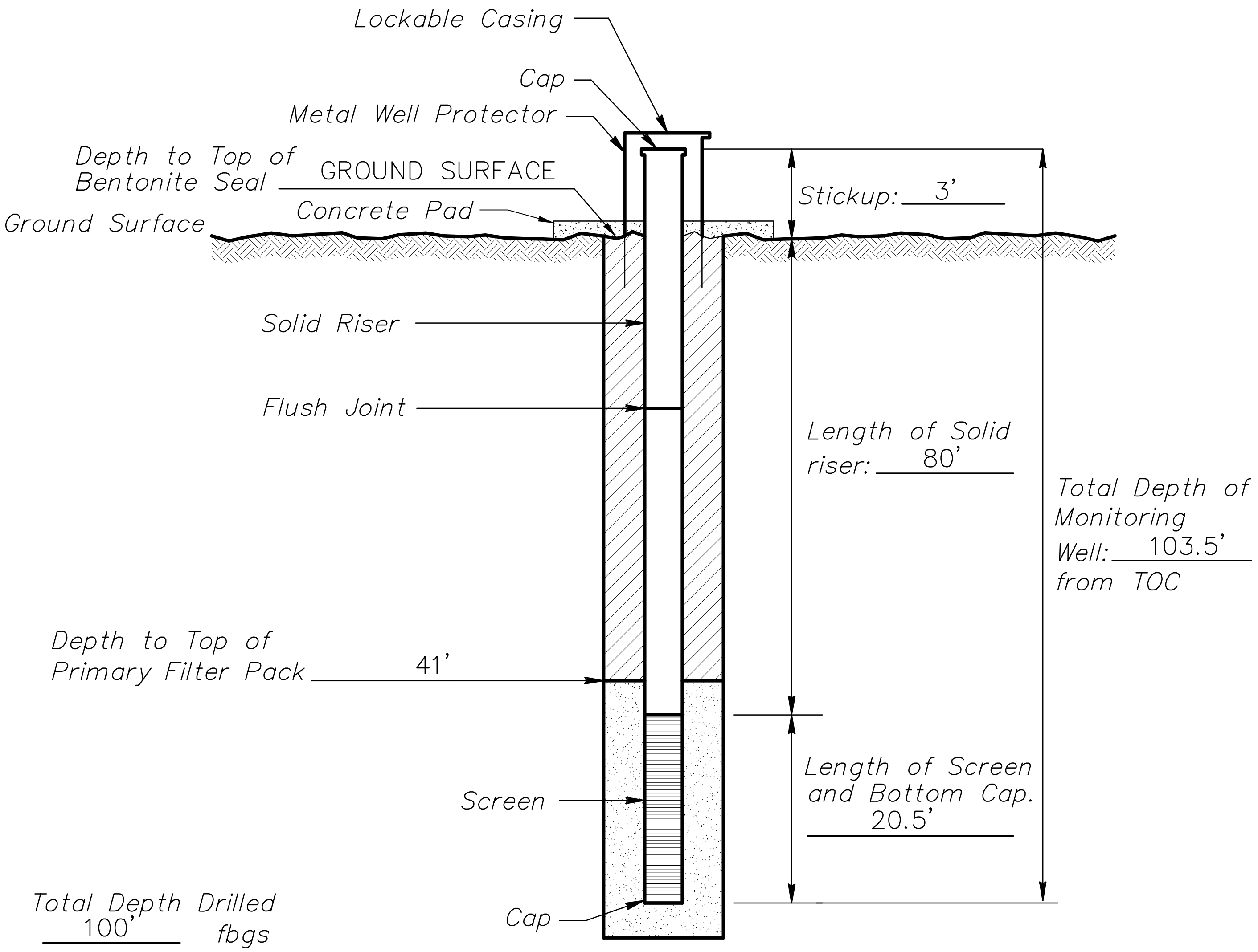


▼ Range of observed potentiometric groundwater elevations in monitoring well
▼

TOC - Top of Casing
GS - Ground Surface
LS - Top of Boone Limestone
BOC - Bottom of Casing
SP - Sand Pack elevations

PIEZOMETER INSTALLATION RECORD

Job Name AEP-SWEPCO FLINT CREEK
Well Number B-7-A
Job Number 35077067
Installation Date 5/17/07
Location GENTRY, ARKANSAS
Datum Elevation N/A
Surface Elevation N/A
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010"
Riser Diameter & Material 2" PVC
Borehole Diameter 8.25"
Granular Backfill Material 10-20 SAND
Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER
Drilling Contractor MOHAWK DRILLING



Depth to Top of Bentonite Seal GROUND SURFACE

Stickup: 3'

Length of Solid riser: 80'

Total Depth of Monitoring Well: 103.5' from TOC

Depth to Top of Primary Filter Pack 41'

Length of Screen and Bottom Cap. 20.5'

Total Depth Drilled 100' fbgs

▨ Bentonite Chips

░ Granular Backfill

(Not to Scale)

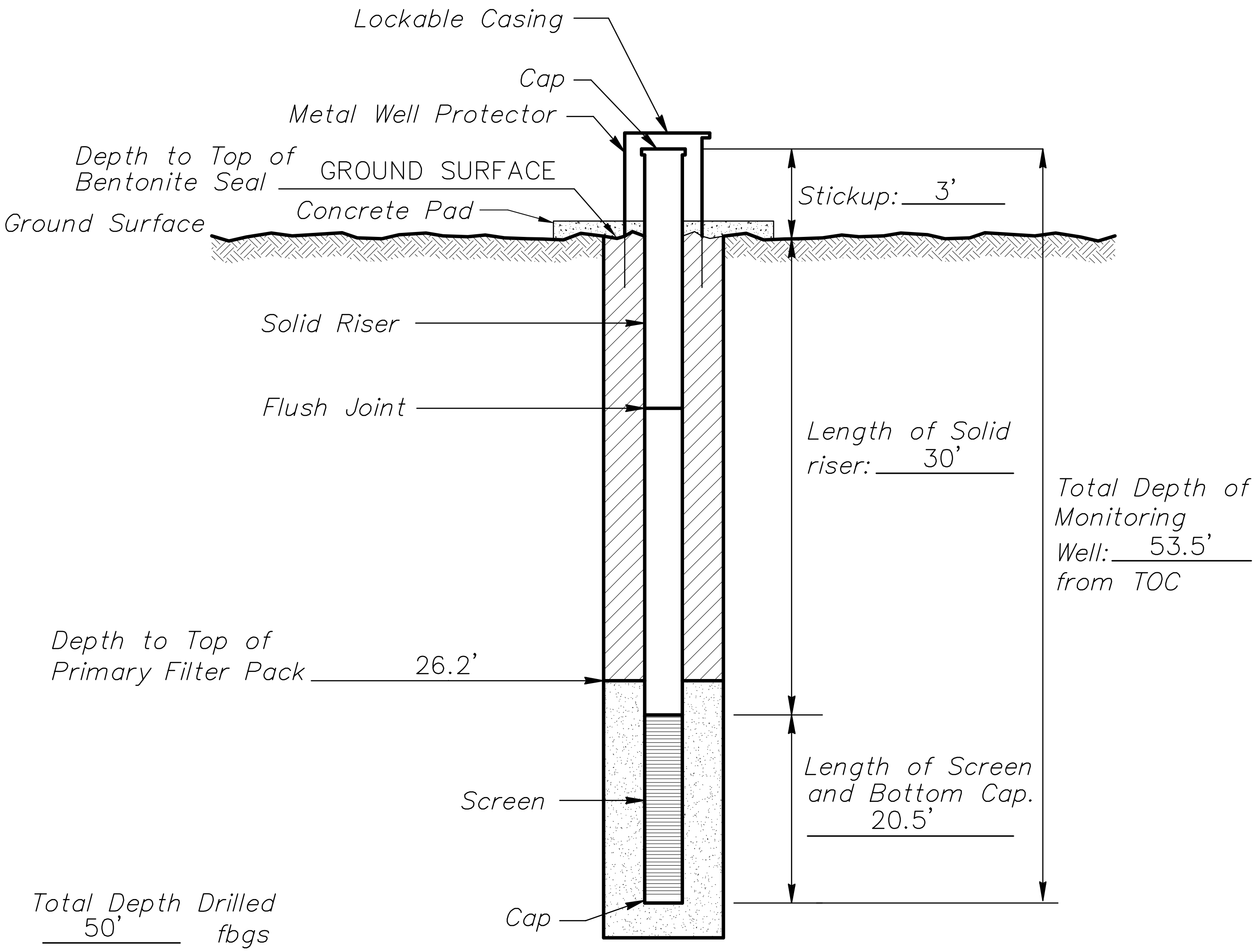
Terracon
Consulting Engineers and Scientists
11400 WEST BASELINE ROAD
LITTLE ROCK, AR. 72209
PH. (501) 455-2199
FAX. (501) 455-4547

PIEZOMETER INSTALLATION RECORD

PROJECT NUMBER: 216-001-35077067
WELL NUMBER: B-7-A
DRAWING NUMBER: 001
CHECKED BY: JBA

MONITORING WELL INSTALLATION RECORD

Job Name AEP-SWEPCO FLINT CREEK
Well Number B-8
Job Number 35077067
Installation Date 5/16/07
Location GENTRY, ARKANSAS
Datum Elevation N/A
Surface Elevation N/A
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010"
Riser Diameter & Material 2" PVC
Borehole Diameter 8.25"
Granular Backfill Material 10-20 SAND
Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER
Drilling Contractor MOHAWK DRILLING



Depth to Top of Bentonite Seal GROUND SURFACE

Stickup: 3'

Length of Solid riser: 30'

Total Depth of Monitoring Well: 53.5' *from TOC*

Depth to Top of Primary Filter Pack 26.2'

Length of Screen and Bottom Cap. 20.5'

Total Depth Drilled 50' *fbgs*

▨ Bentonite Chips

░ Granular Backfill

(Not to Scale)

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Consulting Engineers and Scientists
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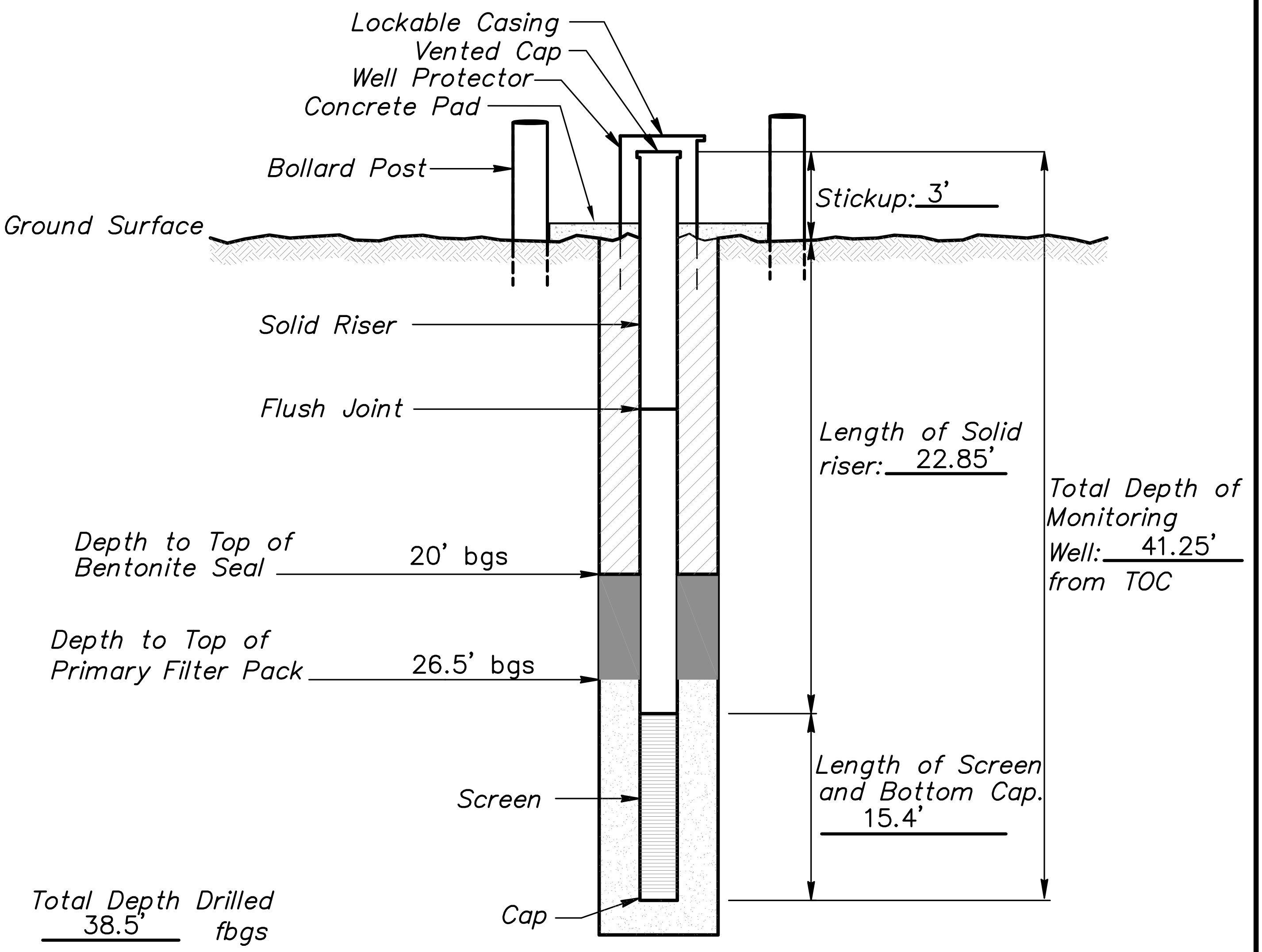
PH. (501) 455-2199 FAX. (501) 455-4547

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216-001-35077067
WELL NUMBER: B-8
DRAWING NUMBER: 003
CHECKED BY: JBA

MONITORING WELL INSTALLATION RECORD

Job Name AEP FLINT CREEK – NATURE AND EXTENT WELLS Well Number NE–8
Job Number 35117108 Installation Date 6/8/2011 Location GENTRY, AR.
Datum Elevation 1,182.13 Surface Elevation 1,179.10
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010"
Riser Diameter & Material 2" PVC Borehole Diameter 8", 3.25"
Granular Backfill Material 12–20 SAND Terracon Representative JODY ADAMS
Drilling Method HOLLOW STEM AUGER Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'
Length of Solid riser: 22.85'
Total Depth of Monitoring Well: 41.25' from TOC
Depth to Top of Bentonite Seal 20' bgs
Depth to Top of Primary Filter Pack 26.5' bgs
Length of Screen and Bottom Cap. 15.4'
Total Depth Drilled 38.5' fbgs

▨ Bentonite Grout

■ Bentonite Plug

□ Granular Backfill

(Not to Scale)

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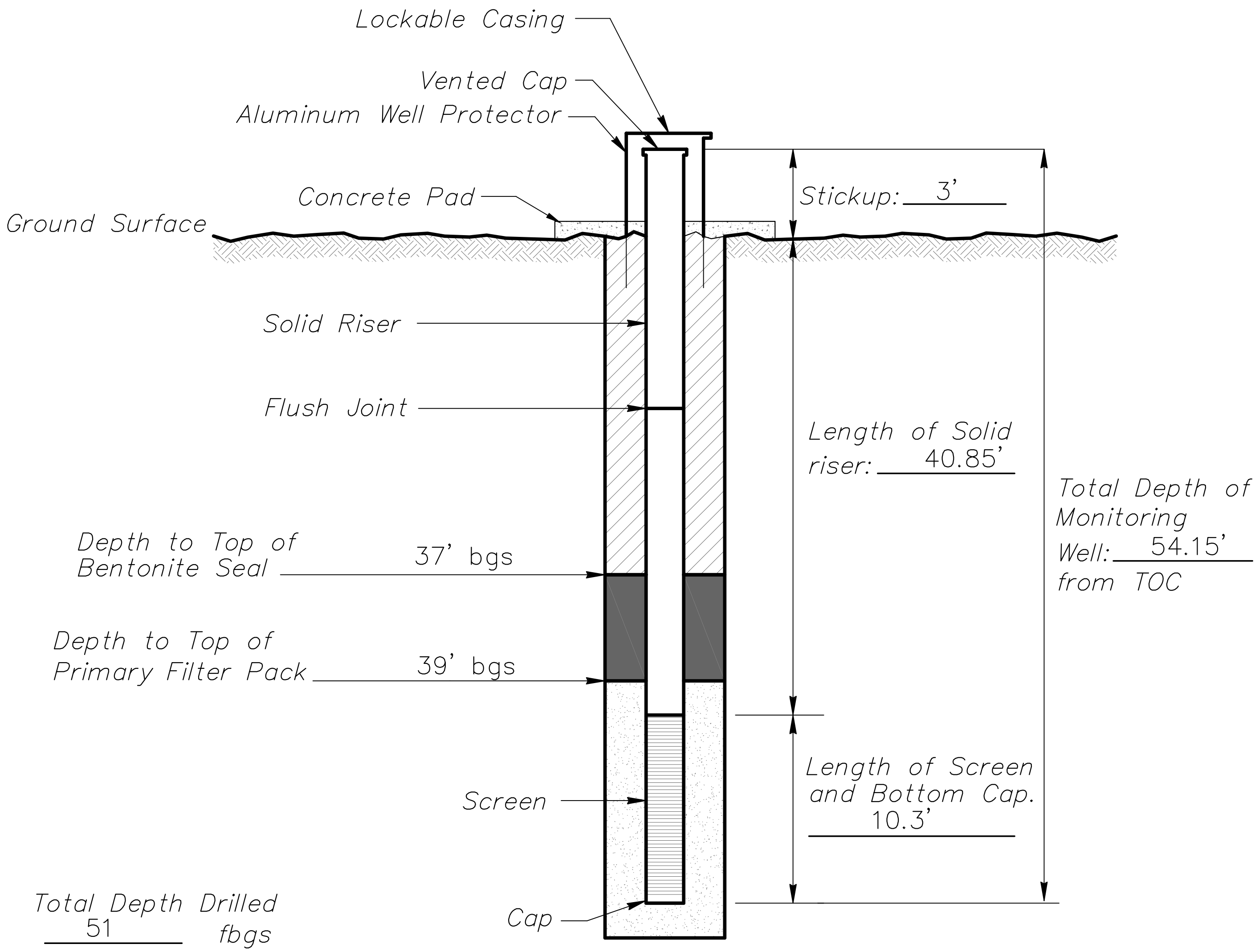
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35117108
WELL NUMBER: NE–8
DRAWING NUMBER: 020 **CHECKED BY:** QEB

MONITORING WELL INSTALLATION RECORD

Job Name AEP–Flint Creek Monitoring Well Installation Well Number B–10
Job Number 35157178 Installation Date 11/11/15–11/12/15 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 4"–8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 40.85'

Total Depth of Monitoring Well: 54.15' from TOC

Depth to Top of Bentonite Seal 37' bgs

Depth to Top of Primary Filter Pack 39' bgs

Length of Screen and Bottom Cap. 10.3'

Total Depth Drilled 51 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

⬚ Granular Backfill

(Not to Scale)

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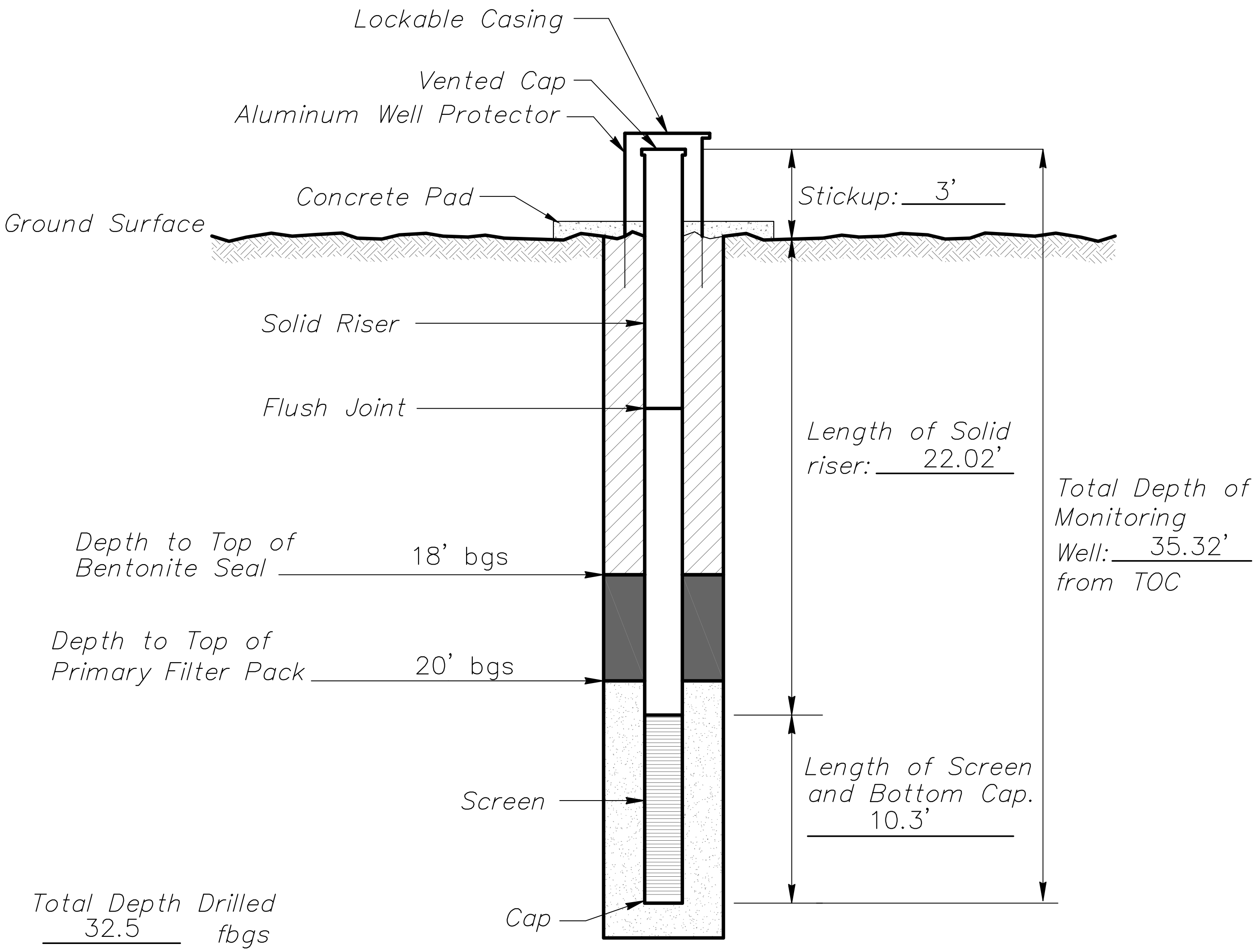
MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157178
WELL NUMBER: B–10
DRAWING NUMBER: 003 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name AEP–Flint Creek Monitoring Well Installation Well Number B–11
Job Number 35157178 Installation Date 11/10/15–11/12/15 Location AEP–FLINT CREEK –GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16–30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'

Length of Solid riser: 22.02'

Total Depth of Monitoring Well: 35.32' from TOC

Depth to Top of Bentonite Seal 18' bgs

Depth to Top of Primary Filter Pack 20' bgs

Length of Screen and Bottom Cap. 10.3'

Total Depth Drilled 32.5 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

Terracon
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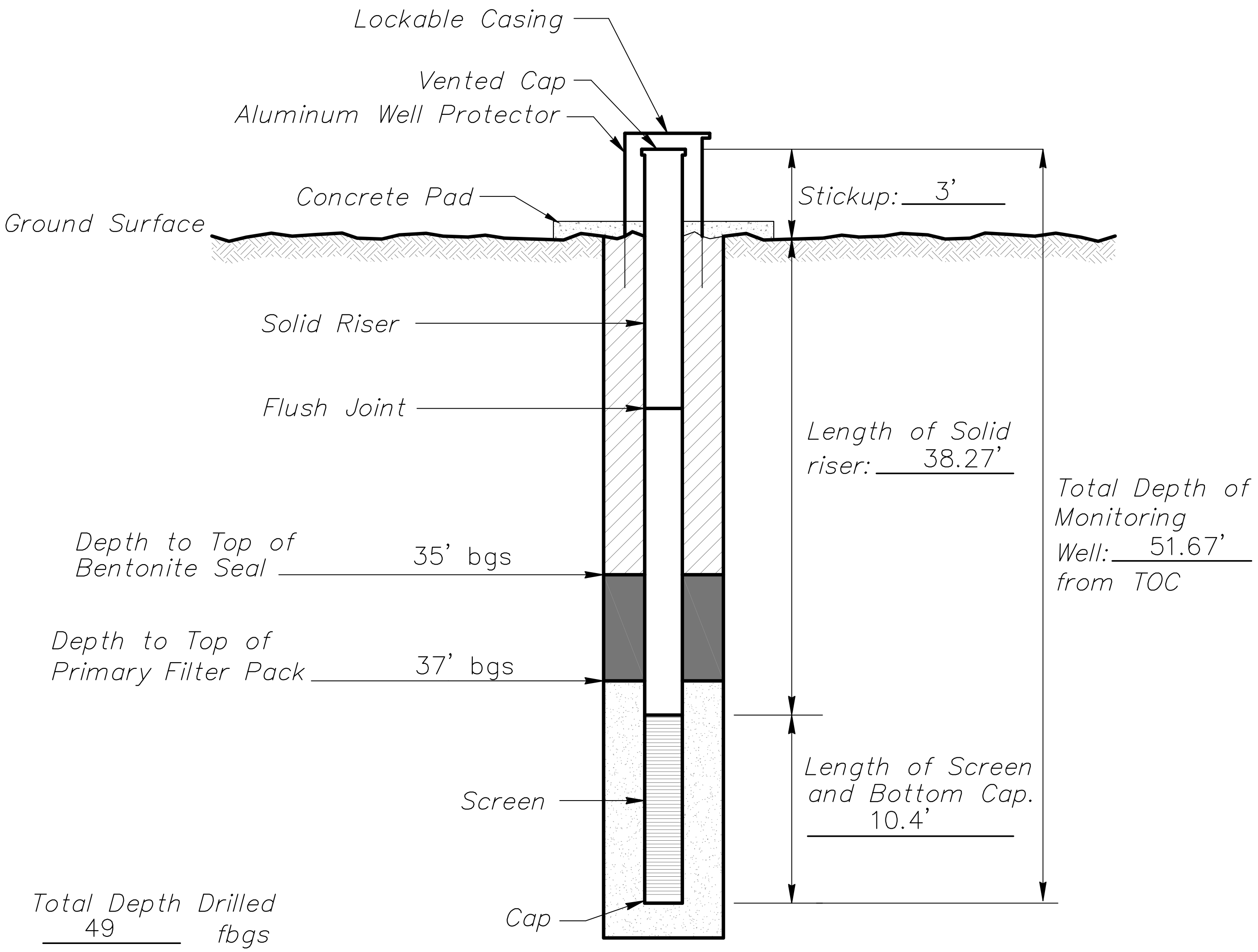
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216–001–35157178
WELL NUMBER: B–11
DRAWING NUMBER: 004 CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION
Well Number B-12
Job Number 35157182
Installation Date 2/10/2016
Location AEP-FLINT CREEK -GENTRY, AR.
Datum Elevation NA
Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC
Slot Size 0.010
Riser Diameter & Material 2" PVC
Borehole Diameter 8"
Granular Backfill Material 16-30 SAND
Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY
Drilling Contractor ANDERSON ENGINEERING



▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

(Not to Scale)

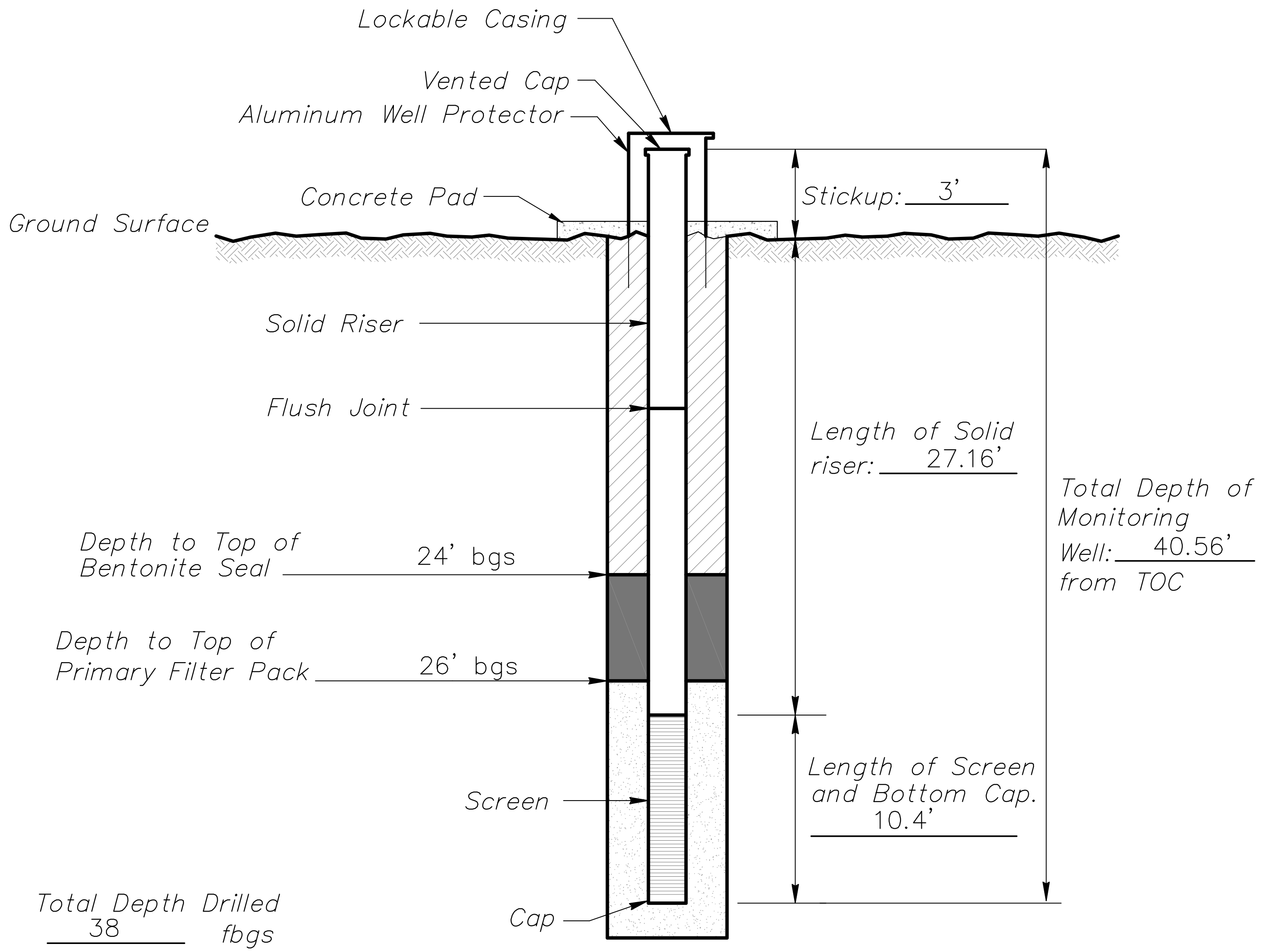
Terracon
Consulting Engineers and Scientists
25809 I-30 South
BRYANT, AR. 72022
PH. (501) 847-9292
FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD

PROJECT NUMBER: 216-001-35157182
WELL NUMBER: B-12
DRAWING NUMBER: 007
CHECKED BY: MR

MONITORING WELL INSTALLATION RECORD

Job Name FLINT CREEK – CCR WELL INSTALLATION Well Number B-13
Job Number 35157182 Installation Date 2/9/2016 Location AEP-FLINT CREEK -GENTRY, AR.
Datum Elevation NA Surface Elevation NA
Datum for Water Level Measurement T.O.C.
Screen Diameter & Material 2" PVC Slot Size 0.010
Riser Diameter & Material 2" PVC Borehole Diameter 8"
Granular Backfill Material 16-30 SAND Terracon Representative ADAM HOOPER
Drilling Method HOLLOW STEM AUGER AND AIR ROTARY Drilling Contractor ANDERSON ENGINEERING



Stickup: 3'
Length of Solid riser: 27.16'
Total Depth of Monitoring Well: 40.56' from TOC
Depth to Top of Bentonite Seal 24' bgs
Depth to Top of Primary Filter Pack 26' bgs
Length of Screen and Bottom Cap. 10.4'
Total Depth Drilled 38 fbgs

▨ Portland/Bentonite Grout

■ Bentonite Pellet Plug

░ Granular Backfill

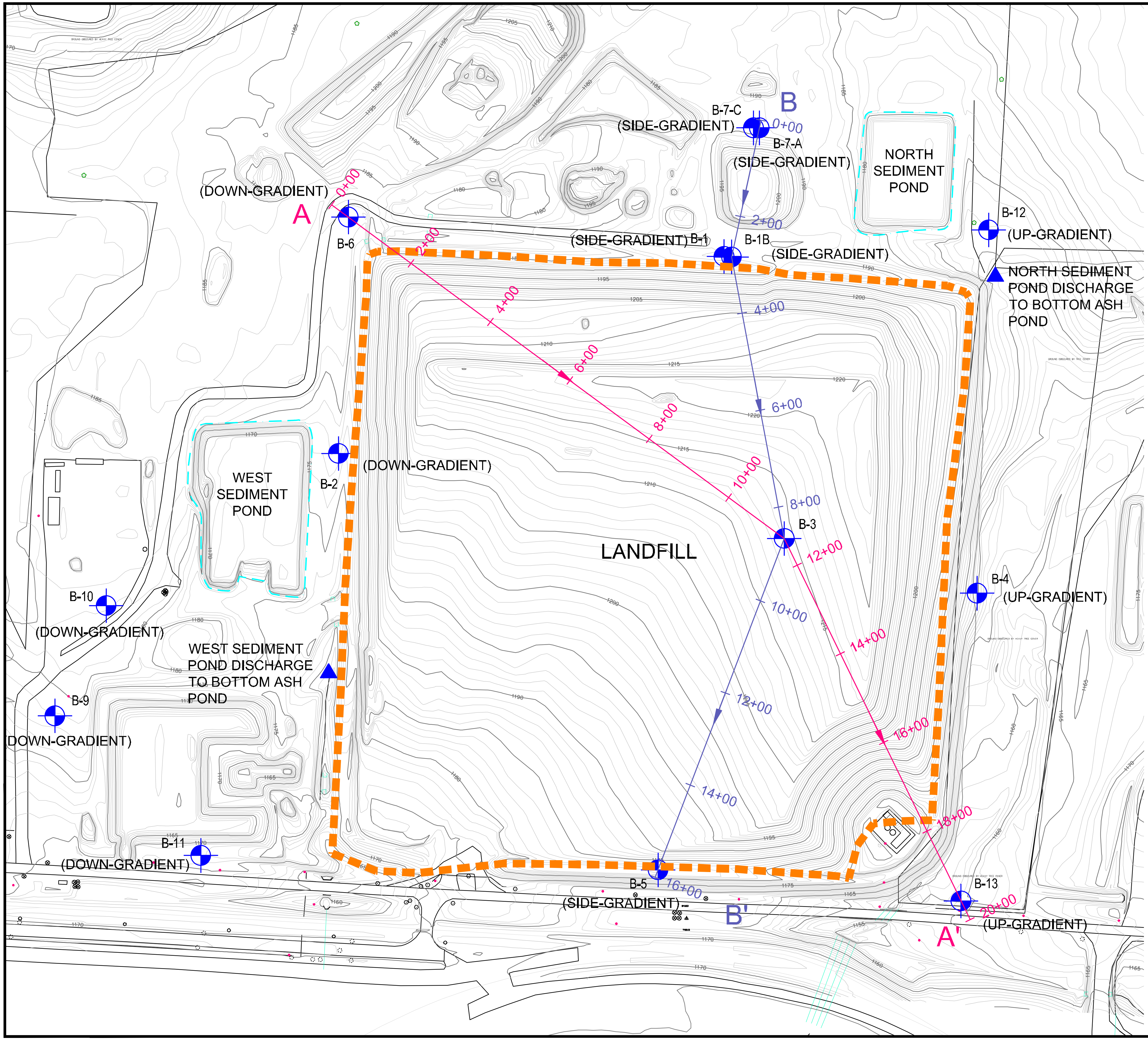
(Not to Scale)

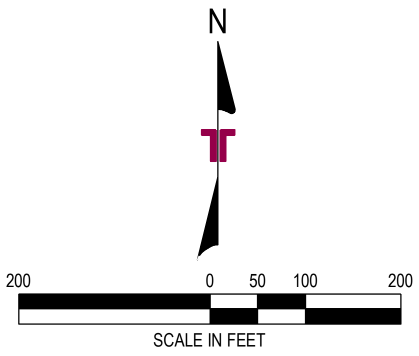
Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

MONITORING WELL INSTALLATION RECORD
PROJECT NUMBER: 216-001-35157182
WELL NUMBER: B-13
DRAWING NUMBER: 008 CHECKED BY: MR

APPENDIX 2

Geologic Cross Sections





LEGEND:

▬ ▬ ▬	LANDFILL WASTE BOUNDARY
⊕	MONITORING WELL

NOTES:

LANDFILL BOTTOM GRADING ESTIMATED FROM BORING LOG DATA AND 1977 SURFACE TOPOGRAPHY (HULL AND ASSOC. DWG. 1-30110-B/1-30111-B, DATED 11/01/2010).

TOP OF LANDFILL ELEVATIONS FROM AERIAL SURVEY BY HENDERSON AERIAL SURVEYS INC., DATED 04/30/2015.

REV.	DATE	BY	DESCRIPTION

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

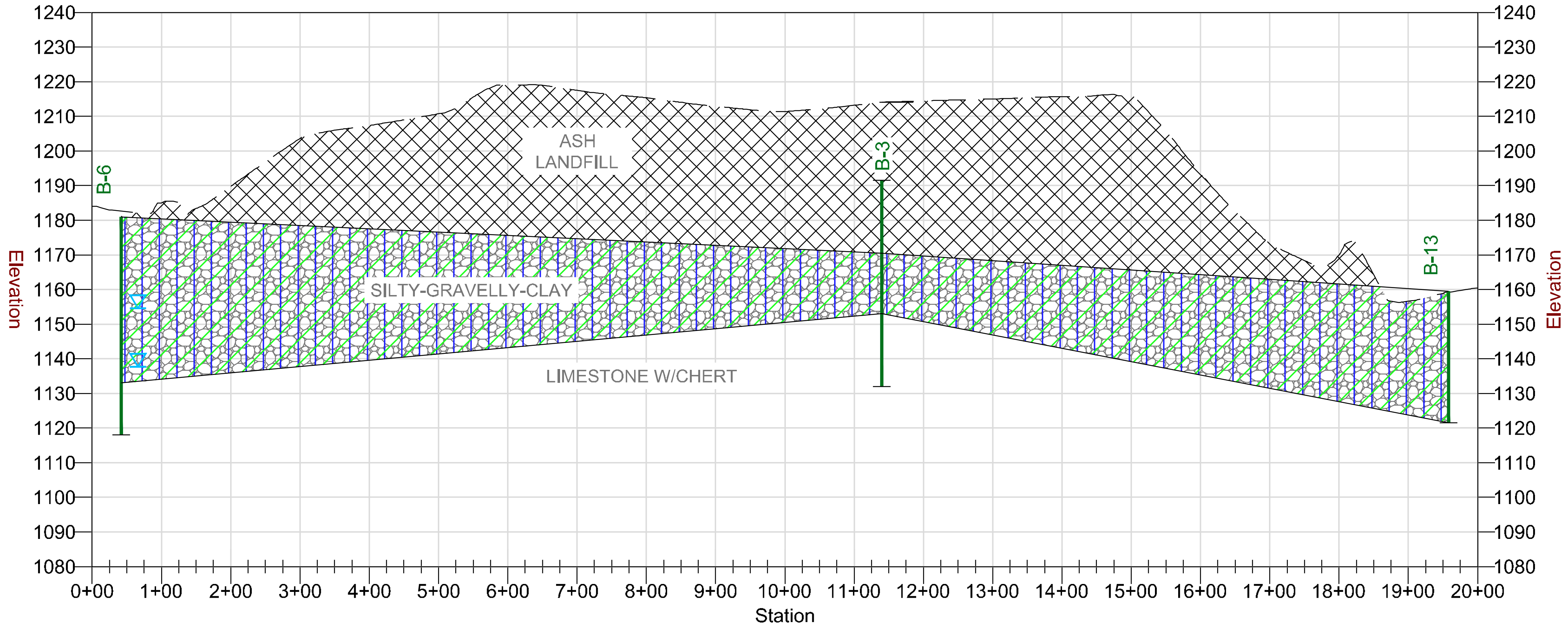
CROSS SECTION LOCATION MAP

LITHOLOGY CROSS SECTIONS
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

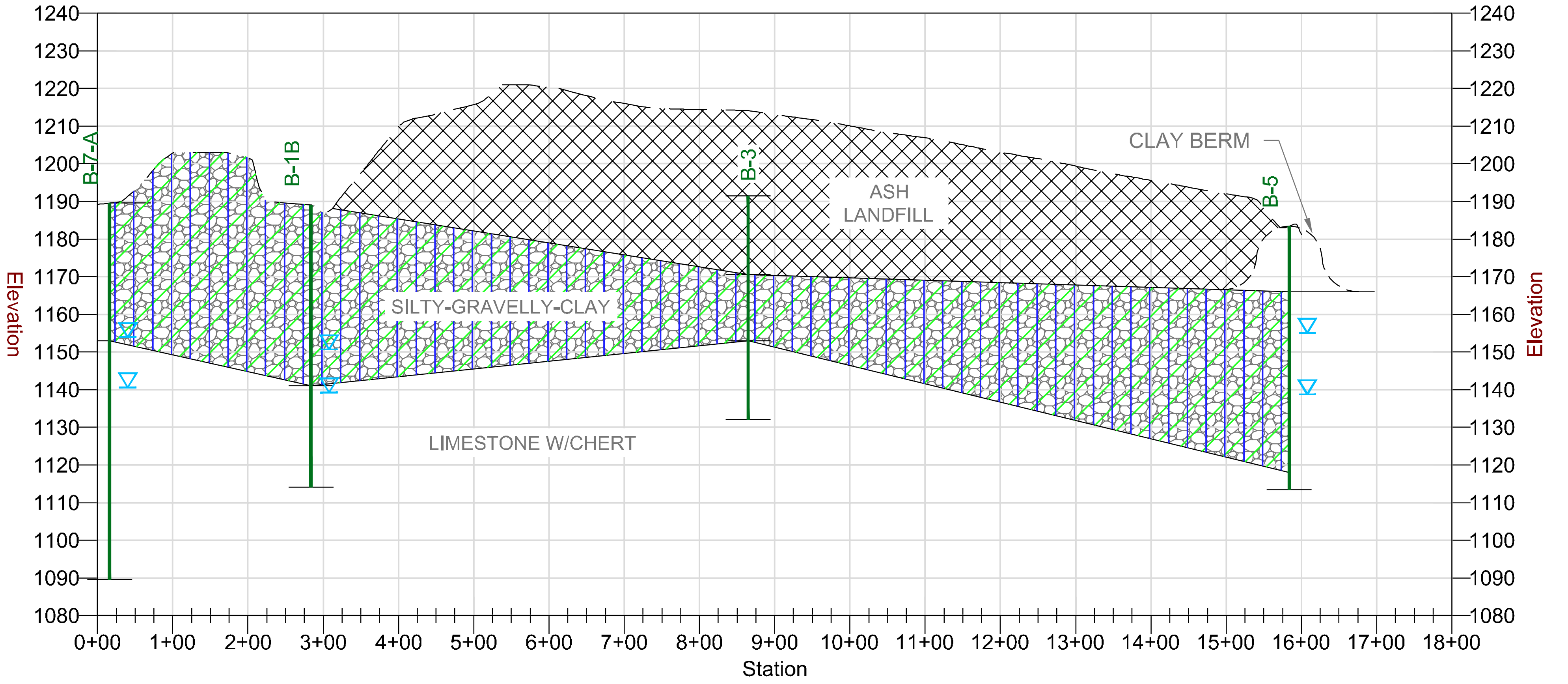
FIGURE 1

DESIGNED BY:	SRE
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	SEE BARSCALE
DATE:	04/27/2016
JOB NO.	216-001-35157124
ACAD NO.	***
SHEET NO.:	1 OF 2

CROSS SECTION A-A'



CROSS SECTION B-B'



▨	BASE
▨	POND FILL
▨	EMBANKMENT FILL (CL) (MADE GROUND)
▨	LEAN CLAY (CL) (NATIVE GROUND)
🟥	SILT
▨	SILTY CLAY (CL-ML) (NATIVE GROUND)
▨	SANDY LEAN CLAY (CL) (NATIVE GROUND)
▨	CLAYSTONE

FIGURE 2

DESIGNED BY:	SRE
DRAWN BY:	SRE
APPVD. BY:	DCM
SCALE:	1" = 200'
DATE:	04/27/2016
JOB NO.	216-001-35157124
ACAD NO.	***
SHEET NO.:	2 OF 2

CROSS SECTIONS - A-A' & B-B'
LITHOLOGY CROSS SECTIONS
AMERICAN ELECTRIC POWER
SWEPCO FLINT CREEL POWER PLANT LANDFILL
GENTRY ARKANSAS

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REV.	DATE	BY	DESCRIPTION

Appendix E

Annual Groundwater Monitoring Reports – January 2020

for

Flint Creek Plant's

Primary Bottom Ash Pond

and

Landfill

Annual Groundwater Monitoring Report

Southwestern Electric Power Company
Flint Creek Power Plant
Primary Bottom Ash Pond CCR Management Unit
Gentry, Arkansas

January 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

SOUTHWESTERN ELECTRIC POWER COMPANY
An AEP Company
BOUNDLESS ENERGY

Page

Table of Contents

I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for an existing CCR unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Flint Creek Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31, 2020.

At the beginning of 2019 the PBAP was in detection monitoring. At the end of 2019 the PBAP was still in detection monitoring.

In general, the following activities were completed:

- Groundwater samples were collected and analyzed for Appendix III constituents, as specified in 40 CFR 257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Two sampling events occurred in 2018 and were not reported in the 2018 annual report. The 1st half 2018 detection monitoring sampling event resulted in no SSIs. The 2nd half 2018 detection monitoring sampling event resulted in no SSIs.
- A SSI was determined for calcium in well AP-59 for the 1st half 2019 groundwater sampling and analysis event;
- A successful alternate source demonstration was prepared for the 1st half 2019 groundwater event;
- The 2nd half 2019 groundwater sampling event has not completed its statistical evaluation report.
- Groundwater Monitoring Statistical Evaluation Reports to evaluate groundwater data were prepared and certified in accordance with 40 CFR 257.93. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009).

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened;

- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs is included in Appendix I;
- Other information required to be included in the annual report such as alternate source demonstration or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

The figure that follows depicts the PE-certified groundwater monitoring network, the monitoring well locations and their corresponding identification numbers.

PBAP Monitoring Wells	
Up Gradient	Down Gradient
AP-51	AP-58
AP-53	AP-59
AP-54	AP-60

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned this year.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion

Appendix I contains tables showing the groundwater quality. Static water elevation data from each monitoring event also are shown in Appendix I, along with the groundwater velocity, groundwater flow direction and potentiometric maps developed after each sampling event.

V. Statistical Evaluation of 2018 and 2019 Events

The 1st half 2018 statistical analysis report is included in Appendix II. No SSIs were determined to for this report.

The 2nd half 2018 statistical analysis report is included in Appendix II. No SSIs were determined to for this report.

The 1st half 2019 statistical analysis report is included in Appendix II. A SSI was determined to exist in this report, however a successful alternate source demonstration was prepared that addressed the SSI.

The 2nd half 2019 statistical analysis report is under development and not available in this report.

VI. Alternate Source Demonstration

In the 1st half 2019 sampling event, a SSI in calcium was determined at well AP-59. An alternate source determination report was prepared. This report documented that natural variation in calcium concentrations caused the relatively high sample concentrations. That is, a cause other than the CCR unit caused the statistical result. See Appendix III.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

There were no groundwater program transitions this year. The detection monitoring program remains in effect.

Regarding defining an alternate monitoring frequency, no modification of the twice-per-year detection monitoring effort is needed.

VIII. Other Information Required

No other information applies at this time.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No problems were encountered this year.

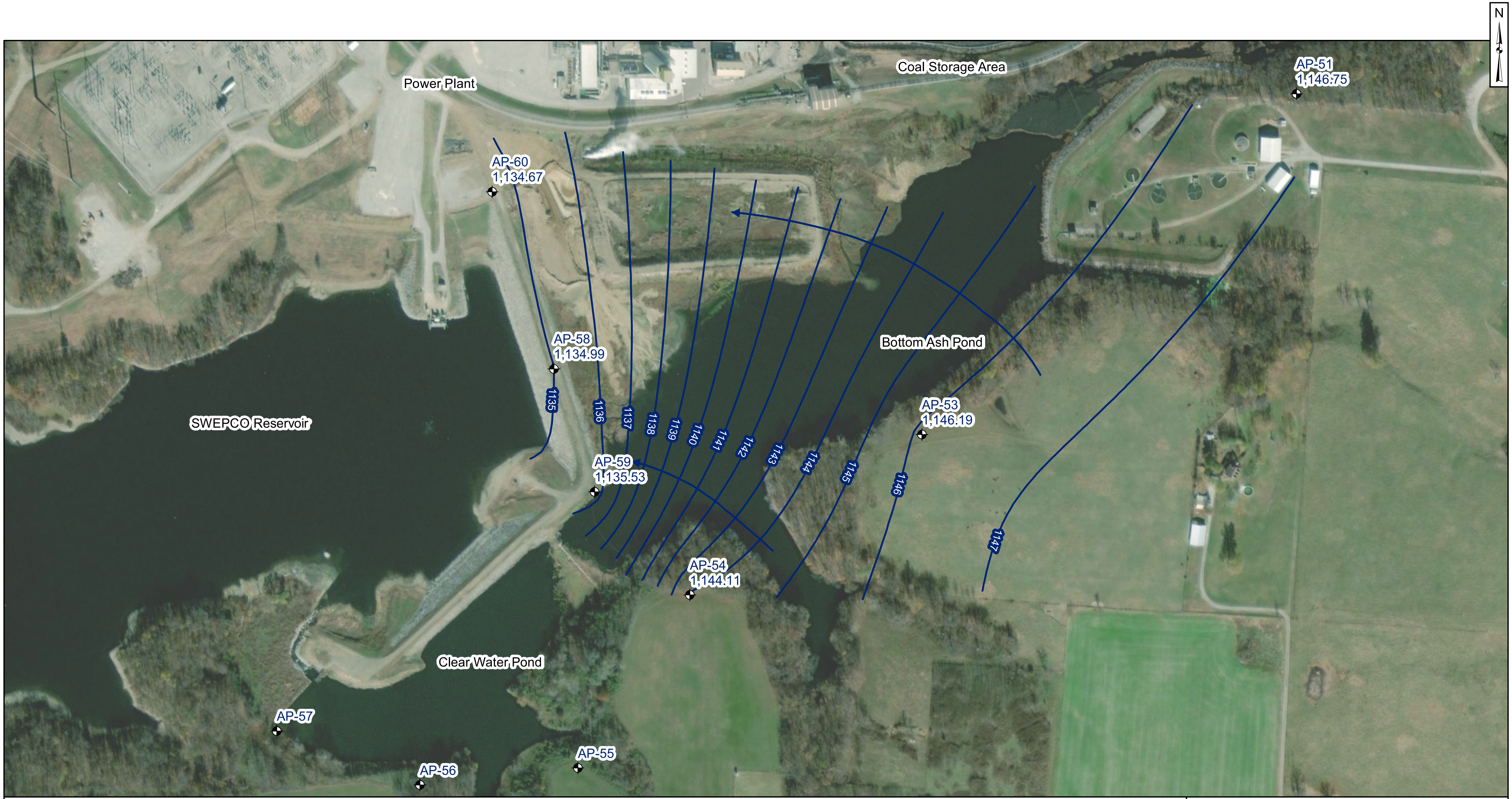
X. A Projection of Key Activities for the Upcoming Year

Key activities for next year include:

- Detection monitoring on a twice per year schedule;
- Evaluation of the detection monitoring results from a statistical analysis viewpoint, looking for any SSIs above background;
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX I

Tables follow, showing the groundwater monitoring data collected, the rate and direction of groundwater flow, and a summary showing the number of samples collected per monitoring well. The dates that the samples were collected also is shown.



Legend

- Monitoring Wells
- Groundwater Contour Elevation
- Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data were collected March 26 - 28, 2018, provided by AEP.
- AP-52 was abandoned December 6, 2016.
- AP-60 was installed January 9, 2017.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - March 2018

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2018/09/17

Figure
X

\\annarbor-01\data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2018\AEP-Flint Creek_GW_BAP_March2018.mxd. ARevezzo. 9/17/2018. CHA8423/01/08.

Legend

- ⯐ Monitoring Wells
- — Groundwater Contour Elevation
- → Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data were collected August 28, 2018, provided by AEP.
- AP-52 was abandoned December 6, 2016.
- AP-60 was installed January 9, 2017.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - August 2018

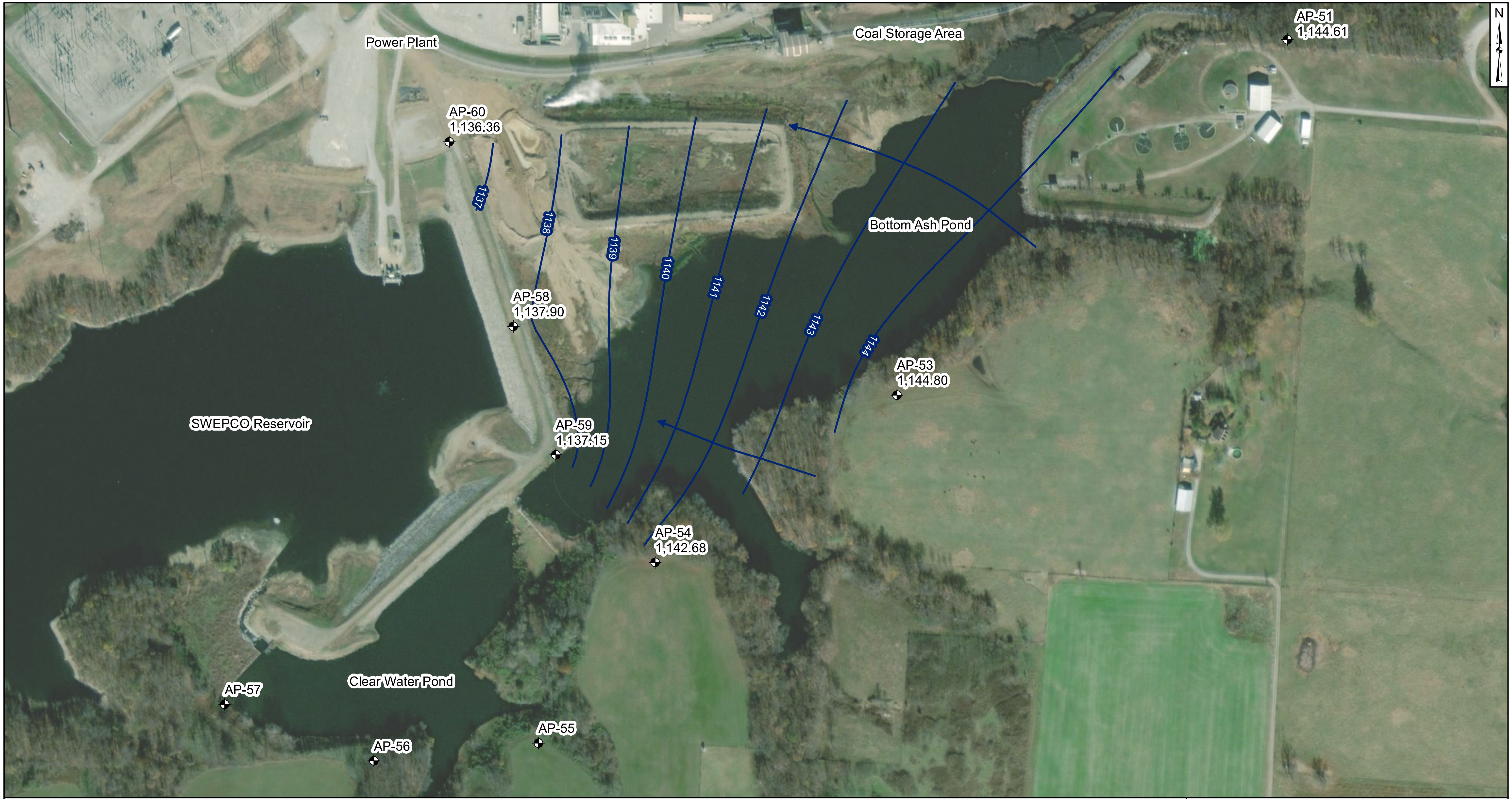
AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec consultants

Columbus, Ohio | 2019/01/22

Figure
X

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2018\AEP-Flint Creek_GW_BAP_Aug2018.mxd. ARevezzo. 1/22/2019. CHA8423/01/08.



Legend

⊕ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

Notes
- Monitoring well coordinates and water level data were collected March 11-12, 2019, provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - March 2019

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio | 2019/11/01

Figure
X

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Legend

⌖ Monitoring Wells

— Groundwater Contour Elevation

→ Groundwater Flow Direction

Notes

- Monitoring well coordinates and water level data were collected August 27-28, 2019 provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Evaluation (Terracon, 2017) provided by AEP.
- Groundwater elevation units are feet above mean sea level.
- AP-55, AP-56, and AP-57 were not gauged in August 2019.

200 100 0 200
Feet

Potentiometric Surface Map
Uppermost Aquifer - August 2019

AEP Flint Creek Plant - Primary Bottom Ash Pond
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio

2019/12/30

Figure

X

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\BAP\2019\AEP-Flint Creek_GW_BAP_August2019.mxd. ARevezzo. 12/30/2019. CHA8423/01/08.

Table 1: Residence Time Calculation Summary
Flint Creek Primary Bottom Ash Pond

			2018-03		2018-08	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Primary Bottom Ash Pond	AP-51 [1]	2.0	96	0.6	62	1.0
	AP-53 [1]	2.0	231	0.3	180	0.3
	AP-54 [1]	2.0	701	0.1	429	0.1
	AP-58 [2]	2.0	240	0.3	180	0.3
	AP-59 [2]	2.0	83	0.7	430	0.1
	AP-60 [2],[3]	2.0	151	0.4	167	0.4

Notes:

[1] - Background Well

[2] - Downgradient Well

[3] - AP-52 was replaced with AP-60 in December 2016

Table 1: Residence Time Calculation Summary
Flint Creek Primary Bottom Ash Pond

			2019-03		2019-08	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Primary Bottom Ash Pond	AP-51 [1]	2.0	61	1.0	62	1.0
	AP-53 [1]	2.0	184	0.3	177	0.3
	AP-54 [1]	2.0	476	0.1	378	0.2
	AP-58 [2]	2.0	128	0.5	137	0.4
	AP-59 [2]	2.0	463	0.1	447	0.1
	AP-60 [2],[3]	2.0	160	0.4	137	0.4

Notes:
[1] - Background Well
[2] - Downgradient Well
[3] - AP-52 was replaced with AP-60 in December 2016

Table 1 - Groundwater Data Summary: AP-51
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.01	4.86	4	<0.083 U	4.6	61	2
7/18/2016	Background	0.01	5.07	6	<0.083 U	5.3	80	4
9/13/2016	Background	0.01	5.84	6	<0.083 U	5.3	64	3
10/5/2016	Background	0.00767833 J	5.24	7	<0.083 U	5.0	80	4
11/8/2016	Background	0.01	5.23	7	<0.083 U	5.2	76	4
1/24/2017	Background	0.00849011 J	5.43	5	<0.083 U	5.1	80	<0.14 U
3/7/2017	Background	0.01	5.05	5	<0.083 U	5.0	40	0.5139 J
4/26/2017	Background	0.01475	4.21	6	0.28 J	5.2	96	6
5/16/2017	Background	0.01135	5.55	6	<0.083 U	5.1	60	3
6/16/2017	Background	0.0186	5.61	7	<0.083 U	5.1	68	3
8/29/2017	Detection	0.01706	5.13	6	<0.083 U	4.8	50	3
3/28/2018	Detection	0.01519	11.1	2	<0.083 U	7.8	96	9
8/28/2018	Detection	0.011	6.69	- -	- -	7.7	74	- -
10/22/2018	Detection	- -	- -	9.71	<0.083 U	- -	- -	2.14
3/11/2019	Detection	0.01 J	6.20	7.84	0.04 J	7.6	70	<0.06 U
6/10/2019	Detection	<0.04 U	13.1	7.79	0.05 J	7.2	106	2.6
8/28/2019	Detection	<0.02 U	6.79	7	<0.083 U	6.0	56	1

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AP-51
Flint Creek - PBAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	80	0.257631 J	0.0935902 J	0.258389 J	0.434643 J	1.063	<0.083 U	<0.68 U	<0.00013 U	0.01938 J	0.92212 J	1.24502 J	<0.86 U
7/18/2016	Background	<0.93 U	<1.05 U	86	0.308658 J	<0.07 U	1	2.39535 J	- -	<0.083 U	0.839767 J	0.003	0.01329 J	<0.29 U	<0.99 U	<0.86 U
9/13/2016	Background	<0.93 U	<1.05 U	128	0.373982 J	<0.07 U	6	14	2.38	<0.083 U	3.72318 J	0.005	0.00978 J	<0.29 U	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	98	0.329677 J	<0.07 U	2	5	1.656	<0.083 U	1.49287 J	0.008	<0.005 U	<0.29 U	<0.99 U	<0.86 U
11/8/2016	Background	1.28923 J	<1.05 U	105	0.453846 J	0.226326 J	4	9	1.387	<0.083 U	2.07767 J	0.004	0.00949 J	<0.29 U	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	103	0.366323 J	<0.07 U	2	4.46068 J	1.916	<0.083 U	<0.68 U	0.003	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/7/2017	Background	7.00	<1.05 U	95	0.355243 J	0.128375 J	2	5	1.31	<0.083 U	0.88397 J	0.002	<0.005 U	0.586637 J	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	<1.05 U	62.43	0.24 J	<0.07 U	1.96	4.08 J	0.6089	0.28 J	<0.68 U	0.00216	<0.005 U	<0.29 U	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	<1.05 U	101	0.42 J	0.1 J	1.86	6.92	2.935	<0.083 U	<0.68 U	0.00315	<0.005 U	<0.29 U	<0.99 U	<0.86 U
6/16/2017	Background	<0.93 U	2.5 J	88.87	0.27 J	<0.07 U	0.89 J	5.26	1.728	<0.083 U	<0.68 U	0.0024	<0.005 U	<0.29 U	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AP-53
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.11	4.15	10	<0.083 U	4.7	80	25
7/18/2016	Background	0.109	3.49	12	<0.083 U	4.5	104	30
9/13/2016	Background	0.155	5.54	13	<0.083 U	4.7	104	35
10/5/2016	Background	0.121	3.39	13	0.205 J	4.9	110	32
11/8/2016	Background	0.138	3.38	14	<0.083 U	5.0	118	31
1/24/2017	Background	0.158	3.87	14	<0.083 U	5.0	132	47
3/7/2017	Background	0.137	3.85	13	<0.083 U	5.0	112	47
4/26/2017	Background	0.124	3.89	15	<0.083 U	5.6	200	48
5/16/2017	Background	0.118	3.46	14	<0.083 U	4.5	90	42
6/16/2017	Background	0.122	3.39	14	<0.083 U	5.0	136	38
8/29/2017	Detection	0.114	2.82	11	<0.083 U	4.8	92	34
3/28/2018	Detection	0.115	3.51	12	<0.083 U	5.0	114	43
8/28/2018	Detection	0.124	3.37	- -	- -	5.6	120	- -
10/22/2018	Detection	- -	- -	19.2	<0.083 U	- -	- -	45
3/11/2019	Detection	0.114	3.09	12.3	0.07 J	5.2	130	34.6
6/10/2019	Detection	0.110	3.37	13.4	0.06	5.2	98	32.8
8/28/2019	Detection	0.083	3.11	8	<0.083 U	5.4	96	21

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AP-53
Flint Creek - PBAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	6	142	1	0.585577 J	37	12	3.55	<0.083 U	11	0.006	0.159	2.50374 J	<0.99 U	<0.86 U
7/18/2016	Background	<0.93 U	2.79903 J	76	0.473295 J	0.0914021 J	7	4.26267 J	- -	<0.083 U	1.07393 J	0.004	0.046	0.344001 J	1.20159 J	<0.86 U
9/13/2016	Background	<0.93 U	24	258	3	1	94	27	5.93	<0.083 U	30	0.036	0.085	6	<0.99 U	0.981236 J
10/5/2016	Background	<0.93 U	<1.05 U	63	0.289207 J	<0.07 U	2	3.26642 J	0.568	0.205 J	<0.68 U	0.009	0.025	<0.29 U	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	8	122	0.980287 J	3	26	13	2.06	<0.083 U	8	0.01	0.118	1.0939 J	<0.99 U	<0.86 U
1/24/2017	Background	1.37199 J	3.86298 J	97	0.663471 J	0.0732158 J	16	9	2.16	<0.083 U	3.91103 J	0.006	0.183	0.821188 J	<0.99 U	<0.86 U
3/7/2017	Background	1.45983 J	7	110	0.851036 J	0.485904 J	21	15	1.915	<0.083 U	8	0.007	0.14	1.44927 J	<0.99 U	<0.86 U
4/26/2017	Background	1.23 J	4.82 J	102	0.61 J	0.22 J	15.41	7.89	1.552	<0.083 U	4.13 J	0.00623	<0.005 U	0.96 J	2.14 J	<0.86 U
5/16/2017	Background	1.95 J	1.53 J	64.08	0.33 J	<0.07 U	3.01	2.9 J	1.327	<0.083 U	<0.68 U	0.00228	0.04	0.31 J	<0.99 U	<0.86 U
6/16/2017	Background	1.15 J	3.1 J	71.32	0.41 J	<0.07 U	5.78	3 J	2.139	<0.083 U	0.87 J	0.00357	0.043	<0.29 U	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AP-54
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.249	10.4	14	<0.083 U	5.8	180	77
7/18/2016	Background	0.255	10	16	<0.083 U	5.8	178	78
9/13/2016	Background	0.266	10.6	16	<0.083 U	5.6	172	75
10/5/2016	Background	0.255	11.8	15	0.1943 J	5.5	164	67
11/8/2016	Background	0.26	11.3	15	<0.083 U	5.7	168	71
1/24/2017	Background	0.284	11.2	14	<0.083 U	5.5	164	71
3/7/2017	Background	0.259	11.3	14	<0.083 U	5.4	150	64
4/26/2017	Background	0.256	10.8	15	<0.083 U	6.1	154	66
5/16/2017	Background	0.256	9.58	16	<0.083 U	5.1	136	66
6/16/2017	Background	0.249	7.53	15	<0.083 U	5.3	192	62
8/29/2017	Detection	0.259	11.3	13	<0.083 U	5.5	156	63
3/28/2018	Detection	0.223	5.61	13	<0.083 U	5.3	130	64
8/28/2018	Detection	0.240	15.5	- -	- -	5.9	168	- -
10/22/2018	Detection	- -	- -	18.3	<0.083 U	- -	- -	54.4
3/11/2019	Detection	0.219	14.5	16.0	0.09 J	6.4	160	47.2
6/10/2019	Detection	0.209	10.7	15.3	0.07	6.5	134	52.5
8/28/2019	Detection	0.213	12.2	12	<0.083 U	6.8	154	51

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AP-54
Flint Creek - PBAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	35	0.177109 J	<0.07 U	0.485517 J	7	1	<0.083 U	<0.68 U	0.000736668 J	0.02407 J	<0.29 U	<0.99 U	1.05347 J
7/18/2016	Background	<0.93 U	<1.05 U	58	0.294165 J	<0.07 U	1	13	- -	<0.083 U	<0.68 U	0.001	0.031	<0.29 U	<0.99 U	<0.86 U
9/13/2016	Background	<0.93 U	<1.05 U	38	0.0361596 J	<0.07 U	0.470668 J	7	3.37	<0.083 U	<0.68 U	0.000599096 J	0.0122 J	<0.29 U	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	35	0.175329 J	<0.07 U	1	6	1.59	0.1943 J	<0.68 U	0.006	0.02499 J	<0.29 U	1.26436 J	<0.86 U
11/8/2016	Background	<0.93 U	1.8333 J	227	0.250807 J	0.164026 J	9	19	1.722	<0.083 U	1.30257 J	0.002	0.049	1.06052 J	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	4.57372 J	109	0.660002 J	0.132116 J	25	24	1.107	<0.083 U	7	0.006	0.082	3.34504 J	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	96	0.164735 J	<0.07 U	4	12	2.125	<0.083 U	<0.68 U	0.003	0.00568 J	0.545312 J	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	<1.05 U	31.04	0.1 J	<0.07 U	0.42 J	4.4 J	0.769	<0.083 U	<0.68 U	0.00048 J	0.017 J	<0.29 U	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	<1.05 U	34.92	0.16 J	<0.07 U	0.44 J	5.33	1.222	<0.083 U	<0.68 U	0.00078 J	0.02 J	<0.29 U	<0.99 U	<0.86 U
6/16/2017	Background	5.57	1.65 J	46.98	0.28 J	<0.07 U	0.53 J	7.14	1.325	<0.083 U	<0.68 U	0.00127	0.018 J	<0.29 U	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AP-58
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	1.44	24.9	18	0.8759 J	7.1	602	213
7/18/2016	Background	1.68	27.4	21	0.8849 J	8.4	691	229
9/13/2016	Background	1.66	17.5	23	0.7518 J	8.3	644	238
10/5/2016	Background	1.56	18.9	27	0.8942 J	8.8	696	231
11/7/2016	Background	1.26	30.5	22	0.5598 J	7.8	562	186
1/24/2017	Background	1.09	34.4	16	<0.083 U	8.1	448	158
3/7/2017	Background	0.829	48.1	14	<0.083 U	7.0	420	123
4/26/2017	Background	0.613	59	14	0.53 J	7.1	374	111
5/16/2017	Background	0.473	69.3	13	0.4677 J	7.5	344	104
6/16/2017	Background	0.416	70.1	12	<0.083 U	6.0	398	101
8/29/2017	Detection	0.333	75.5	12	<0.083 U	7.8	344	96
12/21/2017	Detection	0.268	73.9	- -	- -	7.4	304	80
3/26/2018	Detection	0.228	77.2	8	<0.083 U	7.4	262	70
8/28/2018	Detection	0.237	75.9	- -	- -	6.9	300	- -
10/23/2018	Detection	- -	- -	12.5	<0.083 U	- -	- -	75.5
3/12/2019	Detection	0.178	74.8	8.13	0.33	8.4	290	49.9
6/11/2019	Detection	0.173	78.3	7.64	0.36	7.6	272	52.2
8/27/2019	Detection	0.149	76.1	6	0.222 J	7.5	292	53

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AP-58
Flint Creek - PBAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	5	37	0.105636 J	<0.07 U	0.810009 J	3.86496 J	0.548	0.8759 J	<0.68 U	<0.00013 U	0.032	62	<0.99 U	<0.86 U
7/18/2016	Background	<0.93 U	22	104	3	0.459763 J	8	7	- -	0.8849 J	12	0.018	0.042	66	2.81093 J	<0.86 U
9/13/2016	Background	0.971405 J	25	39	0.162863 J	<0.07 U	2	2.29869 J	1.007	0.7518 J	2.19582 J	0.007	0.02274 J	68	1.13435 J	1.02461 J
10/5/2016	Background	1.99545 J	18	41	0.382276 J	<0.07 U	3	2.68738 J	0.787	0.8942 J	1.93685 J	0.017	<0.005 U	63	2.55318 J	<0.86 U
11/7/2016	Background	<0.93 U	14	41	0.108253 J	<0.07 U	1	1.28551 J	1.65	0.5598 J	<0.68 U	0.008	0.00775 J	44	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	11	56	0.0635907 J	<0.07 U	2	1.8255 J	1.896	<0.083 U	<0.68 U	0.009	0.00625 J	39	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	8	42	0.0245 J	<0.07 U	1	1.05431 J	0.938	<0.083 U	0.928114 J	0.015	<0.005 U	26	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	6.14	49.86	0.09 J	<0.07 U	1.57	1.36 J	1.163	0.53 J	<0.68 U	0.01194	0.006 J	16.9	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	4.32 J	43.08	0.03 J	<0.07 U	0.75 J	0.87 J	0.663	0.4677 J	<0.68 U	0.01188	<0.005 U	14.05	<0.99 U	<0.86 U
6/16/2017	Background	2.16 J	2.71 J	41.48	0.03 J	<0.07 U	0.58 J	0.57 J	2.268	<0.083 U	<0.68 U	0.01182	<0.005 U	12.23	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AP-59
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.25	39.3	19	0.7409 J	7.4	240	37
7/18/2016	Background	0.339	38	14	0.6517 J	6.8	220	27
9/13/2016	Background	0.38	36.5	13	0.583 J	7.3	216	25
10/5/2016	Background	0.347	34.6	14	0.7085 J	7.1	220	26
11/7/2016	Background	0.323	35.6	15	0.5832 J	7.2	216	32
1/24/2017	Background	0.317	38.4	13	<0.083 U	7.0	240	40
3/7/2017	Background	0.253	42	13	<0.083 U	7.9	236	43
4/26/2017	Background	0.222	41.4	15	0.61 J	7.2	226	40
5/16/2017	Background	0.208	39.5	13	0.5762 J	7.1	186	38
6/16/2017	Background	0.227	36.2	12	<0.083 U	6.7	224	31
8/29/2017	Detection	0.295	35.4	12	0.6463 J	7.1	210	21
12/21/2017	Detection	0.279	46.8	- -	- -	6.9	228	- -
3/26/2018	Detection	0.218	43.2	12	<0.083 U	7.0	180	40
8/28/2018	Detection	0.277	42.2	- -	- -	7.1	180	- -
10/23/2018	Detection	- -	- -	19	0.548 J	- -	- -	26.7
3/11/2019	Detection	0.221	45.2	15.0	0.59	7.4	46	35.5
6/11/2019	Detection	0.233	46.7	14.7	0.65	7.3	88	38.4
7/9/2019	Detection	- -	45.3	- -	- -	7.0	- -	- -
8/27/2019	Detection	0.246	42.6	11	0.413 J	8.9	228	26

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AP-59
Flint Creek - PBAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	67	<0.02 U	<0.07 U	0.583478 J	2.01538 J	0.711	0.7409 J	<0.68 U	0.000378518 J	0.029	7	<0.99 U	1.24044 J
7/18/2016	Background	<0.93 U	<1.05 U	72	0.0339425 J	<0.07 U	3	2.54042 J	- -	0.6517 J	1.02999 J	0.000590098 J	0.035	9	<0.99 U	1.07757 J
9/13/2016	Background	<0.93 U	<1.05 U	82	<0.02 U	<0.07 U	<0.23 U	2.3351 J	0.725	0.583 J	<0.68 U	0.000162193 J	<0.005 U	9	<0.99 U	1.01454 J
9/14/2016	Background	- -	- -	- -	- -	- -	- -	- -	1.288	- -	- -	- -	- -	- -	- -	- -
10/5/2016	Background	<0.93 U	<1.05 U	89	<0.02 U	<0.07 U	0.300781 J	2.72689 J	0.725	0.7085 J	<0.68 U	0.011	<0.005 U	8	<0.99 U	1.63378 J
11/7/2016	Background	<0.93 U	<1.05 U	93	<0.02 U	<0.07 U	<0.23 U	3.0738 J	1.109	0.5832 J	<0.68 U	0.00039204 J	<0.005 U	8	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	107	<0.02 U	<0.07 U	<0.23 U	3.38517 J	0.3279	<0.083 U	<0.68 U	0.000152708 J	<0.005 U	8	<0.99 U	1.21456 J
3/7/2017	Background	<0.93 U	<1.05 U	96	<0.02 U	<0.07 U	0.244944 J	3.32152 J	0.713	<0.083 U	<0.68 U	0.006	<0.005 U	7	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	1.58 J	104	<0.02 U	<0.07 U	<0.23 U	3.36 J	1.319	0.61 J	<0.68 U	0.00026 J	<0.005 U	5.33	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	<1.05 U	93.9	<0.02 U	<0.07 U	<0.23 U	3 J	0.618	0.5762 J	<0.68 U	0.00033 J	0.006 J	5.66	<0.99 U	1.09 J
6/16/2017	Background	<0.93 U	1.96 J	86.79	<0.02 U	<0.07 U	<0.23 U	2.83 J	2.251	<0.083 U	<0.68 U	0.00021 J	<0.005 U	6.4	<0.99 U	<0.86 U
3/26/2018	Detection	1.79 J	3.19 J	105	<0.02 U	<0.07 U	0.63 J	3.84 J	1.044	<0.083 U	0.98 J	0.00036 J	<0.005 U	4.68 J	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: AP-60
Flint Creek - PBAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
12/19/2016	Background	1.4	16.7	14	0.0946 J	8.9	369	165
1/24/2017	Background	1.12	33.2	13	<0.083 U	7.8	356	152
3/7/2017	Background	1.26	25.9	12	<0.083 U	8.1	340	145
3/29/2017	Background	1.14	43	13	<0.083 U	8.4	368	140
4/26/2017	Background	1.3	25	15	0.58 J	7.6	340	160
5/16/2017	Background	1.41	16.3	14	0.558 J	8.6	302	167
6/16/2017	Background	1.2	29.2	15	<0.083 U	7.8	368	152
6/28/2017	Background	1.35	17.7	16	0.5516 J	7.5	368	166
8/29/2017	Detection	1.13	32.3	13	0.4518 J	7.7	356	146
12/21/2017	Detection	0.857	46.2	- -	- -	7.2	332	128
3/26/2018	Detection	0.645	45.5	9	<0.083 U	8.6	284	113
8/28/2018	Detection	1.27	31.1	- -	- -	7.8	276	- -
10/23/2018	Detection	- -	- -	15.7	<0.083 U	- -	- -	135
3/11/2019	Detection	0.728	21.2	11.0	0.31	10.9	310	114
6/11/2019	Detection	0.559	3.44	9.79	0.29	10.0	304	108
7/9/2019	Detection	- -	- -	- -	- -	7.7	- -	- -
8/27/2019	Detection	0.756	10.7	8	0.2 J	10.9	330	99

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: AP-60
Flint Creek - PBAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
12/19/2016	Background	<0.93 U	9	17	0.0543046 J	<0.07 U	2	1.92133 J	1.176	0.0946 J	0.742652 J	0.001	<0.005 U	60	<0.99 U	<0.86 U
1/24/2017	Background	1.34724 J	3.61807 J	34	<0.02 U	<0.07 U	0.502321 J	0.87237 J	0.771	<0.083 U	<0.68 U	0.000637932 J	<0.005 U	55	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	9	15	<0.02 U	<0.07 U	0.297514 J	0.458637 J	1.121	<0.083 U	<0.68 U	0.003	<0.005 U	57	<0.99 U	<0.86 U
3/29/2017	Background	<0.93 U	7	41	0.023217 J	<0.07 U	3	2.22346 J	1.158	<0.083 U	1.84769 J	0.002	0.00961 J	53	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	11.42	24.03	0.12 J	<0.07 U	3.75	3.01 J	0.429	0.58 J	2.91 J	0.00236	0.01 J	56.38	<0.99 U	0.98 J
5/16/2017	Background	1 J	11.39	13.05	0.03 J	<0.07 U	0.91 J	0.66 J	2.082	0.558 J	<0.68 U	0.00048 J	0.009 J	62.09	<0.99 U	<0.86 U
6/16/2017	Background	<0.93 U	7.69	27.23	<0.02 U	<0.07 U	<0.23 U	0.42 J	3.697	<0.083 U	<0.68 U	0.00063 J	<0.005 U	54.18	<0.99 U	<0.86 U
6/28/2017	Background	<0.93 U	9.32	12.61	<0.02 U	<0.07 U	0.37 J	0.37 J	7.167	0.5516 J	<0.68 U	0.00031 J	0.006 J	63.76	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

APPENDIX II

Where applicable, show in this appendix the results from statistical analyses, and a description of the statistical analysis method chosen. These statistical analyses are to be conducted separately for each constituent in each monitoring well.

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Memorandum

Date: January 11, 2019

To: David Miller (AEP)

Copies to: Terence Wehling (AEP)

From: Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at Flint Creek Plant's Primary Bottom Ash Pond (PBAP)

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), a detection monitoring event was completed on March 26, 2018 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas.

Ten background monitoring events were conducted at the Flint Creek PBAP prior to these detection monitoring events, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on April 3, 2018 which resulted in a revision to the calculated prediction limits for all Appendix III parameters.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL. Because the initial result did not exceed the UPL, a second sample was not required.

Detection monitoring results and the relevant background values are summarized in Table 1. No SSIs were observed at the Flint Creek PBAP CCR unit, and as a result the Flint Creek PBAP will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Flint Creek Plant - PBAP

Parameter	**Units**	**Description**	AP-58	AP-59	AP-60
			3/26/2018	3/26/2018	3/26/2018
Boron	mg/L	Intrawell Background Value (UPL)	2.20	0.424	1.55
		Detection Monitoring Data	0.228	0.218	0.645
Calcium	mg/L	Intrawell Background Value (UPL)	85.1	43.6	48.7
		Detection Monitoring Data	77.2	43.2	45.5
Chloride	mg/L	Intrawell Background Value (UPL)	29	19	17
		Detection Monitoring Data	8	12	9
Fluoride	mg/L	Intrawell Background Value (UPL)	1.09	0.774	0.95
		Detection Monitoring Data	0.083	0.083	0.083
pH	SU	Intrawell Background Value (UPL)	9.42	7.91	9.26
		Intrawell Background Value (LPL)	5.78	6.41	6.90
		Detection Monitoring Data	7.41	7.04	8.62
Sulfate	mg/L	Intrawell Background Value (UPL)	296	49	181
		Detection Monitoring Data	70	40	113
TDS	mg/L	Intrawell Background Value (UPL)	822	258	409
		Detection Monitoring Data	262	180	284

Notes

UPL: Upper prediction limit

LPL: Lower prediction limit

TDS: Total dissolved solids

Bold values exceed the background value.

Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Flint Creek PBAP CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER
No. 15296

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

15296
License Number

ARKANSAS
Licensing State

01.17.19
Date

Geosyntec consultants

941 Chatham Lane, Suite 103
Columbus, Ohio 43212
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www.geosyntec.com

Memorandum

Date: February 8, 2019

To: David Miller (AEP)

Copies to: Terence Wehling (AEP)

From: Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at
Flint Creek Plant's Primary Bottom Ash Pond (PBAP)

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), a detection monitoring event was completed on August 28, 2018 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas. Because the sample analyses for chloride, fluoride, and sulfate were completed out of past holding time, resampling was completed on October 22, 2018.

Ten background monitoring events were conducted at the Flint Creek PBAP prior to these detection monitoring events, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on April 3, 2018 which resulted in a revision to the calculated prediction limits for all Appendix III parameters.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL. Because the initial result did not exceed the UPL, a second sample was not required.

Detection monitoring results and the relevant background values are summarized in Table 1. No SSIs were observed at the Flint Creek PBAP CCR unit, and as a result the Flint Creek PBAP will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Flint Creek Plant - Primary Bottom Ash Pond

Parameter	Units	Description	AP-58	AP-59	AP-60
			10/22/2018	10/22/2018	10/22/2018
Boron	mg/L	Intrawell Background Value (UPL)	2.20	0.424	1.55
		Detection Monitoring Result	0.237	0.277	1.27
Calcium	mg/L	Intrawell Background Value (UPL)	85.1	43.6	48.7
		Detection Monitoring Result	76	42	31.1
Chloride	mg/L	Intrawell Background Value (UPL)	29	19	17
		Detection Monitoring Result	13	19	16
Fluoride	mg/L	Intrawell Background Value (UPL)	1.09	0.774	0.950
		Detection Monitoring Result	<0.083	0.548	<0.083
pH	SU	Intrawell Background Value (UPL)	9.42	7.91	9.26
		Intrawell Background Value (LPL)	5.78	6.41	6.90
		Detection Monitoring Result	6.90	7.07	7.76
Sulfate	mg/L	Intrawell Background Value (UPL)	296	49	181
		Detection Monitoring Result	76	27	135
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	822	258	409
		Detection Monitoring Result	300	180	276

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

Chloride, Fluoride, and Sulfate parameters analyzed on October 22, 2018, all other Appendix III parameters analyzed on August 28, 2018

Based on a 1-of-2 resampling, a statistically significant increase (SSI) is only identified when both samples in the detection monitoring period are above the calculated background value.

ATTACHMENT A

Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Flint Creek PBAP CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER
No. 15296

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

15296

License Number

ARKANSAS

Licensing State

02.18.19

Date

Geosyntec consultants

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Memorandum

Date:	August 13, 2019
To:	David Miller (AEP)
Copies to:	Terence Wehling (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Flint Creek Plant's Primary Bottom Ash Pond (PBAP)

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), detection monitoring sampling events were completed on March 11-12, 2019 and July 9, 2019 at the Primary Bottom Ash Pond (PBAP), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas.

Upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values based on the ten background monitoring events conducted prior to October 17, 2017. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on April 3, 2018 which resulted in a revision to the calculated prediction limits for all Appendix III parameters.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL. For samples where the initial result did not exceed the UPL, a second sample was not required.

Detection monitoring results and the relevant background values are summarized in Table 1. Calcium concentrations exceeded the intrawell UPL of 43.6 mg/L in both the initial (45.2 mg/L) and second (45.3 mg/L) samples collected at AP-59. Therefore, an SSI over background is concluded for calcium at AP-59.

In response to the exceedances noted above, the Flint Creek PBAP CCR unit will either transition to assessment monitoring or an alternate source demonstration for calcium will be conducted.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Flint Creek - Primary Bottom Ash Pond

Parameter	**Units**	**Description**	AP-58	AP-59		AP-60	
			3/12/2019	3/11/2019	7/9/2019	3/11/2019	7/9/2019
Boron	mg/L	Intrawell Background Value (UPL)	2.20	0.424		1.55	
		Detection Monitoring Data	0.178	0.221	--	0.728	--
Calcium	mg/L	Intrawell Background Value (UPL)	85.1	43.6		48.7	
		Detection Monitoring Data	74.8	**45.2**	**45.3**	21.2	--
Chloride	mg/L	Intrawell Background Value (UPL)	29.3	18.5		17.2	
		Detection Monitoring Data	8.13	15.0	--	11.0	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.09	0.774		0.95	
		Detection Monitoring Data	0.33	0.59	--	0.31	--
pH	SU	Intrawell Background Value (UPL)	9.4	7.9		9.3	
		Intrawell Background Value (LPL)	5.8	6.4		6.9	
		Detection Monitoring Data	8.4	7.4	**--**	**10.9**	7.0
Sulfate	mg/L	Intrawell Background Value (UPL)	296	48.5		181	
		Detection Monitoring Data	49.9	35.5	--	114	--
TDS	mg/L	Intrawell Background Value (UPL)	822	258		409	
		Detection Monitoring Data	264	232	--	300	--

Notes

UPL: Upper prediction limit

LPL: Lower prediction limit

TDS: Total dissolved solids

Bold values exceed the background value.

Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Flint Creek PBAP CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER
No. 15296

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

15296

License Number

ARKANSAS

Licensing State

08.13.19

Date

APPENDIX III

Alternate source demonstrations are included in this appendix. Alternate sources are sources or reasons that explain that statistically significant increases over background or statistically significant levels above the groundwater protection standard are not attributable to the CCR unit.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

Flint Creek Plant
Primary Bottom Ash Pond
Gentry, Arkansas

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

November 8, 2019

CHA8462

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LPL	Lower Prediction Limit
PBAP	Primary Bottom Ash Pond
QA	Quality Assurance
QC	Quality Control
SI	Saturation Index
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

Ten background monitoring events were conducted at the Flint Creek Primary Bottom Ash Pond (PBAP). Upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceeds the UPL, or in the case of pH is above the LPL. In practice, if the initial result did not result in an exceedance, a second sample was not collected or analyzed.

The first semi-annual detection monitoring event of 2019 was performed in March 2019 (initial sampling event) and July 2019 (verification sampling event), and the results were compared to the calculated prediction limits. An SSI was identified for calcium at well AP-59 by intrawell analysis. A summary of the detection monitoring analytical results and the calculated prediction limits to which they were compared is provided in Table 1.

1.1 CCR Rule Requirements

United States Environmental Protection Agency (USEPA) regulations (USEPA, 2015) regarding detection monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration (ASD) when an SSI is identified (40 CFR 257.94(e)(2)):

> *The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer… verifying the accuracy of the information in the report.*

Calcium concentrations at AP-59 of 45.2 milligrams per liter (mg/L) and 45.3 mg/L were reported for the sampling and re-sampling events on March 11, 2019 and July 9, 2019, respectively. Both concentrations exceeded the UPL of 43.6 mg/L. Pursuant to 40 CFR 257.94(e)(2) of the CCR Rule (40 CFR 257), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report, which documents that the SSI for calcium at AP-59 should not be attributed to the Flint Creek PBAP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which the identified SSI could be attributed. Alternative sources were identified amongst five types, based on methodology provided by EPRI (2017):

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to show that the increase in calcium concentration was based on a Type IV cause and not by a release from the Flint Creek PBAP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The method used to assess possible alternative sources of the SSI for calcium at AP-59 and the proposed alternative source are described below. In addition, the future sampling requirements for the Flint Creek PBAP are presented.

2.1 Proposed Alternative Source

An initial review of field forms, site geochemistry, and laboratory quality assurance/quality control (QA/QC) data did not identify alternative sources due to Type I or Type II issues. A review of the statistical analyses of the groundwater data for calcium did not identify any Type III issues. However, a review of the geochemistry at the site identified the calcium exceedance at AP-59 as due to natural variation, which is a Type IV issue.

Based on the boring logs and well logs in the groundwater monitoring network report for the PBAP, the site is underlain by weathered residuum of the Boone Formation, which overlies the cherty limestone of the Boone Formation (Terracon, 2017). The report describes the Boone Formation as a gray, crinoidal limestone that is nearly pure calcium carbonate ($CaCO_3$). Well AP-59 is screened from 20 to 30 feet below ground surface (ft bgs), where the boring log noted a heavily weathered limestone (Attachment A).

Groundwater saturation with respect to limestone mineral calcite ($CaCO_3$) was evaluated using the geochemical modeling code PHREEQC. Saturation indices (SI) were calculated for datasets where concentrations for all major cations, anions and pH were available. Model results show that AP-59 groundwater has fluctuated between undersaturated conditions (denoted by SI values below -0.2) and saturated conditions (between -0.2 and 0.2) since monitoring began (Figure 1). Results indicate that AP-59 groundwater was saturated with respect to calcite in March 2017 (SI=0.15) and March 2019 (SI=-0.19) and below saturation at all other sampling events.

Figure 2 shows SI results compared to water level measurements for the same time interval. It appears that higher water levels drive the system toward calcite equilibrium, while falling water levels lead to undersaturation. Mechanistically, as water levels rise, calcite dissolves in order for the system to reach equilibrium from a state of undersaturation, which contributes calcium to the aqueous phase (Garrels and Christ, 1965). This may be brought about by changing contact with more weathered (passivated) limestone at lower elevations and fresher (more reactivated) limestone surfaces at higher elevations. Changes in water levels, and thus calcite saturation, at AP-59 appear to be driven by recharge from precipitation, as shown by the corresponding peaks in groundwater elevation following major rain events in April 2017 and May 2019 (Figure 3).

While natural variation due to changes in water level elevation is identified as the cause of fluctuating calcium concentrations at AP-59, the lack of exceedances for other parameters is further evidence that there has not been a release from the PBAB. If a release had occurred, groundwater at well AP-59 likely would have experienced a rise in highly mobile constituents such as boron and chloride. However, a review of boron and chloride data show that they have remained stable over time (Figure 4). Likewise, while the calcium concentrations increased in the March and July 2019 events, they do not appear to be part of a longer trend of consistently increasing concentrations (Figure 5). A subsequent sample was collected at AP-59 in August 2019 to serve as the initial sample for the second semiannual detection monitoring event of 2019 at the Flint Creek PBAP. The reported calcium concentration for this sample is 42.6 mg/L, which is below the UPL and provides further evidence that there is not an increasing trend for calcium at AP-59.

Based on the presence of calcite in the aquifer, the lack of other exceedances, and the absence of a positive trend in calcium at AP-59, the observed calcium concentrations during the first semi-annual event are not considered indicative of a release from the Flint Creek PBAP.

2.2 Sampling Requirements

The ASD described above supports the position that the identified SSI is not due to a release from the Flint Creek PBAP. Therefore, the unit will remain in the detection monitoring. Groundwater at the unit will be sampled for Appendix III parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the position that the SSIs in Appendix III detection monitoring constituents are not due to a release from the Flint Creek PBAP during the March and July 2019 sampling events. The identified SSI for calcium at well AP-59 was attributed to natural variation. Therefore, no further action is warranted, and the Flint Creek PBAP will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment B.

SECTION 4

REFERENCES

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites. 3002010920. October.

Garrels, R. M. and Christ, C. L. 1965. Solutions, minerals, and equilibria. New York, Harper & Row.

Terracon, 2017. Report 1 – Groundwater Monitoring Network for CCR Compliance. SWEPCO – Flint Creek Primary Bottom Ash Pond. October.

USEPA, 2015. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Final Rule). Fed. Reg. 80 FR 21301, pp. 21301-21501, 40 CFR Parts 257 and 261, April.

TABLES

Table 1: Detection Monitoring Data Evaluation
Flint Creek - Primary Bottom Ash Pond

Parameter	**Units**	**Description**	AP-58	AP-59		AP-60	
			3/12/2019	3/11/2019	7/9/2019	3/11/2019	7/9/2019
Boron	mg/L	Intrawell Background Value (UPL)	2.20	0.424		1.55	
		Detection Monitoring Data	0.178	0.221	--	0.728	--
Calcium	mg/L	Intrawell Background Value (UPL)	85.1	43.6		48.7	
		Detection Monitoring Data	74.8	**45.2**	**45.3**	21.2	--
Chloride	mg/L	Intrawell Background Value (UPL)	29.3	18.5		17.2	
		Detection Monitoring Data	8.13	15.0	--	11.0	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.09	0.774		0.95	
		Detection Monitoring Data	0.33	0.59	--	0.31	--
pH	SU	Intrawell Background Value (UPL)	9.4	7.9		9.3	
		Intrawell Background Value (LPL)	5.8	6.4		6.9	
		Detection Monitoring Data	8.4	7.4	**--**	**10.9**	7.0
Sulfate	mg/L	Intrawell Background Value (UPL)	296	48.5		181	
		Detection Monitoring Data	49.9	35.5	--	114	--
TDS	mg/L	Intrawell Background Value (UPL)	822	258		409	
		Detection Monitoring Data	264	232	--	300	--

Notes

UPL: Upper prediction limit

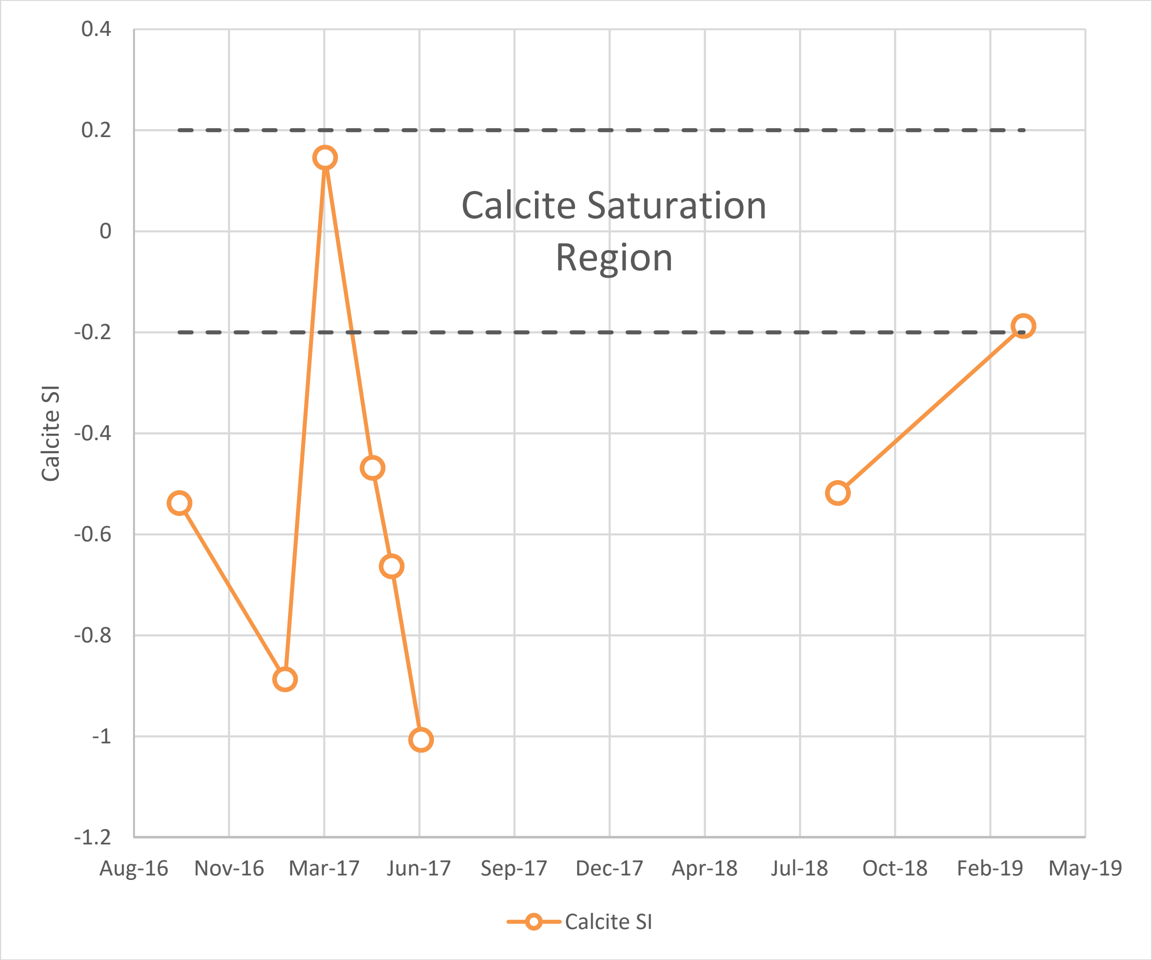
LPL: Lower prediction limit

TDS: Total dissolved solids

Bold values exceed the background value.

Background values are shaded gray.

FIGURES



Notes: Saturation indices were calculated for events where all major cations, anions, and pH data were available. No line is shown between July 2017 and July 2018, as insufficient data were available during this time period. Dashed horizontal lines have values of -0.2 and 0.2, which define a typical range for mineral saturation.

Calcite Saturation Indices at AP-59

Flint Creek PBAP

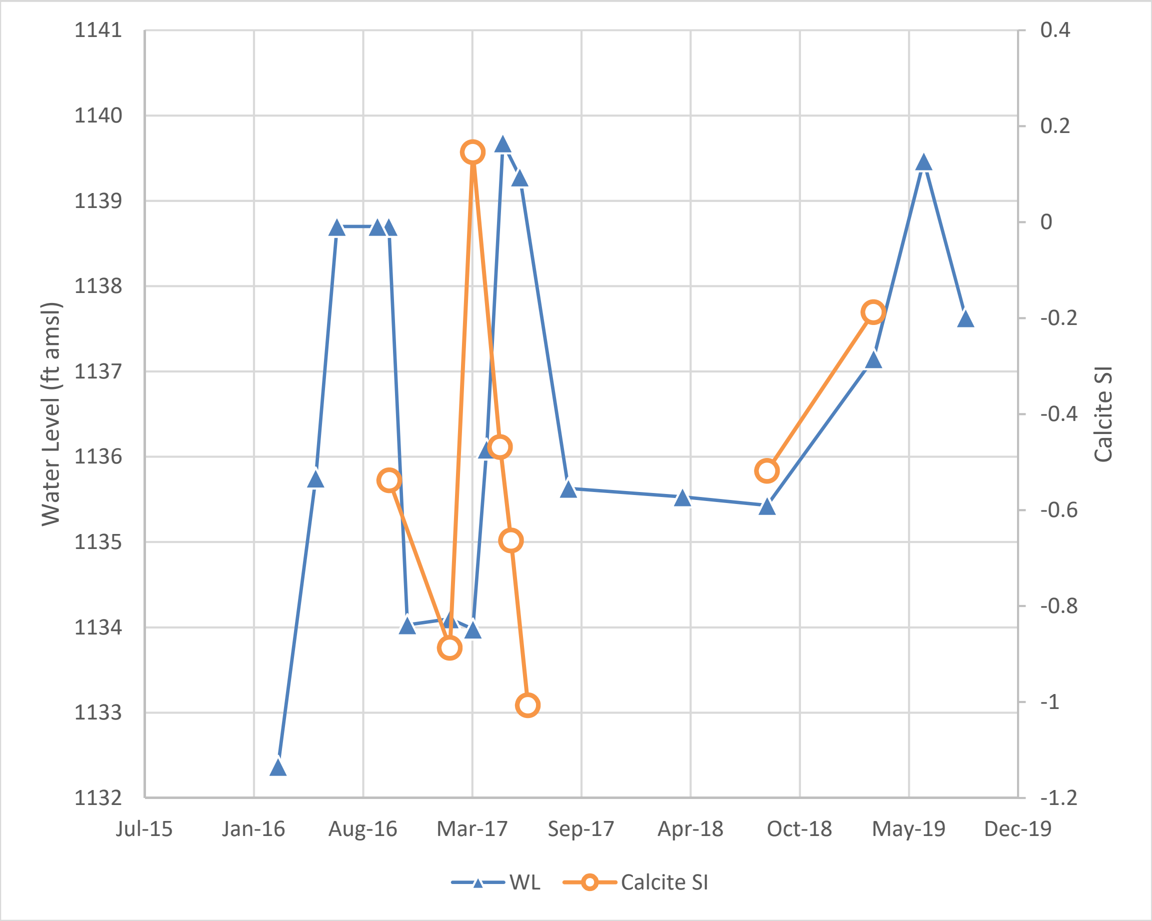
Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure
1

Columbus, Ohio

24-Oct-2019



Notes: Groundwater elevation is shown as feet above mean sea level (ft amsl). AP-59 is screened from 1125 to 1135 ft amsl. Saturation indices (SI) were calculated for events where all major cations, anions, and pH data were available. No line for saturation indices is shown between July 2017 and July 2018, as insufficient data were available during this time period.

Saturation Indices and Water Levels at AP-59

Flint Creek PBAP

Geosyntec consultants

AMERICAN ELECTRIC POWER

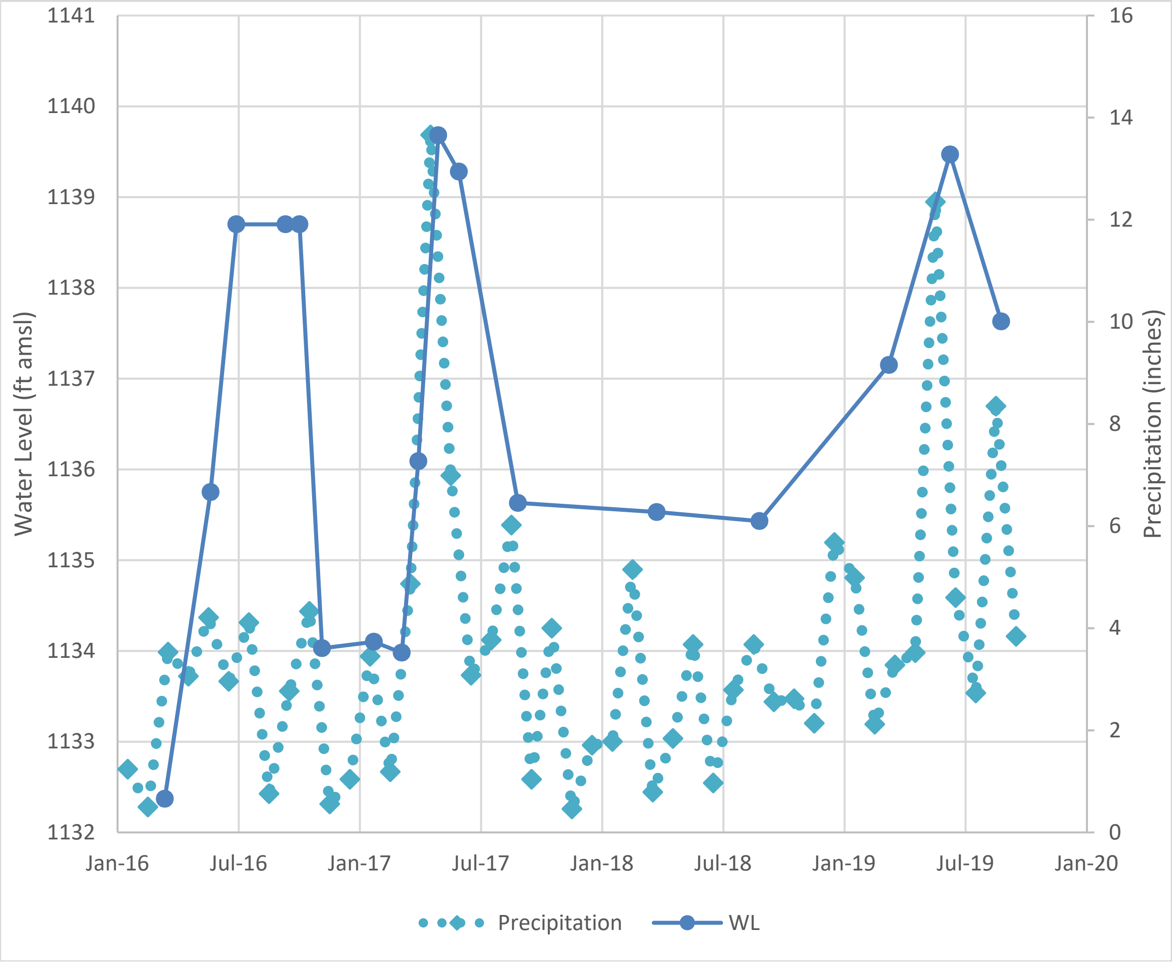
Figure

2

Columbus, Ohio

24-Oct-2019

internal info: path, date revised, author



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Notes: Groundwater elevation at AP-59 is shown as feet above mean sea level (ft amsl). Precipitation was reported for the Northwest Arkansas Regional Airport, which is located approximately 13 miles east of the site. Data was accessed via www.weatherunderground.com. Precipitation is reported as the cumulative inches for each month.

Precipitation and Water Levels at AP-59

Flint Creek PBAP

Geosyntec consultants

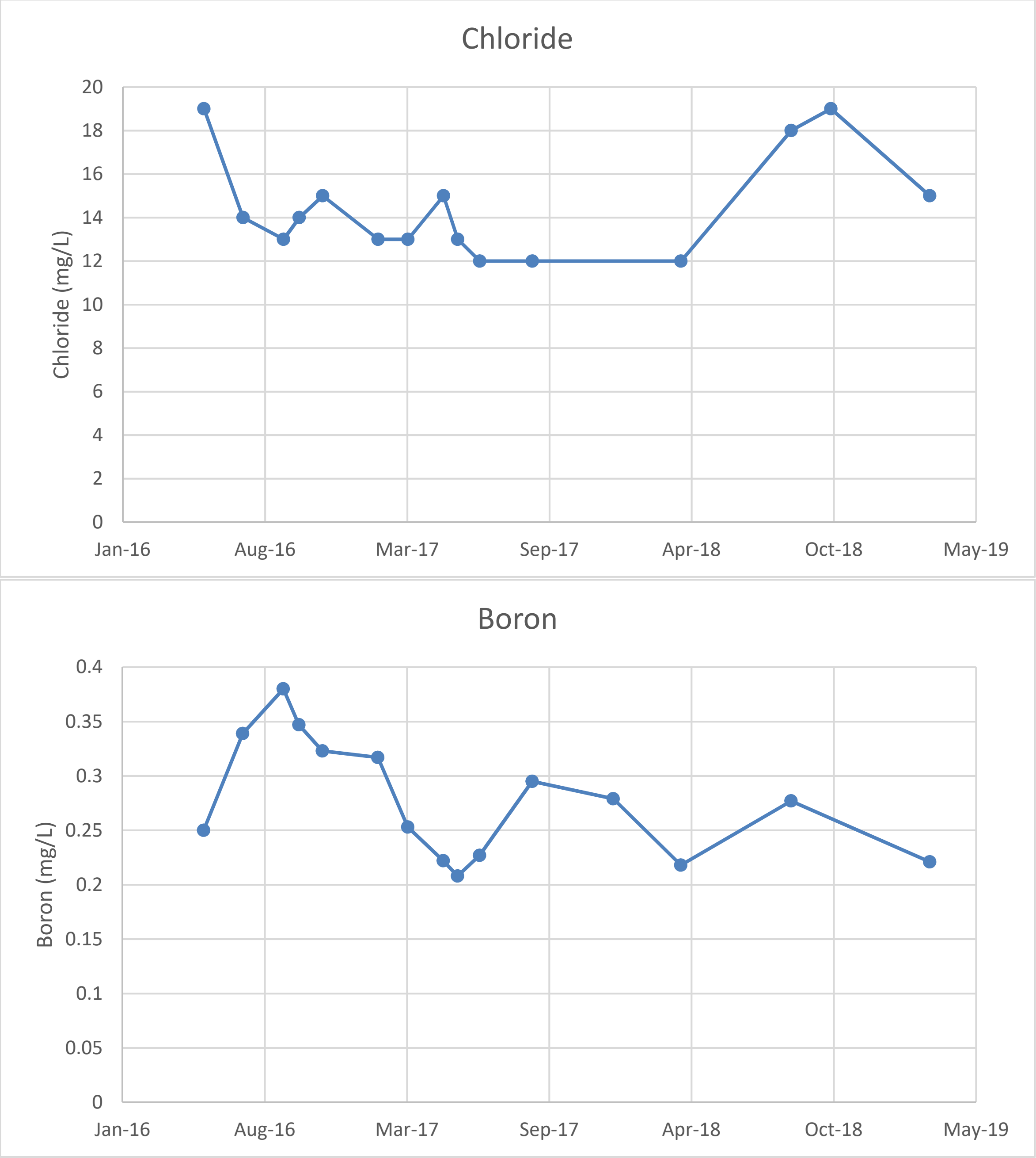
AMERICAN ELECTRIC POWER

Figure

3

Columbus, Ohio

31-Oct-2019



Notes: Data collected from AP-59 during the background and detection monitoring periods under the Federal CCR Rule are shown.

Boron and Chloride Time Series at AP-59

Flint Creek PBAP

Geosyntec consultants

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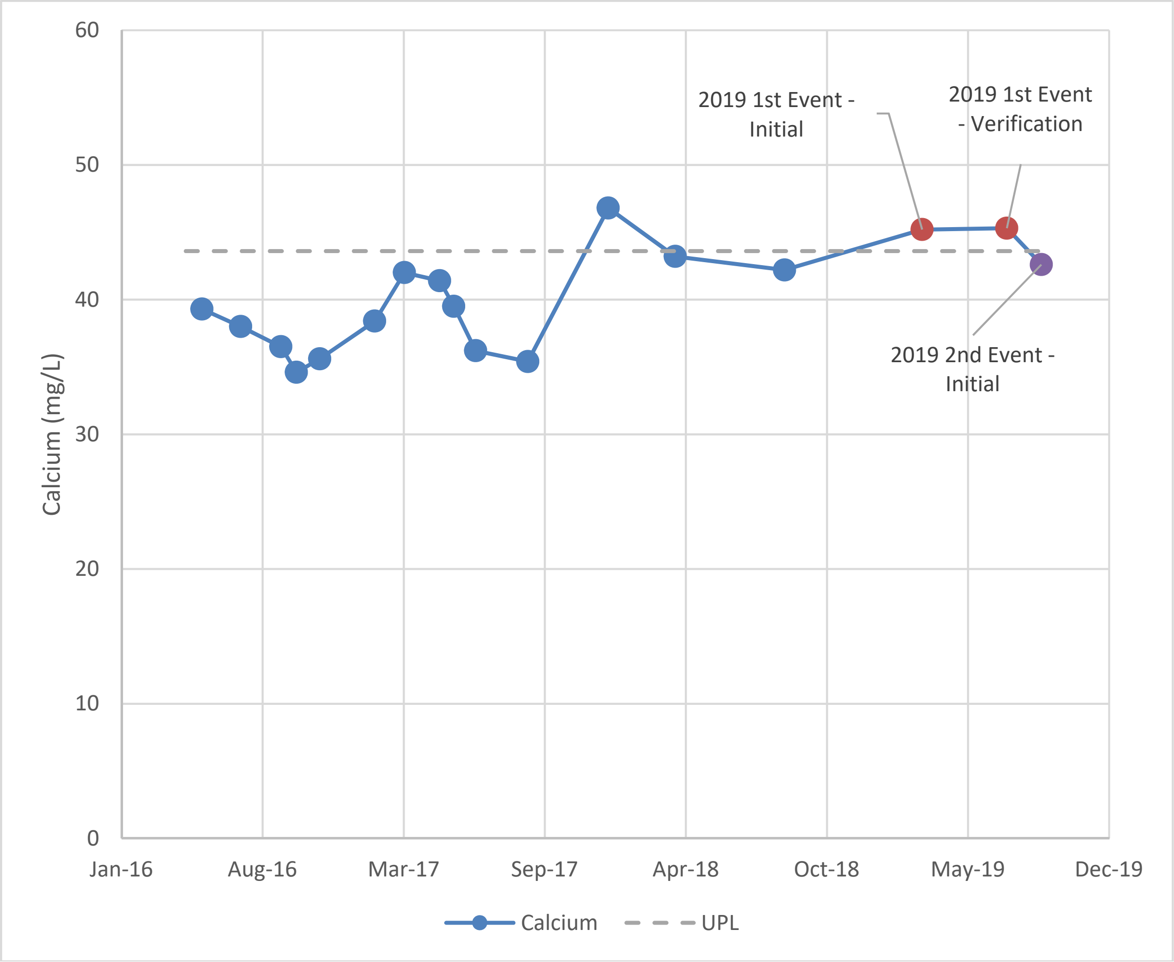
Figure

4

Columbus, Ohio

24-Oct-2019

internal info: path, date revised, author



Notes: Data collected from AP-59 during the background and detection monitoring period under the Federal CCR Rule are shown. Red circles represent data for the current detection monitoring event. The purple circle represents data collected for the second semiannual detection monitoring event of 2019.

Calcium Time Series at AP-59

Flint Creek PBAP

Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure
5

Columbus, Ohio

24-Oct-2019

ATTACHMENT A

AP-59 Boring Log

Terracon
Consulting Engineers and Scientists
25809 I-30 South BRYANT, AR. 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIELD BORING LOG

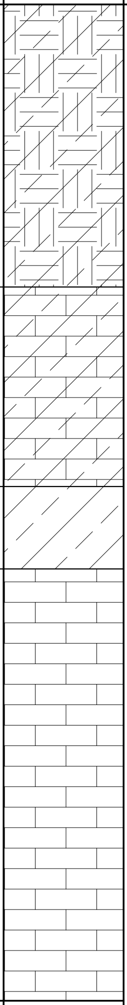
BORING NO.: AP-59 PAGE: 1 of 1
TOTAL DEPTH: 30 FEET BELOW GROUND SURFACE (BGS)

CLIENT: AMERICAN ELECTRIC POWER	PROJECT: FLINT CREEK - CCR WELL INSTALLATION
JOB NO.: 216-001-35157182-001	DRILLING CO.: ANDERSON ENGINEERING
LOGGED BY: ADAM HOOPER	DRILLER: GARY MOYERS
DATE DRILLED: 2/3/2016	RIG TYPE: CME 75 BUGGY

DRILLING METHOD: HOLLOW STEM AUGER /AIR ROTARY
SAMPLING METHOD: 5' CONTINUOUS SAMPLER - LOGGED BY CUTTINGS

N: N/A E: N/A G.S. ELEV. N/A

Depth BGS	DESCRIPTION	Litho. Symbol	Remarks
0	0'-8.5' <u>SILTY CLAY</u> - FILL red and brown		
5			
10	8.5'-14.5' <u>LIMESTONE and SILTY CLAY</u> hard while drilling		
15	14.5'-17' <u>SILTY CLAY</u> red		
	17'-30' <u>LIMESTONE</u> light gray, crystalline, thin fracture/void at 22' bgs		Moisture at top of rock at 17' bgs
20			
	▽		Water at 22' bgs 17' - 30' Logged by cuttings
25			
30	Total Depth of Boring at 30' bgs		



ATTACHMENT B

Certification by a Qualified Professional Engineer

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Flint Creek Primary Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.

BETH ANN GROSS
No. 9846

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Ann Gross
Signature

Geosyntec Consultants
2039 Centre Point Blvd, Suite 103
Tallahassee, FL 32308

9846	Arkansas	11/11/2019
License Number	Licensing State	Date

CERTIFICATE OF AUTHORIZATION
GEOSYNTEC CONSULTANTS
No. 52
ARKANSAS

Annual Groundwater Monitoring Report

Southwestern Electric Power Company
Flint Creek Power Plant
Landfill CCR Management Unit
Gentry, Arkansas

January 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

SOUTHWESTERN ELECTRIC POWER COMPANY
An AEP Company
BOUNDLESS ENERGY

Page

Table of Contents

I. **Overview**

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for an existing CCR unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), Flint Creek Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31, 2020.

At the beginning of 2019 the landfill was in assessment monitoring. The landfill remained in assessment monitoring through the end of the year. No exceedances of a groundwater protection standard (GWPS) occurred during 2019.

In general, the following activities were completed:

- Groundwater samples were collected and analyzed for Appendix III and Appendix IV constituents, as specified in 40 CFR 257.94 or 95 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- The assessment monitoring events determined that no statistically significant levels (SSLs) above the groundwater protection standards existed.
- Groundwater Monitoring Statistical Evaluation Reports to evaluate groundwater data were prepared and certified in accordance with 40 CFR 257.93. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009).

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs is included in Appendix I;
- A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection

monitoring to assessment monitoring, in addition to identifying the constituents detected at a statistically significant increase over background concentrations.

- Other information required to be included in the annual report such as alternate source demonstration or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

The figure that follows depicts the PE-certified groundwater monitoring network, the monitoring well locations and their corresponding identification numbers.

Landfill Monitoring Wells	
Up Gradient	Down Gradient
B-1B	B-2
B-4	B-6
B-5	B-9
B-7A	B-10
B-12	B-11
B-13	

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned this year.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion

Appendix I contains tables showing the groundwater quality. Static water elevation data from each monitoring event also are shown in Appendix I, along with the groundwater velocity, groundwater flow direction and potentiometric maps developed after each sampling event.

V. Statistical Evaluation of 2019 Events

There were two groundwater monitoring events in 2019. Their statistical reports are included in Appendix II.

The first half 2019 sampling event occurred in March, 2019. There were no statistically significant levels (SSLs) above the groundwater protection standards identified.

The June 2019 sampling event was in furtherance of 257.95(b) which determines which constituents in Appendix IV (to 40 CFR 257) were detected. The results are in Appendix I.

The second half 2019 sampling event occurred in August, 2019. There were no SSLs above the groundwater protection standards identified.

VI. Alternate Source Demonstration

There were no alternate source demonstrations during 2019.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

There were no transitions between groundwater programs in 2019. The groundwater program started in assessment monitoring and ended in assessment monitoring.

VIII. Other Information Required

No other information applies at this time.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No problems were encountered this year.

X. A Projection of Key Activities for the Upcoming Year

Key activities for next year include:

- Assessment monitoring sampling will be conducted;
- Evaluation of the assessment monitoring results from a statistical analysis viewpoint, looking for any SSLs above GWPS;
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX I

Tables follow, showing the groundwater monitoring data collected, the rate and direction of groundwater flow, and a summary showing the number of samples collected per monitoring well. The dates that the samples were collected also is shown.

Monitoring Wells
- Shallow
- Intermediate
- Deep

Groundwater Elevation Contour
- Shallow
- Shallow Flow Direction
- Intermediate
- Intermediate Flow Direction
- Deep
- Deep Flow Direction

Notes
- Monitoring well coordinates and water level data (collected on March 11-12, 2019) provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Locations of NE-5D, NE-7R, and NE-9 are approximate.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
March 2019

AEP Flint Creek Plant - Landfill
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio | 2019/12/13

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Monitoring Wells
- ◆ Shallow
- ◆ Intermediate
- ◆ Deep

Groundwater Elevation Contour
- — Shallow
- → Shallow Flow Direction
- — Intermediate
- → Intermediate Flow Direction
- — Deep
- → Deep Flow Direction

Notes
- Monitoring well coordinates and water level data (collected on June 10-11, 2019) provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Locations of NE-5D, NE-7R, and NE-9 are approximate.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
June 2019

AEP Flint Creek Plant - Landfill
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio	2019/12/13

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Monitoring Wells
- Shallow
- Intermediate
- Deep

Groundwater Elevation Contour
- Intermediate
- Intermediate Flow Direction
- Deep
- Deep (Inferred)
- Deep Flow Direction

Notes
- Monitoring well coordinates and water level data (collected on August 27-28, 2019) provided by AEP.
- Site features are based on information available in the Groundwater Monitoring Well Network Elevation (Terracon, 2016) provided by AEP.
- Locations of NE-5D, NE-7R, and NE-9 are approximate.
- Groundwater elevation units are feet above mean sea level.

200 100 0 200
Feet

Potentiometric Surface Map
August 2019

AEP Flint Creek Plant - Landfill
Gentry, Arkansas

Geosyntec
consultants

Columbus, Ohio | 2019/12/24

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Flint Creek\Landfill\2019\AEP-Flint Creek_GW_Landfill_2019-08August.mxd. ARevezzo. 12/24/2019. CHA8423/01/08.

Table 1: Residence Time Calculation Summary
Flint Creek Landfill

			2019-03		2019-06		2019-08	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Landfill	B-1B [3]	2.0	106	0.6	188	0.3	206	0.3
	B-2 [2]	2.0	69	0.9	62	1.0	70	0.9
	B-4 [1]	2.0	44	1.4	117	0.5	93	0.7
	B-5 [3]	2.0	32	1.9	98	0.6	82	0.7
	B-6 [2]	2.0	73	0.8	40	1.5	16	3.7
	B-7A [3]	2.0	79	0.8	309	0.2	72	0.8
	B-9 [2]	2.0	NC	NC	NC	NC	96	0.6
	B-10 [2]	2.0	53	1.1	110	0.6	34	1.8
	B-11 [2]	2.0	138	0.4	44	1.4	95	0.6
	B-12 [1]	2.0	96	0.6	306	0.2	233	0.3
	B-13 [1]	2.0	20	3.1	96	0.6	43	1.4

Notes:
[1] - Background Well
[2] - Downgradient Well
[3] - Crossgradient Well
NC - Not Calculated

Table 1 - Groundwater Data Summary: B-1B
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.02	90.8	3	0.5955 J	8.1	296	22
7/19/2016	Background	0.02	92.4	4	0.4424 J	7.1	281	25
9/14/2016	Background	0.02	96.3	3	0.4087 J	7.0	296	24
10/5/2016	Background	0.02	89.3	5	0.4557 J	7.5	294	25
11/8/2016	Background	0.02	86.5	4	<0.083 U	7.2	270	24
1/24/2017	Background	0.02	85.9	2	<0.083 U	7.7	276	22
3/7/2017	Background	0.02	88.7	2	<0.083 U	7.4	272	23
4/26/2017	Background	0.02041	88.1	4	0.53 J	6.5	268	23
5/16/2017	Background	0.01982	85.5	3	0.4551 J	6.8	240	20
6/16/2017	Background	0.02962	85.1	4	<0.083 U	6.3	276	21
8/29/2017	Detection	0.0579	83.3	3	0.416 J	7.9	264	20
3/26/2018	Assessment	0.01493	89.6	2	0.098 J	7.5	268	22
8/28/2018	Assessment	0.026	87.6	- -	- -	7.3	288	- -
10/23/2018	Assessment	- -	- -	5.53	0.489 J	- -	- -	14.8
3/12/2019	Assessment	0.02 J	93.1	2.31	0.41	7.6	228	17.5
6/10/2019	Assessment	0.05 J	92.4	2.31	0.49	6.6	266	20.7
8/27/2019	Assessment	<0.02 U	86.5	2	0.275 J	7.4	312	20

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-1B
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	112	0.0480724 J	<0.07 U	0.801049 J	0.441945 J	3.583	0.5955 J	<0.68 U	0.028	0.02301 J	2.01197 J	<0.99 U	<0.86 U
7/19/2016	Background	<0.93 U	<1.05 U	118	0.0361035 J	<0.07 U	0.611765 J	0.527203 J	- -	0.4424 J	1.03545 J	0.028	0.01793 J	0.869973 J	<0.99 U	<0.86 U
9/14/2016	Background	<0.93 U	<1.05 U	125	<0.02 U	<0.07 U	1	0.454131 J	8.375	0.4087 J	0.999779 J	0.028	<0.005 U	0.612698 J	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	122	0.0372394 J	<0.07 U	0.984649 J	0.750457 J	8.79	0.4557 J	1.03454 J	0.041	<0.005 U	<0.29 U	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	<1.05 U	131	0.033331 J	0.0774505 J	2	0.917319 J	4.63	<0.083 U	1.03555 J	0.027	0.00589 J	0.297867 J	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	1.26762 J	97	0.0223085 J	<0.07 U	1	0.385362 J	3.178	<0.083 U	<0.68 U	0.026	0.00757 J	0.6452 J	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	123	<0.02 U	<0.07 U	<0.23 U	0.325089 J	3.604	<0.083 U	<0.68 U	0.034	<0.005 U	0.561767 J	<0.99 U	<0.86 U
4/26/2017	Background	1.27 J	<1.05 U	112	0.04 J	<0.07 U	0.85 J	0.49 J	3.841	0.53 J	<0.68 U	0.02658	<0.005 U	<0.29 U	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	<1.05 U	118	0.03 J	<0.07 U	0.3 J	0.49 J	1.448	0.4551 J	<0.68 U	0.02701	0.009 J	<0.29 U	<0.99 U	<0.86 U
6/16/2017	Background	<0.93 U	1.43 J	123	<0.02 U	<0.07 U	0.33 J	0.47 J	5.15	<0.083 U	<0.68 U	0.02717	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/26/2018	Assessment	<0.93 U	<1.05 U	108	<0.02 U	<0.07 U	1.22	0.21 J	4.485	0.098 J	0.8 J	0.0266	<0.005 U	<0.29 U	<0.99 U	<0.86 U
8/28/2018	Assessment	0.08	0.33	112	0.02 J	0.07	0.263	0.102	6.51	0.489 J*	0.247	0.0278	<0.005 U	1.17	0.04 J	0.01 J
3/12/2019	Assessment	<0.1 U	0.4 J	112	<0.1 U	<0.05 U	<0.2 U	<0.1 U	3.924	0.41	1.25	0.0264	<0.005 U	<2 U	<0.2 U	<0.5 U
6/10/2019	Assessment	0.03 J	0.62	112	0.02 J	0.02 J	0.368	0.051	5.96	0.49	0.530	<0.02 U	<0.005 U	0.8 J	<0.03 U	<0.1 U
8/27/2019	Assessment	0.11	0.57	114	<0.02 U	0.06	0.278	0.05 J	4.73	0.275 J	0.395	0.0231	<0.005 U	1 J	<0.03 U	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*: Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-2
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	1.13	91.9	6	<0.083 U	7.0	1212	619
7/19/2016	Background	1.33	59.9	7	0.3361 J	6.7	936	464
9/14/2016	Background	1.19	62.6	7	<0.083 U	6.6	1124	560
10/5/2016	Background	1.32	45.3	7	<0.083 U	5.9	741	339
11/8/2016	Background	1.82	27.5	6	<0.083 U	6.0	365	145
1/24/2017	Background	1.56	24	5	<0.083 U	5.8	296	119
3/7/2017	Background	1.04	32.1	5	<0.083 U	5.9	260	105
4/26/2017	Background	1.44	23.1	6	<0.083 U	6.3	400	179
5/16/2017	Background	1.33	20.7	6	<0.083 U	5.5	328	153
6/16/2017	Background	0.936	39.6	6	<0.083 U	5.9	278	109
8/29/2017	Detection	1.07	18	6	<0.083 U	6.0	270	116
12/21/2017	Detection	0.7	- -	- -	- -	5.9	- -	- -
3/26/2018	Assessment	0.851	15.3	4	<0.083 U	6.7	324	138
8/27/2018	Assessment	0.702	56.3	- -	- -	6.7	532	- -
10/23/2018	Assessment	- -	- -	10.8	<0.083 U	- -	- -	198
3/12/2019	Assessment	0.634	34.5	5.88	0.1 J	6.9	376	129
6/11/2019	Assessment	0.697	14.2	4.16	0.06 J	6.4	246	80.9
8/27/2019	Assessment	0.735	15.4	3	<0.083 U	5.9	230	65

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-2
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	94	0.131152 J	<0.07 U	4	0.952324 J	1.06	<0.083 U	<0.68 U	0.009	0.02106 J	6	82	<0.86 U
7/19/2016	Background	<0.93 U	<1.05 U	114	0.297284 J	<0.07 U	6	2.18888 J	- -	0.3361 J	1.98005 J	0.005	0.00946 J	2.74335 J	50	<0.86 U
9/14/2016	Background	1.81571 J	8	226	1	0.348046 J	26	15	1.752	<0.083 U	13	0.021	0.027	2.59675 J	49	0.98925 J
10/5/2016	Background	<0.93 U	<1.05 U	73	0.168987 J	<0.07 U	5	1.57645 J	4.1	<0.083 U	1.52736 J	0.016	<0.005 U	0.783837 J	35	<0.86 U
11/8/2016	Background	1.15186 J	17	543	3	0.870406 J	37	31	3.87	<0.083 U	26	0.027	0.05	2.69221 J	13	<0.86 U
1/24/2017	Background	1.32054 J	2.57288 J	214	0.763757 J	<0.07 U	10	6	1.408	<0.083 U	4.36086 J	0.007	0.01252 J	0.832511 J	9	<0.86 U
3/7/2017	Background	6.00	<1.05 U	70	0.157872 J	<0.07 U	2	0.632449 J	1.372	<0.083 U	<0.68 U	0.005	<0.005 U	0.478127 J	20	<0.86 U
4/26/2017	Background	<0.93 U	1.39 J	97.47	0.22 J	0.08 J	3.44	1.24 J	1.881	<0.083 U	1.32 J	0.00242	<0.005 U	0.77 J	9.94	<0.86 U
5/16/2017	Background	1.17 J	1.77 J	51.22	0.17 J	<0.07 U	2.49	0.47 J	1.429	<0.083 U	0.8 J	0.00161	<0.005 U	0.34 J	9.52	<0.86 U
6/16/2017	Background	<0.93 U	1.08 J	79.45	0.17 J	0.09 J	3.76	1.67 J	1.839	<0.083 U	0.8 J	0.00287	<0.005 U	2.1 J	20.57	<0.86 U
3/26/2018	Assessment	1.6 J	1.44 J	62.23	0.15 J	<0.07 U	2.15	0.62 J	2.018	<0.083 U	<0.68 U	0.0023	<0.005 U	<0.29 U	8.63	0.88 J
8/27/2018	Assessment	0.02 J	0.67	62.7	0.062	0.05	2.17	0.371	2.403	<0.083 U*	0.332	0.00172	0.005 J	4.42	27.3	0.066
3/12/2019	Assessment	<0.1 U	0.4 J	63.9	0.1 J	0.06 J	2.83	0.2 J	1.93	0.1 J	0.2 J	0.00188	<0.005 U	<2 U	14.3	<0.5 U
6/11/2019	Assessment	<0.02 U	0.18	38.5	0.208	0.04 J	1.57	0.069	0.959	0.06 J	<0.05 U	<0.02 U	<0.005 U	0.4 J	6.7	<0.1 U
8/27/2019	Assessment	<0.02 U	0.22	41.3	0.149	0.03 J	1.75	0.105	0.888	<0.083 U	0.08 J	0.00128	<0.005 U	0.5 J	6.8	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-4
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.03	8.23	8	<0.083 U	7.0	92	14
7/19/2016	Background	0.03	8.86	9	<0.083 U	6.7	75	12
9/14/2016	Background	0.03	19.4	8	<0.083 U	6.8	128	8
10/5/2016	Background	0.02	8.22	10	<0.083 U	6.2	78	13
11/8/2016	Background	0.04	13.3	9	<0.083 U	6.7	72	10
1/24/2017	Background	0.04	23.6	8	<0.083 U	6.8	84	5
3/7/2017	Background	0.02	22.8	8	<0.083 U	7.1	52	5
4/26/2017	Background	0.0382	32.4	9	<0.083 U	6.9	86	8
5/16/2017	Background	0.03844	15.5	8	<0.083 U	7.2	88	10
6/16/2017	Background	0.0588	7.13	9	<0.083 U	7.4	76	11
8/29/2017	Detection	0.04762	5.5	8	<0.083 U	7.2	60	8
3/26/2018	Assessment	0.03141	6.06	5	<0.083 U	7.4	72	10
8/28/2018	Assessment	0.030	8.23	- -	- -	7.6	44	- -
10/23/2018	Assessment	- -	- -	9.61	<0.083 U	- -	- -	13.6
3/12/2019	Assessment	0.036	3.37	4.58	0.02 J	7.5	68	12.1
6/11/2019	Assessment	0.07 J	3.50	3.74	0.02 J	7.5	60	13.4
8/28/2019	Assessment	0.056	2.92	3	<0.083 U	6.0	66	11

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-4
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	49	0.205178 J	<0.07 U	1	0.36974 J	0.734	<0.083 U	<0.68 U	<0.00013 U	0.01529 J	<0.29 U	<0.99 U	<0.86 U
7/19/2016	Background	<0.93 U	<1.05 U	49	0.211526 J	<0.07 U	1	0.15016 J	- -	<0.083 U	<0.68 U	0.002	0.00738 J	<0.29 U	<0.99 U	<0.86 U
9/14/2016	Background	<0.93 U	<1.05 U	65	0.037683 J	<0.07 U	2	0.4142 J	8.344	<0.083 U	1.16564 J	0.001	<0.005 U	<0.29 U	<0.99 U	0.918935 J
10/5/2016	Background	<0.93 U	<1.05 U	71	0.439546 J	<0.07 U	5	2.34157 J	3.969	<0.083 U	1.65693 J	0.009	<0.005 U	<0.29 U	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	1.75787 J	62	0.382027 J	0.130549 J	4	1.2283 J	0.351	<0.083 U	0.943091 J	0.003	0.00809 J	<0.29 U	<0.99 U	<0.86 U
1/24/2017	Background	2.63622 J	<1.05 U	60	0.210311 J	<0.07 U	2	0.749001 J	0.945	<0.083 U	<0.68 U	0.001	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/7/2017	Background	1.09461 J	<1.05 U	51	0.24192 J	<0.07 U	1	0.605358 J	1.588	<0.083 U	<0.68 U	0.003	<0.005 U	<0.29 U	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	<1.05 U	63.66	0.08 J	<0.07 U	0.91 J	0.28 J	0.679	<0.083 U	0.87 J	0.00083 J	<0.005 U	<0.29 U	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	<1.05 U	70.02	0.09 J	<0.07 U	0.99 J	<0.14 U	2.89	<0.083 U	<0.68 U	0.00077 J	0.005 J	<0.29 U	1.11 J	<0.86 U
6/16/2017	Background	4.52 J	1.18 J	49.29	0.22 J	0.08 J	0.82 J	0.19 J	3.373	<0.083 U	<0.68 U	0.00119	<0.005 U	<0.29 U	<0.99 U	0.9 J
3/26/2018	Assessment	2.1 J	<1.05 U	46.33	0.09 J	<0.07 U	0.99 J	0.18 J	2.309	<0.083 U	<0.68 U	0.00114	<0.005 U	<0.29 U	1.94 J	<0.86 U
8/28/2018	Assessment	0.01 J	0.17	40.5	0.208	0.13	1.03	0.184	0.3669	<0.083 U*	0.184	0.00110	<0.005 U	0.07 J	0.8	0.03 J
3/12/2019	Assessment	<0.1 U	<0.2 U	34.3	0.2 J	0.1 J	1.26	<0.1 U	0.2946	0.02 J	<0.1 U	0.00123	<0.005 U	<2 U	0.6 J	<0.5 U
6/11/2019	Assessment	<0.02 U	0.06 J	31.2	0.215	0.05 J	1.03	0.04 J	0.68	0.02 J	<0.05 U	<0.02 U	<0.005 U	<0.4 U	0.7	<0.1 U
8/28/2019	Assessment	<0.02 U	0.06 J	31.1	0.204	0.04 J	1.11	0.084	1.053	<0.083 U	<0.05 U	0.000925	<0.005 U	<0.4 U	0.8	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-5
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.01	17.4	6	<0.083 U	5.1	424	189
7/19/2016	Background	0.01	16.2	7	<0.083 U	5.2	424	205
9/14/2016	Background	0.01	17.6	7	<0.083 U	6.4	372	187
10/5/2016	Background	0.01	18.7	12	0.2728 J	6.5	404	197
11/8/2016	Background	0.02	15.9	9	<0.083 U	6.6	352.94	160
1/24/2017	Background	0.02	18	6	<0.083 U	5.6	404	212
3/7/2017	Background	0.02	16.9	6	<0.083 U	5.1	392	200
4/26/2017	Background	0.02255	17.6	7	<0.083 U	5.9	422	226
5/16/2017	Background	0.01833	18.3	7	<0.083 U	4.9	416	229
6/16/2017	Background	0.03663	17	8	<0.083 U	5.0	410	206
8/29/2017	Detection	0.03455	16.4	8	<0.083 U	5.4	376	199
3/28/2018	Assessment	0.01591	15.5	6	<0.083 U	5.4	372	169
8/28/2018	Assessment	0.014	16.5	- -	- -	5.5	396	- -
10/23/2018	Assessment	- -	- -	10	<0.083 U	- -	- -	216
3/12/2019	Assessment	0.01 J	16.2	8.30	0.07 J	5.3	372	205
6/11/2019	Assessment	<0.04 U	17.9	7.02	0.08	5.7	438	271
8/28/2019	Assessment	<0.02 U	15.9	6	<0.083 U	5.0	402	219

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-5
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	49	0.538281 J	0.130546 J	3	0.63546 J	0.700	<0.083 U	<0.68 U	225069333E-04	0.035	<0.29 U	36	1.07783 J
7/19/2016	Background	<0.93 U	1.09501 J	53	0.578371 J	<0.07 U	2	0.670288 J	- -	<0.083 U	0.951208 J	0.003	0.01341 J	<0.29 U	37	<0.86 U
9/14/2016	Background	<0.93 U	<1.05 U	59	0.421905 J	0.107531 J	3	0.632453 J	0.7219	<0.083 U	<0.68 U	0.003	0.01083 J	<0.29 U	37	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	70	0.70802 J	0.0937694 J	6	2.24689 J	4.38	0.2728 J	2.22182 J	0.014	0.049	<0.29 U	39	<0.86 U
11/8/2016	Background	<0.93 U	<1.05 U	64	0.556725 J	1	4	0.96226 J	0.673	<0.083 U	<0.68 U	0.003	0.02149 J	<0.29 U	33	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	60	0.634776 J	0.136621 J	5	1.12636 J	1.222	<0.083 U	<0.68 U	0.003	0.053	<0.29 U	38	1.02071 J
3/7/2017	Background	<0.93 U	<1.05 U	42	0.548248 J	<0.07 U	3	0.601941 J	0.557	<0.083 U	<0.68 U	0.002	0.0138 J	<0.29 U	36	<0.86 U
4/26/2017	Background	1.24 J	1.87 J	36.3	0.56 J	0.15 J	3.27	0.92 J	0.698	<0.083 U	<0.68 U	0.003	0.013 J	<0.29 U	37.33	<0.86 U
5/16/2017	Background	<0.93 U	1.16 J	38.38	0.65 J	0.08 J	3.63	0.84 J	4.934	<0.083 U	<0.68 U	0.00348	0.013 J	<0.29 U	39.1	<0.86 U
6/16/2017	Background	<0.93 U	<1.05 U	37.52	0.6 J	0.07 J	3.33	0.63 J	8.709	<0.083 U	<0.68 U	0.00323	0.008 J	<0.29 U	36.88	<0.86 U
3/28/2018	Assessment	4.41 J	<1.05 U	42.4	0.46 J	0.27 J	2.38	0.63 J	0.721	<0.083 U	0.74 J	0.00263	0.015 J	<0.29 U	35.97	1.16 J
8/28/2018	Assessment	0.04 J	0.88	45.0	0.525	0.19	3.01	0.414	1.501	<0.083 U*	0.482	0.00223	0.096	0.06 J	38.7	0.070
3/12/2019	Assessment	0.2 J	0.62	80.5	0.638	0.56	2.89	0.477	0.969	0.07 J	0.833	0.00274	0.028	<2 U	39.2	<0.5 U
6/11/2019	Assessment	<0.02 U	0.67	26.0	0.376	0.18	3.00	0.349	1.27	0.08	0.203	<0.02 U	0.007 J	<0.4 U	39	<0.1 U
8/28/2019	Assessment	<0.02 U	0.44	33.7	0.487	0.18	2.40	0.331	0.717	<0.083 U	0.1 J	0.00215	0.006 J	<0.4 U	37.5	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-6
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.05	36.9	6	<0.083 U	6.7	180	19
7/19/2016	Background	0.06	49.5	8	<0.083 U	7.2	208	24
9/14/2016	Background	0.06	52.3	8	<0.083 U	6.6	232	38
10/5/2016	Background	0.06	44.7	8	<0.083 U	7.0	220	29
11/8/2016	Background	0.06	40	7	<0.083 U	6.9	208	29
1/24/2017	Background	0.08	51.9	7	<0.083 U	7.0	244	34
3/7/2017	Background	0.06	43	6	<0.083 U	7.0	178	24
4/26/2017	Background	0.05207	56.5	8	<0.083 U	6.2	238	37
5/16/2017	Background	0.04277	48.6	7	<0.083 U	6.5	206	24
6/16/2017	Background	0.05859	53.8	8	<0.083 U	6.6	252	26
8/28/2017	Detection	0.06251	37	8	0.2066 J	7.0	162	16
12/21/2017	Detection	0.06498	- -	- -	- -	7.0	- -	- -
3/26/2018	Detection	0.04773	34	6	<0.083 U	6.4	156	13
8/28/2018	Detection	0.050	34.6	- -	- -	6.4	144	- -
10/23/2018	Assessment	- -	- -	12.2	<0.083 U	- -	- -	24.6
3/12/2019	Assessment	0.037	41.9	8.16	<0.04 U	6.9	100	17.1
6/10/2019	Assessment	0.05 J	49.7	7.78	0.03 J	6.8	188	21.7
8/27/2019	Assessment	0.03 J	44.8	6	<0.083 U	6.6	250	36

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-6
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	42	0.0329713 J	<0.07 U	2	0.5336 J	0.625	<0.083 U	<0.68 U	0.000846322 J	0.0121 J	<0.29 U	1.38371 J	<0.86 U
7/19/2016	Background	<0.93 U	<1.05 U	60	0.169224 J	<0.07 U	3	1.23508 J	- -	<0.083 U	0.848543 J	0.002	0.00953 J	0.863908 J	3.30254 J	<0.86 U
9/14/2016	Background	<0.93 U	<1.05 U	65	<0.02 U	<0.07 U	4	1.26649 J	1.556	<0.083 U	1.53065 J	0.002	<0.005 U	<0.29 U	3.35098 J	<0.86 U
10/5/2016	Background	<0.93 U	3.63583 J	87	0.559451 J	0.268209 J	11	4.75063 J	7.58	<0.083 U	4.70003 J	0.016	0.01261 J	0.732328 J	3.04012 J	<0.86 U
11/8/2016	Background	<0.93 U	<1.05 U	58	0.134729 J	0.116659 J	5	1.68272 J	0.846	<0.083 U	1.07347 J	0.002	0.01235 J	<0.29 U	2.02161 J	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	76	0.216535 J	<0.07 U	6	2.57434 J	1.415	<0.083 U	1.31013 J	0.003	0.00759 J	0.868445 J	1.16358 J	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	55	0.140509 J	<0.07 U	4	1.95733 J	0.705	<0.083 U	2.18218 J	0.004	0.00738 J	0.328653 J	1.0391 J	<0.86 U
4/26/2017	Background	<0.93 U	1.89 J	75.05	0.26 J	0.16 J	6.35	2.74 J	0.671	<0.083 U	2.44 J	0.0038	0.008 J	0.62 J	4.5 J	<0.86 U
5/16/2017	Background	<0.93 U	1.49 J	59.86	0.12 J	<0.07 U	3.12	1.16 J	13.943	<0.083 U	1.16 J	0.00182	<0.005 U	0.43 J	1.04 J	<0.86 U
6/16/2017	Background	<0.93 U	1.5 J	65.93	0.16 J	<0.07 U	4.2	1.58 J	1.14	<0.083 U	1.03 J	0.00238	<0.005 U	0.5 J	<0.99 U	1.16 J
3/26/2018	Assessment	1.45 J	1.46 J	56.88	0.1 J	0.27 J	4.42	1.8 J	1.055	<0.083 U	2.42 J	0.00281	0.005 J	0.58 J	2.87 J	1.32 J
8/28/2018	Assessment	0.01 J	0.14	41.3	0.007 J	0.02 J	1.73	0.022	0.567	<0.083 U*	0.005 J	0.000415	0.007 J	0.54	1.7	0.03 J
3/12/2019	Assessment	<0.1 U	0.61	48.3	<0.1 U	<0.05 U	2.32	0.597	0.571	<0.04 U	0.748	0.0009 J	<0.005 U	<2 U	2.2	<0.5 U
6/10/2019	Assessment	0.08 J	0.51	49.8	0.08 J	0.08 J	2.18	0.537	0.8101	0.03 J	0.697	<0.02 U	<0.005 U	<0.8 U	2.4	<0.2 U
8/27/2019	Assessment	0.05 J	0.36	48.6	0.04 J	0.04 J	1.96	0.387	0.347	<0.083 U	0.509	0.000518	<0.005 U	<0.4 U	2.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-7A
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.02	95.1	3	<0.083 U	6.7	320	29
7/19/2016	Background	0.02	98.1	4	0.3892 J	7.2	314	34
9/14/2016	Background	0.02	100	4	<0.083 U	7.2	304	33
10/5/2016	Background	0.02	97.1	5	0.3235 J	7.6	312	33
11/8/2016	Background	0.02	100	4	<0.083 U	7.5	332	32
1/24/2017	Background	0.02	102	3	<0.083 U	7.3	314	34
3/7/2017	Background	0.02	105	3	<0.083 U	7.1	296	33
4/26/2017	Background	0.01786	101	5	<0.083 U	7.0	298	34
5/16/2017	Background	0.01605	107	4	<0.083 U	6.9	306	35
6/16/2017	Background	0.03032	106	5	<0.083 U	6.8	320	35
8/28/2017	Detection	0.03116	102	5	0.2740 J	- -	304	33
3/26/2018	Detection	0.01576	100	3	<0.083 U	7.1	300	33
8/28/2018	Detection	0.018	105	- -	- -	7.7	314	- -
10/23/2018	Assessment	- -	- -	7.28	<0.083 U	- -	- -	35.6
3/11/2019	Assessment	0.02 J	99.6	3.43	0.24	7.5	336	30.7
6/10/2019	Assessment	<0.04 U	105	3.12	0.24	7.1	312	35.4
8/27/2019	Assessment	<0.02 U	102	2	0.144 J	8.3	378	36

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-7A
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	60	<0.02 U	<0.07 U	<0.23 U	0.648714 J	2.556	<0.083 U	<0.68 U	0.021	0.033	0.838425 J	<0.99 U	<0.86 U
7/19/2016	Background	<0.93 U	1.33211 J	60	0.0763658 J	<0.07 U	0.240969 J	0.345176 J	- -	0.3892 J	0.791157 J	0.022	0.034	0.619545 J	<0.99 U	1.98498 J
9/14/2016	Background	<0.93 U	<1.05 U	69	<0.02 U	<0.07 U	0.354374 J	0.39525 J	3.54	<0.083 U	<0.68 U	0.021	0.00796 J	0.476503 J	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	66	<0.02 U	<0.07 U	<0.23 U	0.842911 J	7.97	0.3235 J	<0.68 U	0.034	<0.005 U	0.68021 J	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	1.1401 J	65	<0.02 U	<0.07 U	0.28162 J	0.667484 J	2.247	<0.083 U	<0.68 U	0.017	0.00705 J	<0.29 U	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	65	<0.02 U	<0.07 U	<0.23 U	0.352624 J	2.311	<0.083 U	<0.68 U	0.015	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	62	<0.02 U	<0.07 U	0.432618 J	0.458003 J	3.154	<0.083 U	<0.68 U	0.022	0.00621 J	<0.29 U	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	<1.05 U	68.64	<0.02 U	<0.07 U	<0.23 U	0.64 J	1.934	<0.083 U	<0.68 U	0.01501	<0.005 U	<0.29 U	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	1.25 J	59.92	<0.02 U	<0.07 U	0.24 J	0.56 J	2.714	<0.083 U	<0.68 U	0.01509	0.008 J	<0.29 U	<0.99 U	<0.86 U
6/16/2017	Background	<0.93 U	<1.05 U	56.32	<0.02 U	<0.07 U	<0.23 U	0.43 J	3.072	<0.083 U	1.74 J	0.01452	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/26/2018	Assessment	1.28 J	1.85 J	51.94	<0.02 U	<0.07 U	<0.23 U	0.24 J	3.93	<0.083 U	<0.68 U	0.0191	<0.005 U	0.29 J	<0.99 U	<0.86 U
8/28/2018	Assessment	0.02 J	1.59	52.4	0.01 J	0.03	0.071	0.400	2.861	<0.083 U *	0.156	0.0158	<0.005 U	0.63	0.04 J	0.03 J
3/11/2019	Assessment	<0.1 U	3.15	74.8	<0.1 U	0.05 J	1.95	0.351	1.962	0.24	0.2 J	0.0200	<0.005 U	<2 U	<0.2 U	<0.5 U
6/10/2019	Assessment	0.06 J	2.35	42.9	<0.02 U	0.02 J	<0.04 U	0.074	2.561	0.24	0.1 J	<0.02 U	<0.005 U	0.5 J	<0.03 U	<0.1 U
8/27/2019	Assessment	0.15	2.93	49.0	<0.02 U	0.03 J	0.2 J	0.134	1.853	0.144 J	0.1 J	0.0164	<0.005 U	0.6 J	0.04 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-9
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.01	81	5	<0.083 U	7.2	234	14
7/19/2016	Background	0.00947041 J	83	5	0.3556 J	7.4	204	14
9/14/2016	Background	0.00711941 J	99.6	7	<0.083 U	7.6	239	18
10/5/2016	Background	0.00768136 J	98.6	8	0.1884 J	7.4	246	21
11/8/2016	Background	0.01	94.3	6	<0.083 U	7.9	240	25
1/24/2017	Background	0.02	99.8	5	<0.083 U	6.6	234	19
3/7/2017	Background	0.01	88.5	6	<0.083 U	6.4	228	21
4/26/2017	Background	0.01036	87.7	6	0.31 J	6.8	224	19
5/16/2017	Background	0.009500 J	98.5	6	<0.083 U	7.5	198	21
6/16/2017	Background	0.02369	124	6	<0.083 U	7.0	270	22
8/28/2017	Detection	0.02463	106	6	0.2389 J	7.2	224	25
3/28/2018	Assessment	0.00998 J	86.1	6	<0.083 U	7.9	260	28
8/27/2018	Assessment	0.010	144	- -	- -	7.7	272	- -
10/23/2018	Assessment	- -	- -	7.22	<0.083 U	- -	- -	36.7
3/12/2019	Assessment	0.01 J	97.3	3.68	0.1 J	8.1	278	34.3
6/11/2019	Assessment	<0.04 U	99.7	3.69	0.13	7.7	248	37.6
8/27/2019	Assessment	<0.02 U	128	3	<0.083 U	7.2	310	37

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-9
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	128	0.0475927 J	<0.07 U	2	0.648715 J	0.25	<0.083 U	<0.68 U	0.005	0.01472 J	0.871853 J	<0.99 U	1.51586 J
7/19/2016	Background	<0.93 U	<1.05 U	139	0.0706417 J	<0.07 U	2	0.520418 J	- -	0.3556 J	0.756023 J	0.003	0.01407 J	<0.29 U	<0.99 U	1.04447 J
9/14/2016	Background	<0.93 U	<1.05 U	143	<0.02 U	<0.07 U	3	1.03431 J	3.039	<0.083 U	<0.68 U	0.002	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	135	<0.02 U	<0.07 U	4	1.7825 J	0.893	0.1884 J	0.693028 J	0.016	<0.005 U	<0.29 U	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	<1.05 U	136	0.0202009 J	<0.07 U	3	1.48231 J	0.569	<0.083 U	<0.68 U	0.003	0.00774 J	<0.29 U	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	154	0.03324 J	<0.07 U	3	1.21896 J	0.618	<0.083 U	<0.68 U	0.003	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/7/2017	Background	1.39106 J	<1.05 U	142	<0.02 U	<0.07 U	2	0.886686 J	2.009	<0.083 U	<0.68 U	0.009	<0.005 U	<0.29 U	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	1.13 J	144	<0.02 U	<0.07 U	2.52	0.93 J	0.989	0.31 J	0.79 J	0.00316	<0.005 U	<0.29 U	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	1.68 J	142	0.03 J	<0.07 U	2.56	0.83 J	9.472	<0.083 U	<0.68 U	0.00311	<0.005 U	<0.29 U	<0.99 U	<0.86 U
6/16/2017	Background	<0.93 U	1.11 J	150	0.04 J	<0.07 U	4.01	1.32 J	1.795	<0.083 U	<0.68 U	0.00343	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/28/2018	Assessment	<0.93 U	<1.05 U	177	<0.02 U	<0.07 U	0.91 J	0.36 J	2.06	<0.083 U	<0.68 U	0.0041	<0.005 U	<0.29 U	<0.99 U	<0.86 U
8/27/2018	Assessment	0.11	1.29	139	0.034	0.06	1.74	2.33	1.12	<0.083 U*	1.08	0.00241	<0.005 U	0.54	0.8	0.04 J
3/12/2019	Assessment	<0.1 U	0.85	175	<0.1 U	<0.05 U	0.6 J	0.2 J	0.629	0.1 J	0.2 J	0.00528	<0.005 U	<2 U	<0.2 U	<0.5 U
6/11/2019	Assessment	<0.1 U	0.90	166	<0.1 U	<0.05 U	1.11	0.2 J	0.1572	0.13	<0.2 U	<0.02 U	<0.005 U	36.1	0.4 J	<0.5 U
8/27/2019	Assessment	0.09 J	1.67	188	0.02 J	0.08	1.61	0.827	1.258	<0.083 U	0.509	0.00409	<0.005 U	0.4 J	0.5	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-10
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.02	77.6	7	<0.083 U	8.4	275	30
7/19/2016	Background	0.01	82.5	8	<0.083 U	7.4	252	30
9/14/2016	Background	0.02	104	8	<0.083 U	7.3	275	31
10/5/2016	Background	0.02	82.9	9	0.2319 J	7.0	308	39
11/8/2016	Background	0.03	116	8	<0.083 U	8.0	268	30
1/24/2017	Background	0.03	77.1	7	<0.083 U	7.1	276	33
3/7/2017	Background	0.02	84.8	6	<0.083 U	6.6	268	29
4/26/2017	Background	0.01728	77.4	8	0.3 J	6.6	266	26
5/16/2017	Background	0.03169	80.6	8	<0.083 U	6.8	284	35
6/16/2017	Background	0.04007	75.6	9	<0.083 U	6.5	296	31
8/28/2017	Detection	0.0448	72.8	9	0.3304 J	7.4	256	28
3/26/2018	Assessment	0.00862 J	76.6	6	<0.083 U	8.0	244	25
8/27/2018	Assessment	0.028	64.4	- -	- -	7.6	254	- -
10/23/2018	Assessment	- -	- -	11.7	<0.083 U	- -	- -	26.4
3/12/2019	Assessment	0.028	72.4	9.68	0.1 J	8.4	226	21.4
6/10/2019	Assessment	<0.04 U	80.4	9.24	0.11	7.4	260	26.1
8/27/2019	Assessment	<0.02 U	70.8	7	<0.083 U	7.3	268	26

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-10
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	**Monitoring Program**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Cadmium**	**Chromium**	**Cobalt**	**Combined Radium**	**Fluoride**	**Lead**	**Lithium**	**Mercury**	**Molybdenum**	**Selenium**	**Thallium**
		µg/L	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**pCi/L**	**mg/L**	**µg/L**	**mg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
5/24/2016	Background	<0.93 U	<1.05 U	77	0.0283721 J	<0.07 U	2	0.567956 J	0.3279	<0.083 U	<0.68 U	0.004	0.01767 J	1.07659 J	<0.99 U	<0.86 U
7/19/2016	Background	<0.93 U	<1.05 U	78	0.0513816 J	<0.07 U	2	0.487304 J	- -	<0.083 U	<0.68 U	0.002	0.02255 J	<0.29 U	<0.99 U	<0.86 U
9/14/2016	Background	<0.93 U	1.73638 J	102	<0.02 U	<0.07 U	16	1.45899 J	0.625	<0.083 U	1.5658 J	0.003	<0.005 U	0.405665 J	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	76	<0.02 U	<0.07 U	1	0.616894 J	1.305	0.2319 J	<0.68 U	0.016	<0.005 U	0.98229 J	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	6	103	0.350438 J	0.413058 J	37	5	1.066	<0.083 U	2.57815 J	0.005	0.01543 J	1.18188 J	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	82	0.049146 J	<0.07 U	1	1.02071 J	0.618	<0.083 U	<0.68 U	0.003	<0.005 U	1.261 J	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	77	<0.02 U	<0.07 U	2	0.814652 J	1.119	<0.083 U	<0.68 U	0.01	<0.005 U	1.02218 J	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	1.5 J	69.33	<0.02 U	<0.07 U	0.26 J	0.65 J	0.668	0.3 J	<0.68 U	0.00287	<0.005 U	0.92 J	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	<1.05 U	82.92	<0.02 U	<0.07 U	0.59 J	0.76 J	1.294	<0.083 U	<0.68 U	0.00357	<0.005 U	1.55 J	<0.99 U	<0.86 U
6/16/2017	Background	<0.93 U	<1.05 U	76.25	<0.02 U	<0.07 U	0.39 J	1.17 J	2.477	<0.083 U	<0.68 U	0.00358	<0.005 U	1.28 J	<0.99 U	<0.86 U
3/26/2018	Assessment	<0.93 U	<1.05 U	81.96	<0.02 U	<0.07 U	1.37	0.44 J	1.869	<0.083 U	1.12 J	0.00156	<0.005 U	0.78 J	<0.99 U	1.36 J
8/27/2018	Assessment	0.10	2.80	74.8	0.02 J	0.03	0.889	1.60	0.887	<0.083 U*	0.189	0.00308	0.005 J	3.52	0.3	0.03 J
3/12/2019	Assessment	0.1 J	0.67	79.1	<0.1 U	0.05 J	0.9 J	0.299	0.860	0.1 J	0.3 J	0.00167	<0.005 U	<2 U	0.3 J	<0.5 U
6/10/2019	Assessment	0.2 J	0.3 J	78.3	<0.1 U	<0.05 U	0.3 J	<0.1 U	1.128	0.11	<0.2 U	<0.02 U	<0.005 U	10 J	0.5 J	<0.5 U
8/27/2019	Assessment	0.11	0.46	79.1	<0.02 U	0.02 J	0.385	0.128	1.344	<0.083 U	0.05 J	0.00169	0.016 J	1 J	0.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*: Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-11
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.171	10.5	4	<0.083 U	5.7	182	26
7/19/2016	Background	0.238	13.3	5	<0.083 U	6.2	144	41
9/14/2016	Background	0.207	14.7	6	<0.083 U	6.6	120	33
10/5/2016	Background	0.19	13	6	<0.083 U	6.4	156	36
11/8/2016	Background	0.188	11.3	5	<0.083 U	6.5	106	36
1/24/2017	Background	0.214	18.2	4	<0.083 U	6.1	128	39
3/7/2017	Background	0.199	12.6	3	<0.083 U	5.5	112	37
4/26/2017	Background	0.253	16.2	6	<0.083 U	5.9	130	45
5/16/2017	Background	0.453	13.6	6	<0.083 U	5.3	142	62
6/16/2017	Background	0.508	14.9	6	<0.083 U	5.4	184	60
8/28/2017	Detection	0.266	9.65	6	<0.083 U	5.3	108	43
12/21/2017	Detection	0.227	- -	- -	- -	6.7	- -	- -
3/28/2018	Assessment	0.465	12.2	4	<0.083 U	5.4	136	53
8/27/2018	Assessment	0.281	10.8	- -	- -	5.9	100	- -
10/23/2018	Assessment	- -	- -	6.93	<0.083 U	- -	- -	47.7
3/12/2019	Assessment	0.409	11.6	4.03	0.04 J	5.8	104	44.9
6/10/2019	Assessment	0.548	17.0	3.73	0.04 J	5.9	82	54.7
8/27/2019	Assessment	0.605	15.4	3	<0.083 U	5.8	138	59

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-11
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	139	0.899874 J	1	13	3.28467 J	1.311	<0.083 U	4.23401 J	0.006	0.02458 J	0.362121 J	<0.99 U	<0.86 U
7/19/2016	Background	<0.93 U	7	187	2	2	22	6	- -	<0.083 U	9	0.018	0.02442 J	0.590003 J	1.89587 J	<0.86 U
9/14/2016	Background	<0.93 U	32	494	6	4	108	25	8.05	<0.083 U	49	0.079	0.097	3.32649 J	<0.99 U	1.00112 J
10/5/2016	Background	<0.93 U	3.13751 J	163	1	1	16	4.44532 J	2.161	<0.083 U	6	0.02	<0.005 U	0.370625 J	1.95476 J	<0.86 U
11/8/2016	Background	<0.93 U	<1.05 U	99	0.259911 J	0.649573 J	2	0.824023 J	0.874	<0.083 U	<0.68 U	0.004	<0.005 U	<0.29 U	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	121	0.136215 J	0.418062 J	2	0.286943 J	1	<0.083 U	<0.68 U	0.003	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	97	0.249082 J	0.477646 J	2	0.554259 J	12.993	<0.083 U	<0.68 U	0.003	<0.005 U	<0.29 U	2.72028 J	<0.86 U
4/26/2017	Background	<0.93 U	<1.05 U	138	0.38 J	0.56 J	5.16	1.24 J	0.512	<0.083 U	0.83 J	0.00566	<0.005 U	<0.29 U	1.52 J	<0.86 U
5/16/2017	Background	<0.93 U	1.16 J	129	0.39 J	0.15 J	3.27	0.97 J	0.911	<0.083 U	<0.68 U	0.00329	<0.005 U	<0.29 U	2.68 J	<0.86 U
6/16/2017	Background	<0.93 U	<1.05 U	127	0.41 J	0.13 J	3.67	1.08 J	2.655	<0.083 U	1.23 J	0.00334	<0.005 U	<0.29 U	1.15 J	<0.86 U
3/28/2018	Assessment	4.89 J	<1.05 U	124	0.34 J	0.16 J	0.99 J	0.48 J	1.183	<0.083 U	1 J	0.00181	<0.005 U	<0.29 U	4.37 J	<0.86 U
8/27/2018	Assessment	0.01 J	0.25	94.9	0.365	0.15	1.36	0.159	1.551	<0.083 U*	0.097	0.00255	<0.005 U	0.08 J	2.4	0.03 J
3/12/2019	Assessment	<0.1 U	0.90	119	0.622	0.1 J	1.95	0.372	0.451	0.04 J	0.935	0.00221	<0.005 U	<2 U	3.5	<0.5 U
6/10/2019	Assessment	<0.04 U	0.36	111	0.316	0.08 J	0.884	0.162	1.121	0.04 J	0.2 J	0.03 J	<0.005 U	<0.8 U	3.1	<0.2 U
8/27/2019	Assessment	<0.02 U	0.55	131	0.317	0.10	1.36	0.256	0.455	<0.083 U	0.416	0.0013	<0.005 U	<0.4 U	4.1	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-12
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	**mg/L**	**mg/L**	**mg/L**	**SU**	**mg/L**	**mg/L**
5/24/2016	Background	0.02	63	10	<0.083 U	8.2	280	19
7/19/2016	Background	0.02	61.1	10	<0.083 U	7.6	216	15
9/14/2016	Background	0.02	70.5	11	<0.083 U	7.1	236	14
10/5/2016	Background	0.02	69.2	12	0.1908 J	7.0	271	12
11/8/2016	Background	0.03	66.7	12	<0.083 U	6.9	308	14
1/24/2017	Background	0.02	67.1	9	<0.083 U	6.7	268	9
3/7/2017	Background	0.02	68.1	9	<0.083 U	6.3	248	11
4/26/2017	Background	0.02379	59.4	9	<0.083 U	6.4	282	10
5/16/2017	Background	0.023	61.5	10	<0.083 U	6.4	236	10
6/16/2017	Background	0.0347	59.4	10	<0.083 U	6.6	252	9
8/29/2017	Detection	0.03061	72	10	<0.083 U	7.2	248	12
3/26/2018	Detection	0.02876	56.2	7	<0.083 U	7.8	176	6
8/28/2018	Detection	0.016	56.4	- -	- -	7.9	258	- -
10/23/2018	Assessment	- -	- -	13.2	<0.083 U	- -	- -	9.16
3/11/2019	Assessment	0.02 J	58.0	11	0.06 J	8.5	254	5.0
6/10/2019	Assessment	0.04 J	60.9	10.6	0.06 J	7.2	244	7.0
8/27/2019	Assessment	<0.02 U	59.6	8	<0.083 U	6.9	252	9

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-12
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	62	0.020013 J	<0.07 U	0.98147 J	3.36185 J	0.28188	<0.083 U	0.779741 J	0.000759267 J	0.01713 J	2.94917 J	<0.99 U	<0.86 U
7/19/2016	Background	<0.93 U	<1.05 U	61	0.0839166 J	<0.07 U	2	2.84565 J	- -	<0.083 U	1.17408 J	0.001	0.0216 J	3.86821 J	<0.99 U	<0.86 U
9/14/2016	Background	<0.93 U	<1.05 U	70	<0.02 U	<0.07 U	2	2.53407 J	1.953	<0.083 U	0.716221 J	0.000874536 J	<0.005 U	3.27157 J	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	67	<0.02 U	<0.07 U	0.86698 J	2.31495 J	1.666	0.1908 J	<0.68 U	0.014	<0.005 U	2.00891 J	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	8	123	1	0.465087 J	22	23	1.743	<0.083 U	15	0.011	0.039	4.65502 J	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	63	<0.02 U	<0.07 U	0.446889 J	1.76121 J	1.357	<0.083 U	<0.68 U	0.000559654 J	<0.005 U	1.1441 J	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	59	<0.02 U	<0.07 U	1	1.61975 J	2.97	<0.083 U	0.903447 J	0.006	<0.005 U	2.06812 J	<0.99 U	<0.86 U
4/26/2017	Background	1.92 J	1.23 J	53.73	0.02 J	<0.07 U	0.65 J	1.34 J	0.908	<0.083 U	<0.68 U	0.00106	0.006 J	0.69 J	<0.99 U	<0.86 U
5/16/2017	Background	<0.93 U	1.65 J	59.7	0.07 J	<0.07 U	1.57	1.95 J	0.6398	<0.083 U	0.77 J	0.00132	<0.005 U	0.58 J	<0.99 U	<0.86 U
6/16/2017	Background	<0.93 U	<1.05 U	56.66	<0.02 U	<0.07 U	0.63 J	1.3 J	2.635	<0.083 U	<0.68 U	0.00085 J	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/26/2018	Assessment	1.15 J	<1.05 U	50.7	<0.02 U	<0.07 U	1.06	1.85 J	0.867	<0.083 U	<0.68 U	0.00069 J	<0.005 U	1.13 J	<0.99 U	0.96 J
8/28/2018	Assessment	0.15	0.43	48.8	0.042	0.03	0.993	2.51	0.891	<0.083 U*	0.535	0.000702	<0.005 U	1.11	0.4	0.03 J
3/11/2019	Assessment	<0.1 U	0.3 J	51.6	<0.1 U	<0.05 U	1.09	3.35	0.777	0.06 J	0.5 J	0.0008 J	<0.005 U	<2 U	0.3 J	<0.5 U
6/10/2019	Assessment	0.1 J	0.29	54.2	<0.04 U	0.03 J	0.585	2.49	0.5134	0.06 J	0.3	<0.02 U	<0.005 U	<0.8 U	0.2 J	<0.2 U
8/27/2019	Assessment	0.24	1.20	60.8	0.150	0.08	2.04	11.2	1.111	<0.083 U	2.65	0.00176	0.006 J	0.4 J	1.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*: Sample collected on 10/23/2018

Table 1 - Groundwater Data Summary: B-13
Flint Creek - Landfill
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/24/2016	Background	0.02	15.1	4	<0.083 U	6.9	108	20
7/19/2016	Background	0.03	14.7	3	<0.083 U	5.9	88	23
9/13/2016	Background	0.02	13	4	<0.083 U	5.1	68	18
10/5/2016	Background	0.02	13.6	5	<0.083 U	5.2	80	20
11/8/2016	Background	0.01	4.07	4	0.2121 J	5.4	52	7
1/24/2017	Background	0.01	4.26	3	<0.083 U	6.2	44	7
3/7/2017	Background	0.02	10.1	3	<0.083 U	4.8	64	16
4/26/2017	Background	0.02539	15	4	<0.083 U	5.3	82	27
5/16/2017	Background	0.03198	20.1	4	<0.083 U	5.7	60	33
6/16/2017	Background	0.04236	20.2	5	<0.083 U	5.2	114	31
8/28/2017	Detection	0.02674	12.7	4	<0.083 U	5.0	72	22
3/28/2018	Assessment	0.02271	14.8	2	<0.083 U	7.5	80	23
8/27/2018	Assessment	0.016	12.4	- -	- -	5.1	58	- -
10/22/2018	Detection	- -	- -	3.6	<0.083 U	- -	- -	21.1
3/12/2019	Assessment	0.02 J	13.5	1.92	0.02 J	7.1	82	21.3
6/10/2019	Assessment	<0.04 U	19.7	3.05	0.02 J	6.9	98	20.7
8/28/2019	Assessment	<0.02 U	10.2	1	<0.083 U	5.4	64	18

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: B-13
Flint Creek - Landfill
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/24/2016	Background	<0.93 U	<1.05 U	53	0.122524 J	0.107623 J	2	1.81817 J	0.4473	<0.083 U	<0.68 U	<0.00013 U	0.02179 J	<0.29 U	<0.99 U	<0.86 U
7/19/2016	Background	<0.93 U	<1.05 U	60	0.224239 J	<0.07 U	4	1.60103 J	- -	<0.083 U	1.35024 J	0.002	0.01382 J	<0.29 U	<0.99 U	<0.86 U
9/13/2016	Background	<0.93 U	<1.05 U	54	<0.02 U	<0.07 U	3	1.45223 J	1.939	<0.083 U	<0.68 U	0.002	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/5/2016	Background	<0.93 U	<1.05 U	61	0.237762 J	<0.07 U	5	2.78529 J	0.829	<0.083 U	1.81371 J	0.011	<0.005 U	0.539075 J	<0.99 U	<0.86 U
11/8/2016	Background	<0.93 U	<1.05 U	32	0.28466 J	0.256467 J	4	1.50224 J	0.3576	0.2121 J	1.58806 J	0.002	0.00767 J	<0.29 U	<0.99 U	<0.86 U
1/24/2017	Background	<0.93 U	<1.05 U	36	0.29327 J	<0.07 U	3	1.48125 J	0.733	<0.083 U	<0.68 U	0.002	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/7/2017	Background	<0.93 U	<1.05 U	44	0.142049 J	<0.07 U	2	0.769644 J	0.841	<0.083 U	<0.68 U	0.002	<0.005 U	<0.29 U	<0.99 U	<0.86 U
4/26/2017	Background	<0.93 U	1.92 J	66.22	0.22 J	0.1 J	4.05	1.94 J	0.844	<0.083 U	1.02 J	0.00252	0.021 J	<0.29 U	1.68 J	<0.86 U
5/16/2017	Background	<0.93 U	<1.05 U	71.99	0.13 J	<0.07 U	2.26	0.99 J	0.918	<0.083 U	<0.68 U	0.00133	<0.005 U	<0.29 U	1.38 J	<0.86 U
6/16/2017	Background	<0.93 U	<1.05 U	72.45	0.12 J	<0.07 U	2.61	1.26 J	2.577	<0.083 U	<0.68 U	0.00151	<0.005 U	<0.29 U	<0.99 U	<0.86 U
3/28/2018	Assessment	<0.93 U	<1.05 U	56.76	<0.02 U	<0.07 U	1.45	0.53 J	0.92	<0.083 U	<0.68 U	0.00101	<0.005 U	<0.29 U	<0.99 U	<0.86 U
8/27/2018	Assessment	0.02 J	0.13	48.3	0.113	0.05	0.611	0.210	0.530	<0.083 U*	0.149	0.000775	<0.005 U	0.08 J	0.5	0.02 J
3/12/2019	Assessment	<0.1 U	0.62	55.4	0.2 J	0.08 J	1.76	1.08	0.882	0.02 J	1.51	0.00115	<0.005 U	<2 U	0.8 J	<0.5 U
6/10/2019	Assessment	<0.02 U	0.07 J	55.1	0.05 J	0.04 J	0.379	0.03 J	0.461	0.02 J	<0.05 U	<0.02 U	<0.005 U	<0.4 U	0.5	<0.1 U
8/28/2019	Assessment	<0.02 U	0.17	47.1	0.151	0.05 J	0.818	0.272	0.862	<0.083 U	0.221	0.000814	<0.005 U	<0.4 U	0.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter
*: Sample collected on 10/22/2018

APPENDIX II

Where applicable, show in this appendix the results from statistical analyses, and a description of the statistical analysis method chosen. These statistical analyses are to be conducted separately for each constituent in each monitoring well.

STATISTICAL ANALYSIS SUMMARY
LANDFILL
Flint Creek Plant
Gentry, Arkansas

Submitted to

AMERICAN ELECTRIC POWER

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Submitted by

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July 12, 2019

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LF	Landfill
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
RSL	Regional Screening Level
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Landfill (LF), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas.

Based on detection monitoring conducted in 2017 and 2018, a statistically significant increase (SSI) over background was concluded for boron at the LF. An alternative source was not identified at the time, so two assessment monitoring events were conducted at the LF in 2018, in accordance with 40 CFR 257.95. No SSLs were identified during these events and the unit remained in assessment monitoring. A semi-annual assessment monitoring event was also completed in March 2019, with the results of the March 2019 event documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. No SSLs were identified, but Appendix III concentrations for boron, calcium, chloride, and sulfate remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can return to detection monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

LANDFILL EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, one set of samples was collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(d)(1). Samples from the March 2019 semi-annual sampling event were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during this assessment monitoring event may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.14 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the LF were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained to meet the requirements of 40 CFR 257.95(d)(1) were screened for potential outliers. No outliers were identified.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for arsenic, barium, beryllium, cadmium, chromium, lead, lithium, mercury, molybdenum, and selenium due to apparent non-normal distributions and for antimony, fluoride, and thallium due to high non-detect frequencies. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

No SSLs were identified at the Flint Creek LF.

2.2.3 Evaluation of Potential Appendix III SSIs

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Prediction limits were calculated for the Appendix III parameters to represent background values. As described in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018), intrawell tests were used to evaluate potential SSIs for calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS), whereas an interwell test was used to evaluate potential SSIs for boron.

Prediction limits for the interwell tests were recalculated using data collected during the March 2019 assessment monitoring event. Eight data points (i.e., one sample from eight background wells) were added to the background dataset for each interwell test. New data were tested for outliers prior to being added to the background dataset. The updated prediction limits were calculated for a one-of-two retesting procedure, as during detection monitoring. The values of the updated prediction limits were similar to the values of the prediction limits calculated during detection monitoring. The revised interwell prediction limits were used to evaluate potential SSIs for boron.

For the intrawell tests, limited data made it possible to add only one data point (i.e., one sample from each compliance well) to each background dataset. Because one sample result is insufficient to compare against the existing background dataset, the prediction limits were not updated for the intrawell tests at this time. The intrawell prediction limits calculated during detection monitoring were used to evaluate potential SSIs for calcium, chloride, fluoride, pH, sulfate, and TDS.

Data collected during the March 2019 assessment monitoring event from each compliance well were compared to the prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 0.0588 mg/L at B-2 (0.634 mg/L) and B-11 (0.409 mg/L)

- The reported sulfate concentration at B-9 exceeded the intrawell UPL of 27.9 mg/L (34.3 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Flint Creek LF during assessment monitoring. As a result, the Flint Creek LF CCR unit will remain in assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the March 2019 data. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. No SSLs were identified.

The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Interwell tests were used to evaluate potential SSIs for boron, and intrawell tests were used to evaluate potential SSIs for calcium, chloride, fluoride, pH, sulfate, and TDS. The prediction limits for the interwell tests were updated with additional data collected from the background wells. Prediction limits were recalculated using a one-of-two retesting procedure. The prediction limits calculated during detection monitoring were used for the intrawell tests. During the most recent sampling event, boron and sulfate results exceeded background levels.

Based on this evaluation, either the Flint Creek LF CCR unit will remain in assessment monitoring or an ASD will be conducted to evaluate if the unit can return to detection monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Flint Creek Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Landfill, Flint Creek Plant, Gentry, Arkansas. January 3, 2018.

United States Environmental Protection Agency (USEPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09-007. March 2009.

TABLES

Table 1 - Groundwater Data Summary
Flint Creek - Landfill

Parameter	Unit	B-1B	B-2	B-4	B-5	B-6	B-7A	B-9	B-10	B-11	B-12	B-13
		3/12/2019	3/12/2019	3/12/2019	3/12/2019	3/12/2019	3/11/2019	3/12/2019	3/12/2019	3/12/2019	3/11/2019	3/12/2019
Antimony	µg/L	0.500 U	0.500 U	0.500 U	0.200 J	0.500 U	0.500 U	0.500 U	0.100 J	0.500 U	0.500 U	0.500 U
Arsenic	µg/L	0.400 J	0.400 J	0.500 U	0.620	0.610	3.15	0.850	0.670	0.900	0.300 J	0.620
Barium	µg/L	112	63.9	34.3	80.5	48.3	74.8	175	79.1	119	51.6	55.4
Beryllium	µg/L	0.500 U	0.100 J	0.200 J	0.638	0.500 U	0.500 U	0.500 U	0.500 U	0.622	0.500 U	0.200 J
Boron	mg/L	0.0200 J	0.634	0.0360	0.0100 J	0.0370	0.0200 J	0.0100 J	0.0280	0.409	0.0200 J	0.0200 J
Cadmium	µg/L	0.200 U	0.0600 J	0.100 J	0.560	0.200 U	0.0500 J	0.200 U	0.0500 J	0.100 J	0.200 U	0.0800 J
Calcium	mg/L	93.1	34.5	3.37	16.2	41.9	99.6	97.3	72.4	11.6	58.0	13.5
Chloride	mg/L	2.31	5.88	4.58	8.30	8.16	3.43	3.68	9.68	4.03	11.0	1.92
Chromium	µg/L	1.00 U	2.83	1.26	2.89	2.32	1.95	0.600 J	0.900 J	1.95	1.09	1.76
Cobalt	µg/L	0.200 U	0.200 J	0.200 U	0.477	0.597	0.351	0.200 J	0.299	0.372	3.35	1.08
Combined Radium	pCi/L	3.92	1.93	0.295	0.969	0.571	1.96	0.629	0.860	0.451	0.777	0.882
Fluoride	mg/L	0.410	0.100 J	0.0200 J	0.0700 J	0.200 U	0.240	0.100 J	0.100 J	0.0400 J	0.0600 J	0.0200 J
Lead	µg/L	1.25	0.200 J	0.500 U	0.833	0.748	0.200 J	0.200 J	0.300 J	0.935	0.500 J	1.51
Lithium	mg/L	0.0264	0.00188	0.00123	0.00274	0.000900 J	0.0200	0.00528	0.00167	0.00221	0.000800 J	0.00115
Mercury	mg/L	0.0000250 U	0.0000250 U	0.0000250 U	0.0000280	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U
Molybdenum	µg/L	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Selenium	µg/L	1.00 U	14.3	0.600 J	39.2	2.20	1.00 U	1.00 U	0.300 J	3.50	0.300 J	0.800 J
Total Dissolved Solids	mg/L	228	376	68.0	372	100	336	278	226	104	254	82.0
Sulfate	mg/L	17.5	129	12.1	205	17.1	30.7	34.3	21.4	44.9	5.00	21.3
Thallium	µg/L	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
pH	SU	7.63	6.92	7.47	5.31	6.93	7.46	8.11	8.35	5.79	8.52	7.05

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

SU: standard unit

U: Non-detect value. For statistical analysis, parameters which were not detected were replaced with the reporting limit.

J: Estimated value. Parameter was detected in concentrations below the reporting limit.

Table 2: Groundwater Protection Standards
Flint Creek Plant - Landfill

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.0045
Arsenic, Total (mg/L)	0.01		0.008
Barium, Total (mg/L)	2		0.13
Beryllium, Total (mg/L)	0.004		0.001
Cadmium, Total (mg/L)	0.005		0.001
Chromium, Total (mg/L)	0.1		0.0083
Cobalt, Total (mg/L)	n/a	0.006	0.0029
Combined Radium, Total (pCi/L)	5		7.81
Fluoride, Total (mg/L)	4		1
Lead, Total (mg/L)	n/a	0.015	0.015
Lithium, Total (mg/L)	n/a	0.04	0.041
Mercury, Total (mg/L)	0.002		0.000096
Molybdenum, Total (mg/L)	n/a	0.1	0.01
Selenium, Total (mg/L)	0.05		0.039
Thallium, Total (mg/L)	0.002		0.002

Notes:

Grey cell indicates calculated UTL is higher than MCL.

MCL = Maximum Contaminant Level

RSL = Regional Screening Level

Calculated UTL (Upper Tolerance Limit) represents site-specific background values.

The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3: Appendix III Data Summary
Flint Creek Plant - Landfill

Parameter	Units	Description	B-1B	B-2	B-5	B-6	B-7A	B-9	B-10	B-11
			3/12/2019	3/12/2019	3/12/2019	3/12/2019	3/11/2019	3/12/2019	3/12/2019	3/12/2019
Boron	mg/L	Interwell Background Value (UPL)	0.0588							
		Detection Monitoring Result	0.0200	**0.634**	0.0100	0.0370	0.0200	0.0100	0.0280	**0.409**
Calcium	mg/L	Intrawell Background Value (UPL)	97.6	99.2	19.6	63.5	111	126	116	19.5
		Detection Monitoring Result	93.1	34.5	16.2	41.9	99.6	97.3	72.4	11.6
Chloride	mg/L	Intrawell Background Value (UPL)	5.79	7.93	12.3	9.10	6.02	8.34	10.1	7.83
		Detection Monitoring Result	2.31	5.88	8.30	8.16	3.43	3.68	9.68	4.03
Fluoride	mg/L	Intrawell Background Value (UPL)	0.651	1.00	1.00	0.200	1.00	1.00	1.00	1.00
		Detection Monitoring Result	0.410	0.100	0.0700	0.0400	0.240	0.100	0.100	0.0400
pH	SU	Intrawell Background Value (UPL)	8.5	7.3	7.3	7.5	7.9	8.4	8.8	7.1
		Intrawell Background Value (LPL)	5.8	5.0	4.0	6.0	6.4	6.0	5.6	4.8
		Detection Monitoring Result	7.6	6.9	5.3	6.9	7.5	8.1	8.4	5.8
Sulfate	mg/L	Intrawell Background Value (UPL)	27.0	776	251	43.9	37.5	27.9	40.2	69.8
		Detection Monitoring Result	17.5	129	205	17.1	30.7	**34.3**	21.4	44.9
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	319	1522	461	280	339	283	316	207
		Detection Monitoring Result	228	376	372	100	336	278	226	104

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Bold values exceed the background value.

Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Flint Creek Landfill CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

No. 15296

DAVID ANTHONY MILLER
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

15296
License Number

ARKANSAS
Licensing State

07.12.19
Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

July 10, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Flint Creek Landfill
Assessment Monitoring Event – Spring 2019

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the statistical analysis of the groundwater data for the Spring 2019 sample event for American Electric Power Inc.'s Flint Creek Landfill. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** B-1B, B-4, B-5, B-7A, B-12, and B-13; and
- **Downgradient wells:** B-2, B-6, B-9, B-10, and B-11.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC. The statistical analysis was reviewed by Dr. Jim Loftis, professor emeritus of Civil and Environmental Engineering at Colorado State University and Senior Advisor to Groundwater Stats Consulting.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) - boron, calcium, chloride, fluoride, pH, sulfate, and TDS;
- **Appendix IV** (Assessment Monitoring) – antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figure A). Values previously flagged during the screening as outliers may be seen in a lighter font and disconnected symbol on the time series graphs. A summary of flagged values follows this letter (Figure B).

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 verification strategy were constructed for boron; and intrawell prediction limits combined with a 1-of-2 verification strategy were constructed for calcium, chloride, fluoride, pH, sulfate and TDS (Figure C & D, respectively). The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data are screened for any newly suspected outliers or obvious trending patterns using time series plots. All values flagged as outliers may be seen on the Outlier Summary report following this letter. No obvious trending patterns were observed in the upgradient wells.

Intrawell prediction limits utilize the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the background data set will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified, and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result, and, therefore, no further action is necessary. Prediction limit exceedances were noted for boron in downgradient wells B-2 and B-11; pH, which exceeded its upper limit in upgradient well B-12; and sulfate in downgradient well B-9. The results of those findings may be found in the Prediction Limit Summary tables following this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether concentrations are statistically increasing, decreasing, or stable (Figure E). Upgradient wells are included in the trend analyses to identify whether similar patterns exist upgradient of the site which is an indication of natural variability in groundwater unrelated to practices at the site.

No statistically significant trends were noted in downgradient wells except for statistically significant increasing trends for boron in well B-11 and sulfate in well B-9. A statistically significant increasing trend was identified for pH in upgradient well B-4; and statistically significant decreasing trends were noted for sulfate in upgradient wells B-12 and B-1B. A Trend Test summary table follows this letter.

Evaluation of Appendix IV Parameters

Parametric tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters with a target of 95% confidence and 95% coverage to determine the Alternate Contaminant Level (ACL) (Figure F). Background data are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. Any flagged values may be seen on the Outlier Summary following this letter. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure G).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of the MCL, CCR-Rule specified level, or ACL as discussed above (Figure H). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No confidence intervals exceedances were found. A summary of the confidence interval results follows this letter.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Flint Creek Landfill. If you have any questions or comments, please feel free to contact me.

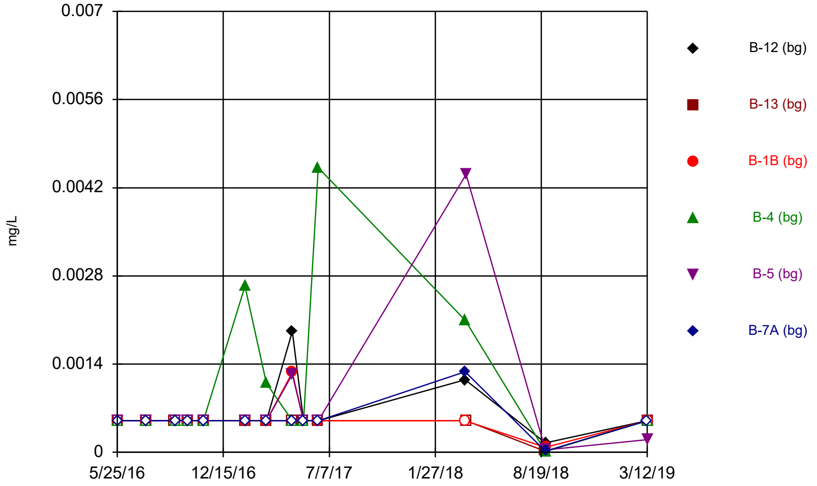
For Groundwater Stats Consulting,

Kristina Rayner

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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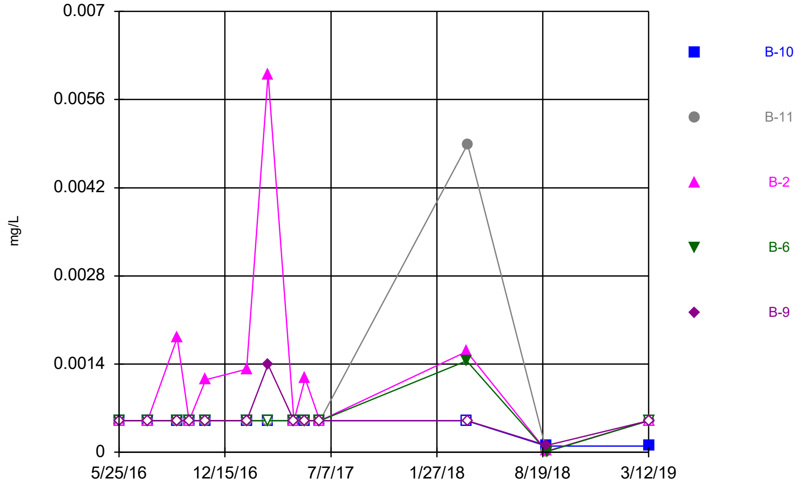

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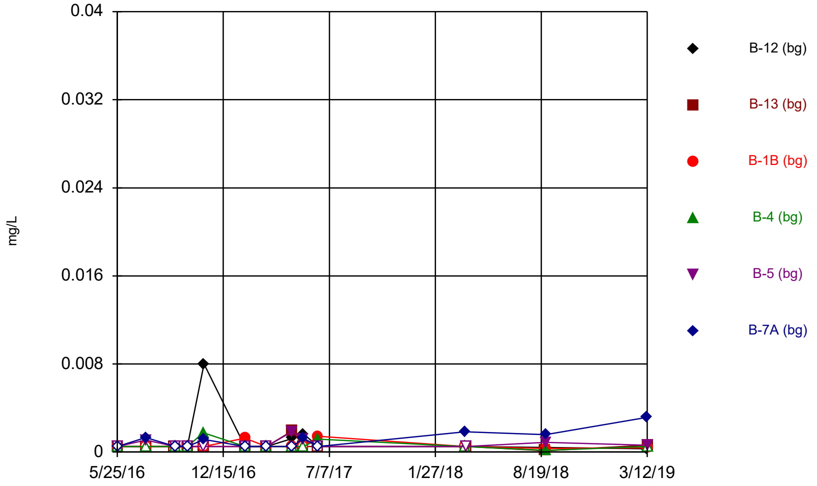

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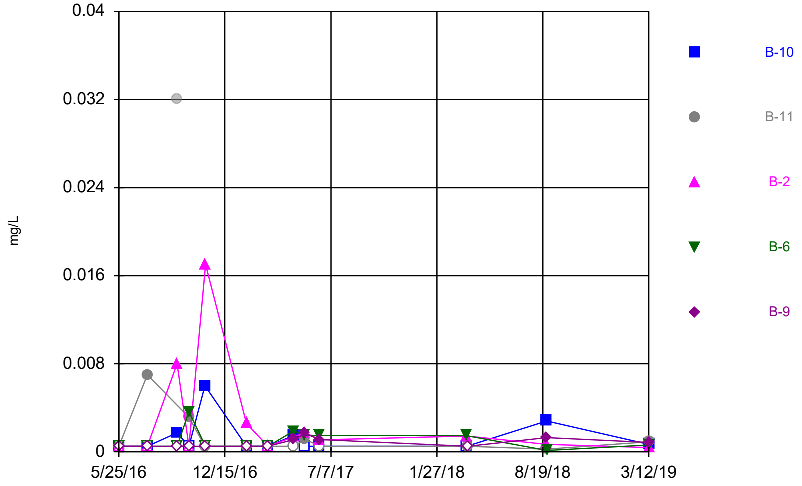

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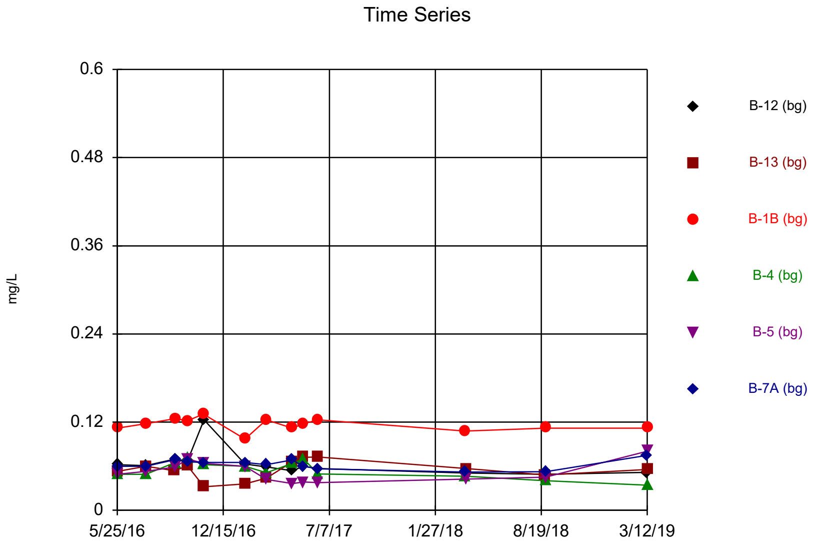

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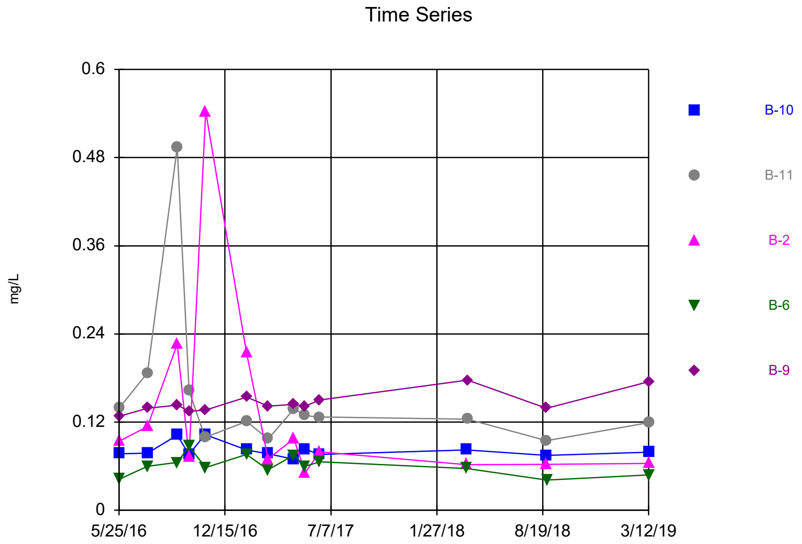

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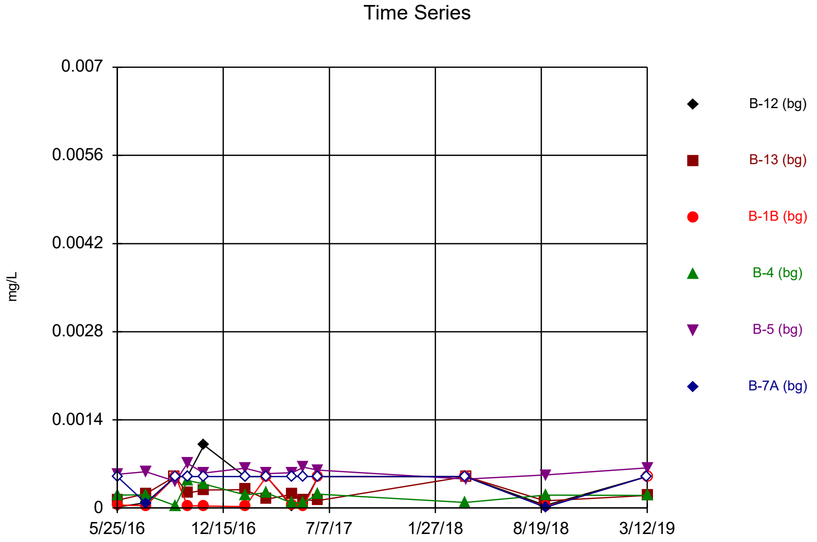

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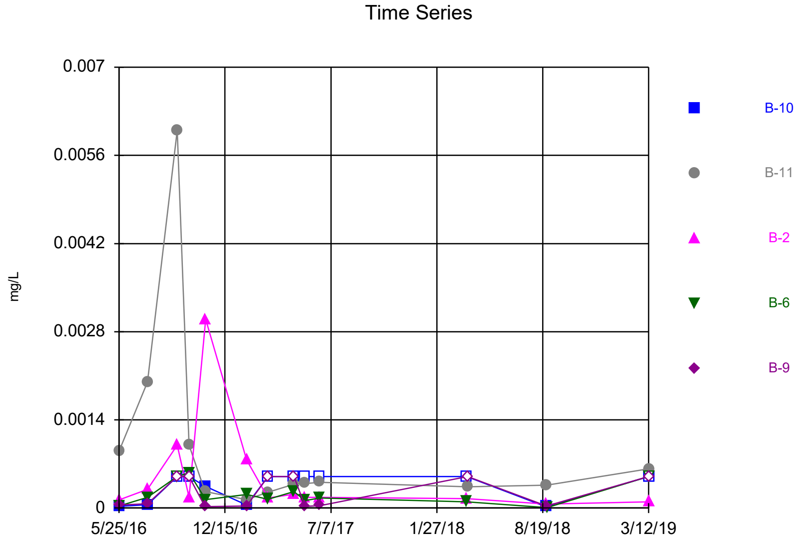

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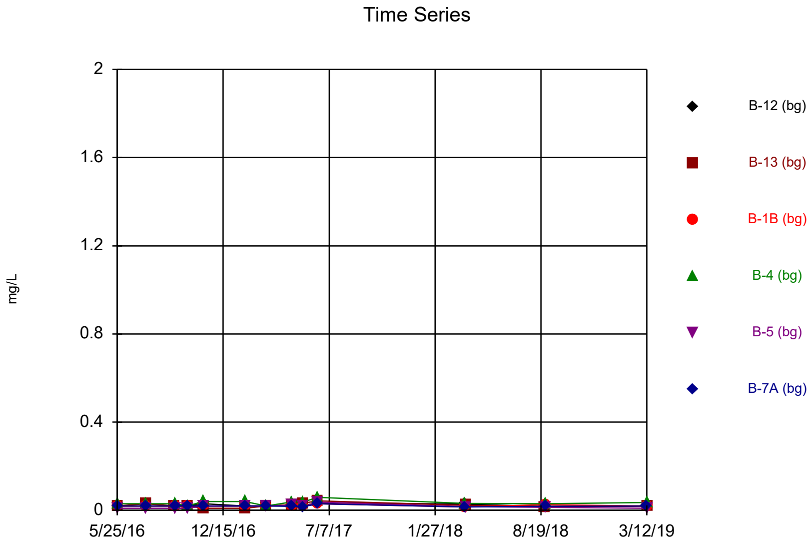

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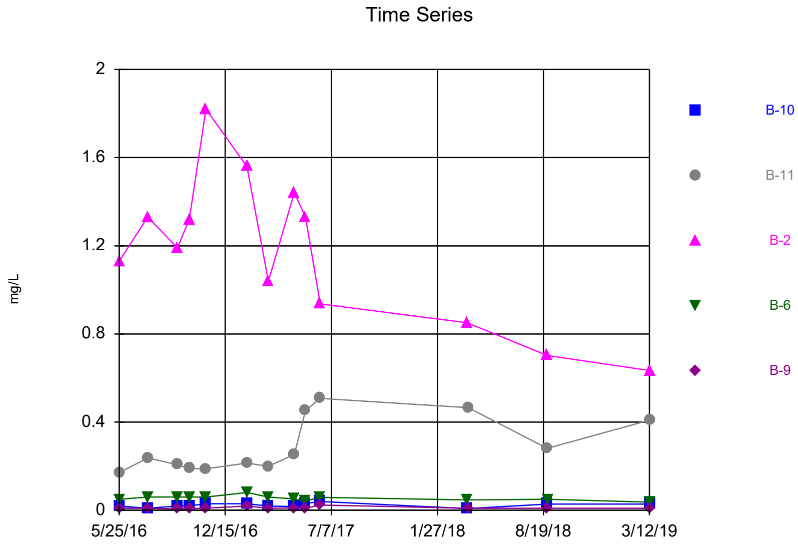

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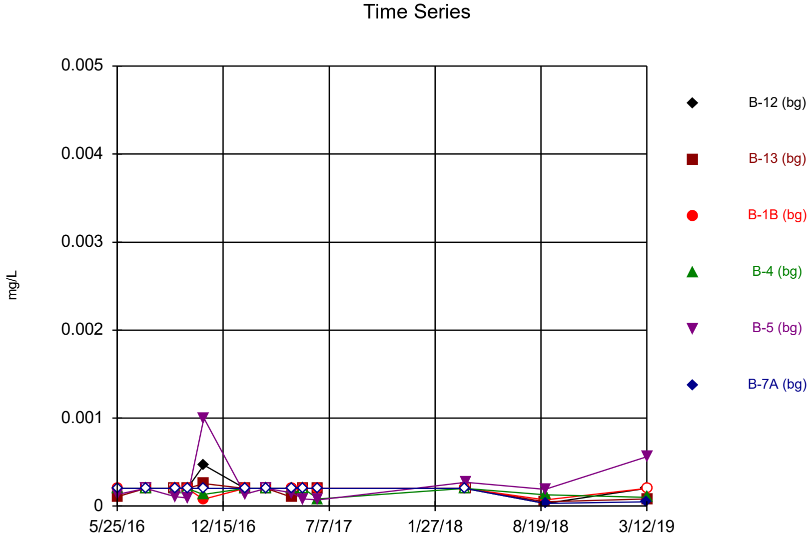

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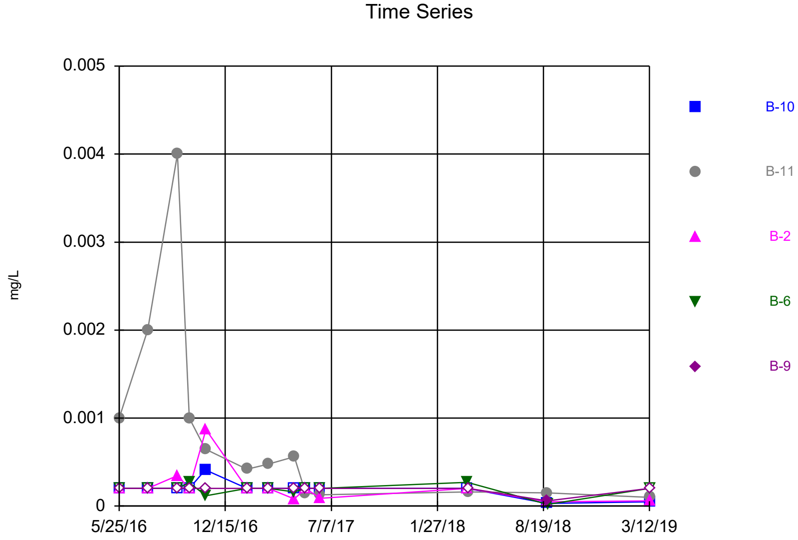

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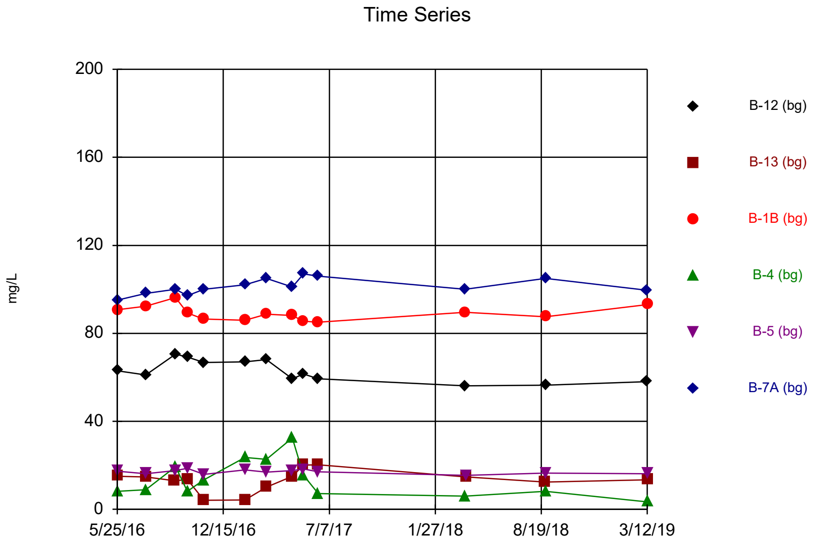

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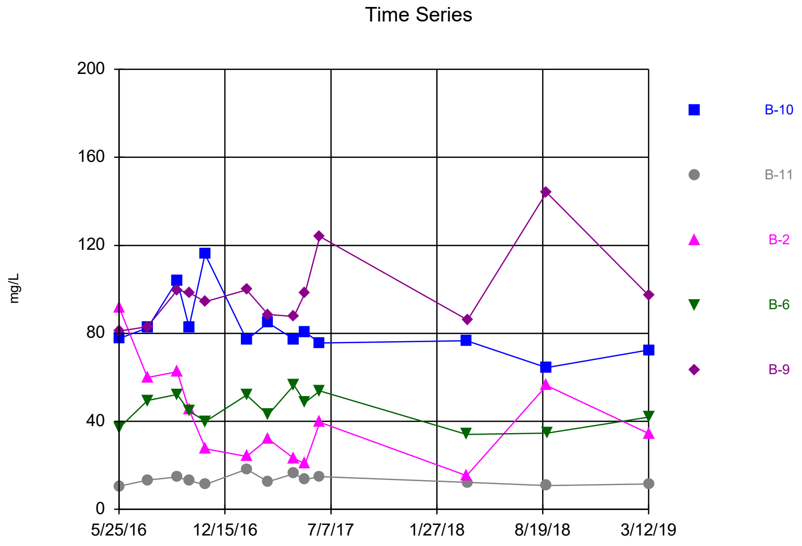

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Flint LF Client: Geosyntec Data: Flint Creek LF

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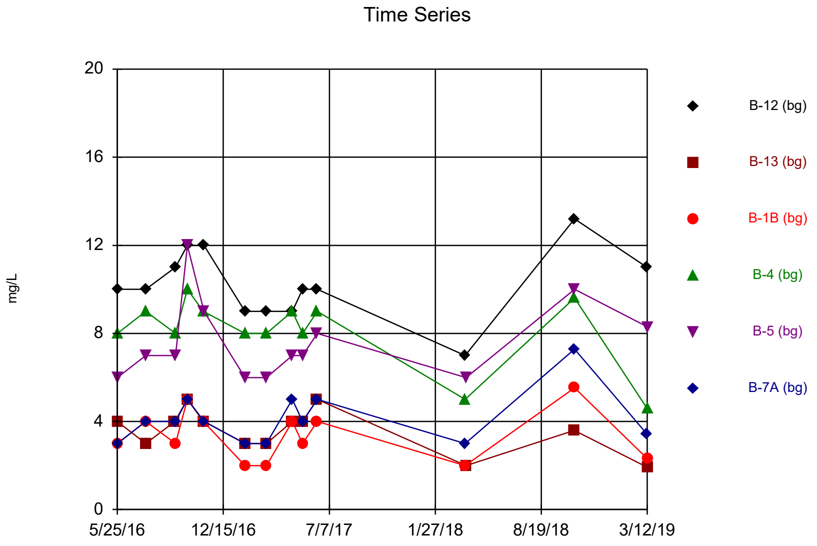

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Flint LF Client: Geosyntec Data: Flint Creek LF

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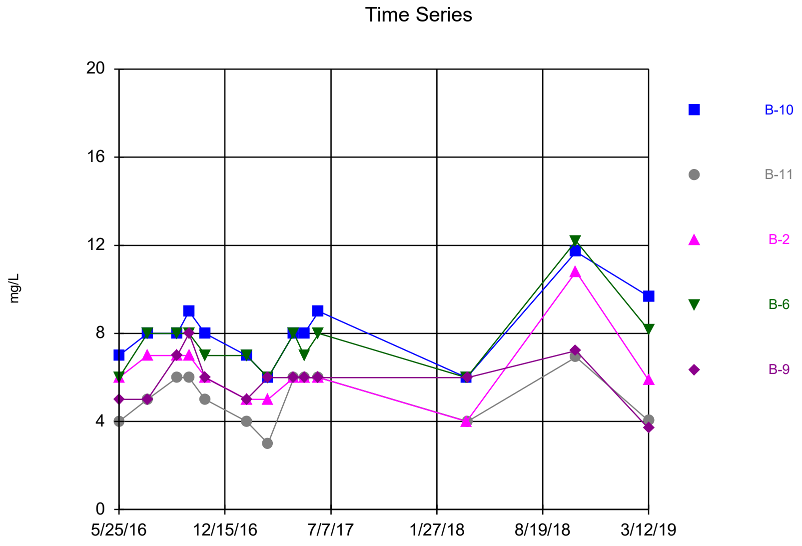

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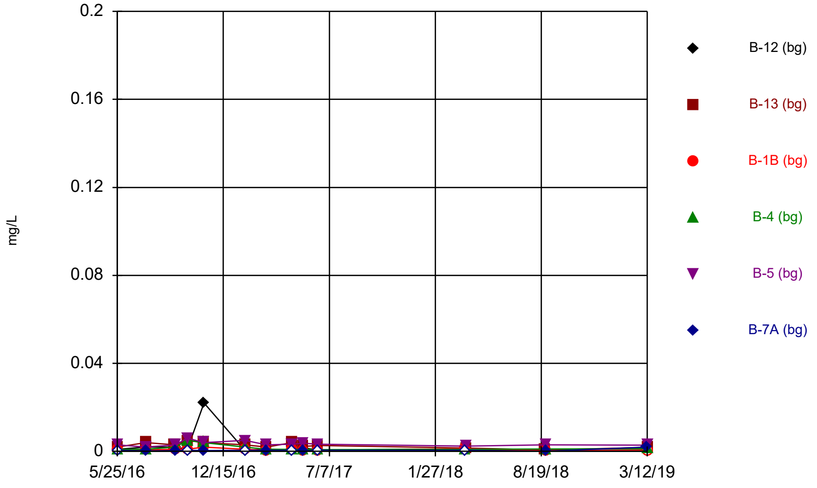

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Flint LF Client: Geosyntec Data: Flint Creek LF

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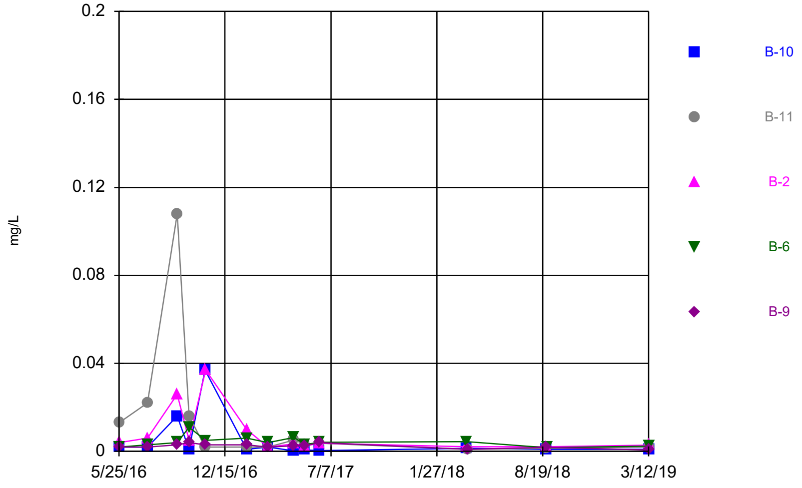

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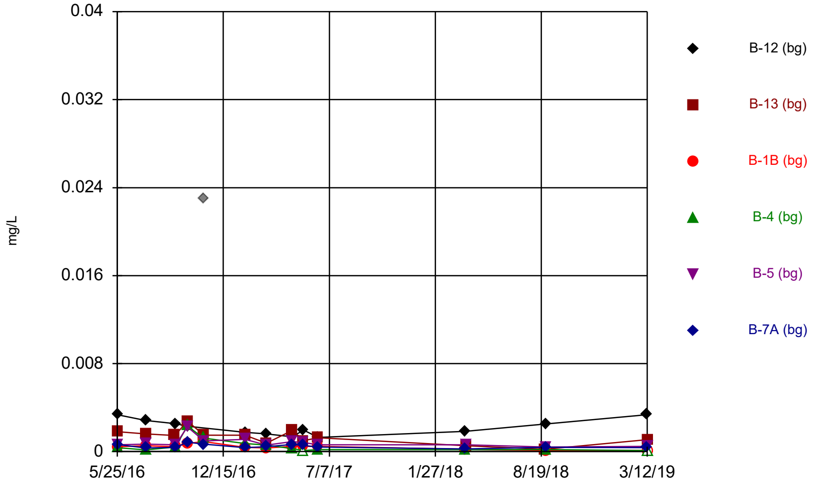
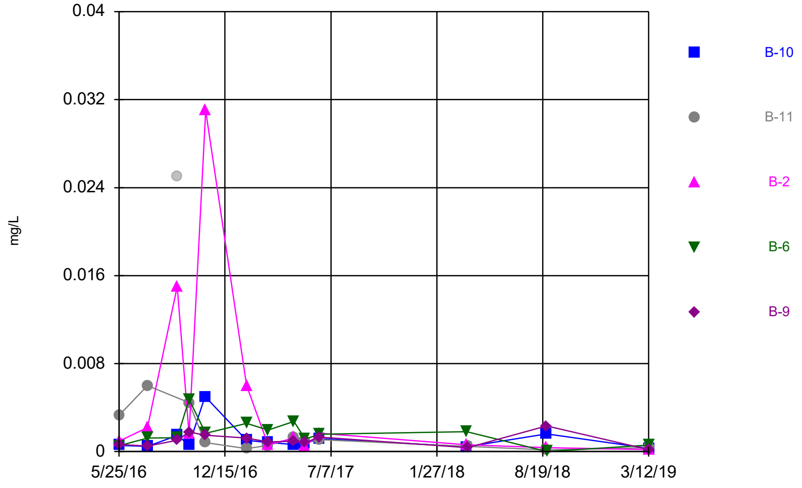


Constituent: Cobalt, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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Flint LF Client: Geosyntec Data: Flint Creek LF

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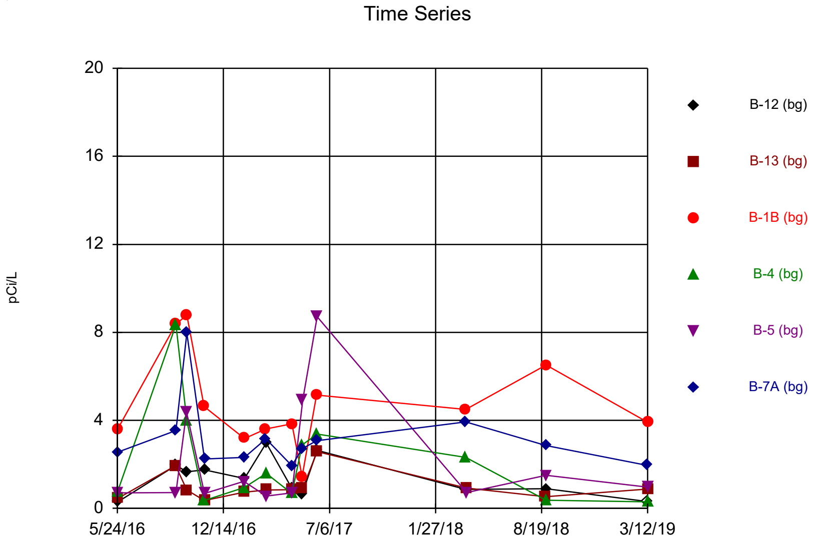

Constituent: Combined Radium 226 + 228 Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

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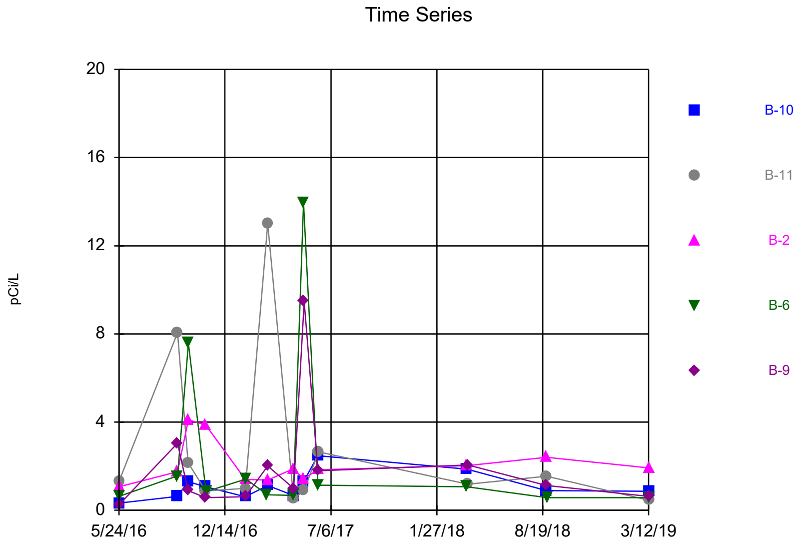

Constituent: Combined Radium 226 + 228 Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

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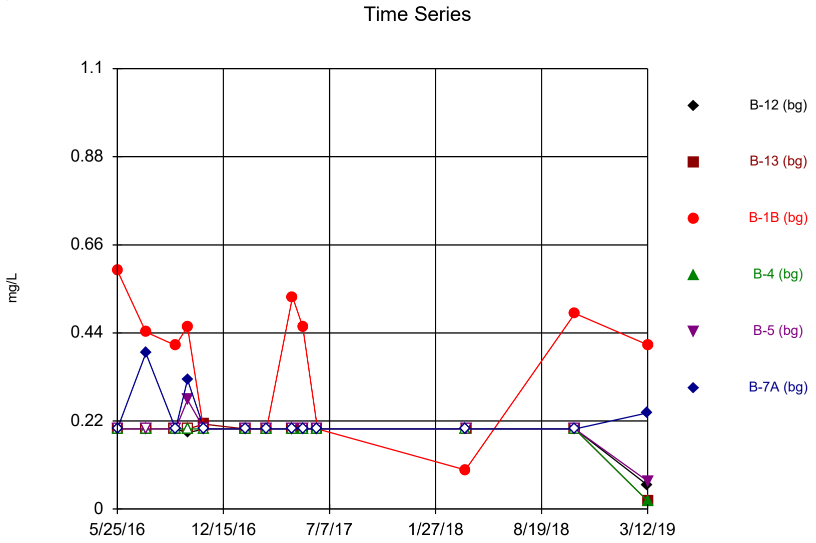

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Flint LF Client: Geosyntec Data: Flint Creek LF

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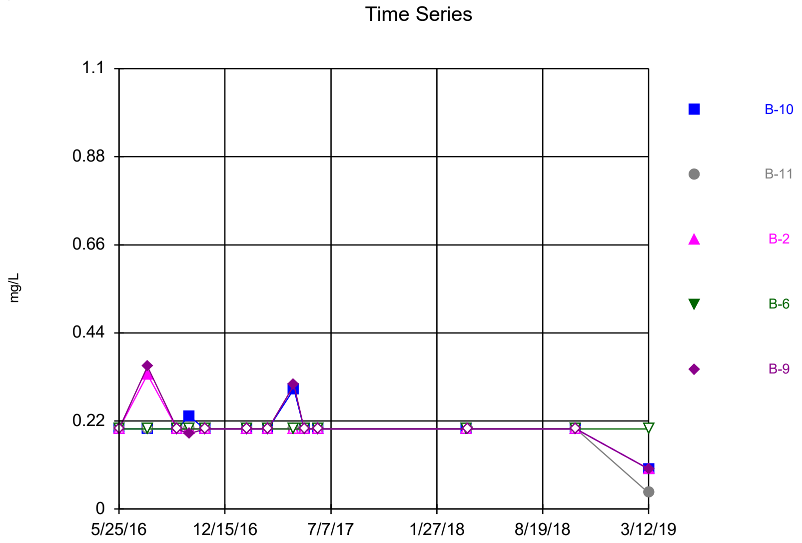

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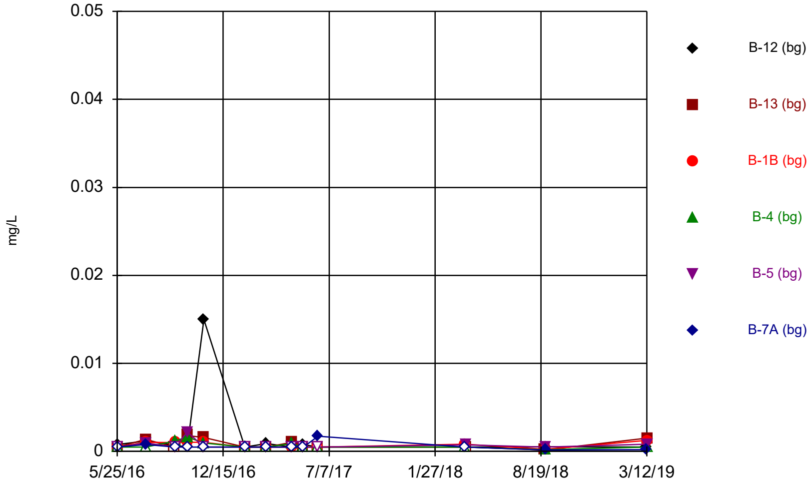
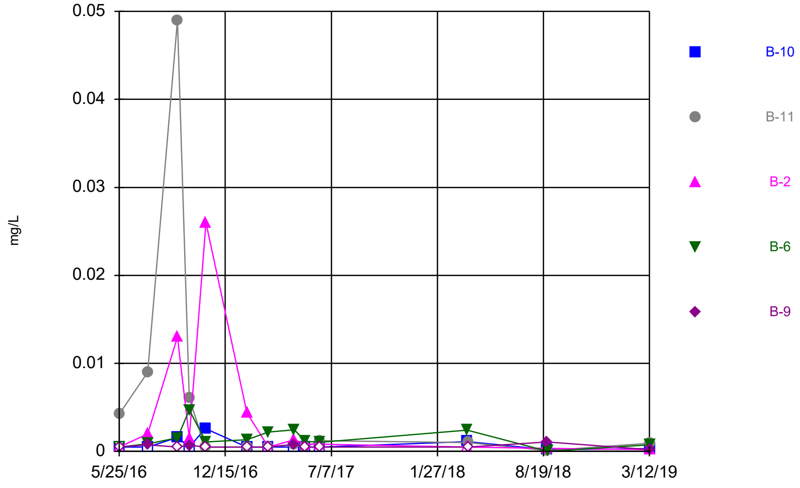
Time Series



Constituent: Lead, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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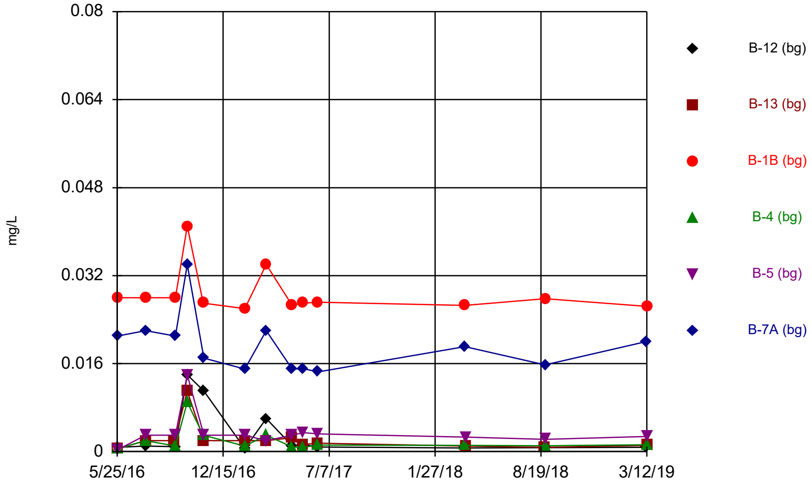
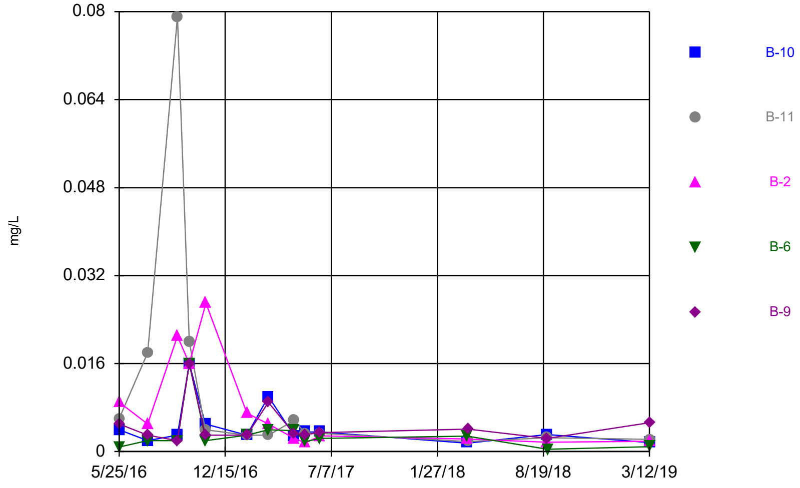
Time Series



Constituent: Lithium, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



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Flint LF Client: Geosyntec Data: Flint Creek LF

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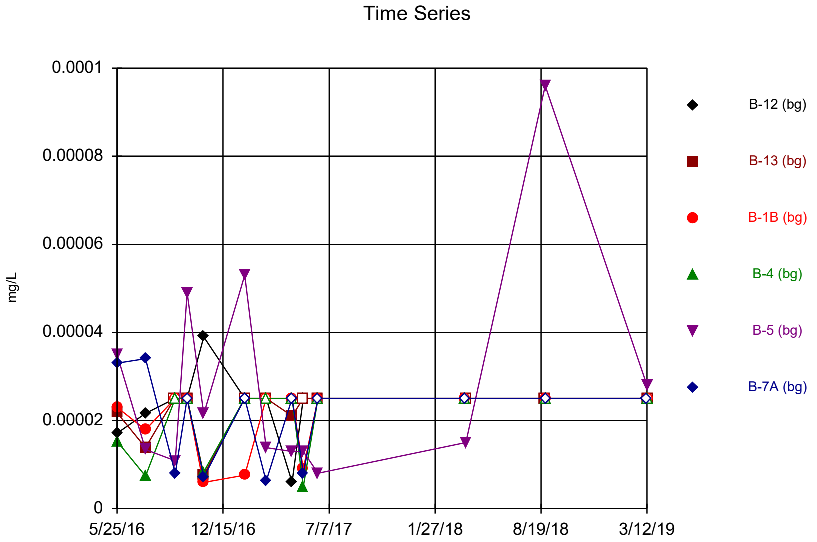

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Flint LF Client: Geosyntec Data: Flint Creek LF

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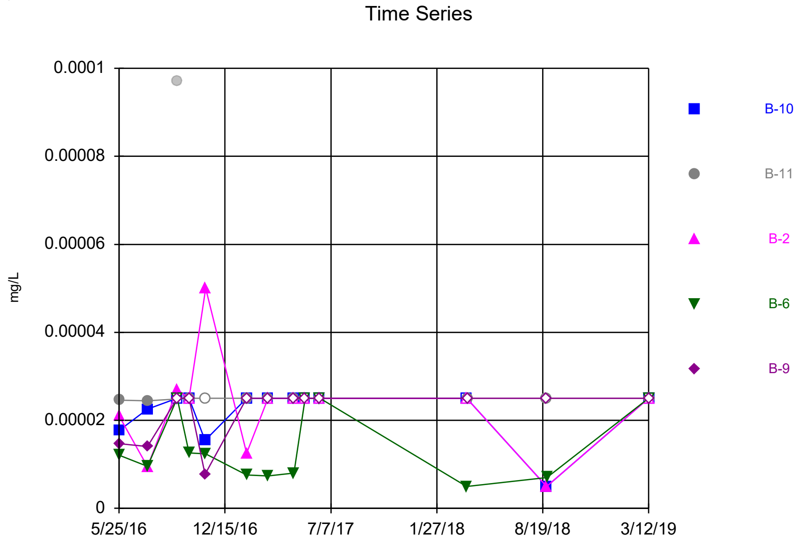

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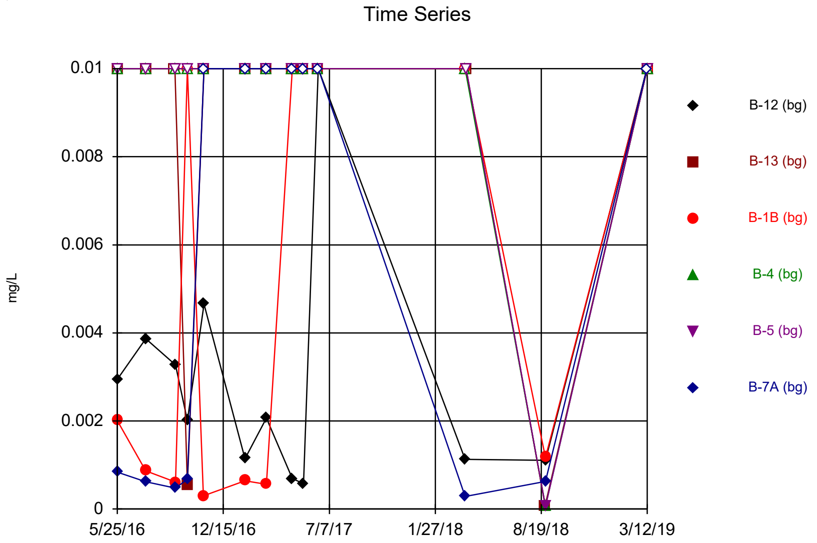

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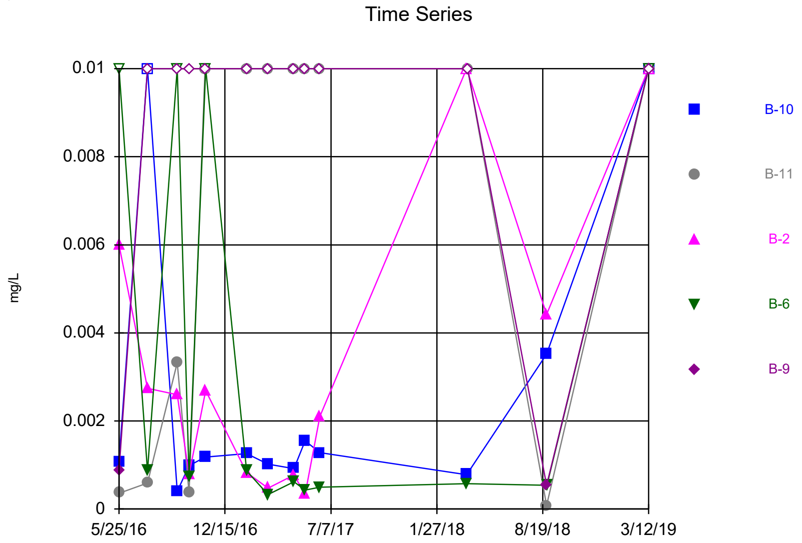
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



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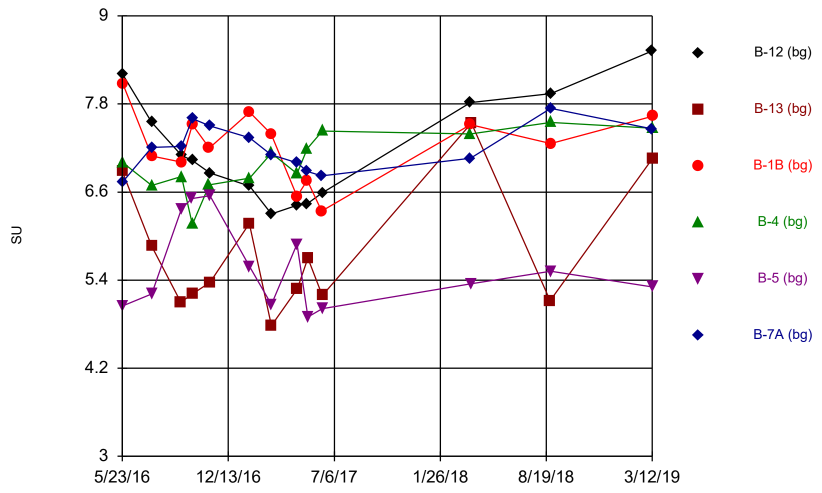
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

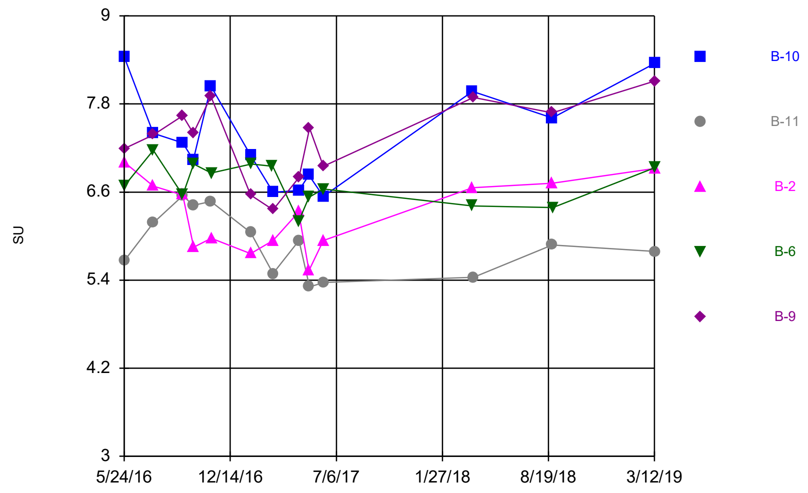
Time Series



Constituent: pH, field Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

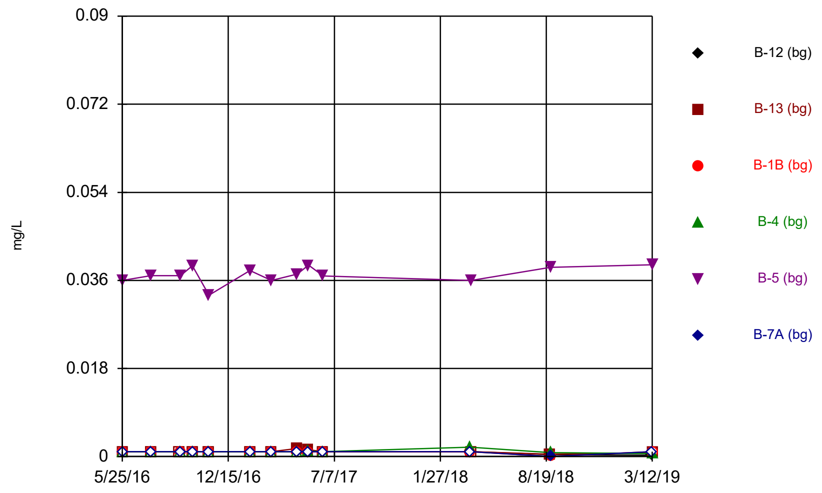
Time Series



Constituent: pH, field Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

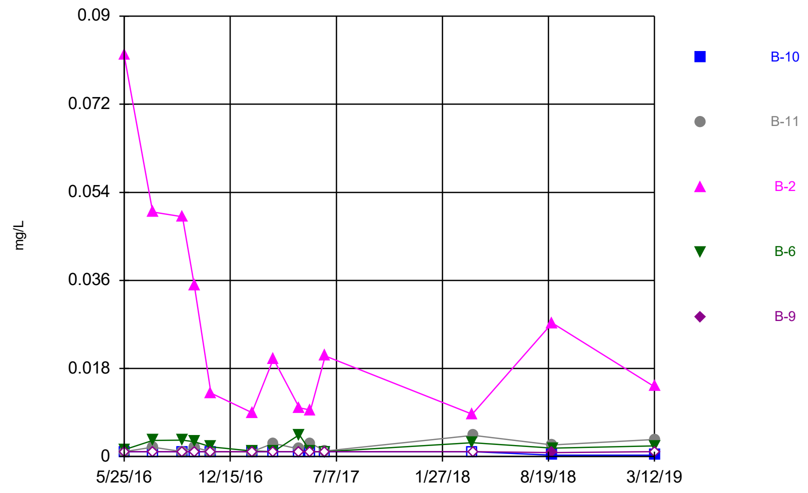
Time Series



Constituent: Selenium, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

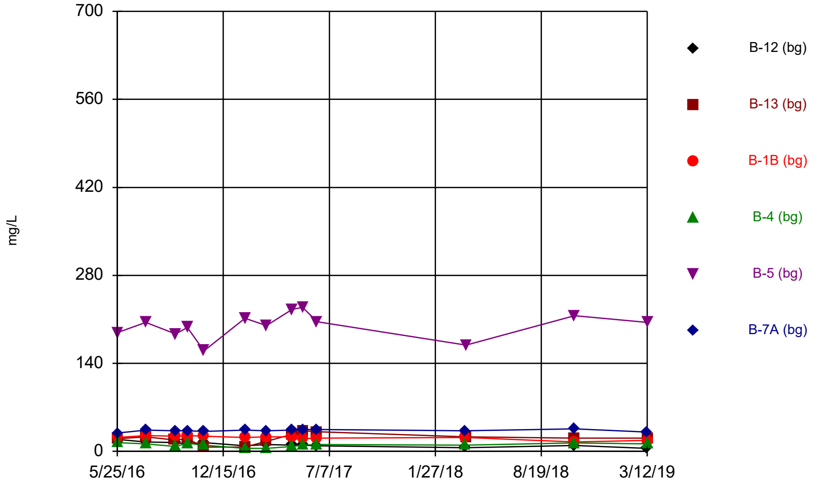
Time Series



Constituent: Selenium, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

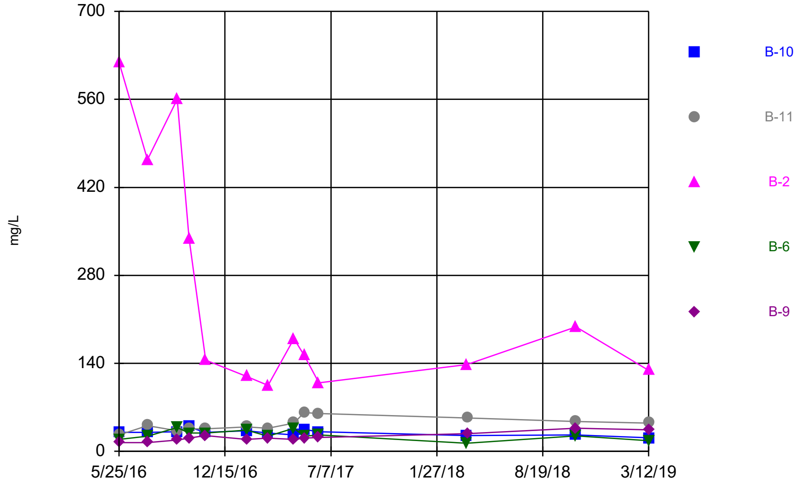
Time Series



Constituent: Sulfate, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

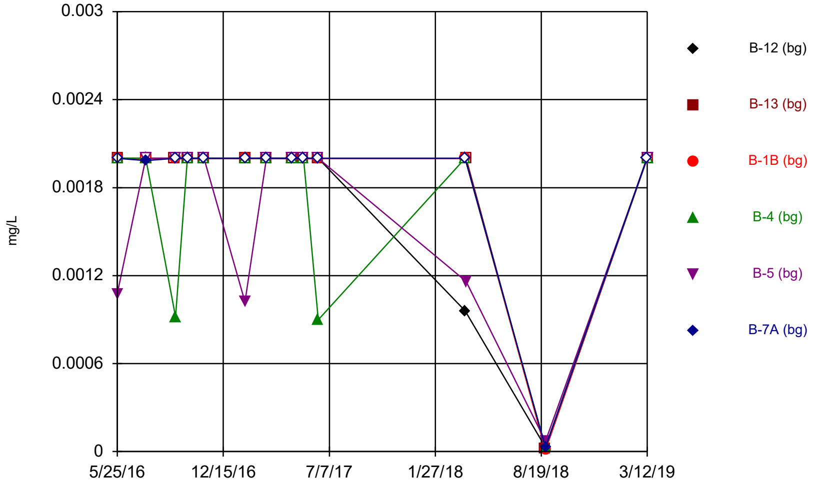
Time Series



Constituent: Sulfate, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

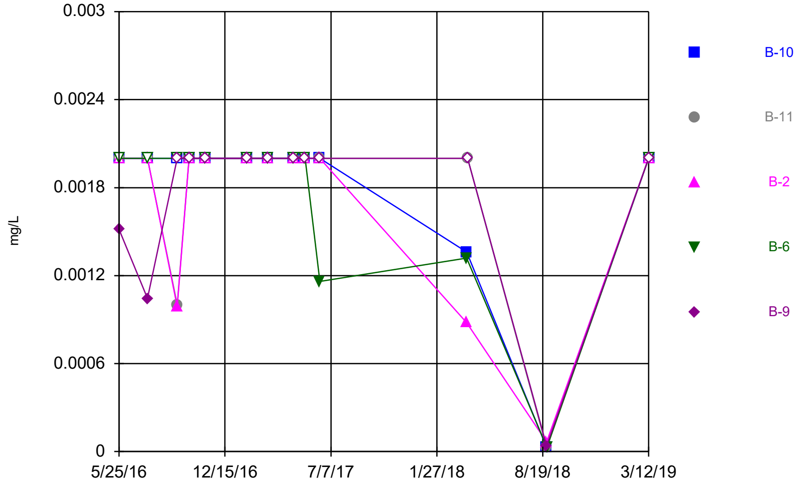
Time Series



Constituent: Thallium, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

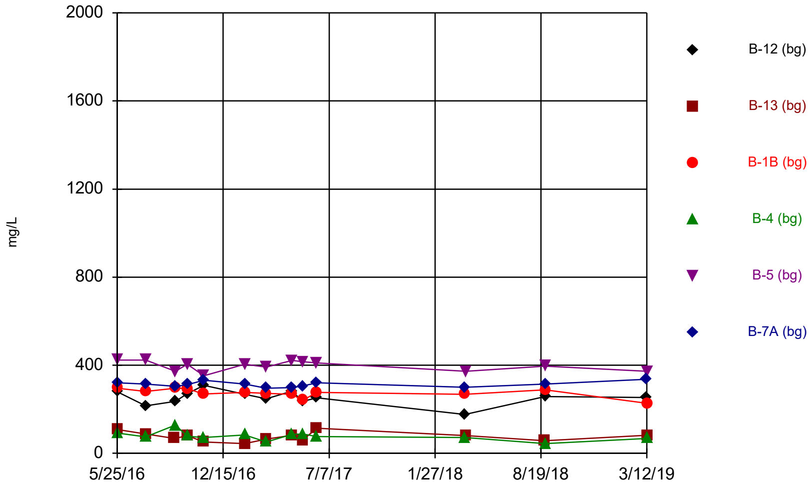
Time Series



Constituent: Thallium, total Analysis Run 7/8/2019 3:12 PM View: Descriptive
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

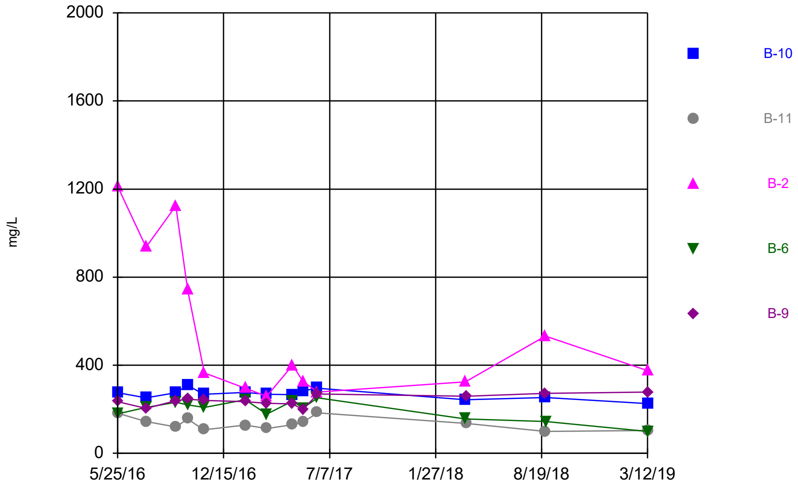
Time Series



Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 3:12 PM   View: Descriptive
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 3:12 PM   View: Descriptive
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Outlier Summary

Flint LF Client: Geosyntec Data: Flint Creek LF Printed 7/8/2019, 3:11 PM

	B-11 Arsenic, total (mg/L)	B-12 Cobalt, total (mg/L)	B-11 Cobalt, total (mg/L)	B-11 Mercury, total (mg/L)
9/14/2016	0.032 (o)		0.025 (o)	9.7E-05 (o)
11/8/2016		0.023 (o)		

Interwell Prediction Limit Summary - Significant Results

Flint LF   Client: Geosyntec   Data: Flint Creek LF   Printed 7/8/2019, 2:48 PM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**B-11**	**0.0588**	**3/12/2019**	**0.409**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**B-2**	**0.0588**	**3/12/2019**	**0.634**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**

Interwell Prediction Limit Summary - All Results

Flint LF Client: Geosyntec Data: Flint Creek LF Printed 7/8/2019, 2:48 PM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	B-10	0.0588	3/12/2019	0.028	No	78	n/a	n/a	0	n/a	n/a	0.000317	NP Inter (normality) 1 of 2
Boron, total (mg/L)	**B-11**	**0.0588**	**3/12/2019**	**0.409**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**B-2**	**0.0588**	**3/12/2019**	**0.634**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	B-6	0.0588	3/12/2019	0.037	No	78	n/a	n/a	0	n/a	n/a	0.000317	NP Inter (normality) 1 of 2
Boron, total (mg/L)	B-9	0.0588	3/12/2019	0.01	No	78	n/a	n/a	0	n/a	n/a	0.000317	NP Inter (normality) 1 of 2

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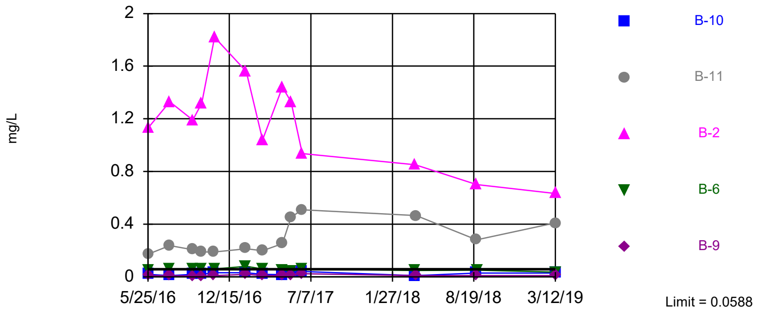
Exceeds Limit: B-11, B-2

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Francia normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 78 background values. Annual per-constituent alpha = 0.003165. Individual comparison alpha = 0.000317 (1 of 2). Comparing 5 points to limit.

Constituent: Boron, total Analysis Run 7/8/2019 2:45 PM View: PLs - Interwell

Flint LF Client: Geosyntec Data: Flint Creek LF

Interwell Prediction Limit Summary - Significant Results

Flint LF   Client: Geosyntec   Data: Flint Creek LF   Printed 7/8/2019, 2:48 PM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**B-11**	**0.0588**	**3/12/2019**	**0.409**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**B-2**	**0.0588**	**3/12/2019**	**0.634**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**

Interwell Prediction Limit Summary - Significant Results

Flint LF   Client: Geosyntec   Data: Flint Creek LF   Printed 7/8/2019, 2:48 PM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**B-11**	**0.0588**	**3/12/2019**	**0.409**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**B-2**	**0.0588**	**3/12/2019**	**0.634**	**Yes**	**78**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.000317**	**NP Inter (normality) 1 of 2**

Intrawell Prediction Limit Summary - Significant Results

Flint LF Client: Geosyntec Data: Flint Creek LF Printed 7/8/2019, 2:55 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
pH, field (SU)	**B-12**	**8.375**	**5.459**	**3/11/2019**	**8.52**	**Yes**	**10**	**6.917**	**0.5883**	**0**	**None**	**No**	**0.000752**	Param 1 of 2
Sulfate, total (mg/L)	**B-9**	**27.92**	**n/a**	**3/12/2019**	**34.3**	**Yes**	**10**	**19.4**	**3.438**	**0**	**None**	**No**	**0.001504**	Param 1 of 2

Intrawell Prediction Limit Summary - All Results

Flint LF Client: Geosyntec Data: Flint Creek LF Printed 7/8/2019, 2:55 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	B-12	74.96	n/a	3/11/2019	58	No	10	64.6	4.182	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-13	26.8	n/a	3/12/2019	13.5	No	10	13.01	5.562	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-1B	97.61	n/a	3/12/2019	93.1	No	10	88.86	3.531	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-4	36.88	n/a	3/12/2019	3.37	No	10	15.94	8.45	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-5	19.55	n/a	3/12/2019	16.2	No	10	17.36	0.8834	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-7A	110.8	n/a	3/11/2019	99.6	No	10	101.1	3.919	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-10	116	n/a	3/12/2019	72.4	No	10	n/a	n/a	0	n/a	n/a	0.01476	NP (normality) 1 of 2
Calcium, total (mg/L)	B-11	19.47	n/a	3/12/2019	11.6	No	10	13.83	2.276	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-2	99.24	n/a	3/12/2019	34.5	No	10	42.67	22.83	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-6	63.49	n/a	3/12/2019	41.9	No	10	47.72	6.364	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	B-9	125.8	n/a	3/12/2019	97.3	No	10	95.5	12.22	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-12	13.01	n/a	3/11/2019	11	No	10	10.2	1.135	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-13	5.728	n/a	3/12/2019	1.92	No	10	3.9	0.7379	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-1B	5.794	n/a	3/12/2019	2.31	No	10	3.4	0.9661	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-4	10.39	n/a	3/12/2019	4.58	No	10	2.93	0.1179	0	None	sqrt(x)	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-5	12.25	n/a	3/12/2019	8.3	No	10	2.722	0.3136	0	None	sqrt(x)	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-7A	6.023	n/a	3/11/2019	3.43	No	10	4	0.8165	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-10	10.08	n/a	3/12/2019	9.68	No	10	7.8	0.9189	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-11	7.827	n/a	3/12/2019	4.03	No	10	5.1	1.101	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-2	7.928	n/a	3/12/2019	5.88	No	10	6.1	0.7379	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-6	9.099	n/a	3/12/2019	8.16	No	10	53.9	11.66	0	None	x^2	0.001504	Param 1 of 2
Chloride, total (mg/L)	B-9	8.336	n/a	3/12/2019	3.68	No	10	6	0.9428	0	None	No	0.001504	Param 1 of 2
Fluoride, total (mg/L)	B-12	1	n/a	3/11/2019	0.06	No	10	n/a	n/a	90	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-13	1	n/a	3/12/2019	0.02	No	10	n/a	n/a	90	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-1B	0.6512	n/a	3/12/2019	0.41	No	10	-0.7395	0.1253	40	Kaplan-Meier	ln(x)	0.001504	Param 1 of 2
Fluoride, total (mg/L)	B-4	1	n/a	3/12/2019	0.02	No	10	n/a	n/a	100	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-5	1	n/a	3/12/2019	0.07	No	10	n/a	n/a	90	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-7A	1	n/a	3/11/2019	0.24	No	10	n/a	n/a	80	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-10	1	n/a	3/12/2019	0.1	No	10	n/a	n/a	80	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-11	1	n/a	3/12/2019	0.04	No	10	n/a	n/a	100	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-2	1	n/a	3/12/2019	0.1	No	10	n/a	n/a	90	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-6	0.2	n/a	3/12/2019	0.2ND	No	10	n/a	n/a	100	n/a	n/a	0.01476	NP (NDs) 1 of 2
Fluoride, total (mg/L)	B-9	1	n/a	3/12/2019	0.1	No	10	n/a	n/a	70	n/a	n/a	0.01476	NP (NDs) 1 of 2
pH, field (SU)	**B-12**	**8.375**	**5.459**	**3/11/2019**	**8.52**	**Yes**	**10**	**6.917**	**0.5883**	**0**	**None**	**No**	**0.000752**	Param 1 of 2
pH, field (SU)	B-13	7.081	4.027	3/12/2019	7.05	No	10	5.554	0.6162	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-1B	8.477	5.845	3/12/2019	7.63	No	10	7.161	0.531	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-4	7.732	6.018	3/12/2019	7.47	No	10	6.875	0.3458	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-5	7.263	3.967	3/12/2019	5.31	No	10	5.615	0.6649	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-7A	7.854	6.43	3/11/2019	7.46	No	10	7.142	0.2873	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-10	8.753	5.623	3/12/2019	8.35	No	10	7.188	0.6317	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-11	7.099	4.789	3/12/2019	5.79	No	10	5.944	0.4661	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-2	7.316	4.998	3/12/2019	6.92	No	10	6.157	0.4676	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-6	7.465	6.045	3/12/2019	6.93	No	10	6.755	0.2864	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	B-9	8.377	5.953	3/12/2019	8.11	No	10	7.165	0.4893	0	None	No	0.000752	Param 1 of 2
Sulfate, total (mg/L)	B-12	20.23	n/a	3/11/2019	5	No	10	12.3	3.199	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-13	42.14	n/a	3/12/2019	21.3	No	10	20.2	8.854	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-1B	27.02	n/a	3/12/2019	17.5	No	10	22.9	1.663	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-4	17.28	n/a	3/12/2019	12.1	No	10	9.6	3.098	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-5	250.7	n/a	3/12/2019	205	No	10	201.1	20.02	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-7A	37.54	n/a	3/11/2019	30.7	No	10	33.2	1.751	0	None	No	0.001504	Param 1 of 2

Intrawell Prediction Limit Summary - All Results

Flint LF Client: Geosyntec Data: Flint Creek LF Printed 7/8/2019, 2:55 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Sulfate, total (mg/L)	B-10	40.23	n/a	3/12/2019	21.4	No	10	31.4	3.565	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-11	69.81	n/a	3/12/2019	44.9	No	10	41.5	11.42	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-2	775.5	n/a	3/12/2019	129	No	10	279.2	200.3	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	B-6	43.86	n/a	3/12/2019	17.1	No	10	28.4	6.24	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	**B-9**	**27.92**	**n/a**	**3/12/2019**	**34.3**	**Yes**	**10**	**19.4**	**3.438**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-12	327.1	n/a	3/11/2019	254	No	10	259.7	27.22	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-13	132.8	n/a	3/12/2019	82	No	10	76	22.92	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-1B	318.6	n/a	3/12/2019	228	No	10	276.9	16.84	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-4	131	n/a	3/12/2019	68	No	10	83.1	19.32	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-5	460.8	n/a	3/12/2019	372	No	10	402.1	23.67	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-7A	338.8	n/a	3/11/2019	336	No	10	311.6	10.99	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-10	316.3	n/a	3/12/2019	226	No	10	276.8	15.94	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-11	207.3	n/a	3/12/2019	104	No	10	140.4	26.99	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-2	1522	n/a	3/12/2019	376	No	10	594	374.5	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-6	279.5	n/a	3/12/2019	100	No	10	216.6	25.39	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-9	282.5	n/a	3/12/2019	278	No	10	231.7	20.49	0	None	No	0.001504	Param 1 of 2

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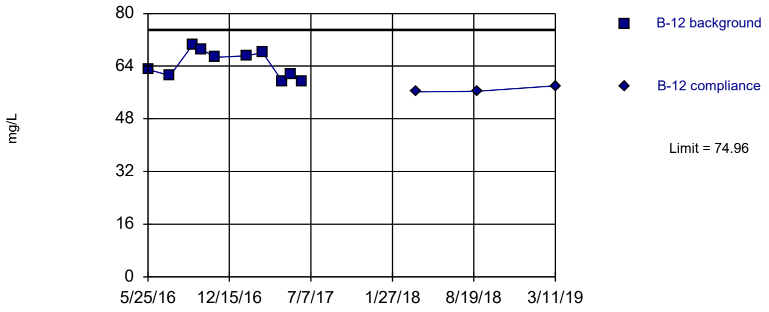
Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=64.6, Std. Dev.=4.182, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9039, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

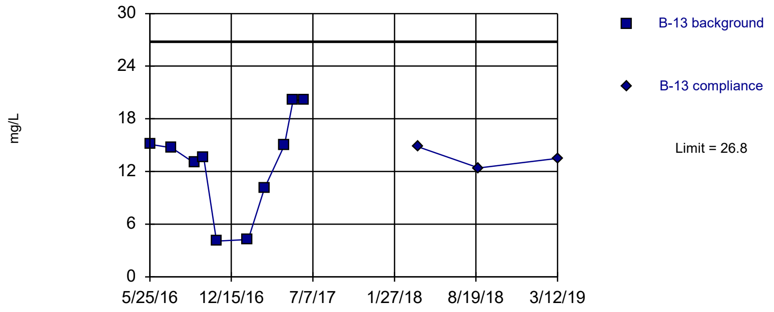
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=13.01, Std. Dev.=5.562, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8998, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

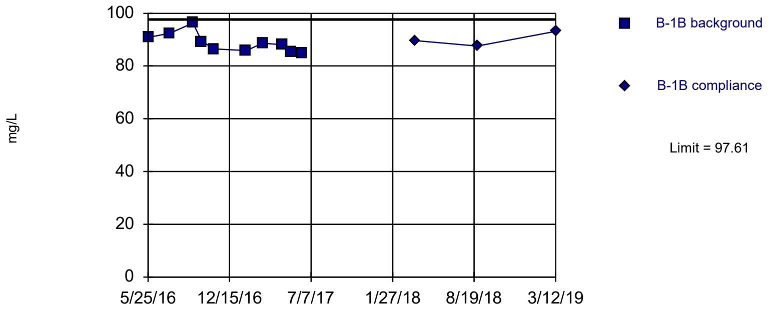
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=88.86, Std. Dev.=3.531, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9117, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

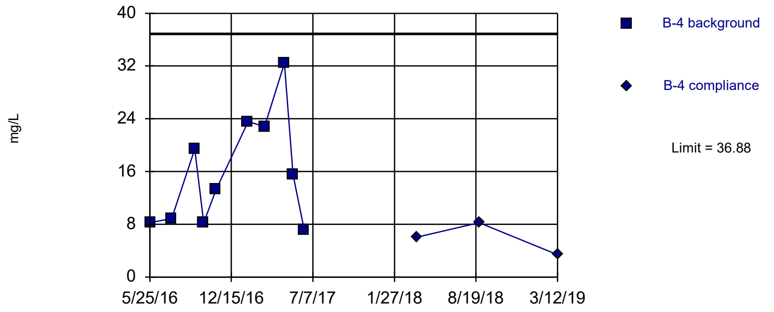
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=15.94, Std. Dev.=8.45, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.901, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

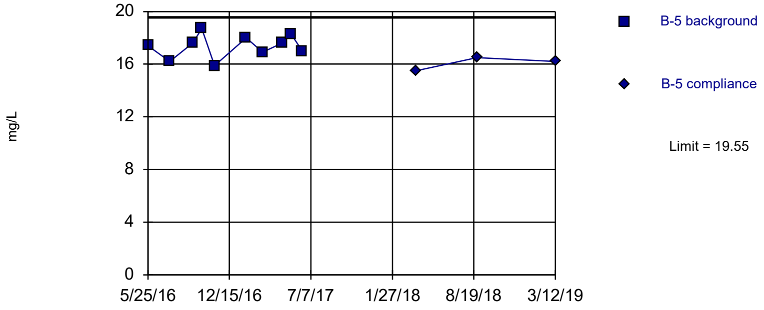
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=17.36, Std. Dev.=0.8834, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9735, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

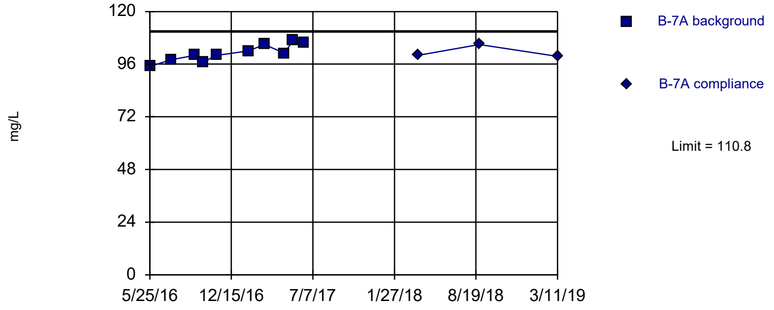
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=101.1, Std. Dev.=3.919, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9599, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

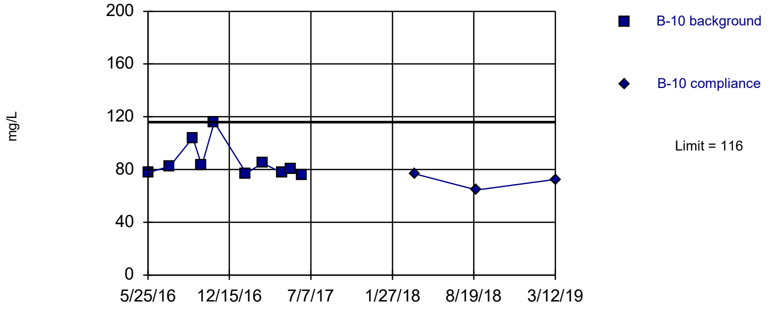
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 10 background values. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

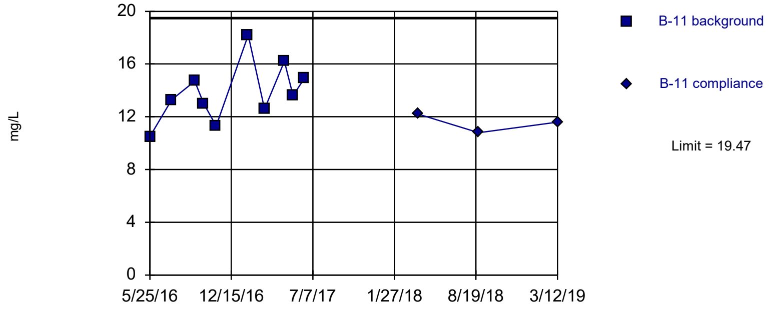
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=13.83, Std. Dev.=2.276, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9752, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

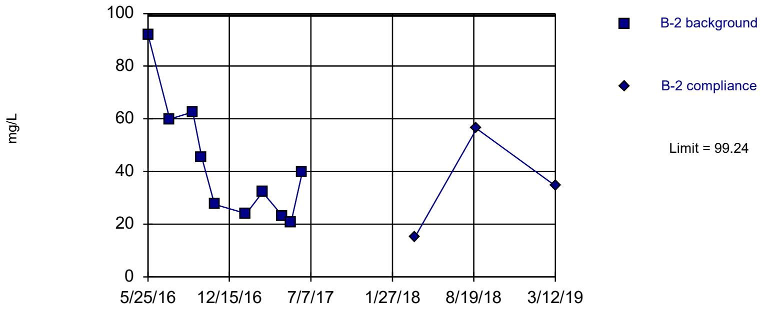
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=42.67, Std. Dev.=22.83, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.874, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

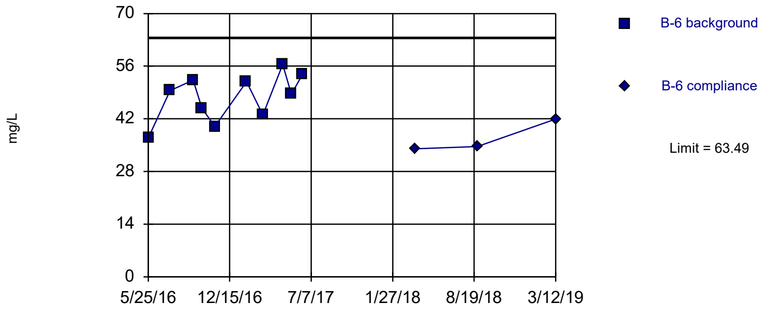
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=47.72, Std. Dev.=6.364, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9592, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

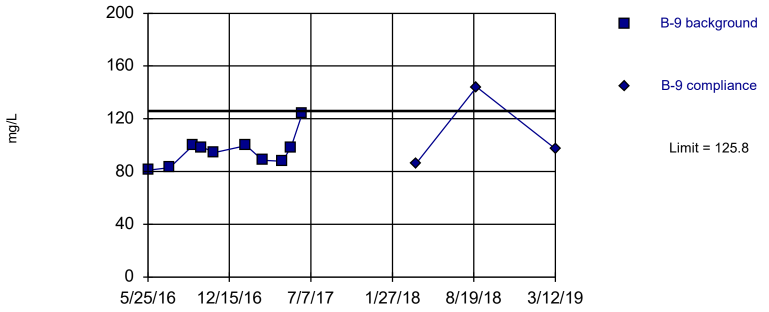
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=95.5, Std. Dev.=12.22, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8682, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

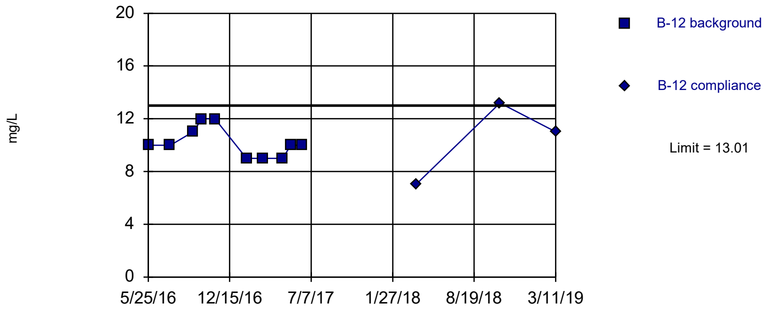
Constituent: Calcium, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=10.2, Std. Dev.=1.135, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8485, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

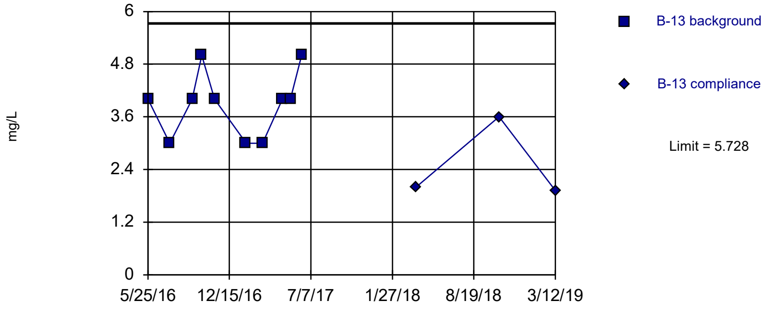
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.9, Std. Dev.=0.7379, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8328, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

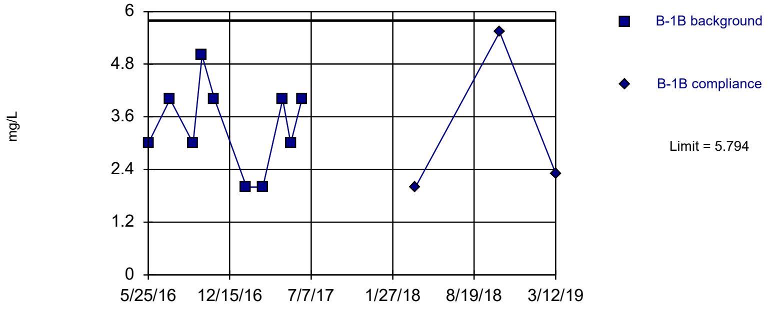
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=3.4, Std. Dev.=0.9661, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9044, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

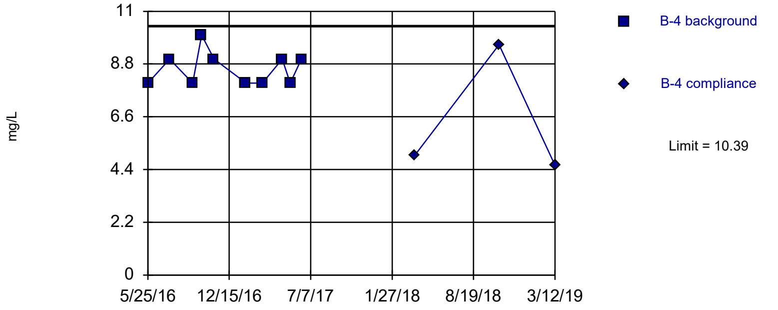
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary (based on square root transformation): Mean=2.93, Std. Dev.=0.1179, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7811, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

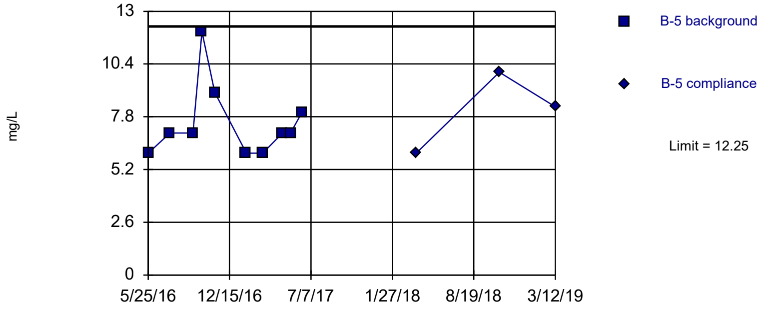
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary (based on square root transformation): Mean=2.722, Std. Dev.=0.3136, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8057, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

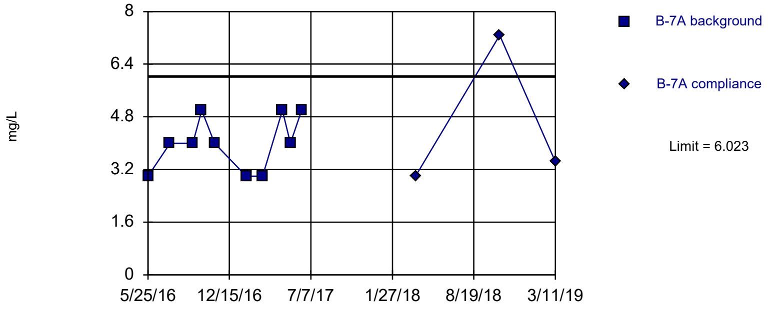
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=4, Std. Dev.=0.8165, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8319, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

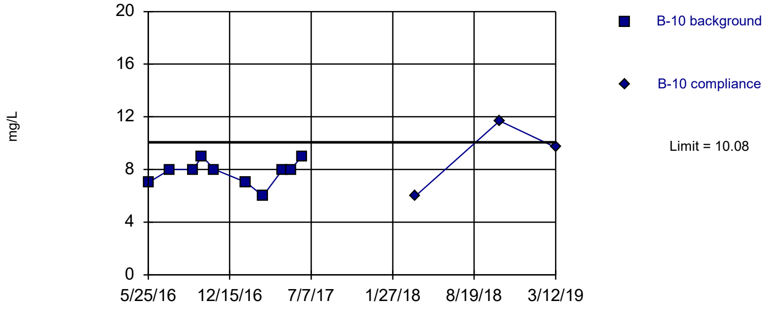
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.8, Std. Dev.=0.9189, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8854, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

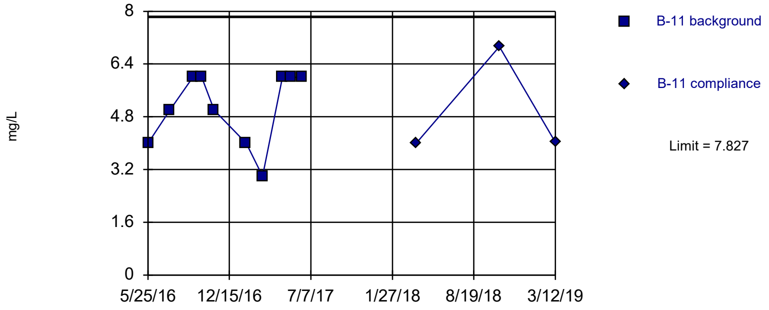
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.1, Std. Dev.=1.101, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8095, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

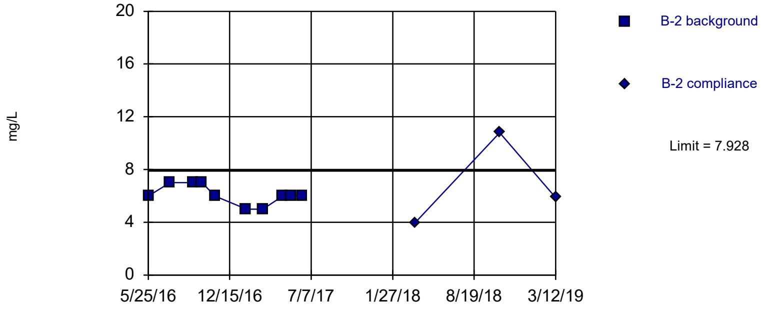
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.1, Std. Dev.=0.7379, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8328, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

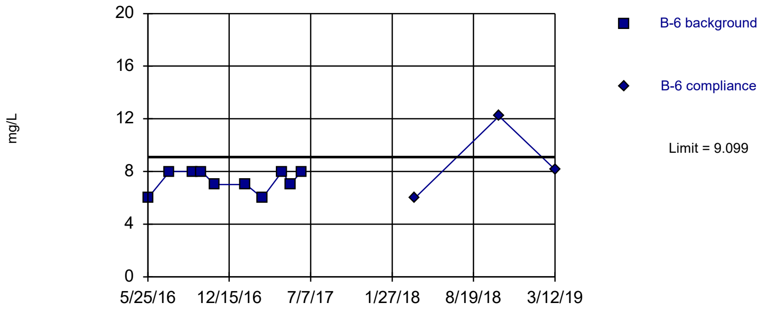
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary (based on square transformation): Mean=53.9, Std. Dev.=11.66, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7823, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

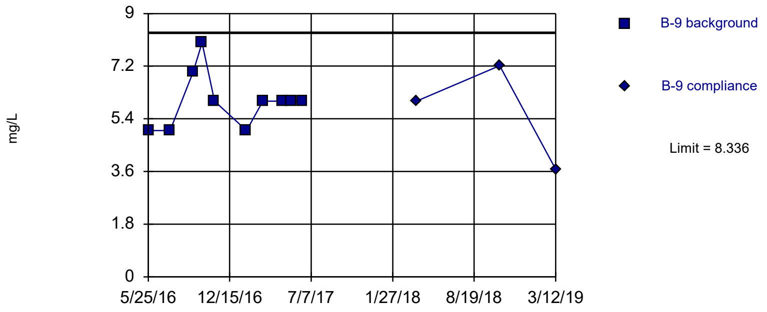
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6, Std. Dev.=0.9428, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8411, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

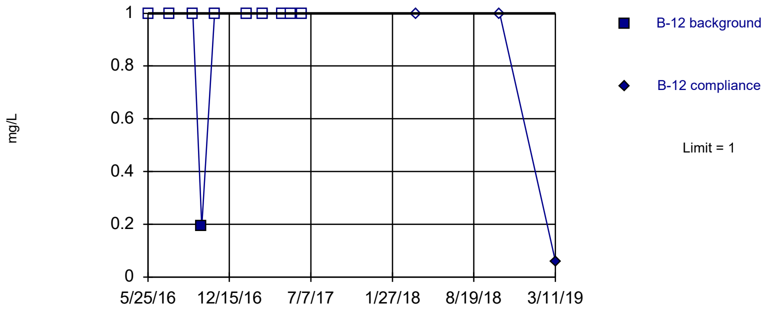
Constituent: Chloride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 90% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

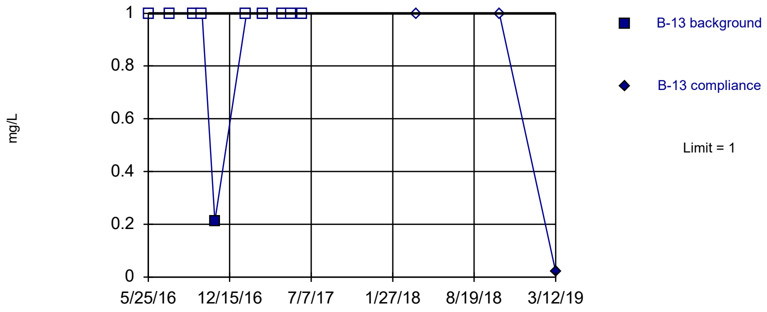
Constituent: Fluoride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 90% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

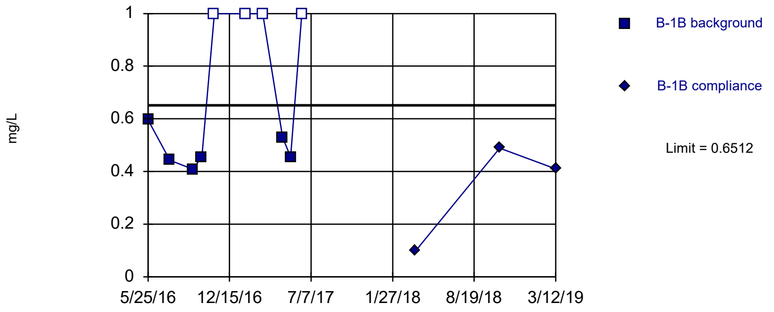
Constituent: Fluoride, total Analysis Run 7/8/2019 2:49 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary (based on natural log transformation) (after Kaplan-Meier Adjustment): Mean=-0.7395, Std. Dev.=0.1253, n=10, 40% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7858, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

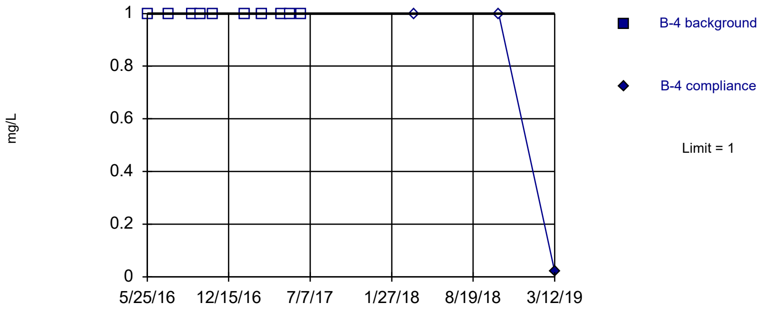
Constituent: Fluoride, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 10) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

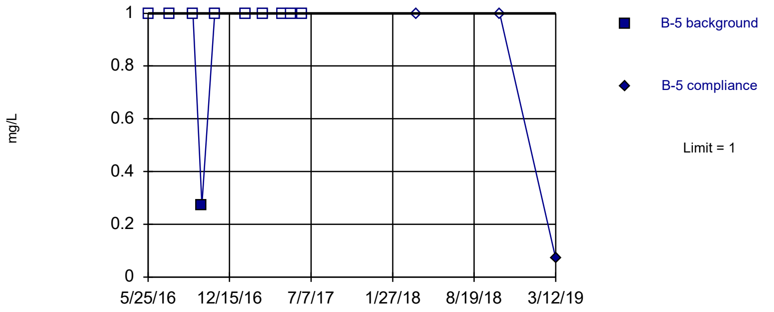
Constituent: Fluoride, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 90% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

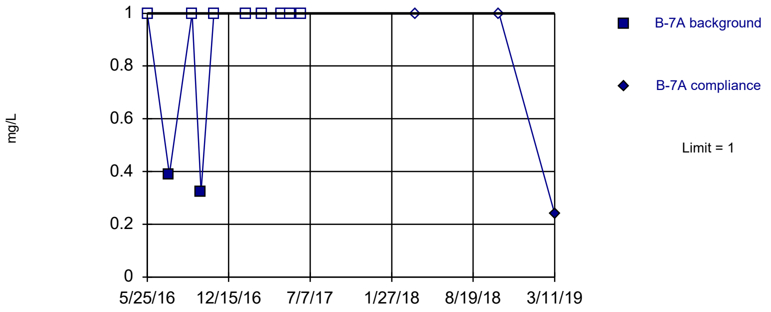
Constituent: Fluoride, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 80% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

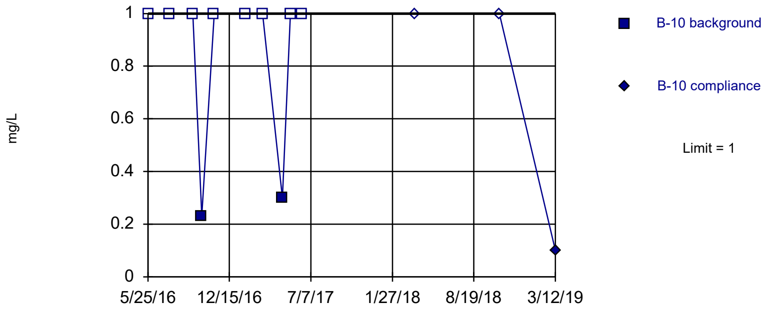
Constituent: Fluoride, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 80% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

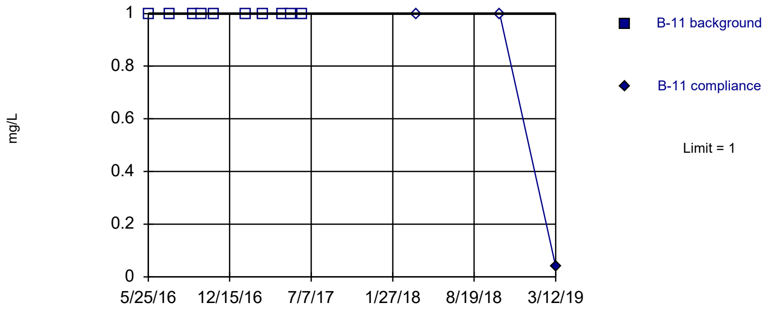
Constituent: Fluoride, total   Analysis Run 7/8/2019 2:50 PM   View: PLs - Intrawell
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 10) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

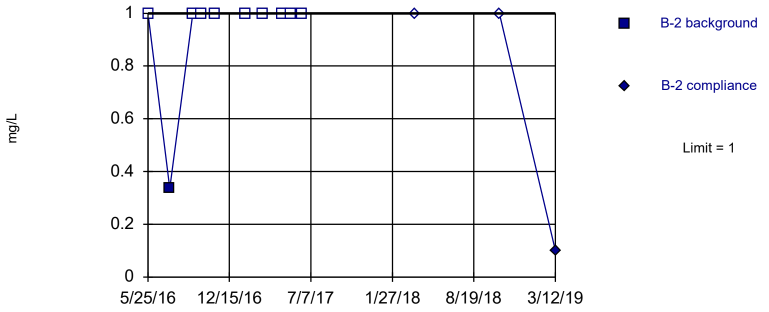
Constituent: Fluoride, total   Analysis Run 7/8/2019 2:50 PM   View: PLs - Intrawell
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 90% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

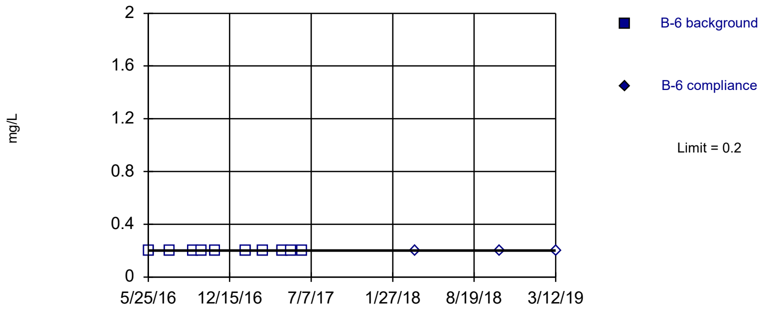
Constituent: Fluoride, total   Analysis Run 7/8/2019 2:50 PM   View: PLs - Intrawell
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 10) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

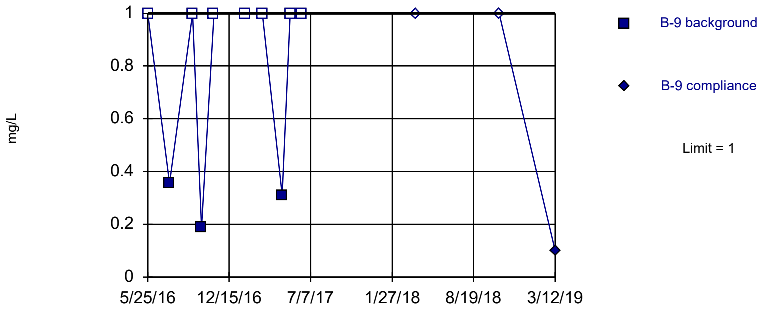
Constituent: Fluoride, total   Analysis Run 7/8/2019 2:50 PM   View: PLs - Intrawell
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 70% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2).

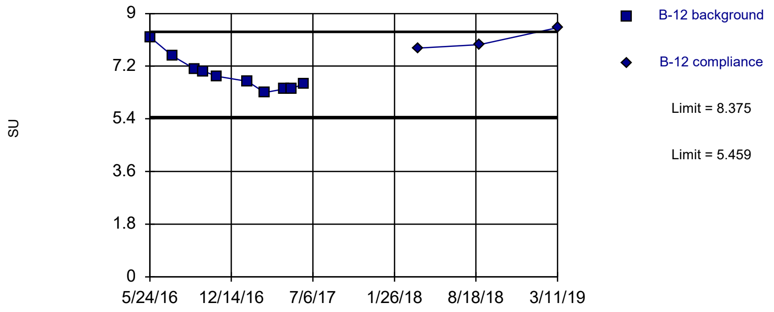
Constituent: Fluoride, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.917, Std. Dev.=0.5883, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8897, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

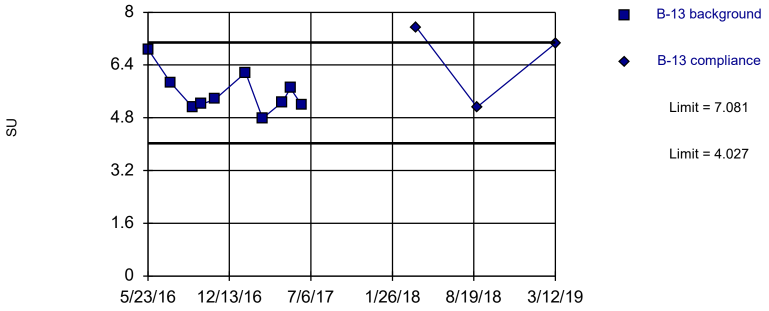
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.554, Std. Dev.=0.6162, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9108, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

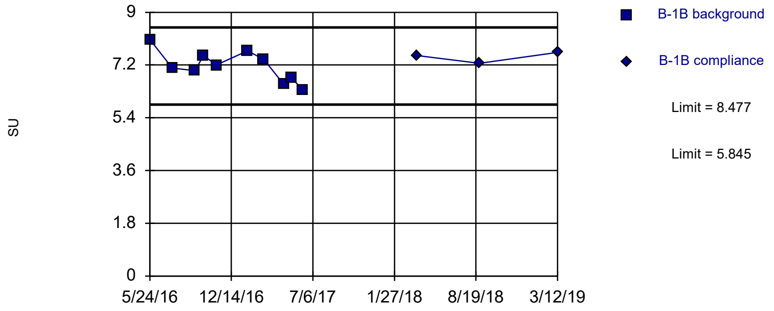
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.161, Std. Dev.=0.531, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.99, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

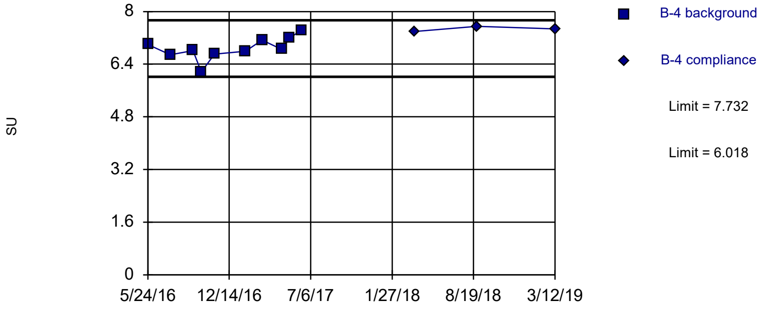
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.875, Std. Dev.=0.3458, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9532, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

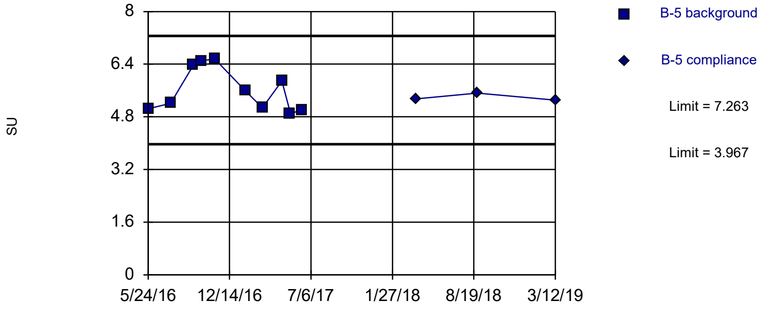
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.615, Std. Dev.=0.6649, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8497, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

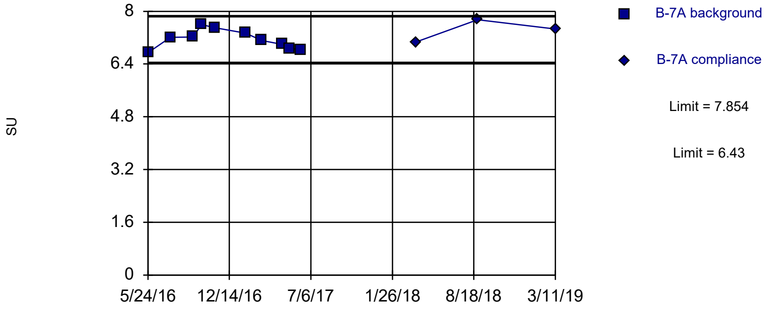
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.142, Std. Dev.=0.2873, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.965, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

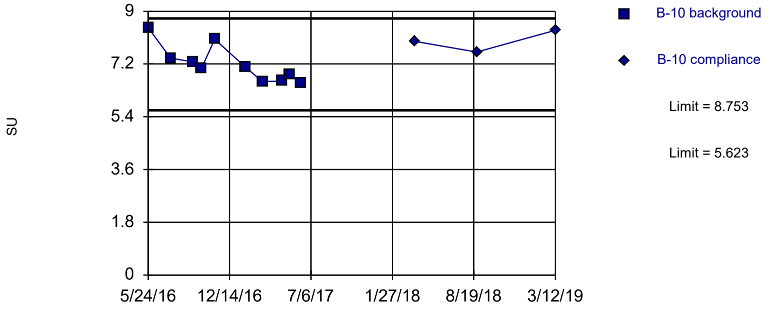
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.188, Std. Dev.=0.6317, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8898, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

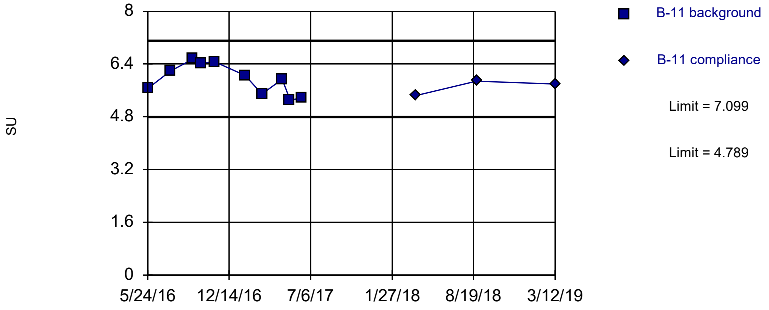
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=5.944, Std. Dev.=0.4661, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9193, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

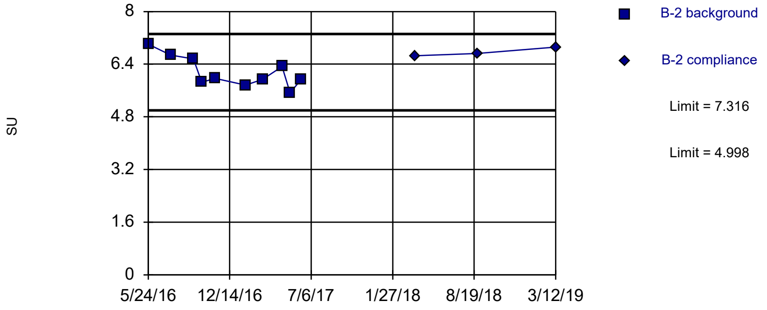
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.157, Std. Dev.=0.4676, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9305, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

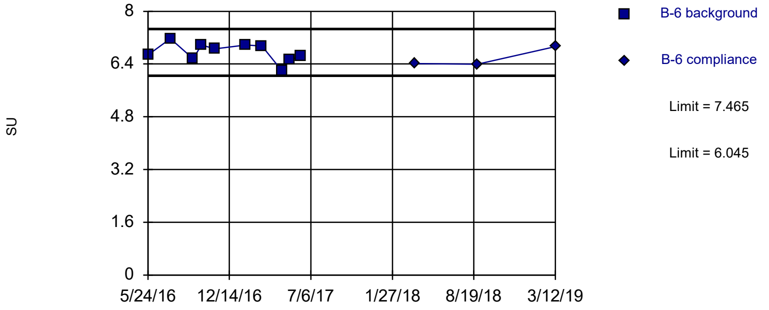
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=6.755, Std. Dev.=0.2864, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9556, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

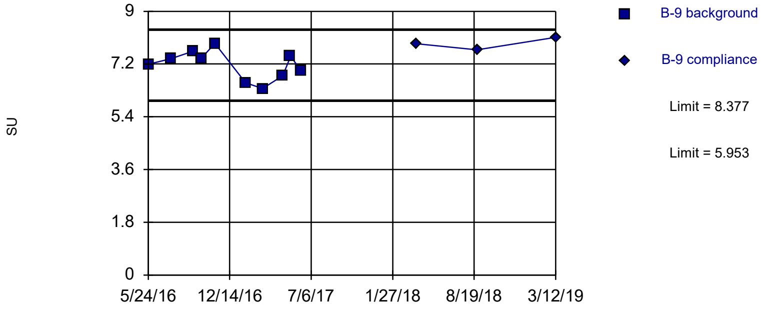
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limits

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=7.165, Std. Dev.=0.4893, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9696, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

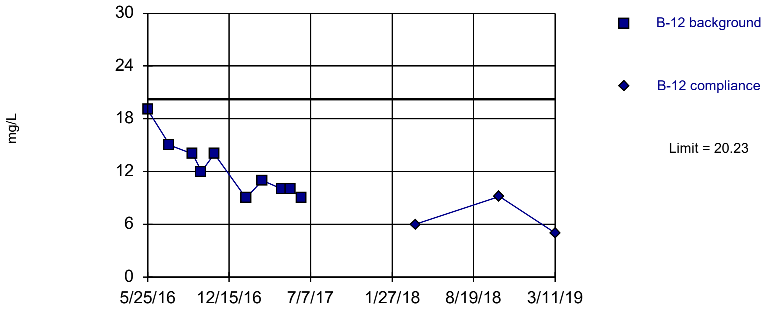
Constituent: pH, field Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=12.3, Std. Dev.=3.199, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.899, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

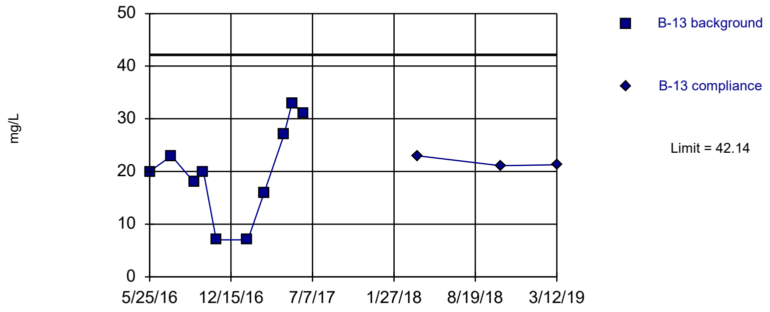
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=20.2, Std. Dev.=8.854, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9424, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

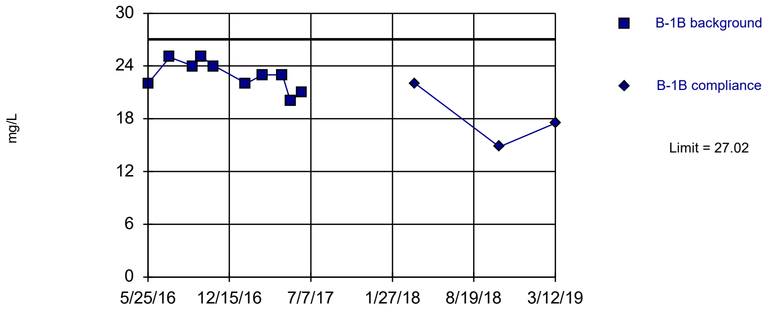
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=22.9, Std. Dev.=1.663, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9481, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

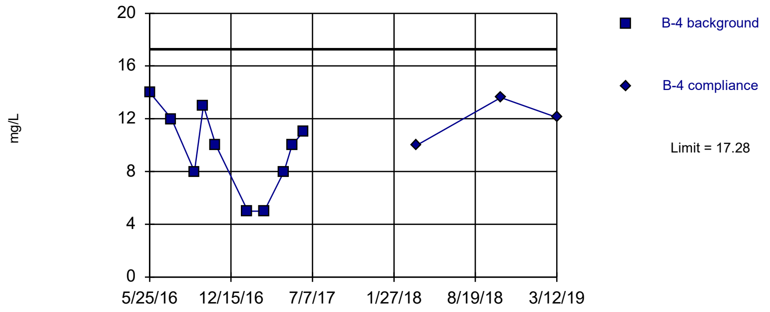
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=9.6, Std. Dev.=3.098, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.942, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

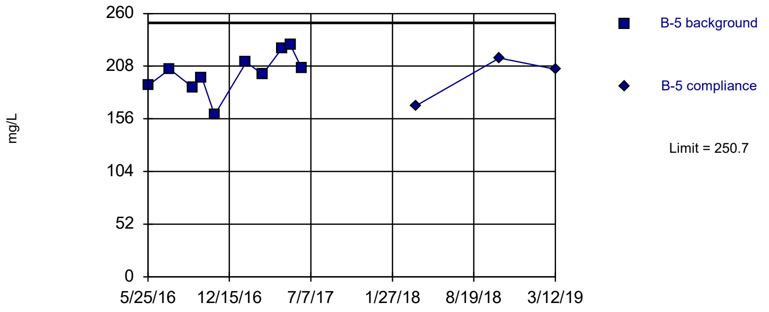
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=201.1, Std. Dev.=20.02, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9535, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

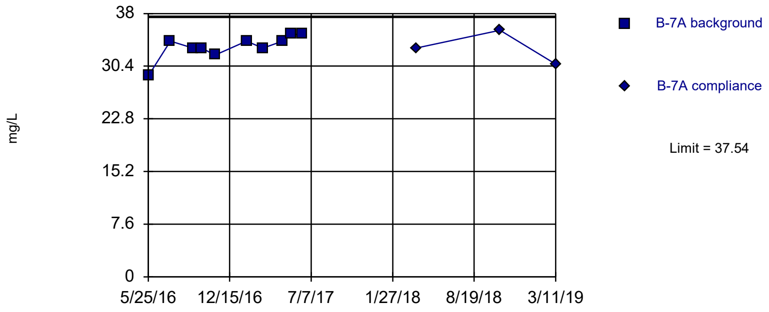
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=33.2, Std. Dev.=1.751, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8373, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

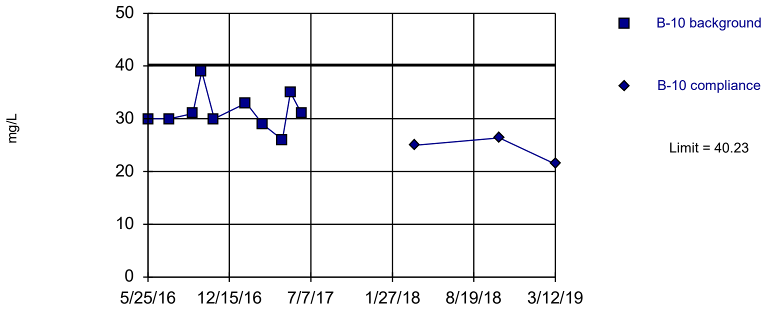
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=31.4, Std. Dev.=3.565, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9166, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

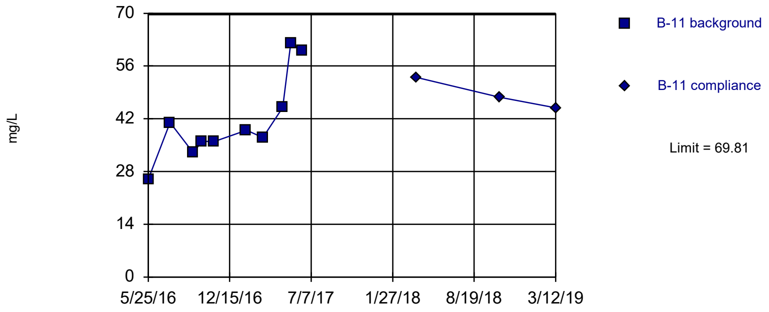
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=41.5, Std. Dev.=11.42, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8809, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

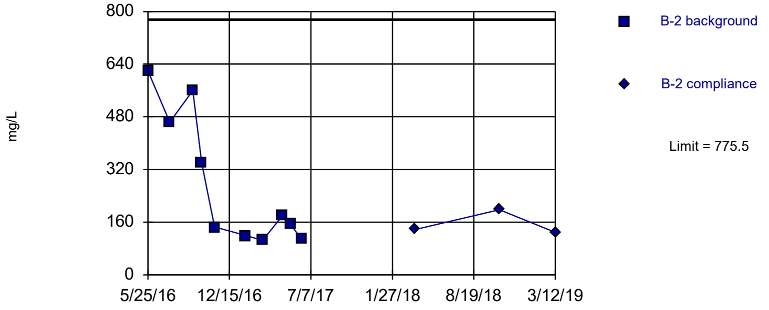
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=279.2, Std. Dev.=200.3, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8139, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

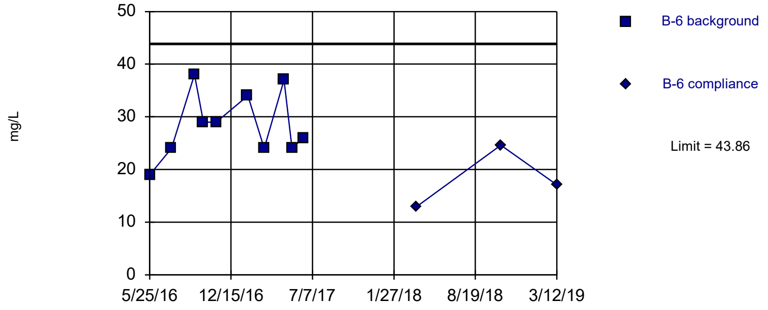
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=28.4, Std. Dev.=6.24, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9303, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

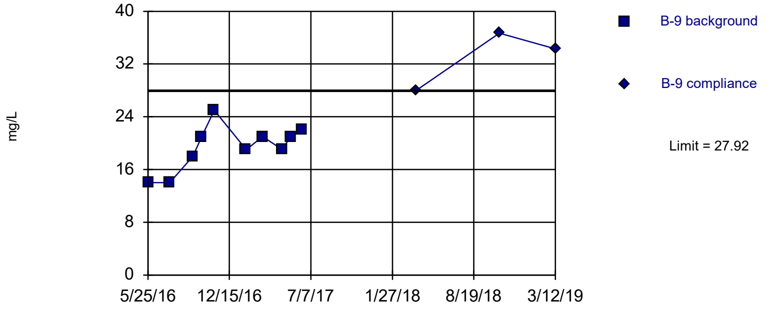
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=19.4, Std. Dev.=3.438, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9235, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

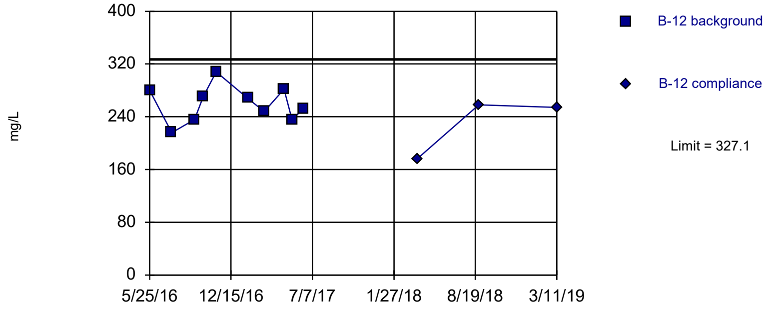
Constituent: Sulfate, total Analysis Run 7/8/2019 2:50 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=259.7, Std. Dev.=27.22, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9794, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

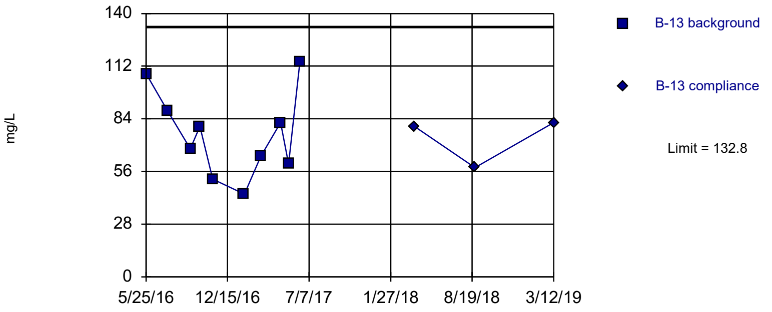
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=76, Std. Dev.=22.92, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9574, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

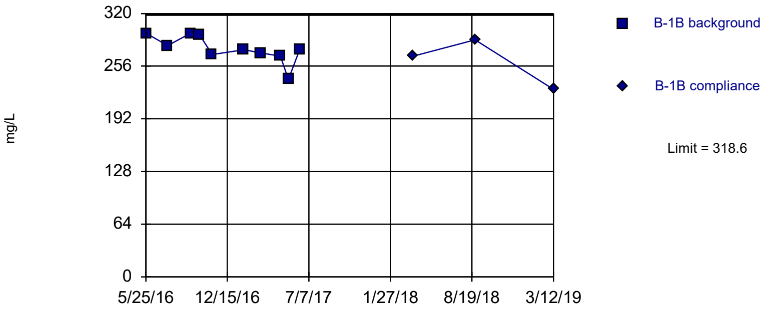
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=276.9, Std. Dev.=16.84, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8873, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

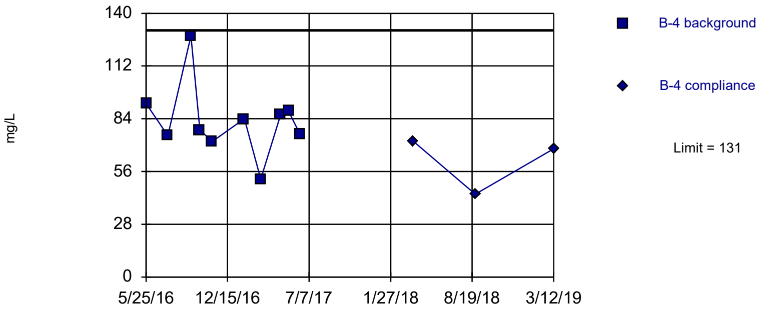
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=83.1, Std. Dev.=19.32, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.882, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

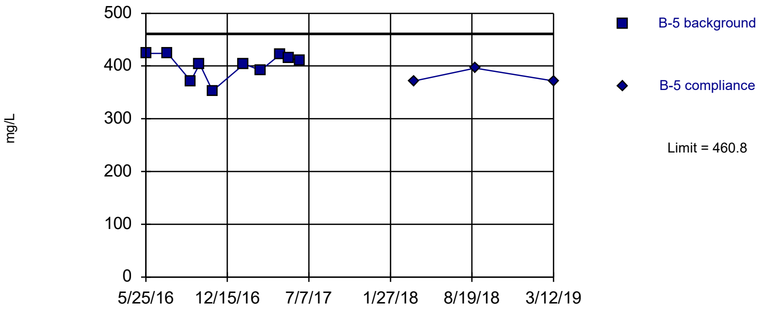
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=402.1, Std. Dev.=23.67, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8645, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

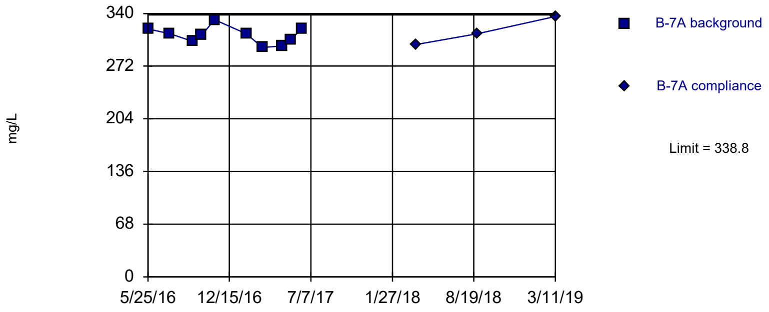
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=311.6, Std. Dev.=10.99, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9654, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

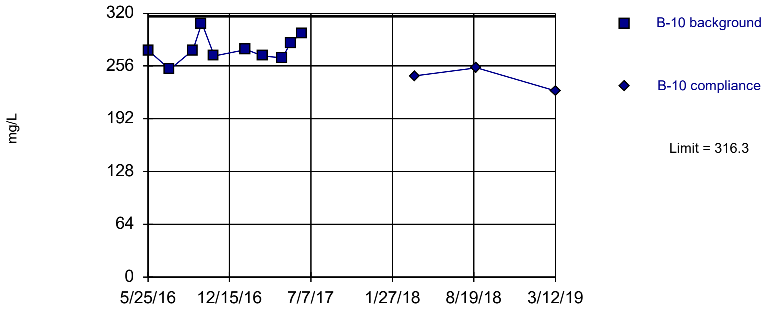
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=276.8, Std. Dev.=15.94, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9418, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

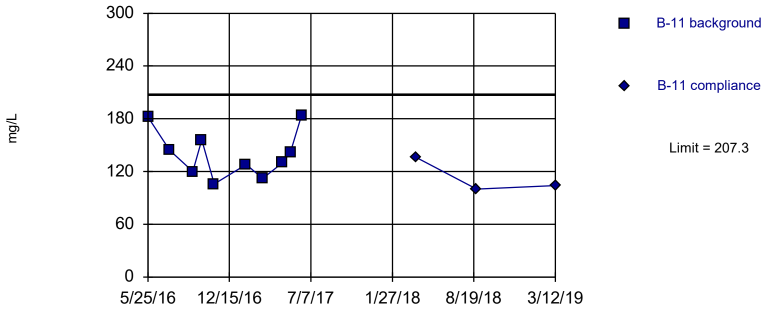
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=140.4, Std. Dev.=26.99, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9264, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

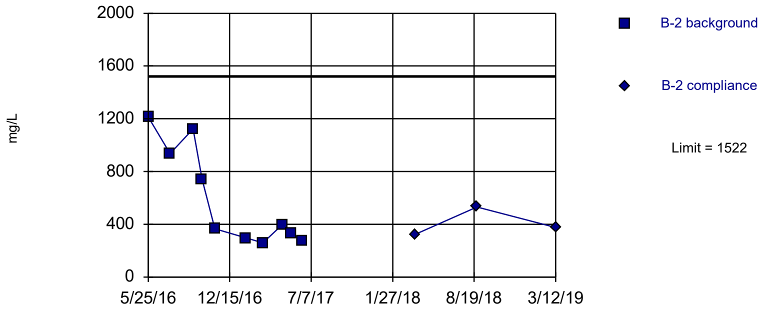
Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



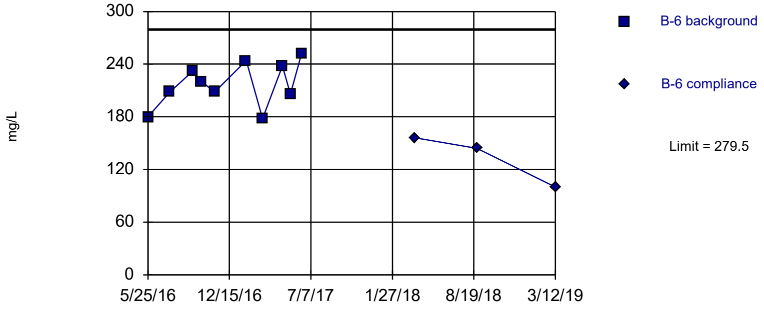
Background Data Summary: Mean=594, Std. Dev.=374.5, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.814, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Within Limit

Prediction Limit

Intrawell Parametric



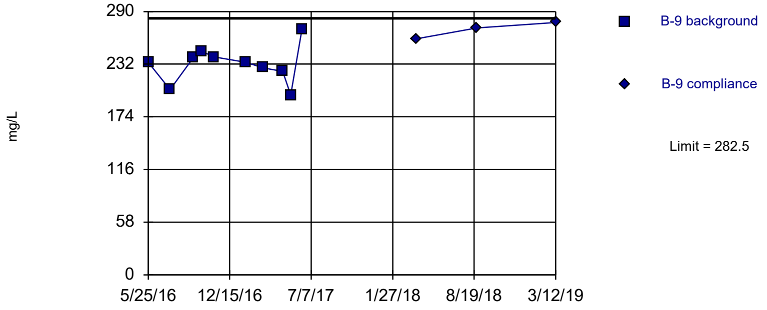
Background Data Summary: Mean=216.6, Std. Dev.=25.39, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9389, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=231.7, Std. Dev.=20.49, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9497, critical = 0.781. Kappa = 2.478 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 2:51 PM View: PLs - Intrawell
Flint LF Client: Geosyntec Data: Flint Creek LF

Trend Test Summary Table - Significant Results

Flint LF Client: Geosyntec Data: Flint Creek LF Printed 7/8/2019, 3:02 PM

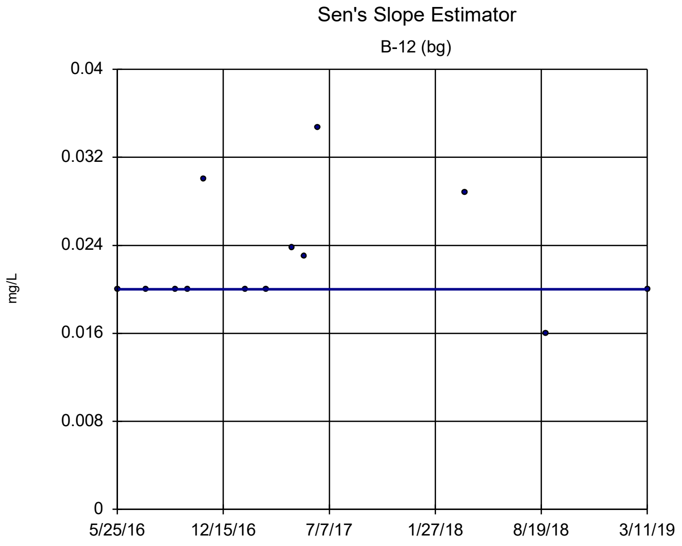
Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	**B-11**	**0.08416**	**44**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
pH, field (SU)	**B-4 (bg)**	**0.3533**	**52**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**B-12 (bg)**	**-4.887**	**-61**	**-43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**B-1B (bg)**	**-2.804**	**-46**	**-43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**B-9**	**7.365**	**55**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

Flint LF   Client: Geosyntec   Data: Flint Creek LF   Printed 7/8/2019, 3:02 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	B-12 (bg)	0	11	43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-13 (bg)	0	7	43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-1B (bg)	0	6	43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-4 (bg)	0.00153	14	43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-5 (bg)	0.001833	15	43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-7A (bg)	0	-18	-43	No	13	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	**B-11**	**0.08416**	**44**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	B-2	-0.2566	-35	-43	No	13	0	n/a	n/a	0.01	NP
pH, field (SU)	B-12 (bg)	-0.2207	-4	-43	No	13	0	n/a	n/a	0.01	NP
pH, field (SU)	B-13 (bg)	0.03545	2	43	No	13	0	n/a	n/a	0.01	NP
pH, field (SU)	B-1B (bg)	-0.1414	-7	-43	No	13	0	n/a	n/a	0.01	NP
pH, field (SU)	**B-4 (bg)**	**0.3533**	**52**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
pH, field (SU)	B-5 (bg)	-0.1788	-10	-43	No	13	0	n/a	n/a	0.01	NP
pH, field (SU)	B-7A (bg)	0.06024	2	43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**B-12 (bg)**	**-4.887**	**-61**	**-43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	B-13 (bg)	1.55	17	43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**B-1B (bg)**	**-2.804**	**-46**	**-43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	B-4 (bg)	0	3	43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	B-5 (bg)	8.328	21	43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	B-7A (bg)	0.9966	22	43	No	13	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**B-9**	**7.365**	**55**	**43**	**Yes**	**13**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



n = 13

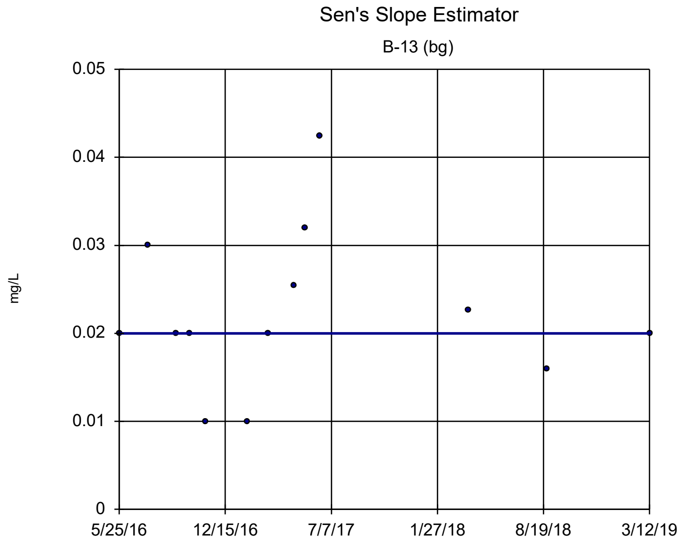
Slope = 0
units per year.

Mann-Kendall
statistic = 11
critical = 43

Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



n = 13

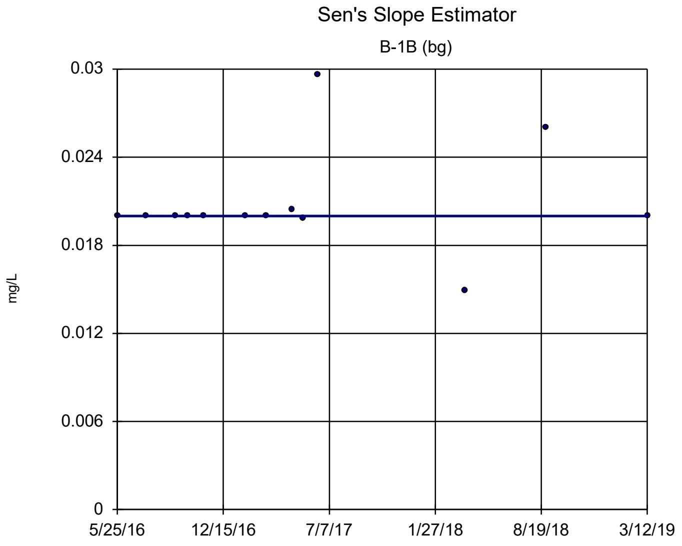
Slope = 0
units per year.

Mann-Kendall
statistic = 7
critical = 43

Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



n = 13

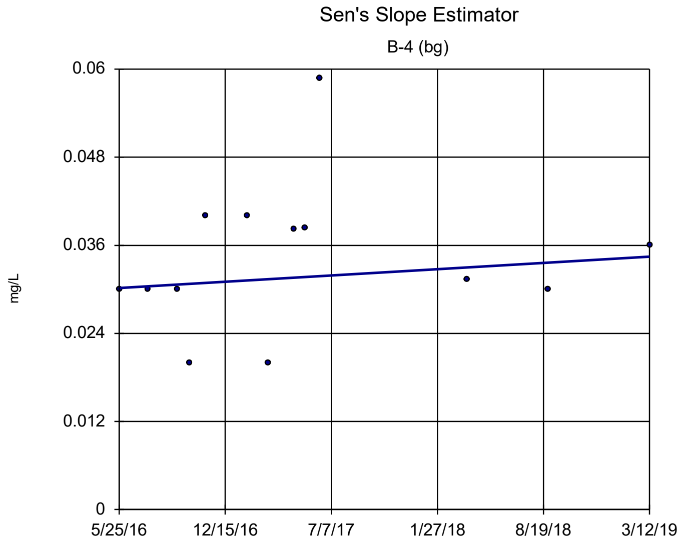
Slope = 0
units per year.

Mann-Kendall
statistic = 6
critical = 43

Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



n = 13

Slope = 0.00153
units per year.

Mann-Kendall
statistic = 14
critical = 43

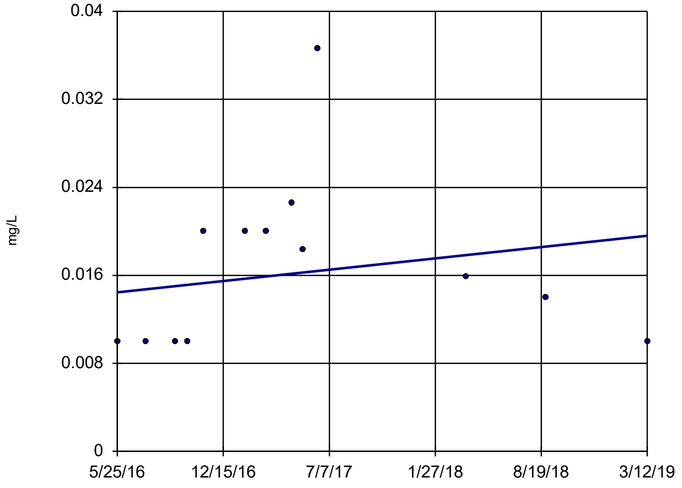
Trend not significant at 99%
confidence level
(α = 0.005 per
tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-5 (bg)



n = 13

Slope = 0.001833
units per year.

Mann-Kendall
statistic = 15
critical = 43

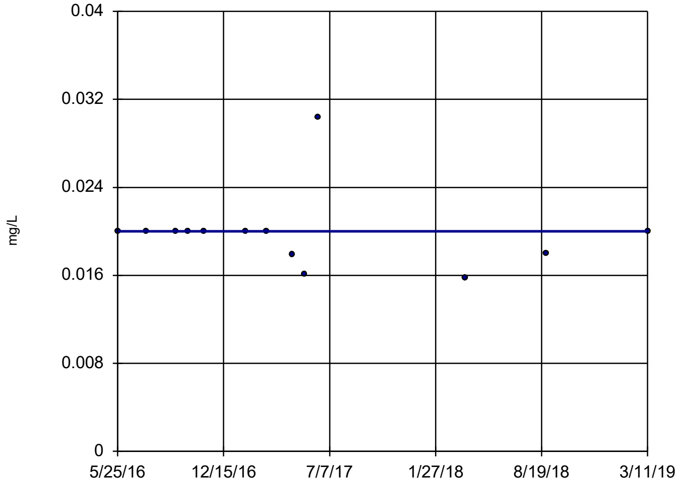
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-7A (bg)



n = 13

Slope = 0
units per year.

Mann-Kendall
statistic = -18
critical = -43

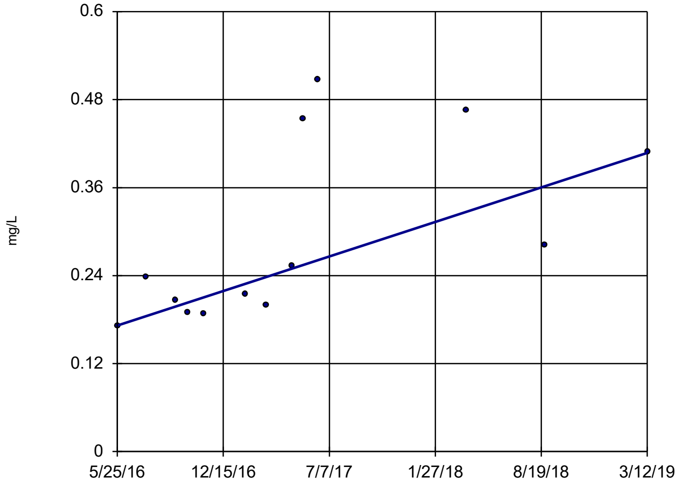
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-11



n = 13

Slope = 0.08416
units per year.

Mann-Kendall
statistic = 44
critical = 43

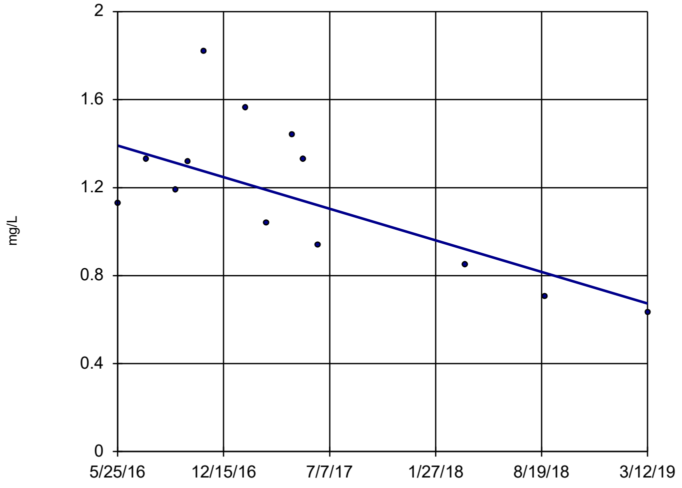
Increasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-2



n = 13

Slope = -0.2566
units per year.

Mann-Kendall
statistic = -35
critical = -43

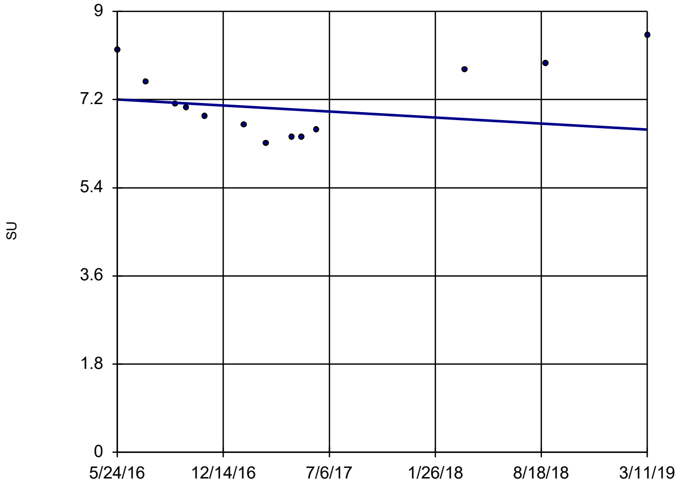
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-12 (bg)



n = 13

Slope = -0.2207 units per year.

Mann-Kendall statistic = -4 critical = -43

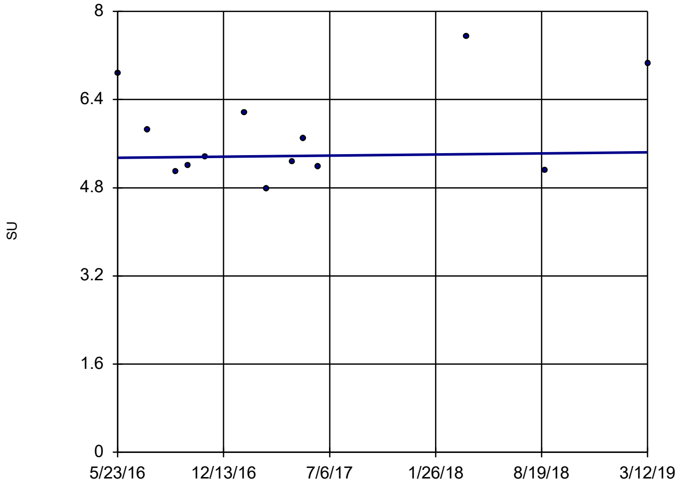
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-13 (bg)



n = 13

Slope = 0.03545 units per year.

Mann-Kendall statistic = 2 critical = 43

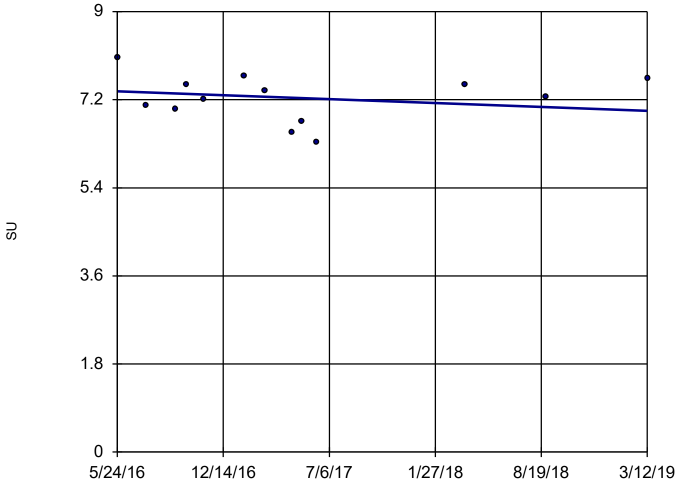
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-1B (bg)



n = 13

Slope = -0.1414 units per year.

Mann-Kendall statistic = -7 critical = -43

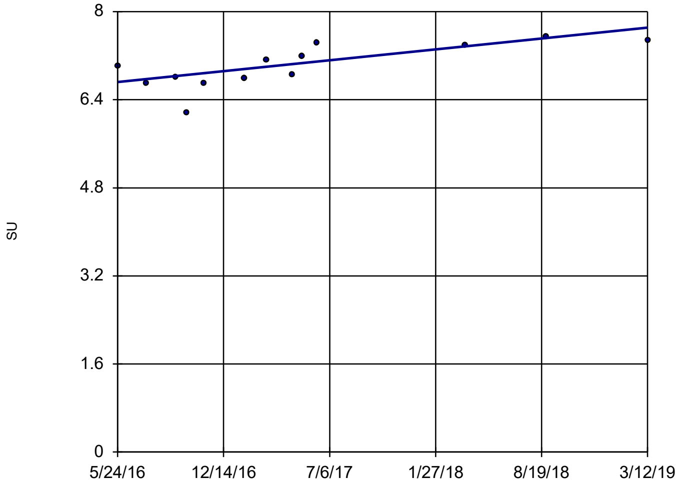
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-4 (bg)



n = 13

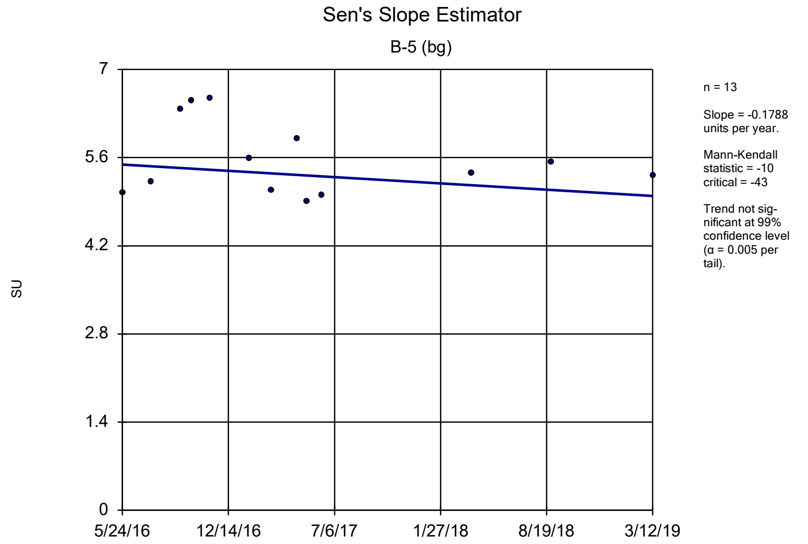
Slope = 0.3533 units per year.

Mann-Kendall statistic = 52 critical = 43

Increasing trend significant at 99% confidence level (α = 0.005 per tail).

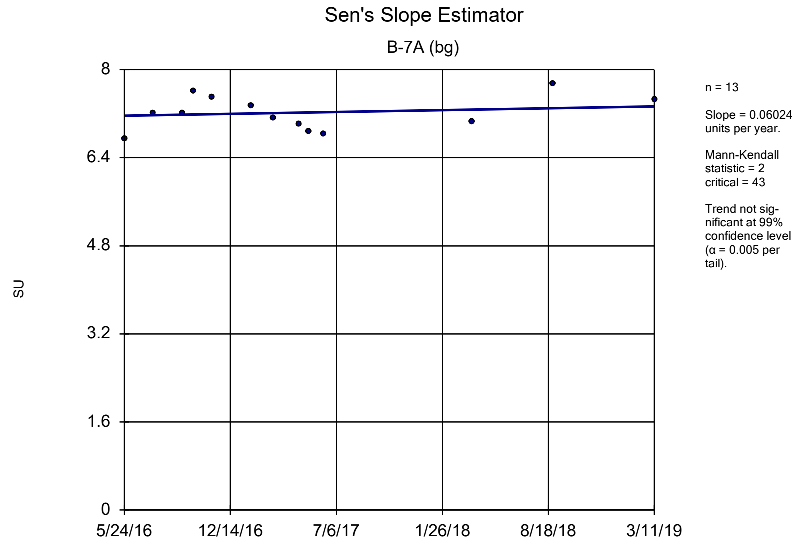
Constituent: pH, field Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



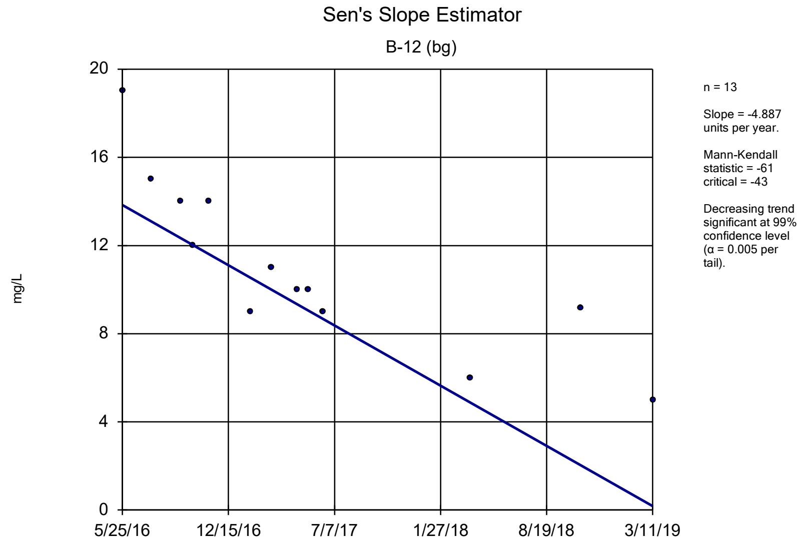
Constituent: pH, field Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



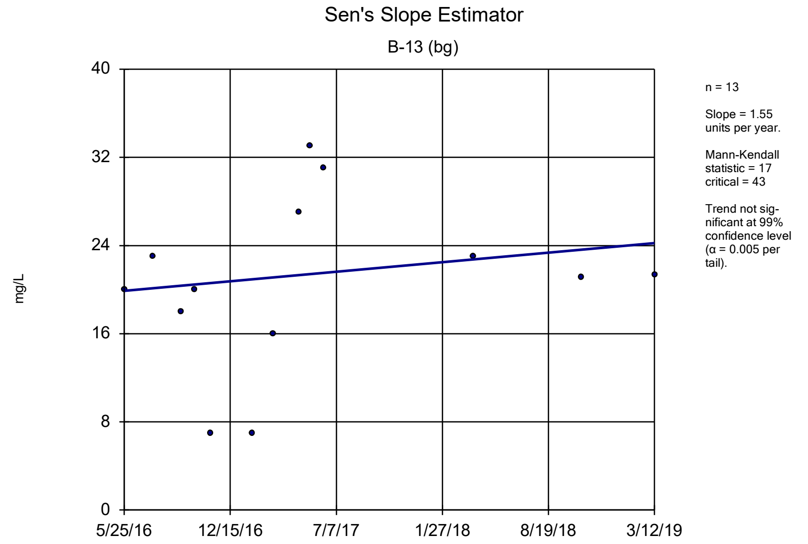
Constituent: pH, field Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



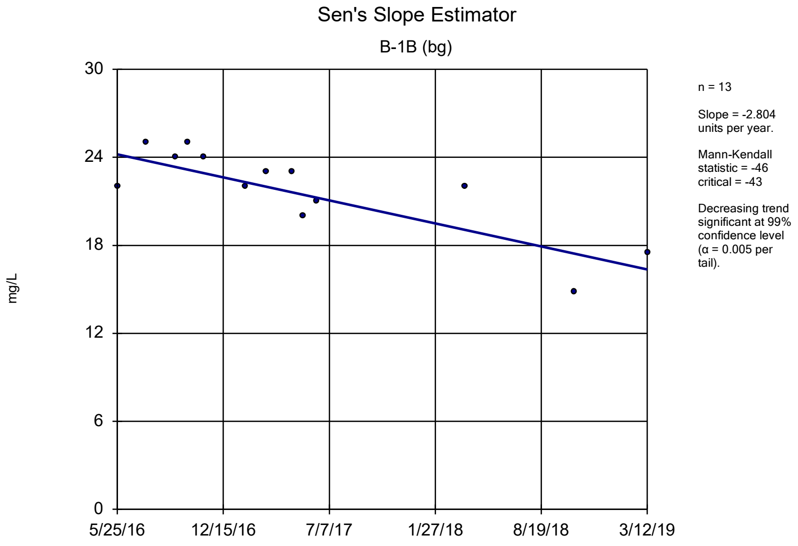
Constituent: Sulfate, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Sulfate, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



n = 13

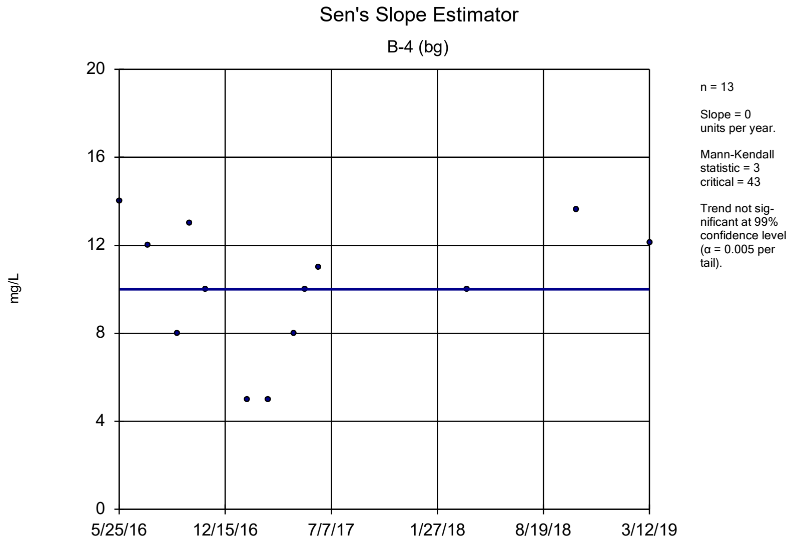
Slope = -2.804 units per year.

Mann-Kendall statistic = -46 critical = -43

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



n = 13

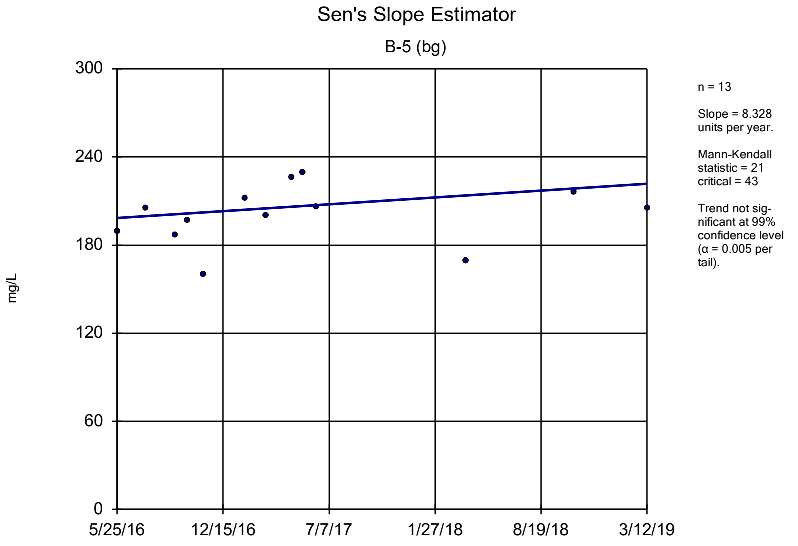
Slope = 0 units per year.

Mann-Kendall statistic = 3 critical = 43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



n = 13

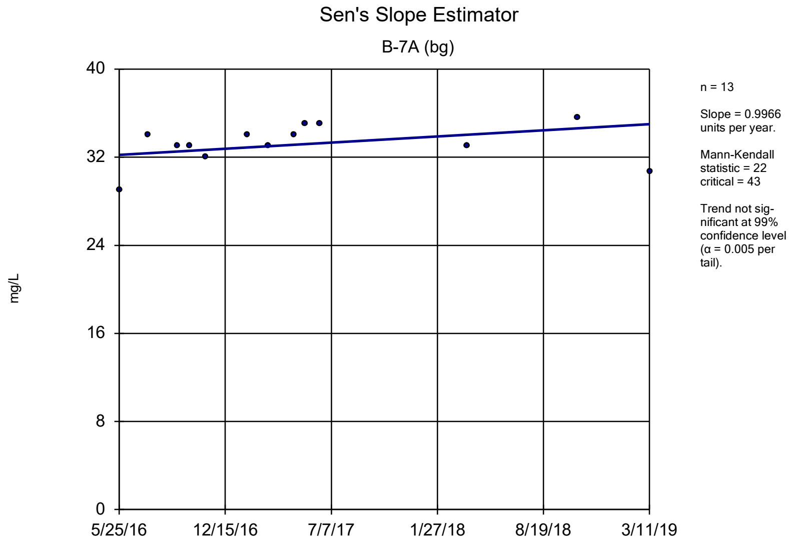
Slope = 8.328 units per year.

Mann-Kendall statistic = 21 critical = 43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG



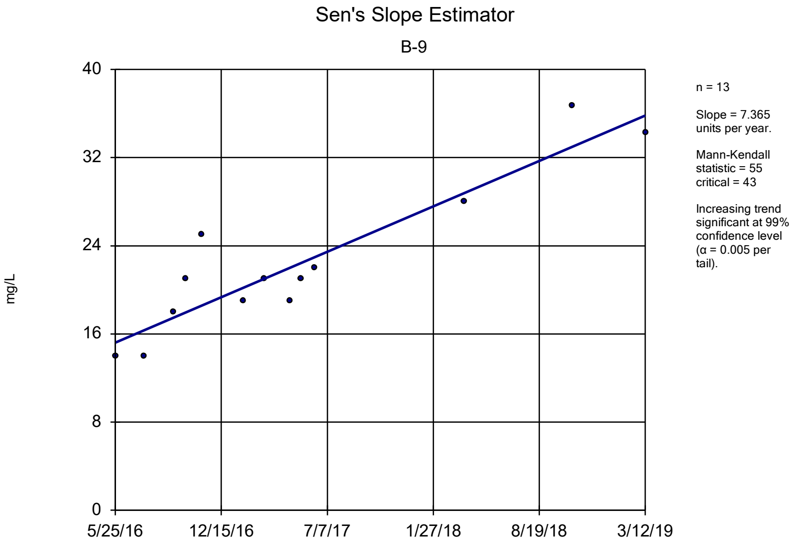
n = 13

Slope = 0.9966 units per year.

Mann-Kendall statistic = 22 critical = 43

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 7/8/2019 3:00 PM View: Trend Tests
Flint LF Client: Geosyntec Data: Flint Creek LF



Constituent: Sulfate, total   Analysis Run 7/8/2019 3:01 PM   View: Trend Tests

Flint LF   Client: Geosyntec   Data: Flint Creek LF

Tolerance Limit Summary Table

Flint LF   Client: Geosyntec   Data: Flint Creek LF   Printed 7/8/2019, 3:07 PM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.00452	78	n/a	n/a	78.21	n/a	n/a	0.0183	NP Inter(NDs)
Arsenic, total (mg/L)	n/a	0.008	78	n/a	n/a	66.67	n/a	n/a	0.0183	NP Inter(normality)
Barium, total (mg/L)	n/a	0.131	78	n/a	n/a	0	n/a	n/a	0.0183	NP Inter(normality)
Beryllium, total (mg/L)	n/a	0.001	78	n/a	n/a	32.05	n/a	n/a	0.0183	NP Inter(normality)
Cadmium, total (mg/L)	n/a	0.001	78	n/a	n/a	66.67	n/a	n/a	0.0183	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.008261	78	-6.684	0.9602	10.26	None	ln(x)	0.05	Inter
Cobalt, total (mg/L)	n/a	0.002944	77	0.0914	0.02638	3.896	None	x^(1/3)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	n/a	7.81	72	1.237	0.3773	1.389	None	x^(1/3)	0.05	Inter
Fluoride, total (mg/L)	n/a	1	78	n/a	n/a	75.64	n/a	n/a	0.0183	NP Inter(NDs)
Lead, total (mg/L)	n/a	0.015	78	n/a	n/a	55.13	n/a	n/a	0.0183	NP Inter(normality)
Lithium, total (mg/L)	n/a	0.041	78	n/a	n/a	2.564	n/a	n/a	0.0183	NP Inter(normality)
Mercury, total (mg/L)	n/a	0.000096	78	n/a	n/a	53.85	n/a	n/a	0.0183	NP Inter(normality)
Molybdenum, total (mg/L)	n/a	0.01	78	n/a	n/a	64.1	n/a	n/a	0.0183	NP Inter(normality)
Selenium, total (mg/L)	n/a	0.0392	78	n/a	n/a	67.95	n/a	n/a	0.0183	NP Inter(normality)
Thallium, total (mg/L)	n/a	0.002	78	n/a	n/a	83.33	n/a	n/a	0.0183	NP Inter(NDs)

Confidence Interval Summary Table - All Results (No Significant)

Flint LF Client: Geosyntec Data: Flint Creek LF Printed 7/8/2019, 3:09 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	B-10	0.0005	0.0001	0.006	n/a	No	13	84.62	No	0.01	NP (NDs)
Antimony, total (mg/L)	B-11	0.00489	0.00001	0.006	n/a	No	13	84.62	No	0.01	NP (NDs)
Antimony, total (mg/L)	B-2	0.001816	0.00002	0.006	n/a	No	13	46.15	No	0.01	NP (Cohens/xfrm)
Antimony, total (mg/L)	B-6	0.00145	0.00001	0.006	n/a	No	13	84.62	No	0.01	NP (NDs)
Antimony, total (mg/L)	B-9	0.001391	0.00011	0.006	n/a	No	13	84.62	No	0.01	NP (NDs)
Arsenic, total (mg/L)	B-10	0.006	0.0015	0.01	n/a	No	13	61.54	No	0.01	NP (normality)
Arsenic, total (mg/L)	B-11	0.007	0.0009	0.01	n/a	No	12	58.33	No	0.01	NP (normality)
Arsenic, total (mg/L)	B-2	0.008	0.00067	0.01	n/a	No	13	30.77	No	0.01	NP (Cohens/xfrm)
Arsenic, total (mg/L)	B-6	0.005	0.00061	0.01	n/a	No	13	46.15	No	0.01	NP (normality)
Arsenic, total (mg/L)	B-9	0.005	0.00111	0.01	n/a	No	13	61.54	No	0.01	NP (normality)
Barium, total (mg/L)	B-10	0.102	0.0748	2	n/a	No	13	0	No	0.01	NP (normality)
Barium, total (mg/L)	B-11	0.187	0.097	2	n/a	No	13	0	No	0.01	NP (normality)
Barium, total (mg/L)	B-2	0.226	0.0622	2	n/a	No	13	0	No	0.01	NP (normality)
Barium, total (mg/L)	B-6	0.07066	0.05093	2	n/a	No	13	0	No	0.01	Param.
Barium, total (mg/L)	B-9	0.1565	0.1359	2	n/a	No	13	0	ln(x)	0.01	Param.
Beryllium, total (mg/L)	B-10	0.0005	0.0000284	0.004	n/a	No	13	61.54	No	0.01	NP (normality)
Beryllium, total (mg/L)	B-11	0.001157	0.0002637	0.004	n/a	No	13	0	ln(x)	0.01	Param.
Beryllium, total (mg/L)	B-2	0.000548	0.0001131	0.004	n/a	No	13	0	ln(x)	0.01	Param.
Beryllium, total (mg/L)	B-6	0.0005	0.000033	0.004	n/a	No	13	15.38	No	0.01	NP (Cohens/xfrm)
Beryllium, total (mg/L)	B-9	0.0005	0.00003	0.004	n/a	No	13	46.15	No	0.01	NP (normality)
Cadmium, total (mg/L)	B-10	0.0004131	0.00005	0.005	n/a	No	13	76.92	No	0.01	NP (NDs)
Cadmium, total (mg/L)	B-11	0.00121	0.0001868	0.005	n/a	No	13	0	x^(1/3)	0.01	Param.
Cadmium, total (mg/L)	B-2	0.000348	0.00006	0.005	n/a	No	13	53.85	No	0.01	NP (Cohens/xfrm)
Cadmium, total (mg/L)	B-6	0.0002682	0.0001167	0.005	n/a	No	13	61.54	No	0.01	NP (normality)
Cadmium, total (mg/L)	B-9	0.0002	0.00006	0.005	n/a	No	13	92.31	No	0.01	NP (NDs)
Chromium, total (mg/L)	B-10	0.016	0.00039	0.1	n/a	No	13	0	No	0.01	NP (normality)
Chromium, total (mg/L)	B-11	0.01299	0.001744	0.1	n/a	No	13	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	B-2	0.026	0.00215	0.1	n/a	No	13	0	No	0.01	NP (normality)
Chromium, total (mg/L)	B-6	0.005905	0.002674	0.1	n/a	No	13	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	B-9	0.003174	0.001647	0.1	n/a	No	13	0	No	0.01	Param.
Cobalt, total (mg/L)	B-10	0.001452	0.0005007	0.006	n/a	No	13	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	B-11	0.002662	0.0003617	0.006	n/a	No	12	0	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	B-2	0.004551	0.0005169	0.006	n/a	No	13	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	B-6	0.002578	0.000791	0.006	n/a	No	13	0	No	0.01	Param.
Cobalt, total (mg/L)	B-9	0.001481	0.0006023	0.006	n/a	No	13	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-10	1.561	0.6251	7.81	n/a	No	12	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-11	3.524	0.7191	7.81	n/a	No	12	0	ln(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-2	2.736	1.385	7.81	n/a	No	12	0	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-6	7.58	0.571	7.81	n/a	No	12	0	No	0.01	NP (normality)
Combined Radium 226 + 228 (pCi/L)	B-9	2.915	0.5473	7.81	n/a	No	12	0	x^(1/3)	0.01	Param.
Fluoride, total (mg/L)	B-10	0.2319	0.1	4	n/a	No	13	76.92	No	0.01	NP (NDs)
Fluoride, total (mg/L)	B-11	0.2	0.04	4	n/a	No	13	92.31	No	0.01	NP (NDs)
Fluoride, total (mg/L)	B-2	0.3361	0.1	4	n/a	No	13	84.62	No	0.01	NP (NDs)
Fluoride, total (mg/L)	B-6	0.2	0.2	4	n/a	No	13	100	No	0.01	NP (NDs)
Fluoride, total (mg/L)	B-9	0.31	0.1884	4	n/a	No	13	69.23	No	0.01	NP (normality)
Lead, total (mg/L)	B-10	0.005	0.0003	0.015	n/a	No	13	61.54	No	0.01	NP (normality)
Lead, total (mg/L)	B-11	0.009	0.00083	0.015	n/a	No	13	30.77	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	B-2	0.013	0.000332	0.015	n/a	No	13	23.08	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	B-6	0.002822	0.0007021	0.015	n/a	No	13	7.692	sqrt(x)	0.01	Param.
Lead, total (mg/L)	B-9	0.005	0.000693	0.015	n/a	No	13	61.54	No	0.01	NP (normality)
Lithium, total (mg/L)	B-10	0.005861	0.002209	0.041	n/a	No	13	0	ln(x)	0.01	Param.
Lithium, total (mg/L)	B-11	0.02	0.00221	0.041	n/a	No	13	0	No	0.01	NP (normality)
Lithium, total (mg/L)	B-2	0.01156	0.002384	0.041	n/a	No	13	0	x^(1/3)	0.01	Param.
Lithium, total (mg/L)	B-6	0.00416	0.001123	0.041	n/a	No	13	0	ln(x)	0.01	Param.
Lithium, total (mg/L)	B-9	0.009	0.00241	0.041	n/a	No	13	0	No	0.01	NP (normality)

Confidence Interval Summary Table - All Results (No Significant)

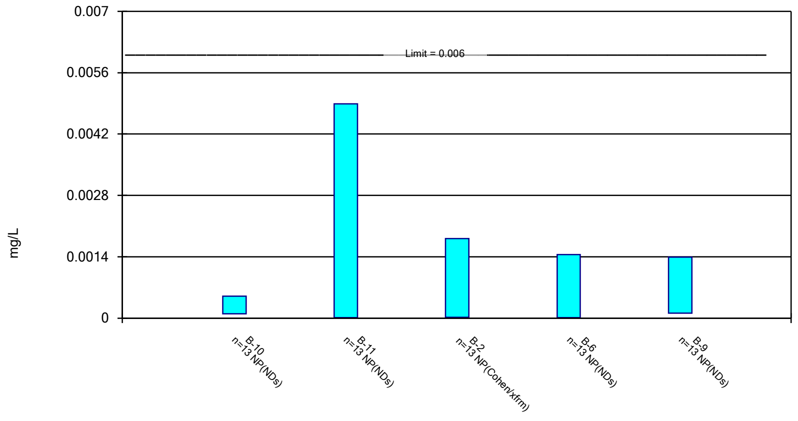
Flint LF   Client: Geosyntec   Data: Flint Creek LF   Printed 7/8/2019, 3:09 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Mercury, total (mg/L)	B-10	0.000025	0.00001543	0.002	n/a	No	13	69.23	No	0.01	NP (normality)
Mercury, total (mg/L)	B-11	0.000025	0.00002458	0.002	n/a	No	12	83.33	No	0.01	NP (NDs)
Mercury, total (mg/L)	B-2	0.000027	0.00000946	0.002	n/a	No	13	53.85	No	0.01	NP (normality)
Mercury, total (mg/L)	B-6	0.000025	0.000007	0.002	n/a	No	13	30.77	No	0.01	NP (Cohens/xfrm)
Mercury, total (mg/L)	B-9	0.000025	0.00001407	0.002	n/a	No	13	76.92	No	0.01	NP (NDs)
Molybdenum, total (mg/L)	B-10	0.00352	0.00078	0.1	n/a	No	13	15.38	No	0.01	NP (normality)
Molybdenum, total (mg/L)	B-11	0.01	0.0003621	0.1	n/a	No	13	61.54	No	0.01	NP (normality)
Molybdenum, total (mg/L)	B-2	0.006	0.0004781	0.1	n/a	No	13	15.38	No	0.01	NP (Cohens/xfrm)
Molybdenum, total (mg/L)	B-6	0.01	0.00043	0.1	n/a	No	13	30.77	No	0.01	NP (normality)
Molybdenum, total (mg/L)	B-9	0.01	0.0008719	0.1	n/a	No	13	84.62	No	0.01	NP (NDs)
Selenium, total (mg/L)	B-10	0.001	0.0003	0.05	n/a	No	13	84.62	No	0.01	NP (NDs)
Selenium, total (mg/L)	B-11	0.002803	0.0006577	0.05	n/a	No	13	30.77	No	0.01	Param.
Selenium, total (mg/L)	B-2	0.03926	0.01157	0.05	n/a	No	13	0	sqrt(x)	0.01	Param.
Selenium, total (mg/L)	B-6	0.003036	0.001366	0.05	n/a	No	13	7.692	No	0.01	Param.
Selenium, total (mg/L)	B-9	0.001	0.0008	0.05	n/a	No	13	92.31	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-10	0.002	0.00136	0.002	n/a	No	13	84.62	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-11	0.002	0.001001	0.002	n/a	No	13	84.62	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-2	0.002	0.00088	0.002	n/a	No	13	76.92	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-6	0.002	0.00116	0.002	n/a	No	13	76.92	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-9	0.002	0.001044	0.002	n/a	No	13	76.92	No	0.01	NP (NDs)

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

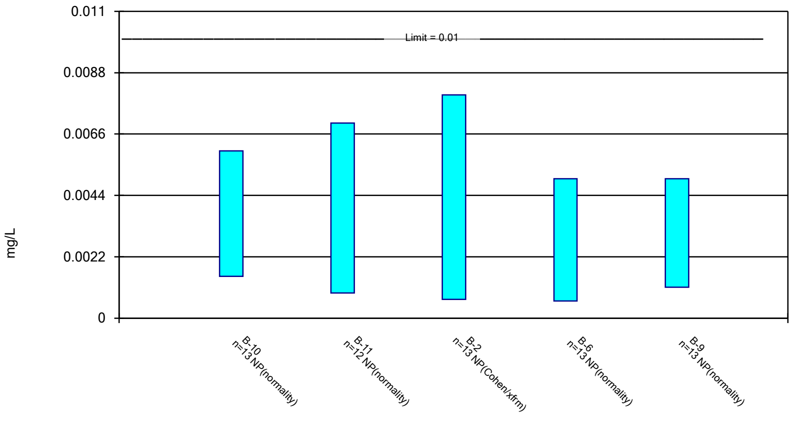


Constituent: Antimony, total   Analysis Run 7/8/2019 3:08 PM   View: Confidence Intervals - App IV
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

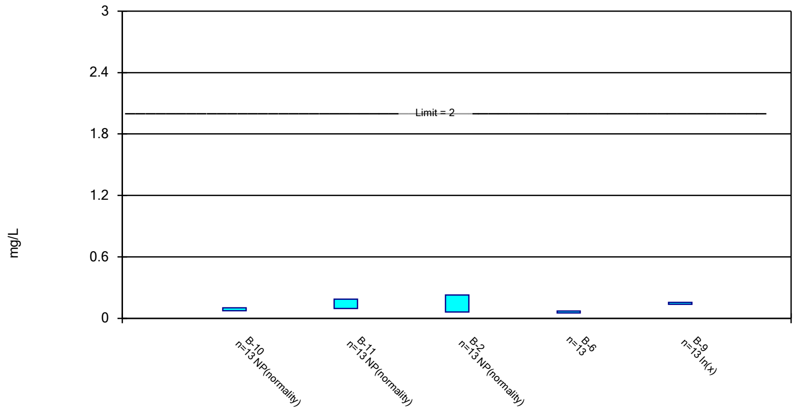


Constituent: Arsenic, total   Analysis Run 7/8/2019 3:08 PM   View: Confidence Intervals - App IV
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

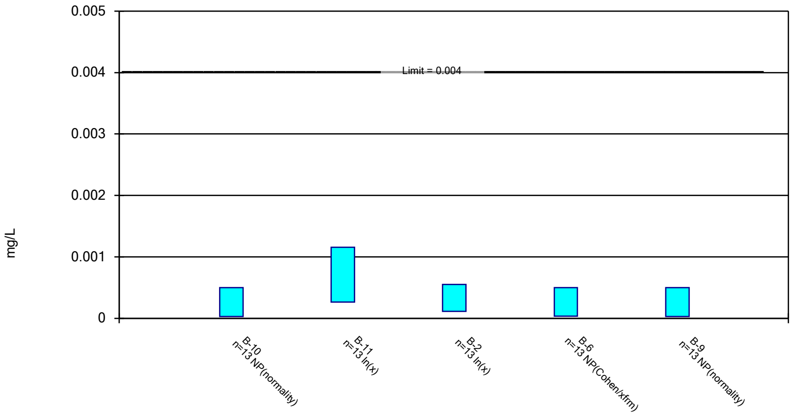


Constituent: Barium, total   Analysis Run 7/8/2019 3:08 PM   View: Confidence Intervals - App IV
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

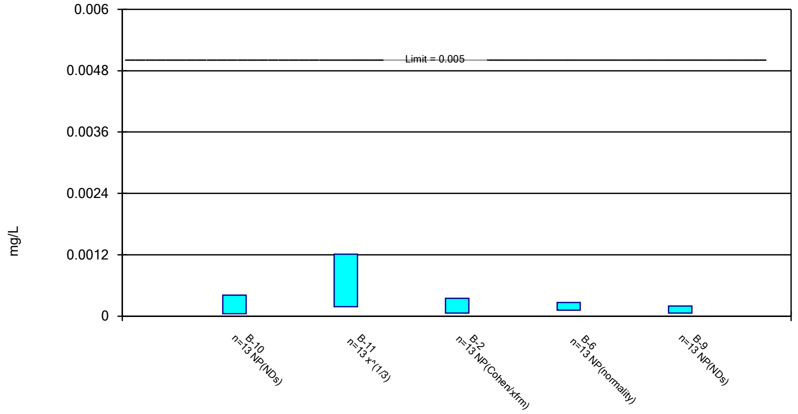


Constituent: Beryllium, total   Analysis Run 7/8/2019 3:08 PM   View: Confidence Intervals - App IV
Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

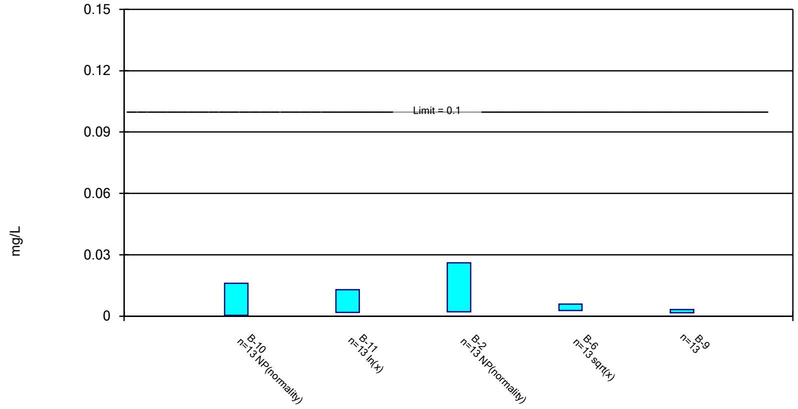


Constituent: Cadmium, total Analysis Run 7/8/2019 3:08 PM View: Confidence Intervals - App IV
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

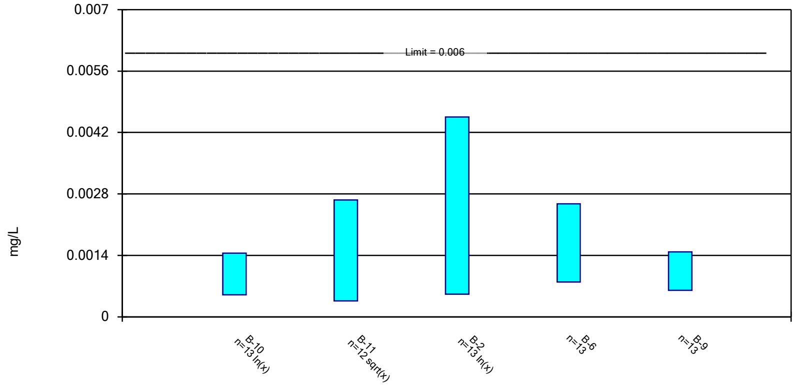


Constituent: Chromium, total Analysis Run 7/8/2019 3:08 PM View: Confidence Intervals - App IV
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

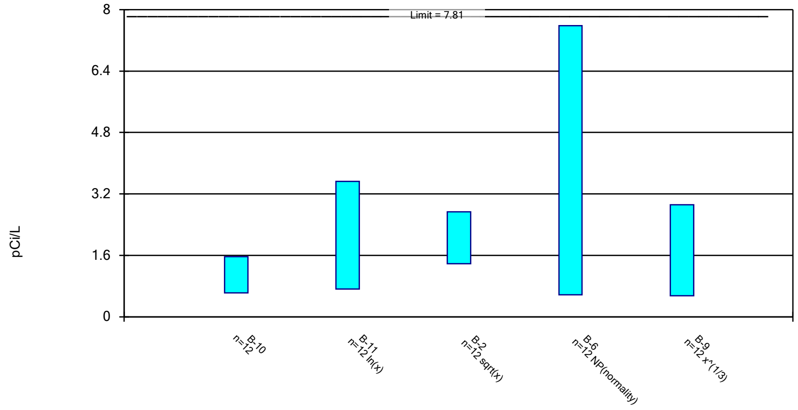


Constituent: Cobalt, total Analysis Run 7/8/2019 3:08 PM View: Confidence Intervals - App IV
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

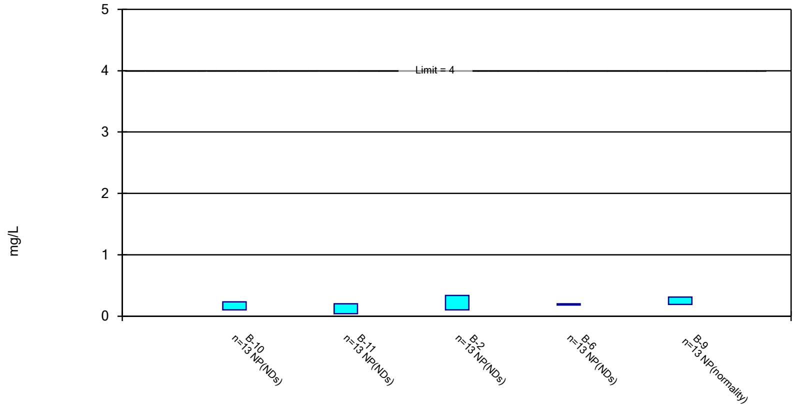


Constituent: Combined Radium 226 + 228 Analysis Run 7/8/2019 3:08 PM View: Confidence Intervals - A
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.



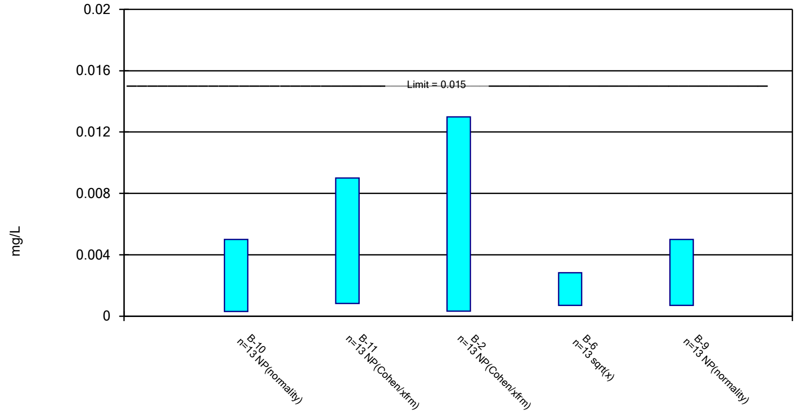
Constituent: Fluoride, total   Analysis Run 7/8/2019 3:09 PM   View: Confidence Intervals - App IV

Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



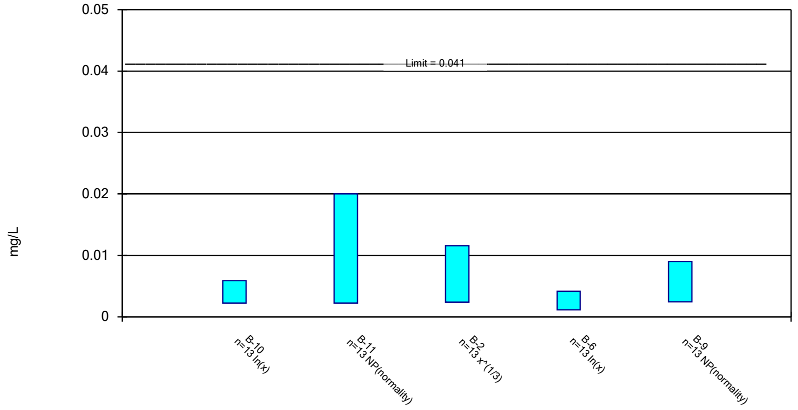
Constituent: Lead, total   Analysis Run 7/8/2019 3:09 PM   View: Confidence Intervals - App IV

Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



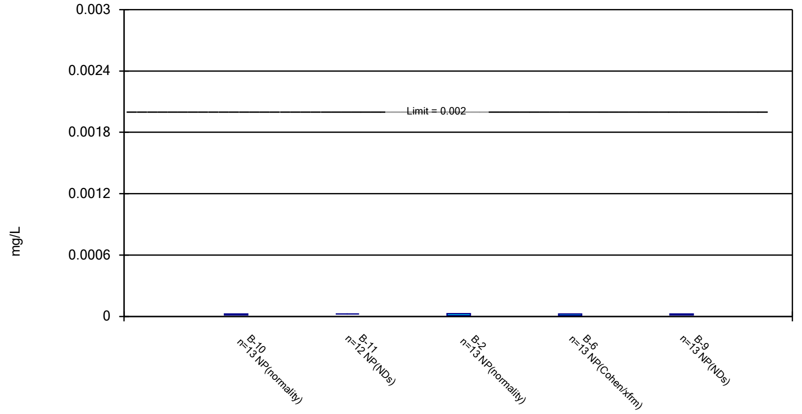
Constituent: Lithium, total   Analysis Run 7/8/2019 3:09 PM   View: Confidence Intervals - App IV

Flint LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

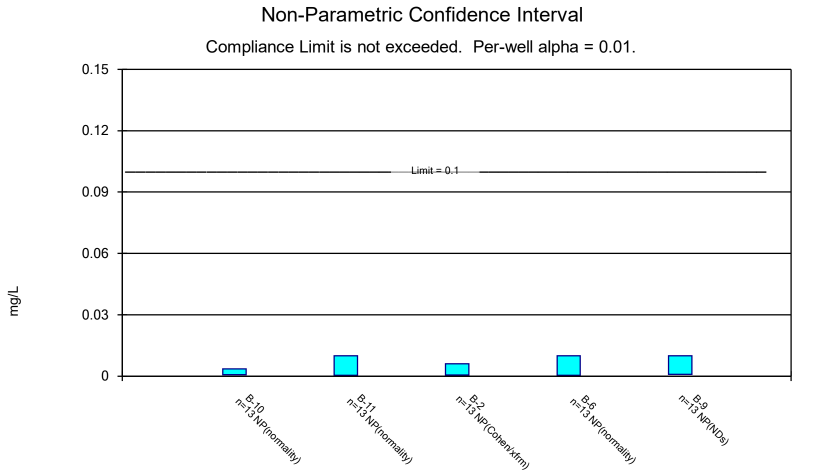
Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Mercury, total   Analysis Run 7/8/2019 3:09 PM   View: Confidence Intervals - App IV

Flint LF   Client: Geosyntec   Data: Flint Creek LF

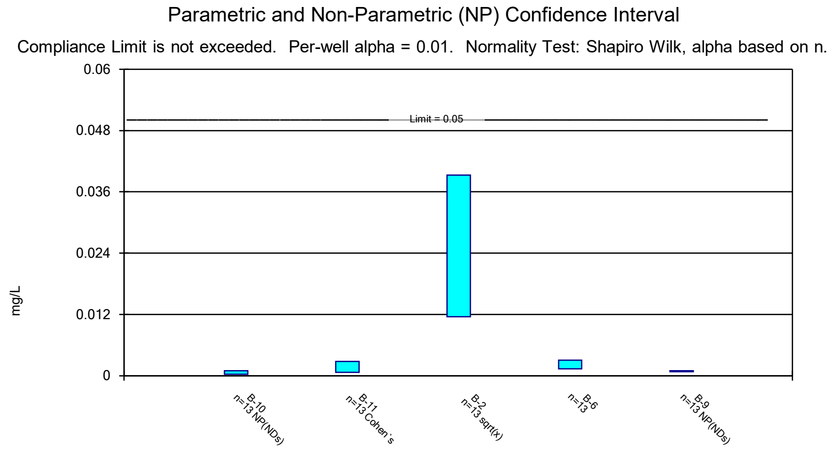
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG


Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

Constituent: Molybdenum, total Analysis Run 7/8/2019 3:09 PM View: Confidence Intervals - App IV
Flint LF Client: Geosyntec Data: Flint Creek LF

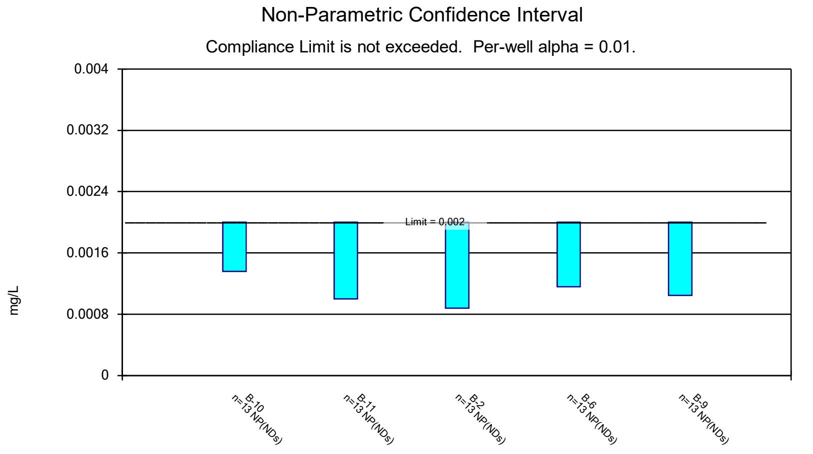
Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG


Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

Constituent: Selenium, total Analysis Run 7/8/2019 3:09 PM View: Confidence Intervals - App IV
Flint LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG


Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

Constituent: Thallium, total Analysis Run 7/8/2019 3:09 PM View: Confidence Intervals - App IV
Flint LF Client: Geosyntec Data: Flint Creek LF

STATISTICAL ANALYSIS SUMMARY
LANDFILL
Flint Creek Plant
Gentry, Arkansas

Submitted to

AMERICAN
ELECTRIC
POWER

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Submitted by

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engineers | scientists | innovators

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December 24, 2019

CHA8473

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LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LF	Landfill
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
SU	Standard Units
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Landfill (LF), an existing CCR unit at the Flint Creek Power Plant located in Gentry, Arkansas.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron at the LF. An alternative source was not identified at the time, so the LF has been in assessment monitoring since. During the most recent assessment monitoring event, completed in March 2019, no SSLs were identified during these events, and the unit remained in assessment monitoring. Two assessment monitoring events were conducted at the LF in June 2019 and August 2019, in accordance with 40 CFR 257.95. The results of these assessment events are documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. No SSLs were identified. Prediction limits were calculated for Appendix III parameters. When compared to the revised prediction limits, concentrations for boron, pH, sulfate, and TDS remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can return to detection monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

LANDFILL EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(b) (June 2019) and 257.95(d)(1) (August 2019). Samples from both sampling events were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during these assessment monitoring events may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.23 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the LF were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained in June and August 2019 were screened for potential outliers. Outliers were identified for lithium in the June 2019 data, including non-detect values where the reporting limit of 0.100 mg/L was used. This value represents a significant increase from previous reporting limits for lithium.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for antimony, arsenic, barium, beryllium, cadmium, fluoride, lead, lithium, mercury, molybdenum, and selenium due to apparent non-normal distributions and for thallium due to a high non-detect frequency. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

No SSLs were identified at the Flint Creek LF.

2.2.3 Establishment of Appendix III Prediction Limits

Upper prediction limits (UPLs) were previously established for all Appendix III parameters following the background monitoring period (Geosyntec, 2018). Intrawell tests were used to evaluate potential SSIs for calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS), whereas an interwell test was used to evaluate potential SSIs for boron. While interwell prediction limits have been updated periodically during the assessment monitoring period as sufficient data became available, this represents the first update to the background dataset for parameters evaluated using intrawell tests.

Mann-Whitney (Wilcoxon rank-sum) tests were performed to determine whether the newer data are affected by a release from the LF. Because the interwell Appendix III limits and the Appendix IV GWPSs are based on data from upgradient wells which we would not expect to have been impacted by a release, these tests were used for intrawell Appendix III tests only. Mann-Whitney tests were used to compare the medians of historical data (May 2016-June 2017) to the new compliance samples (August 2017-March 2019) for calcium, chloride, fluoride, pH, sulfate, and TDS. Results were evaluated to determine if the medians of the two groups were similar at the 99% confidence level. Where no significant difference was found, the new compliance data were added to the background dataset. Where a statistically significant difference was found between the medians of the two groups, the data were reviewed to evaluate the cause of the difference and to determine if adding newer data to the background dataset, replacing the background dataset with the newer data, or continuing to use the existing background dataset was most appropriate. If the differences appeared to have been caused by a release, then the previous background dataset continued to be used.

The complete Mann-Whitney test results and a summary of the significant findings can be found in Appendix B. Significant differences were found between the two groups for calcium at B-10, sulfate at B-9 and B-10, and TDS at B-6 and B-10. However, when the entire records were evaluated using the time series graphs, more recent concentrations appeared only slightly different from historical measurements. For this reason, combined with the limited data available at this time, all background data sets were updated through March 2019.

After the revised background set was established, a parametric or non-parametric analysis was selected based on the distribution of the data and the frequency of non-detect data. Estimated results less than the practical quantitation limit (PQL) – i.e., "J-flagged" data – were considered detections and the estimated results were used in the statistical analyses. Non-parametric analyses were selected for datasets with at least 50% non-detect data or datasets that could not be normalized. Parametric analyses were selected for datasets (either transformed or untransformed) that passed the Shapiro-Wilk / Shapiro-Francía test for normality. The Kaplan-Meier non-detect adjustment was applied to datasets with between 15% and 50% non-detect data. For datasets with fewer than 15% non-detect data, non-detect data were replaced with one half of the PQL. The selected analysis (i.e., parametric or non-parametric) and transformation (where applicable) for each background dataset are shown in Attachment B.

UPLs were updated using all the historical data through March 2019 to represent background values. LPLs were also updated for pH. The updated prediction limits are summarized in Table 3. Intrawell tests continued to be used to evaluate potential SSIs for calcium, chloride, fluoride, pH, sulfate, and TDS, whereas an interwell test continued to be used to evaluate potential SSIs for boron. The UPLs were calculated for a one-of-two retesting procedure; i.e., if at least one sample in a series of two does not exceed the UPL, then it can be concluded that an SSI has not occurred. In practice, where the initial result did not exceed the UPL, a second sample was not collected. The retesting procedures allowed achieving an acceptably high statistical power to detect changes at downgradient wells for constituents evaluated using intrawell prediction limits.

2.2.4 Evaluation of Potential Appendix III SSIs

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Data collected during the June 2019 and August 2019 assessment monitoring events from each compliance well were compared to the prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 4. The following exceedances of the UPLs were noted:

- Boron concentrations exceeded the interwell UPL of 0.059 mg/L at B-11 (0.548 mg/L and 0.605 mg/L) and B-2 (6.97 mg/L and 0.735 mg/L). While boron was not detected at B-5, B-6, B-7, B-9, or B-10 during the June 2019 event, the reporting limit of 0.100 mg/L was above the interwell UPL.

- The pH measurement exceeded the intrawell UPL of 7.9 SU at B-7 (8.3 SU).
- The sulfate concentration exceeded the intrawell UPL of 243 mg/L at B-5 (271 mg/L).
- TDS concentrations exceeded the intrawell UPL of 339 mg/L at B-7 (378 mg/L) and the intrawell UPL of 293 mg/L at B-9 (310 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Flint Creek LF during assessment monitoring. As a result, the Flint Creek LF CCR unit will remain in assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified outliers for lithium in the June 2019 data. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. No SSLs were identified.

Revised prediction limits were calculated for Appendix III parameters. Intrawell tests continued to be used to evaluate potential SSIs for calcium, chloride, fluoride, pH, sulfate, and total dissolved solids (TDS), whereas an interwell test continued to be used to evaluate potential SSIs for boron. Prediction limits were recalculated using a one-of-two retesting procedure. The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Boron, pH, sulfate, and TDS results exceeded background levels.

Based on this evaluation, either the Flint Creek LF CCR unit will remain in assessment monitoring or an ASD will be conducted to evaluate if the unit can return to detection monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Flint Creek Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Landfill, Flint Creek Plant, Gentry, Arkansas. January 15, 2018.

TABLES

Table 1 - Groundwater Data Summary
Flint Creek - Landfill

Component	Unit	B-1B		B-2		B-4		B-5		B-6		B-7A	
		6/10/2019	8/27/2019	6/11/2019	8/27/2019	6/11/2019	8/28/2019	6/11/2019	8/28/2019	6/10/2019	8/27/2019	6/10/2019	8/27/2019
Antimony	µg/L	0.0300 J	0.110	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.100 U	0.0800 J	0.0500 J	0.0600 J	0.150
Arsenic	µg/L	0.620	0.570	0.180	0.220	0.0600 J	0.0600 J	0.670	0.440	0.510	0.360	2.35	2.93
Barium	µg/L	112	114	38.5	41.3	31.2	31.1	26.0	33.7	49.8	48.6	42.9	49.0
Beryllium	µg/L	0.0200 J	0.100 U	0.208	0.149	0.215	0.204	0.376	0.487	0.0800 J	0.0400 J	0.100 U	0.100 U
Boron	mg/L	0.0500 J	0.0500 U	0.697	0.735	0.0700 J	0.0560	0.100 U	0.0500 U	0.0500 J	0.0300 J	0.100 U	0.0500 U
Cadmium	µg/L	0.0200 J	0.0600	0.0400 J	0.0300 J	0.0500 J	0.0400 J	0.180	0.180	0.0800 J	0.0400 J	0.0200 J	0.0300 J
Calcium	mg/L	92.4	86.5	14.2	15.4	3.50	2.92	17.9	15.9	49.7	44.8	105	102
Chloride	mg/L	2.31	2.00	4.16	3.00	3.74	3.00	7.02	6.00	7.78	6.00	3.12	2.00
Chromium	µg/L	0.368	0.278	1.57	1.75	1.03	1.11	3.00	2.40	2.18	1.96	0.200 U	0.200 J
Cobalt	µg/L	0.0510	0.0500 J	0.0690	0.105	0.0400 J	0.0840	0.349	0.331	0.537	0.387	0.0740	0.134
Combined Radium	pCi/L	5.96	4.73	0.959	0.888	0.680	1.05	1.27	0.717	0.810	0.347	2.56	1.85
Fluoride	mg/L	0.490	0.275 J	0.0600 J	1.00 U	0.0200 J	1.00 U	0.0800	1.00 U	0.0300 J	1.00 U	0.240	0.144 J
Lead	µg/L	0.530	0.395	0.200 U	0.0800 J	0.200 U	0.200 U	0.203	0.100 J	0.697	0.509	0.100 J	0.100 J
Lithium	mg/L	0.100 U	0.0231	0.100 U	0.00128	0.100 U	0.000925	0.100 U	0.00215	0.100 U	0.000518	0.100 U	0.0164
Mercury	mg/L	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U	0.00000700 J	0.00000600 J	0.0000250 U	0.0000250 U	0.0000250 U	0.0000250 U
Molybdenum	µg/L	0.800 J	1.00 J	0.400 J	0.500 J	2.00 U	2.00 U	2.00 U	2.00 U	4.00 U	2.00 U	0.500 J	0.600 J
Selenium	µg/L	0.200 U	0.200 U	6.70	6.80	0.700	0.800	39.0	37.5	2.40	2.40	0.200 U	0.0400 J
Total Dissolved Solids	mg/L	266	312	246	230	60.0	66.0	438	402	188	250	312	378
Sulfate	mg/L	20.7	20.0	80.9	65.0	13.4	11.0	271	219	21.7	36.0	35.4	36.0
Thallium	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	1.00 U	0.500 U	0.500 U	0.500 U
pH	SU	6.58	7.42	6.36	5.94	7.48	5.96	5.69	5.00	6.78	6.60	7.09	8.30

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above the method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit

Table 1 - Groundwater Data Summary
Flint Creek - Landfill

Component	Unit	B-9		B-10		B-11		B-12		B-13	
		6/11/2019	8/27/2019	6/10/2019	8/27/2019	6/10/2019	8/27/2019	6/10/2019	8/27/2019	6/10/2019	8/28/2019
Antimony	µg/L	0.500 U	0.0900 J	0.200 J	0.110	0.200 U	0.100 U	0.100 J	0.240	0.100 U	0.100 U
Arsenic	µg/L	0.900	1.67	0.300 J	0.460	0.360	0.550	0.290	1.20	0.0700 J	0.170
Barium	µg/L	166	188	78.3	79.1	111	131	54.2	60.8	55.1	47.1
Beryllium	µg/L	0.500 U	0.0200 J	0.500 U	0.100 U	0.316	0.317	0.200 U	0.150	0.0500 J	0.151
Boron	mg/L	0.100 U	0.0500 U	0.100 U	0.0500 U	0.548	0.605	0.0400 J	0.0500 U	0.100 U	0.0500 U
Cadmium	µg/L	0.200 U	0.0800	0.200 U	0.0200 J	0.0800 J	0.100	0.0300 J	0.0800	0.0400 J	0.0500 J
Calcium	mg/L	99.7	128	80.4	70.8	17.0	15.4	60.9	59.6	19.7	10.2
Chloride	mg/L	3.69	3.00	9.24	7.00	3.73	3.00	10.6	8.00	3.05	1.00
Chromium	µg/L	1.11	1.61	0.300 J	0.385	0.884	1.36	0.585	2.04	0.379	0.818
Cobalt	µg/L	0.200 J	0.827	0.200 U	0.128	0.162	0.256	2.49	11.2	0.0300 J	0.272
Combined Radium	pCi/L	0.157	1.26	1.13	1.34	1.12	0.455	0.513	1.11	0.461	0.862
Fluoride	mg/L	0.130	1.00 U	0.110	1.00 U	0.0400 J	1.00 U	0.0600 J	1.00 U	0.0200 J	1.00 U
Lead	µg/L	1.00 U	0.509	1.00 U	0.0500 J	0.200 J	0.416	0.300	2.65	0.200 U	0.221
Lithium	mg/L	0.100 U	0.00409	0.100 U	0.00169	0.0300 J	0.00130	0.100 U	0.00176	0.100 U	0.000814
Mercury	mg/L	0.0000250 U	0.0000250 U	0.0000250 U	0.0000160 J	0.0000250 U	0.0000250 U	0.0000250 U	0.00000600 J	0.0000250 U	0.0000250 U
Molybdenum	µg/L	36.1	0.400 J	10.0 J	1.00 J	4.00 U	2.00 U	4.00 U	0.400 J	2.00 U	2.00 U
Selenium	µg/L	0.400 J	0.500	0.500 J	0.400	3.10	4.10	0.200 J	1.40	0.500	0.400
Total Dissolved Solids	mg/L	248	310	260	268	82.0	138	244	252	98.0	64.0
Sulfate	mg/L	37.6	37.0	26.1	26.0	54.7	59.0	7.00	9.00	20.7	18.0
Thallium	µg/L	2.00 U	0.500 U	2.00 U	0.500 U	1.00 U	0.500 U	1.00 U	0.500 U	0.500 U	0.500 U
pH	SU	7.71	7.18	7.35	7.31	5.92	5.76	7.18	6.88	6.94	5.41

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above the method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit

Table 2: Groundwater Protection Standards
Flint Creek Plant - Landfill

Constituent Name	MCL	CCR Rule-Specified	Calculated UTL
Antimony, Total (mg/L)	0.006		0.005
Arsenic, Total (mg/L)	0.01		0.008
Barium, Total (mg/L)	2		0.13
Beryllium, Total (mg/L)	0.004		0.001
Cadmium, Total (mg/L)	0.005		0.001
Chromium, Total (mg/L)	0.1		0.0051
Cobalt, Total (mg/L)	n/a	0.006	0.0052
Combined Radium, Total (pCi/L)	5		9.42
Fluoride, Total (mg/L)	4		1
Lead, Total (mg/L)	n/a	0.015	0.005
Lithium, Total (mg/L)	n/a	0.04	0.05
Mercury, Total (mg/L)	0.002		0.000096
Molybdenum, Total (mg/L)	n/a	0.1	0.01
Selenium, Total (mg/L)	0.05		0.039
Thallium, Total (mg/L)	0.002		0.002

Notes:

Grey cell indicates calculated UTL is higher than MCL or CCR Rule-specified value.

MCL = Maximum Contaminant Level

Calculated UTL (Upper Tolerance Limit) represents site-specific background values.

The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3: Revised Prediction Limits
Flint Creek - Landfill

Parameter	Unit	Description	B-10	B-11	B-1B	B-2	B-5	B-6	B-7	B-9
Boron	mg/L	Interwell Background Value (UPL)	0.0588							
Calcium	mg/L	Intrawell Background Value (UPL)	112	18.3	96.7	88.0	19.2	61.5	109	137
Chloride	mg/L	Intrawell Background Value (UPL)	11.5	7.73	5.84	9.83	11.6	12.2	6.87	8.31
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00	0.707	1.00	1.00	1.00	1.00	1.00
pH	SU	Intrawell Background Value (UPL)	8.8	7.0	8.4	7.3	6.8	7.4	7.9	8.5
		Intrawell Background Value (LPL)	5.9	4.8	6.2	5.2	4.3	6.1	6.5	6.2
Sulfate	mg/L	Intrawell Background Value (UPL)	39.4	65.7	28.1	803	243	42.3	37.1	37.6
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	315	193	317	1409	447	292	339	293

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

Table 4: Appendix III Data Summary
Flint Creek - Landfill

Parameter	Unit	Description	B-10		B-11		B-1B		B-2		B-5		B-6		B-7		B-9	
			6/10/2019	8/27/2019	6/10/2019	8/27/2019	6/10/2019	8/27/2019	6/11/2019	8/27/2019	6/11/2019	8/28/2019	6/10/2019	8/27/2019	6/10/2019	8/27/2019	6/11/2019	8/27/2019
Boron	mg/L	Interwell Background Value (UPL)	0.0588															
		Detection Monitoring Result	**0.100**	0.0200	**0.548**	**0.605**	0.0500	0.0200	**0.697**	**0.735**	**0.100**	0.0200	0.0500	0.0300	**0.100**	0.0200	**0.100**	0.0200
Calcium	mg/L	Intrawell Background Value (UPL)	112		18.3		96.7		88.0		19.2		61.5		109		137	
		Detection Monitoring Result	80.4	70.8	17.0	15.4	92.4	86.5	14.2	15.4	17.9	15.9	49.7	44.8	105	102	99.7	128
Chloride	mg/L	Intrawell Background Value (UPL)	11.5		7.73		5.84		9.83		11.6		12.2		6.87		8.31	
		Detection Monitoring Result	9.24	7.00	3.73	3.00	2.31	2.00	4.16	3.00	7.02	6.00	7.78	6.00	3.12	2.00	3.69	3.00
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		1.00		0.707		1.00		1.00		1.00		1.00		1.00	
		Detection Monitoring Result	0.110	0.0830	0.0400	0.0830	0.490	0.275	0.0600	0.0830	0.0800	0.0380	0.0300	0.0830	0.240	0.144	0.130	0.0830
pH	SU	Intrawell Background Value (UPL)	8.8		7.0		8.4		7.3		6.8		7.4		7.9		8.5	
		Intrawell Background Value (LPL)	5.9		4.8		6.2		5.2		4.3		6.1		6.5		6.2	
		Detection Monitoring Result	7.4	7.3	5.9	5.8	6.6	7.4	6.4	5.9	5.7	5.0	6.8	6.6	7.1	**8.3**	7.7	7.2
Sulfate	mg/L	Intrawell Background Value (UPL)	39.4		65.7		28.1		803		243		42.3		37.1		37.6	
		Detection Monitoring Result	26.1	26.0	54.7	59.0	20.7	20.0	80.9	65.0	**271**	219	21.7	36.0	35.4	36.0	37.6	37.0
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	315		193		317		1409		447		292		339		293	
		Detection Monitoring Result	260	268	82.0	138	266	312	246	230	438	402	188	250	312	**378**	248	**310**

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Flint Creek Landfill CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

15296
License Number

ARKANSAS
Licensing State

01.03.20
Date

No. 15296
DAVID ANTHONY MILLER

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

December 24, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

Re: Flint Creek Landfill - Assessment Monitoring & Background Update 2019

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide statistical analysis and background update of 2019 groundwater data for American Electric Power Inc.'s Flint Creek Landfill. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at the site for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** B-1B, B-4, B-5, B-7A, B-12, and B-13; and
- **Downgradient wells:** B-2, B-6, B-9, B-10, and B-11.

Data were sent electronically, and the report was reviewed by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC. The statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Cameron.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS;

  - **Appendix IV** (Assessment Monitoring) – antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters are provided for all wells and are used to evaluate concentrations over time as well as for the purpose of updating statistical limits (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B). Values in background which have been flagged as outliers may be seen in a lighter font and as a disconnected symbol on the graph. A summary of these values follows this letter (Figure C). The time series plots are used to initially screen for suspected outliers and trends, while the box plots provide visual representation of variation within individual wells and between all wells.

During the background screening conducted in December 2017 data at all wells were evaluated for the following: 1) outliers; 2) trends; 3) most appropriate statistical method for Appendix III parameters based on site characteristics of groundwater data upgradient of the facility; and 4) eligibility of downgradient wells when intrawell statistical methods are recommended. Power curves were provided to demonstrate that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Summary of Statistical Method:

1) Intrawell prediction limits, combined with a 1-of-2 resample plan for calcium, chloride, fluoride, pH, sulfate and TDS;
2) Interwell prediction limits, combined with a 1-of-2 resample plan for boron.

Parametric prediction limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are nondetects, a nonparametric test is utilized. While the false positive rate associated with the parametric limits is based on an annual 10% as recommended by the EPA Unified Guidance (2009), the false positive rate associated with the nonparametric limits is dependent upon the available background sample size, number of future comparisons, and verification resample plan. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (US EPA, 2009), data are analyzed using either parametric or non-parametric prediction limits.

- No statistical analyses are required on wells and analytes containing 100% nondetects (USEPA Unified Guidance, 2009, Chapter 6).

- When data contain <15% nondetects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric prediction limits are used on data containing greater than 50% nondetects.

Summary of Background Screening Conducted in November 2017

Outlier Evaluation

Time series plots were used to identify suspected outliers, or extreme values that would result in limits that are not conservative from a regulatory perspective, in proposed background data. Suspected outliers at all wells for Appendix III and Appendix IV parameters were formally tested using Tukey's box plot method and, when identified, flagged in the computer database with "o" and deselected prior to construction of statistical limits.

Tukey's outlier test noted a few outliers as may be seen on the Outlier Summary Table and accompanying graphs. Any values flagged as outliers are plotted in a lighter font on the time series graph. A substitution of the most recent reporting limit was applied when varying detection limits existed in data.

No true seasonal patterns were observed on the time series plots for any of the detected data; therefore, no deseasonalizing adjustments were made to the data. When seasonal patterns are observed, data may be deseasonalized so that the resulting limits will correctly account for the seasonality as a predictable pattern rather than random variation or a release.

While trends may be visual, a quantification of the trend and its significance is needed. The Sen's Slope/Mann Kendall trend test was used to evaluate all data at each well to identify statistically significant increasing or decreasing trends. In the absence of suspected contamination, significant trending data are typically not included as part of the background data used for construction of prediction limits. This step serves to eliminate the trend and, thus, reduce variation in background. When statistically significant decreasing trends are present, earlier data are evaluated to determine whether earlier concentration levels are significantly different than current reported concentrations and will be deselected as necessary. When the historical records of data are truncated for the reasons above, a summary report will be provided to show the date ranges used in construction of the statistical limits.

The results of the trend analyses showed several statistically significant decreasing trends and one increasing trend for calcium in an upgradient well, as may be seen on the Trend Test Summary Table that accompanies the trend tests. These trends were relatively low in magnitude when compared to average concentrations; therefore, no adjustments were made to the data sets.

Appendix III – Determination of Spatial Variation

The Analysis of Variance (ANOVA) was used to statistically evaluate differences in average concentrations among upgradient wells, which assists in identifying the most appropriate statistical approach. Interwell tests, which compare downgradient well data to statistical limits constructed from pooled upgradient well data, are appropriate when average concentrations are similar across upgradient wells. Intrawell tests, which compare compliance data from a single well to screened historical data within the same well, are appropriate when upgradient wells exhibit spatial variation; when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; and when downgradient water quality is unimpacted compared to upgradient water quality for the same parameter.

The ANOVA identified variation for all Appendix III parameters; therefore, these data were further evaluated as described for the appropriateness of intrawell testing to accommodate the groundwater quality. A summary table of the ANOVA results was included with the reports.

Appendix III - Statistical Limits

Intrawell limits constructed from carefully screened background data from within each well serve to provide statistical limits that are conservative (i.e. lower) from a regulatory perspective, and that will rapidly identify a change in more recent compliance data from within a given well. When natural variability is present, interwell prediction limits which pool upgradient well data to construct a single limit for each constituent are not recommended for comparison of all downgradient wells. Intrawell prediction limits which use historical data from within a given well to construct limits for the same well are, however, recommended because they remove the element of variation across wells and eliminate the chance of mistaking natural spatial variation for a release from the facility. Prior to performing intrawell prediction limits, several steps are required to reasonably demonstrate downgradient water quality does not have existing impacts from the practices of the facility.

Exploratory data analysis was used as a general comparison of concentrations in downgradient wells for all Appendix III parameters recommended for intrawell analyses to concentrations reported in upgradient wells. Upper tolerance limits are used in conjunction with confidence intervals to determine whether the estimated averages in downgradient wells are higher than observed levels upgradient of the facility. The upper tolerance limits were constructed to represent the extreme upper range of possible background levels at the site.

In cases where downgradient average concentrations are higher than observed concentrations upgradient for a given constituent, an independent study and hydrogeological investigation would be required to identify local geochemical conditions and expected groundwater quality for the region to justify an intrawell approach. Such an assessment is beyond the scope of services provided by Groundwater Stats Consulting. When there is not an obvious explanation for observed concentration differences in downgradient wells relative to reported concentrations in upgradient wells, interwell prediction limits will initially be selected for the statistical method until further evidence shows that concentrations are due to natural variation rather than a result of the facility.

Parametric tolerance limits were constructed with a target of 99% confidence and 95% coverage using pooled upgradient well data for each of the Appendix III parameters. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. As more data are collected, the background population is better represented and the confidence and coverage levels increase.

Confidence intervals were constructed on downgradient wells for each of the Appendix III parameters, using the tolerance limits discussed above, to determine intrawell eligibility. When the entire confidence interval is above a background standard for a given parameter, interwell methods are initially recommended as the statistical method. Therefore, only parameters with confidence intervals which did not exceed background standards are eligible for intrawell prediction limits.

Confidence intervals for the above parameters were found to be within their respective background limit for all Appendix III parameters with the exception of boron. Therefore, intrawell methods are recommended for calcium, chloride, fluoride, pH, sulfate and TDS; and interwell methods are recommended initially for boron. As mentioned earlier, if a demonstration supports natural variation in groundwater, intrawell methods will be considered for all parameters.

All available data through June 2017 at each well were used to establish intrawell background limits based on a 1-of-2 resample plan that will be used for future comparisons. Interwell prediction limits, combined with a 1-of-2 resample plan, were constructed from upgradient wells for boron. Downgradient measurements are compared to these background limits during each subsequent semi-annual sampling event.

Natural systems continuously evolve due to physical changes made to the environment. Examples include capping a landfill, paving areas near a well, or lining a drainage channel to prevent erosion. Periodic updating of background statistical limits will be necessary to accommodate these types of changes In the interwell case, newer data will be included in background during each event after careful screening for any new outliers or changes in concentrations. In the intrawell case, data for all wells and constituents are re-evaluated when a minimum of 4 new data points are available to determine whether earlier concentrations are representative of present-day groundwater quality. In some cases, the earlier portion of data are deselected prior to construction of limits in order to provide sensitive limits that will rapidly detect changes in groundwater quality. Even though the data are excluded from the calculation, the values will continue to be reported and shown in tables and graphs.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of an additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered to be a false positive result and, therefore, no further action is necessary.

Appendix III Background Update – November 2019

Prior to updating background data, samples are re-evaluated for all wells for parameters tested with intrawell analyses (calcium, chloride, fluoride, pH, sulfate and TDS), and for combined upgradient well data for parameters tested with interwell analyses (boron) using Tukey’s outlier test and visual screening for all historical data through June 2019 samples (Figure C). When Tukey's outlier test detects an outlier for the most recent sample, it will not be flagged in the event that the data precede a trend that is more representative of current concentrations. No outliers were identified for the Appendix III parameters during this screening. A summary of Tukey's test results and flagged outliers follows this letter.

For constituents requiring intrawell prediction limits, the Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through June 2017 to the new compliance samples at each well through March 2019 to evaluate whether the groups are statistically different at the 99% confidence level, in which case background data may be updated with compliance data (Figure D).

The following well/constituent pairs were noted to have statistically significant lower medians in the more recent set of measurements when compared to background data: calcium, sulfate and TDS in downgradient well B-10 and TDS in downgradient well B-6. A statistically significant difference was noted for sulfate in downgradient well B-9 which had a higher median in more recent data compared to the historical data. Typically, when the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background are not updated to include the newer data but will be reconsidered in the future.

However, when the entire records were evaluated using the time series graphs, more recent concentrations appeared only slightly different from historical measurements. In the case of sulfate in well B-9, more recent measurements are similar to those reported upgradient of the facility indicating natural variability in groundwater. It was noted that earlier measurements for sulfate and TDS at well B-2 were higher than those reported currently. Because these measurements represent pre-waste data, they are currently retained in the records. For these reasons, combined with the limited data available at this time, all background data sets were updated through March 2019. All data will be re-evaluated during the next background update and, if it is determined that historical measurements are no longer representative of recent measurements, records will be adjusted at that time. In cases where concentrations are increasing in a downgradient well but similar patterns are not occurring in at least one upgradient well, further investigation would be required prior to updating the data set with more recent measurements. A summary of these results follows this letter and the test results are included with the Mann Whitney test section at the end of this report.

Intrawell prediction limits using all historical data through March 2019, combined with a 1-of-2 resample plan, were constructed for calcium, chloride, fluoride, pH, sulfate and TDS (Figure E).

For boron, which is tested using interwell prediction limits, the Sen's Slope/Mann-Kendall trend test was used on upgradient wells to determine whether concentrations are statistically increasing, decreasing or stable (Figure F). No statistically significant increasing or decreasing trends were noted. As more data are collected, all upgradient well data will be re-evaluated for possible deselection of earlier measurements if they no longer represent present-day groundwater quality conditions. A summary of those results is included with the trend tests.

Interwell prediction limits, combined with a 1-of-2 resample plan, were updated using all available data from upgradient wells for the same time period for boron (Figure G). Interwell prediction limits pool upgradient well data to establish a background limit for an individual constituent. A summary table of the updated limits may be found following this letter in the Prediction Limit Summary Tables.

Evaluation of Appendix IV Parameters

Parametric tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters with a target of 95% confidence and 95% coverage to determine the Alternate Contaminant Level (ACL) (Figure H). All are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. It was noted that several constituents had higher reported concentrations in several wells during the September and November 2016 events which appear to be either a laboratory or sampling issue. Therefore, these values were flagged as outliers since they do not represent the population within these wells. Additionally, several reporting limits for the metals are significantly lower beginning in March 2019 than those reported historically. No adjustment was made at this time; however, all data will be re-evaluated during the next background update to determine whether a substitution of the most recent reporting limit is required. For lithium, the reporting limit during the June 2019 event increased from a historical limit of 0.001 mg/L to 0.1 mg/L. Therefore, this value was flagged in all wells as it appears to be related to laboratory or sampling practices. A summary of Tukey's test results and flagged outliers follows this letter.

Any flagged values may be seen on the Outlier Summary following this letter. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum

Contaminant Levels (MCLs) and CCR-Rule specified levels in the Groundwater Protection Standard (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure I).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of the MCL, CCR-Rule specified level, or ACL as discussed above (Figure J). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No confidence intervals exceedances were found. A summary of the confidence interval results follows this letter.

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Flint Creek Landfill. If you have any questions or comments, please feel free to contact me.

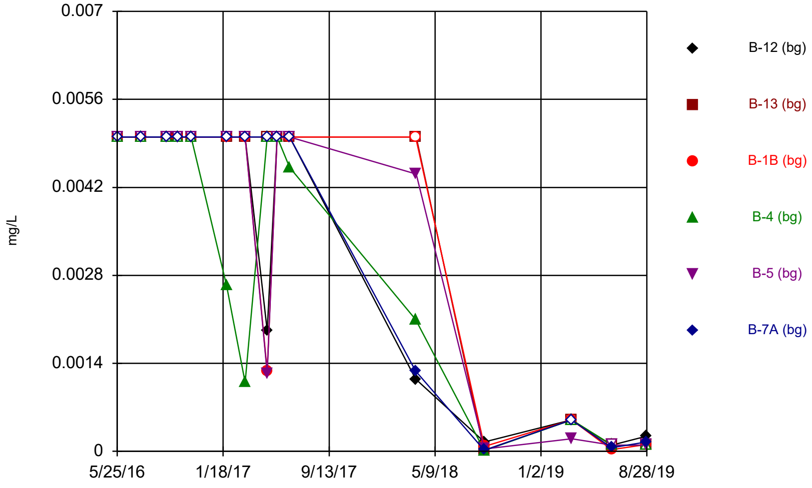
For Groundwater Stats Consulting,

Kristina Rayner

Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



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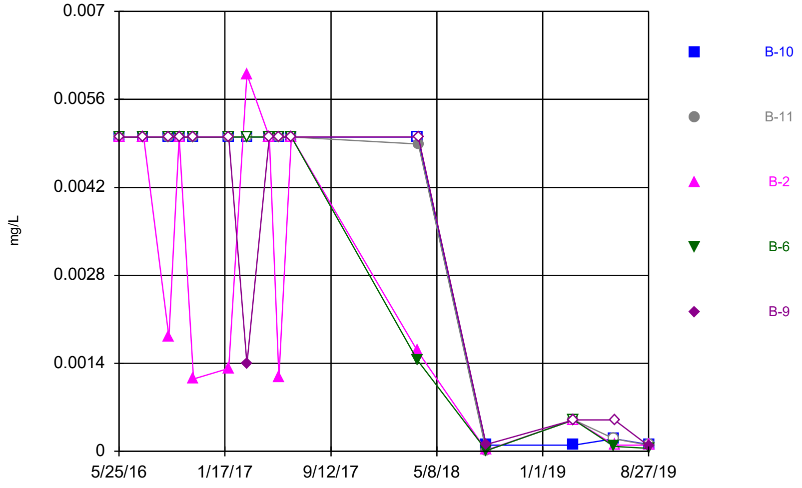

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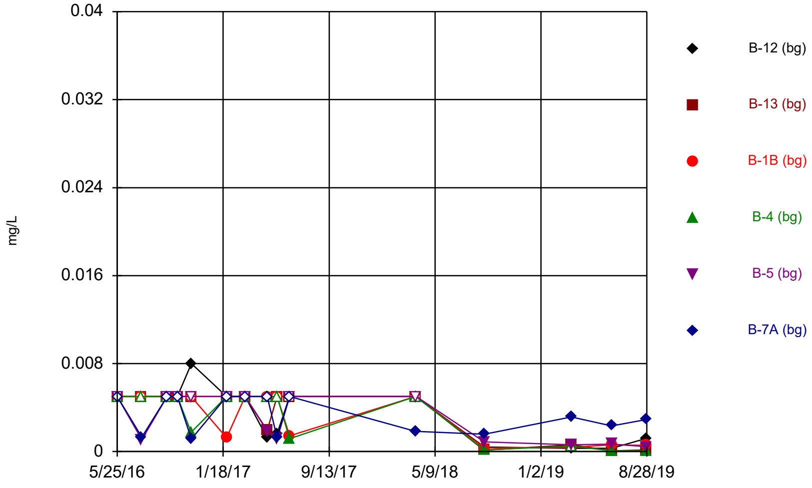

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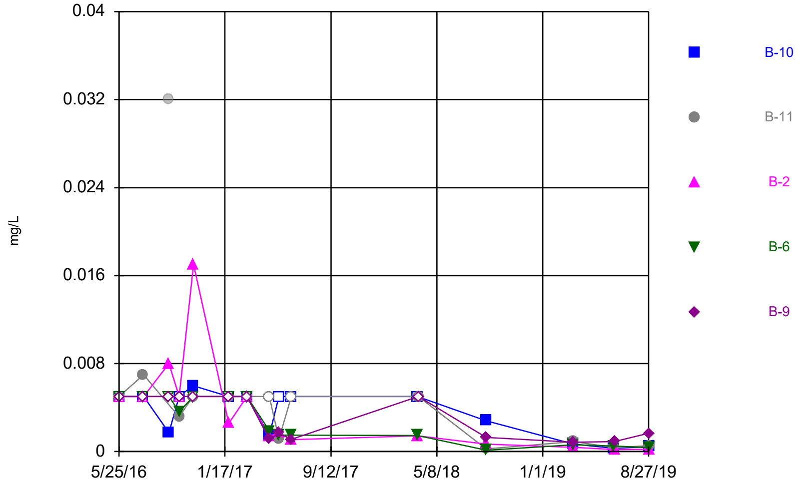

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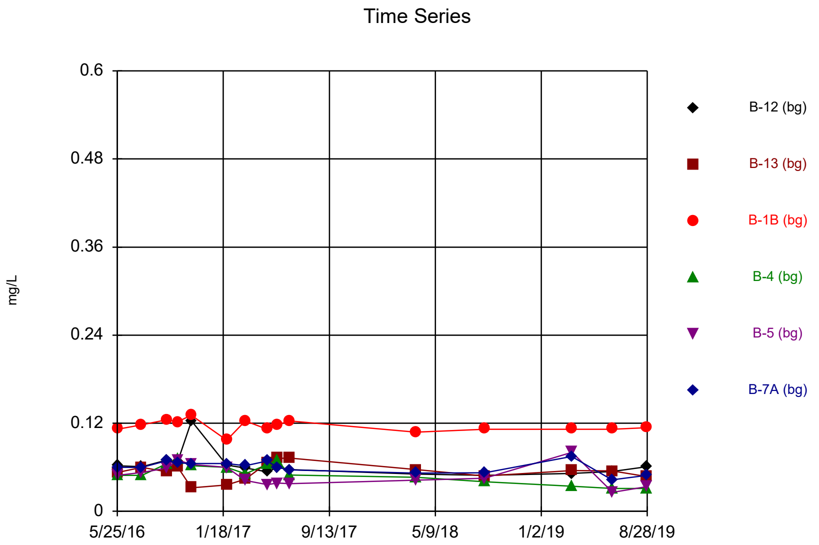

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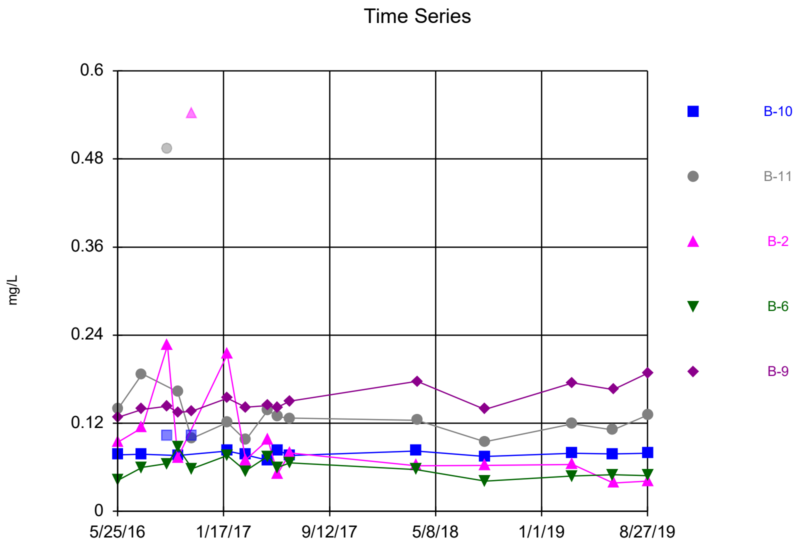

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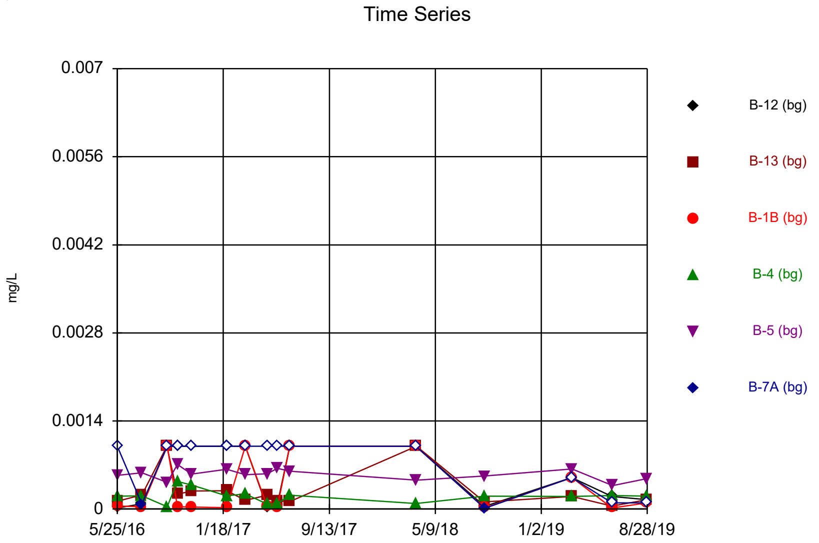

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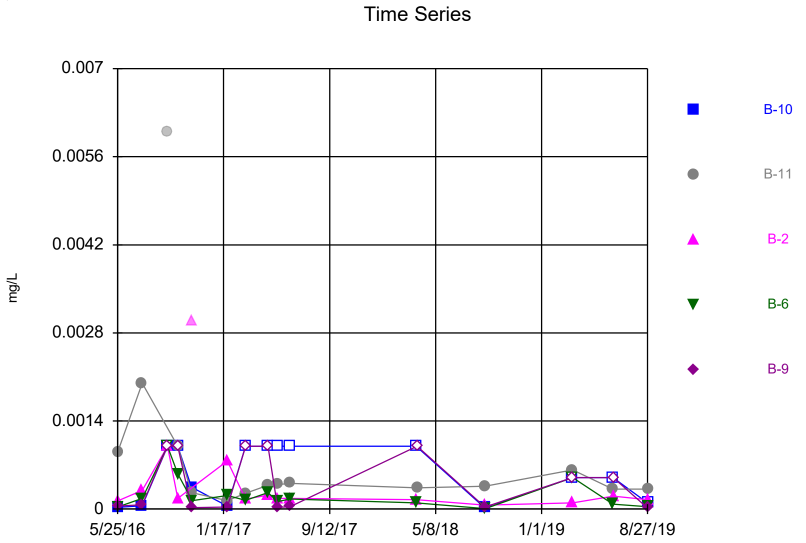

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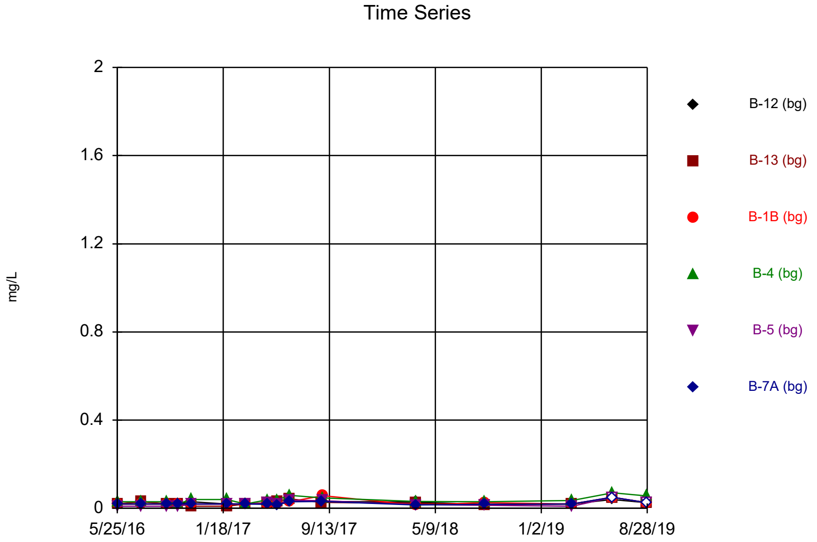

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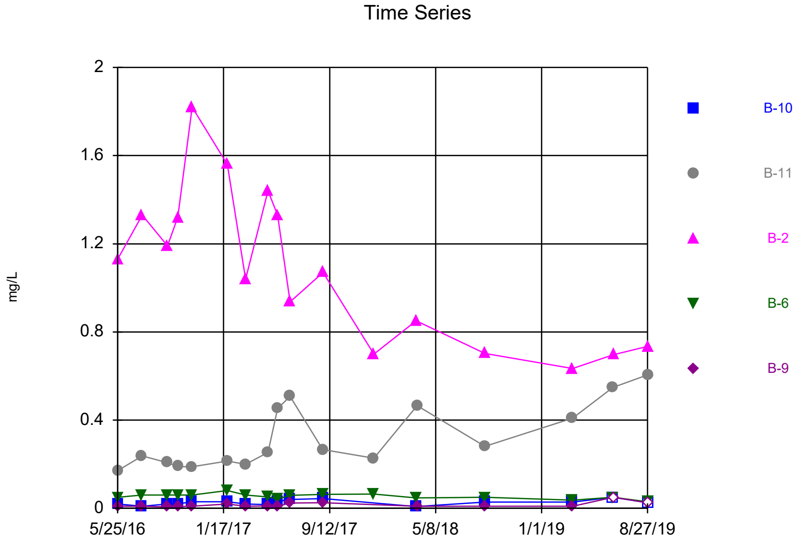

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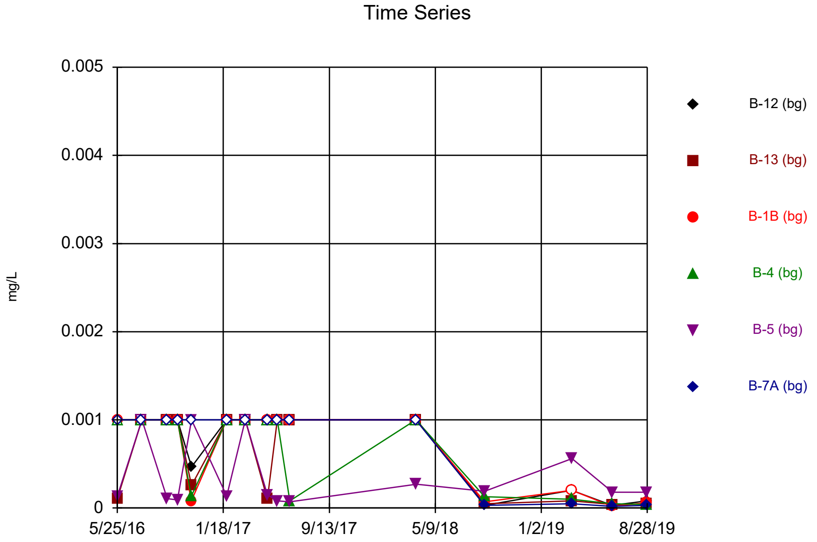

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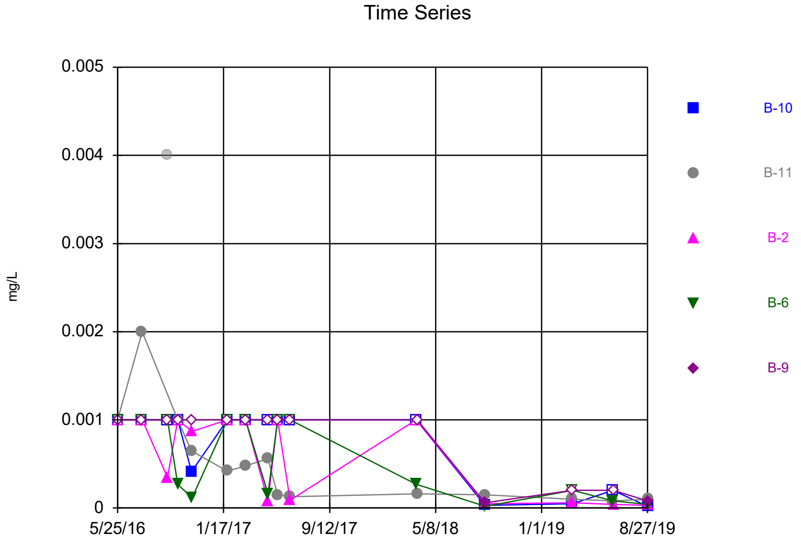

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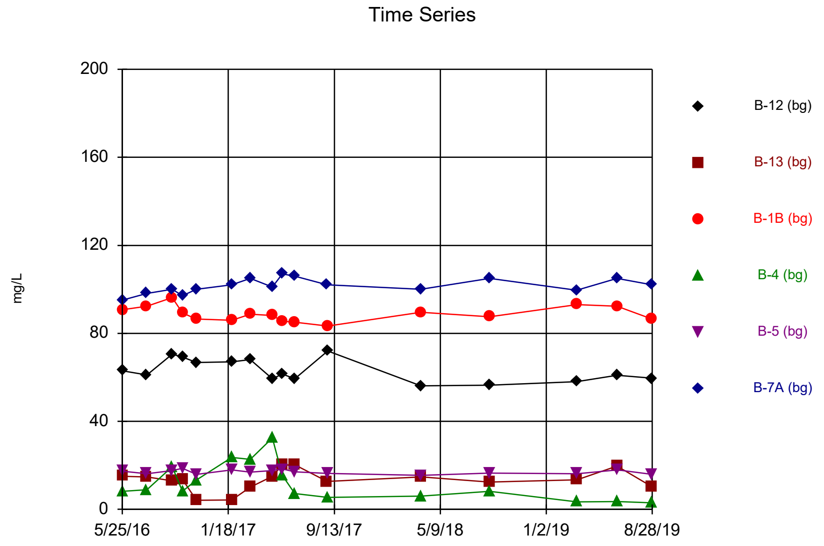

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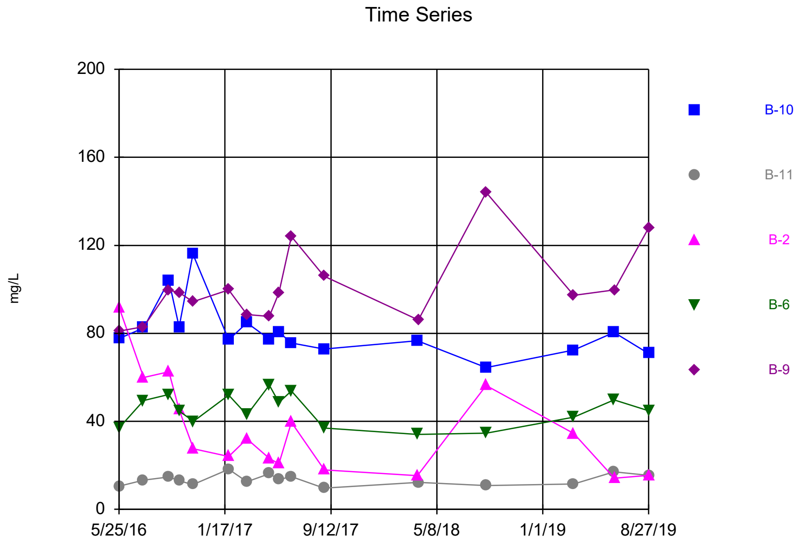

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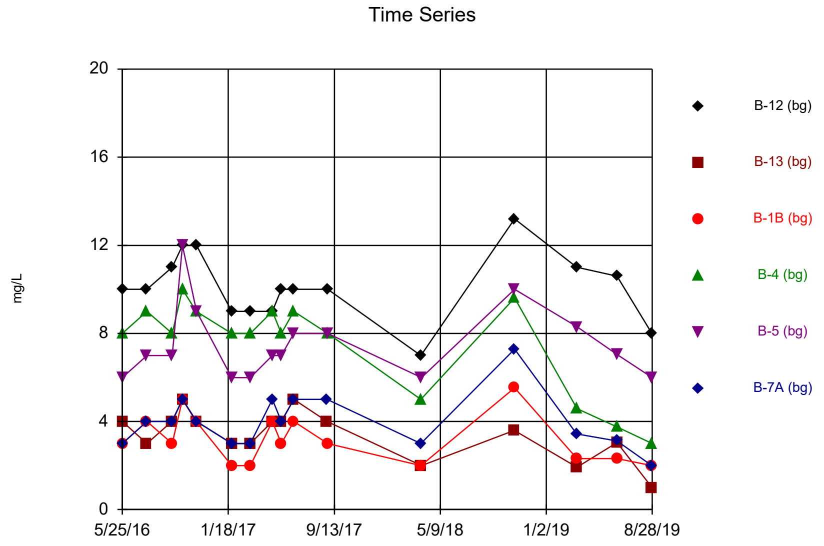

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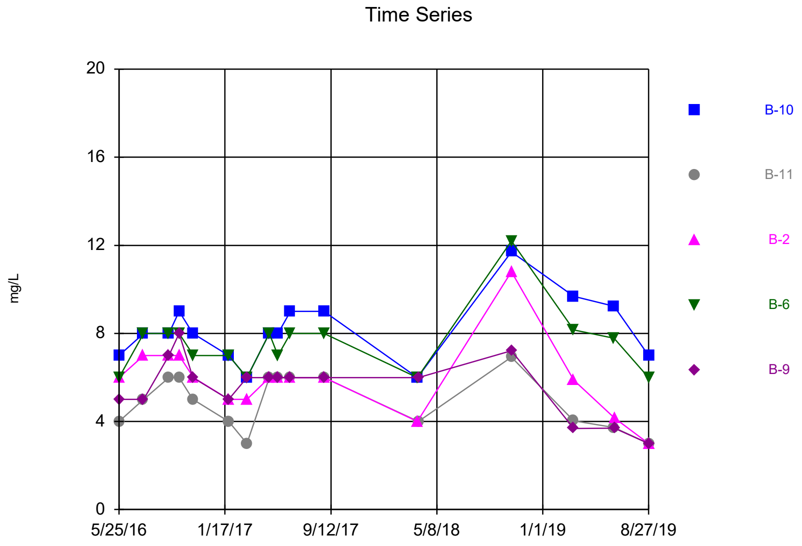

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Flint Creek LF Client: Geosyntec Data: Flint Creek LF

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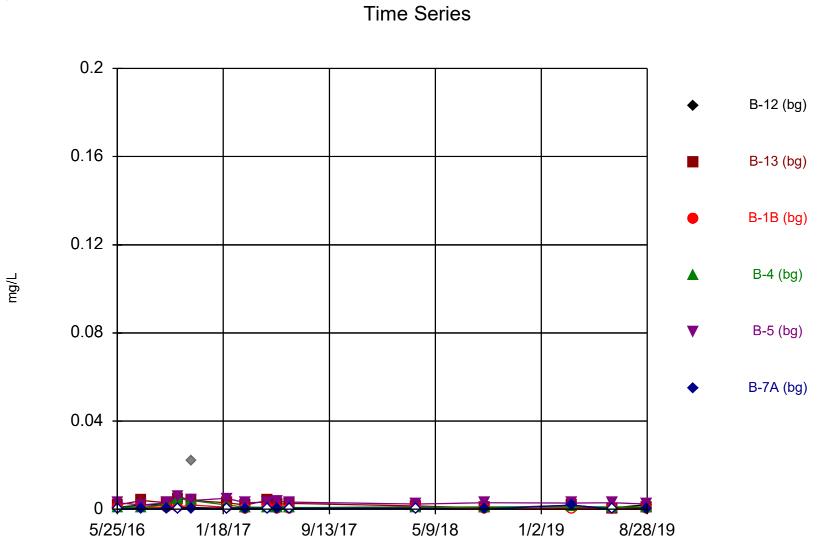
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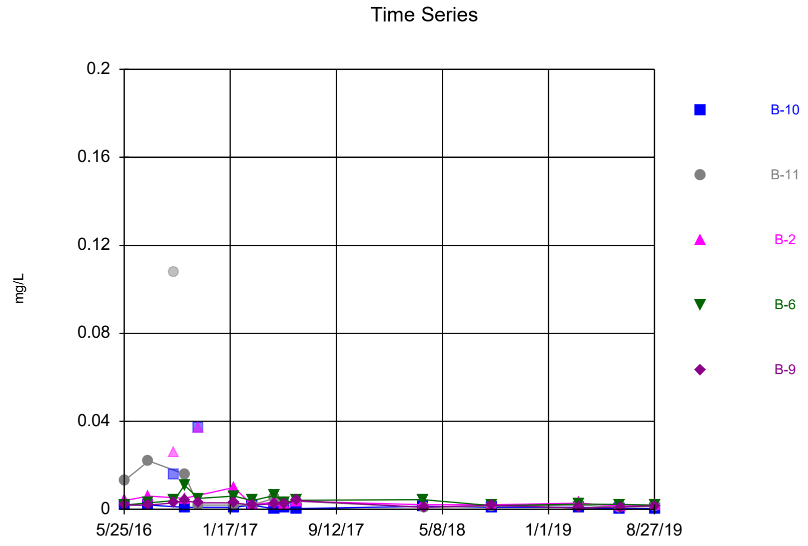
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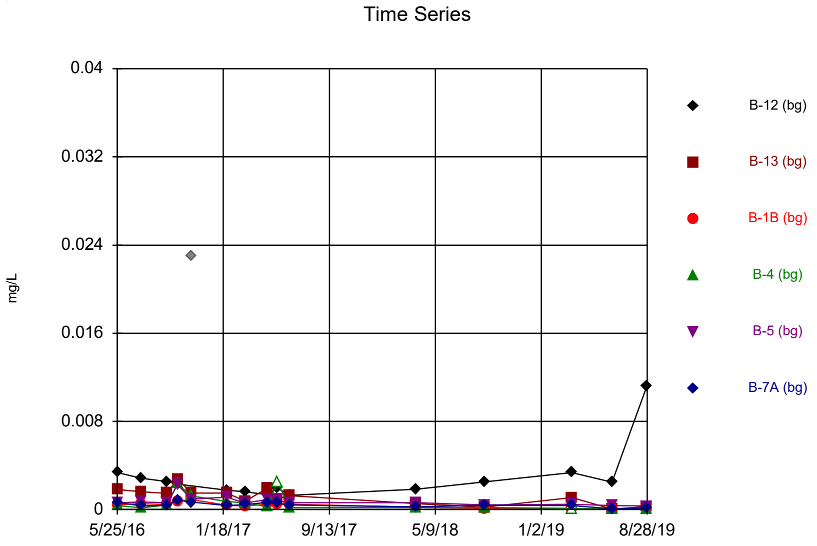
Time Series

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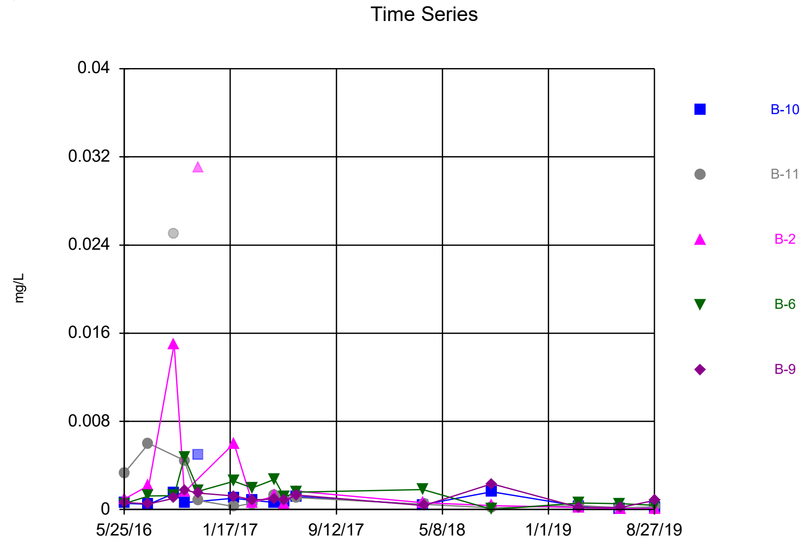
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

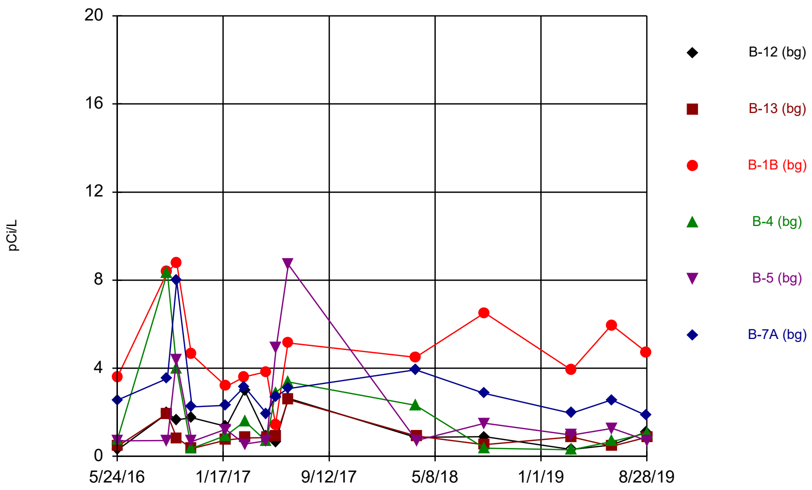
Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.


Time Series

Constituent: Cobalt, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

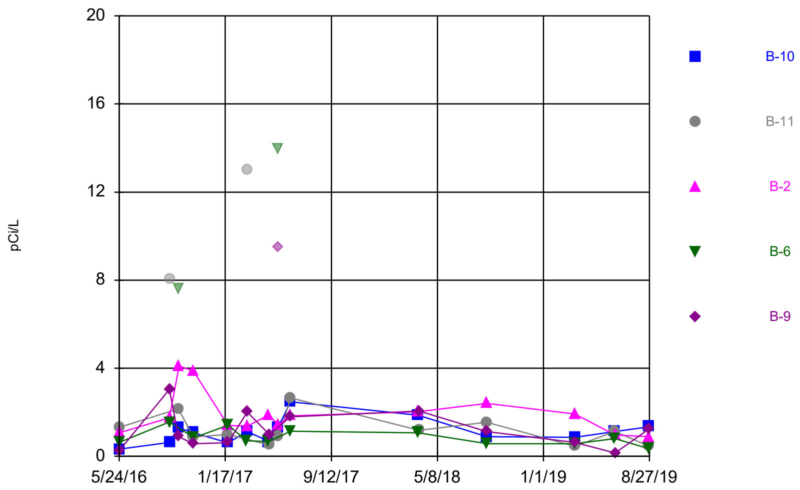
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

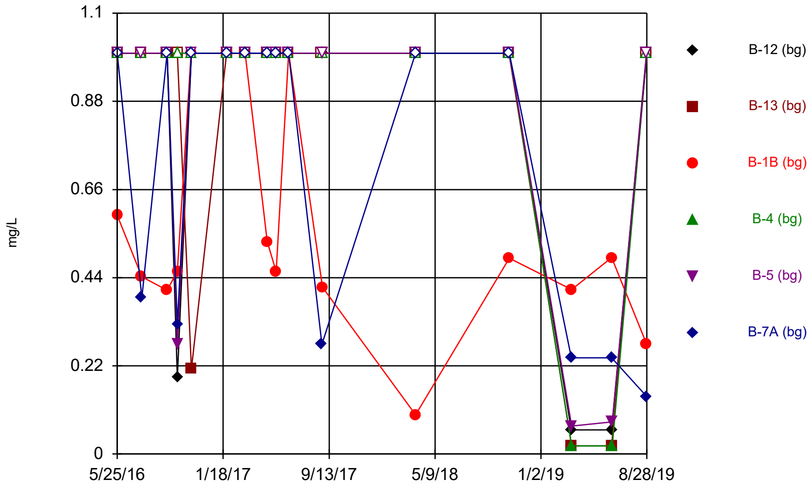
Time Series



Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

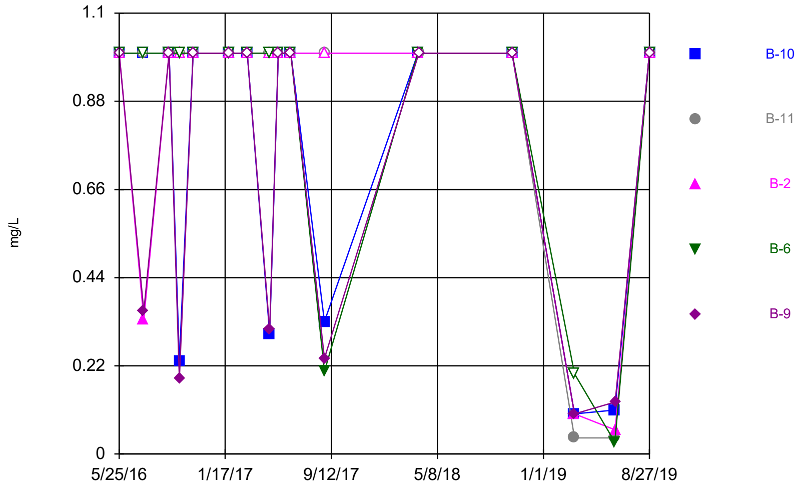
Time Series



Constituent: Fluoride, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

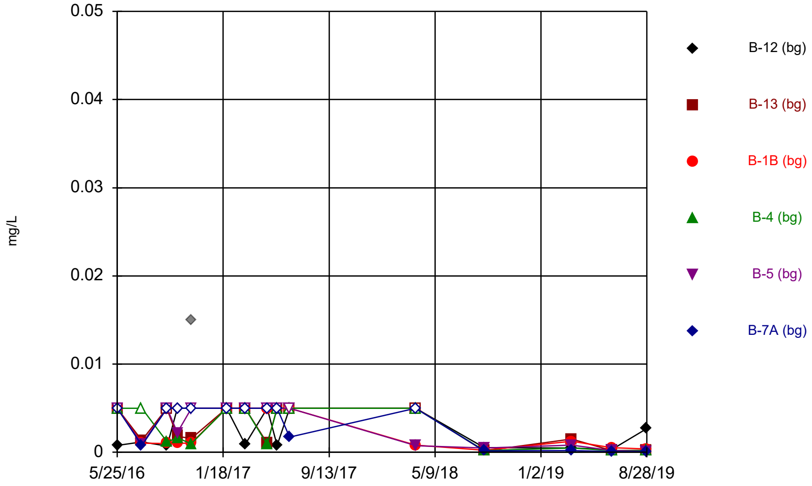
Time Series



Constituent: Fluoride, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

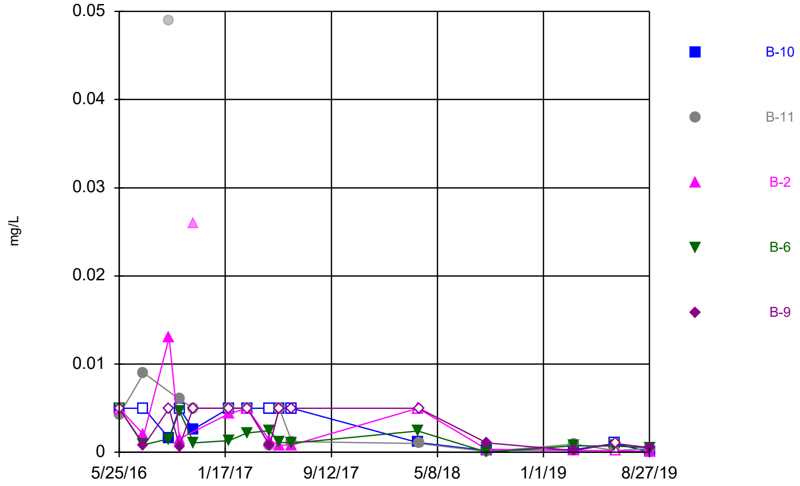
Time Series



Constituent: Lead, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

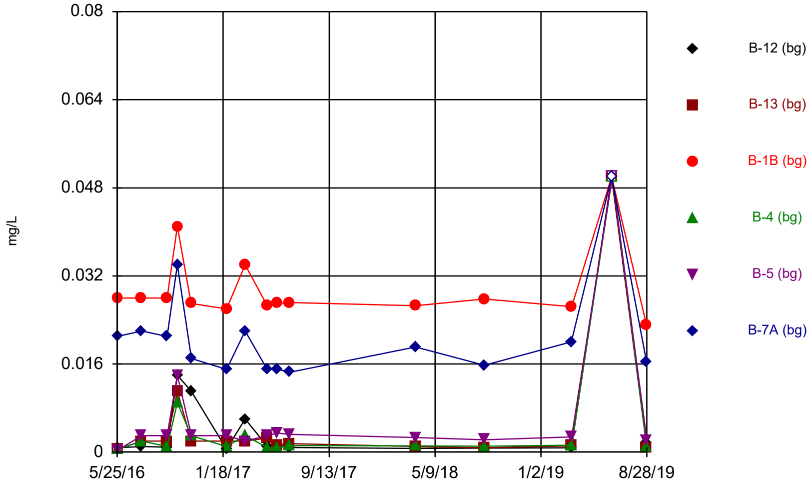
Time Series



Constituent: Lead, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

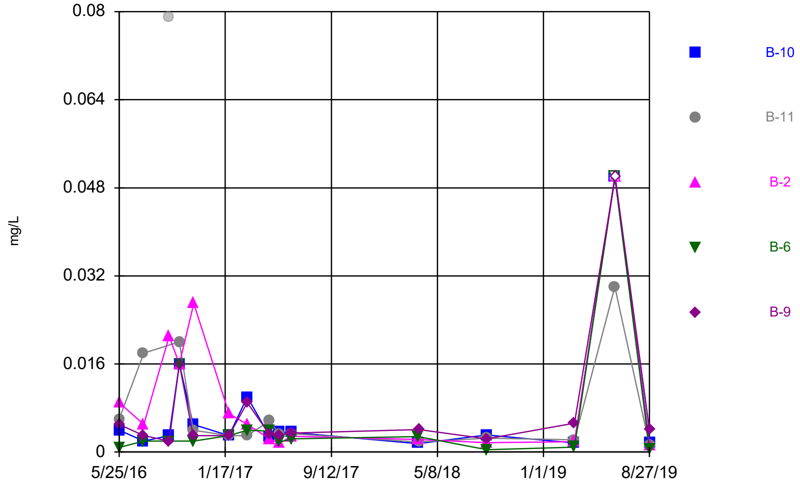
Time Series



Constituent: Lithium, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

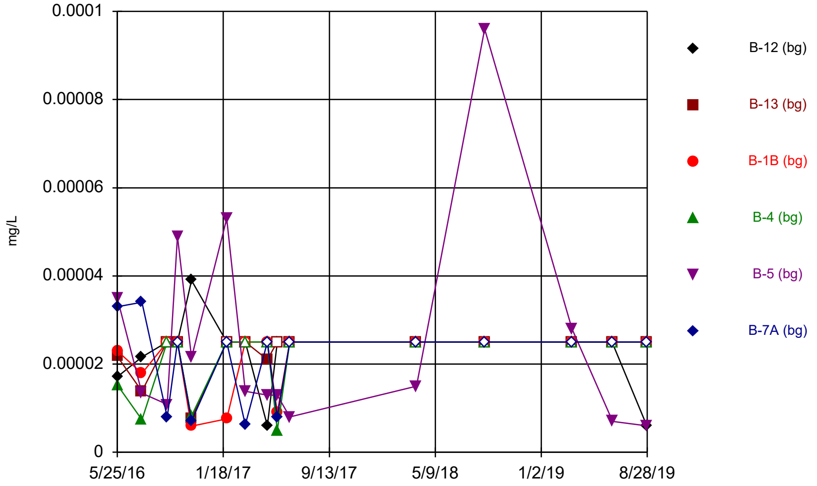
Time Series



Constituent: Lithium, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

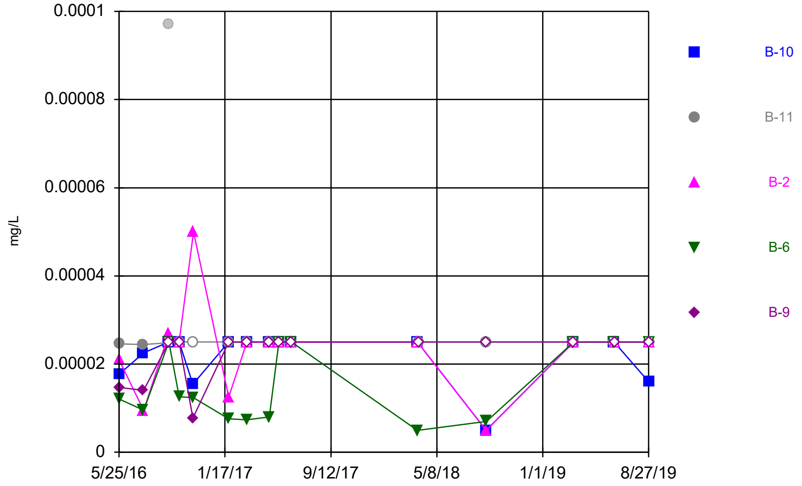
Time Series



Constituent: Mercury, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

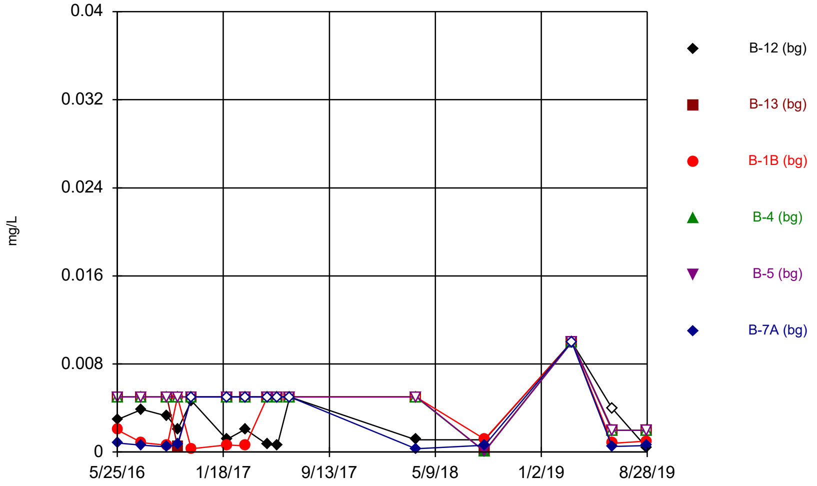
Time Series



Constituent: Mercury, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

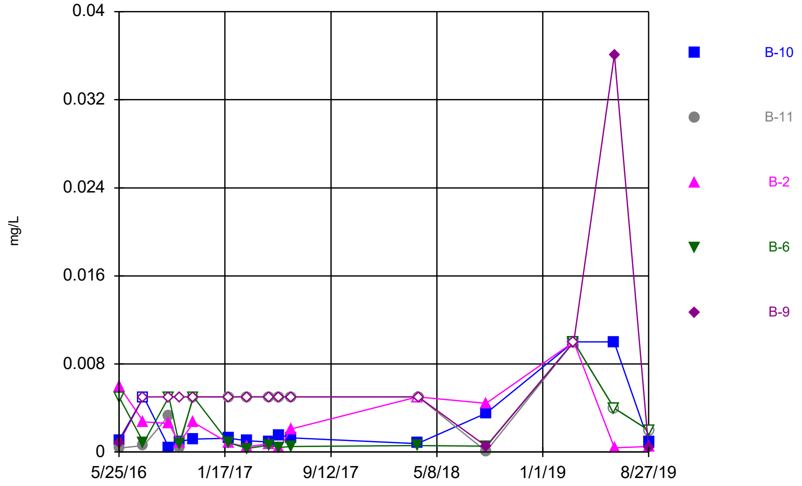
Time Series



Constituent: Molybdenum, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

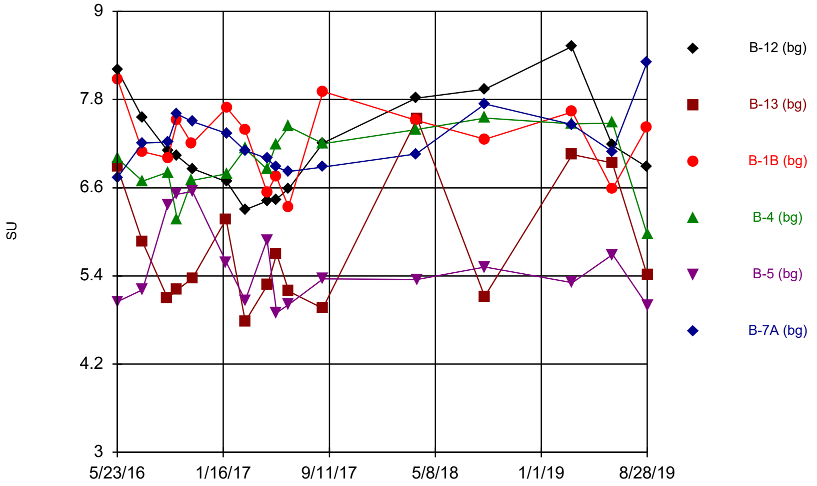
Time Series



Constituent: Molybdenum, total Analysis Run 12/8/2019 11:48 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

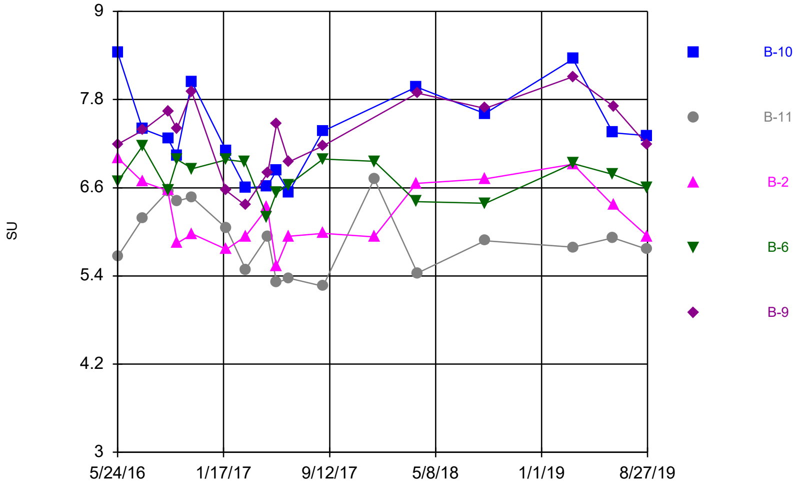


Constituent: pH, field   Analysis Run 12/8/2019 11:48 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

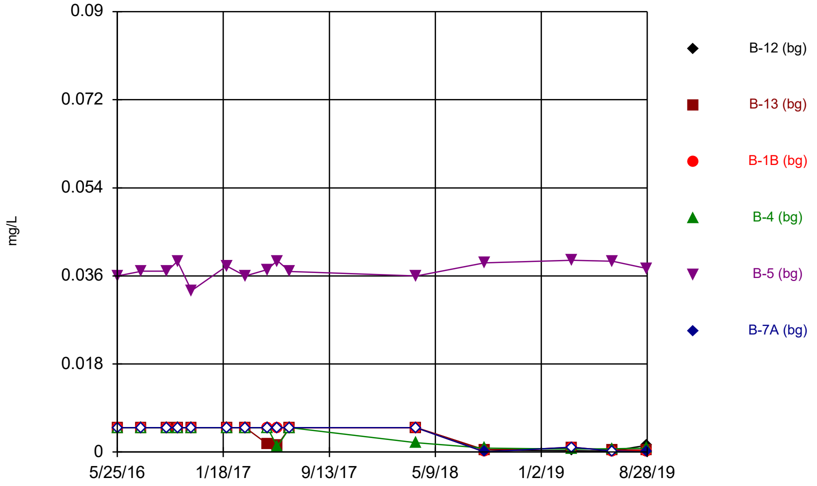


Constituent: pH, field   Analysis Run 12/8/2019 11:48 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series

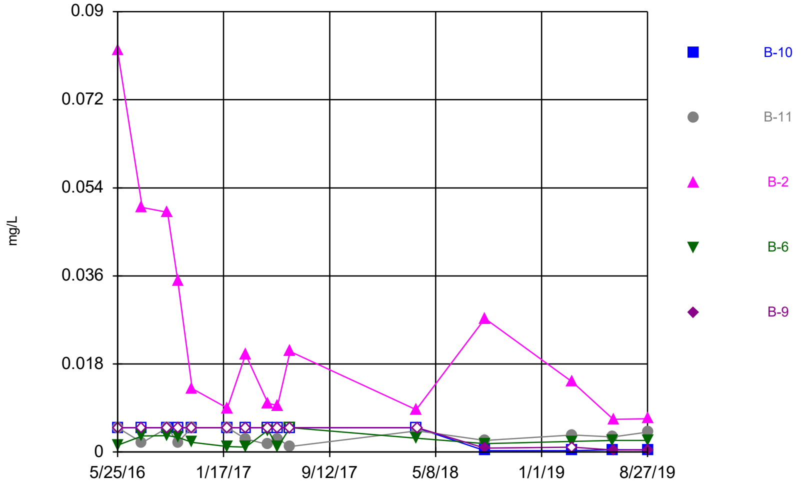


Constituent: Selenium, total   Analysis Run 12/8/2019 11:48 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series

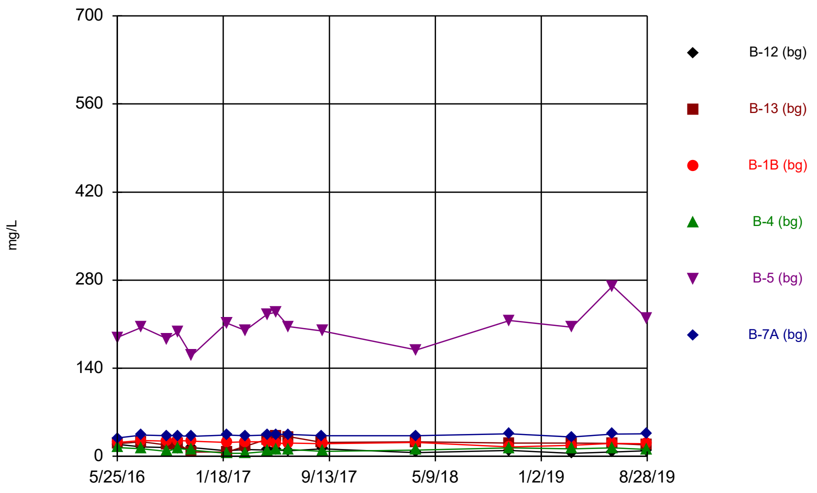


Constituent: Selenium, total   Analysis Run 12/8/2019 11:48 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series

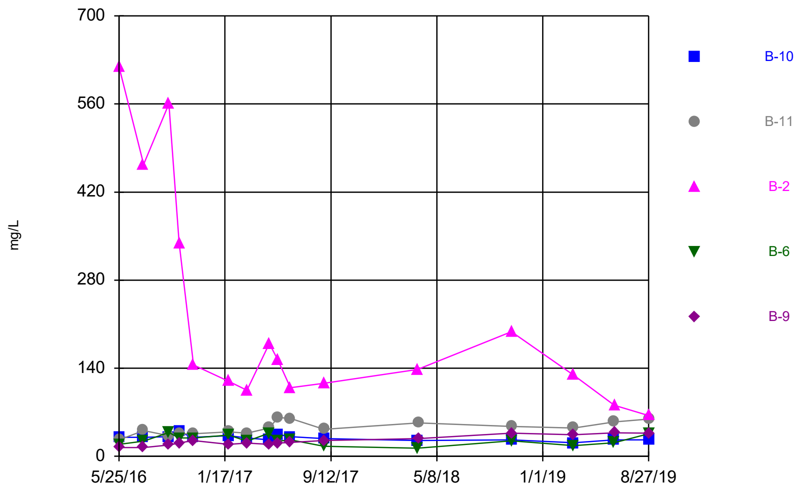


Constituent: Sulfate, total Analysis Run 12/8/2019 11:48 AM View: Descriptive

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



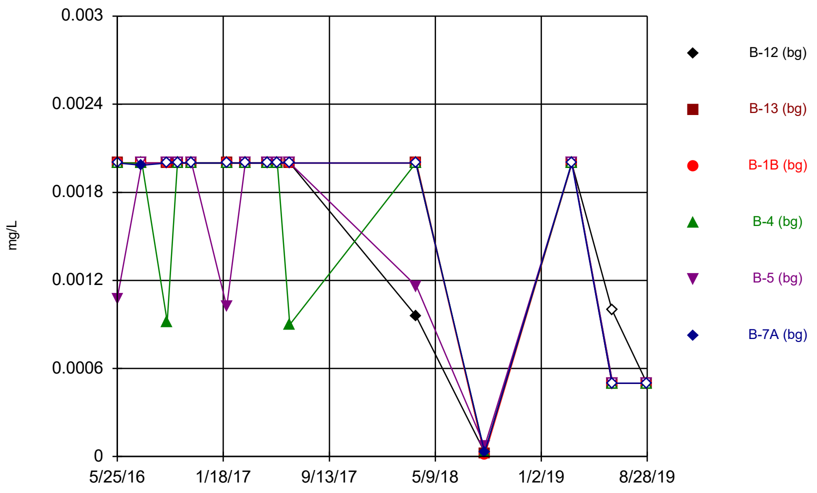
Constituent: Sulfate, total Analysis Run 12/8/2019 11:48 AM View: Descriptive

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series



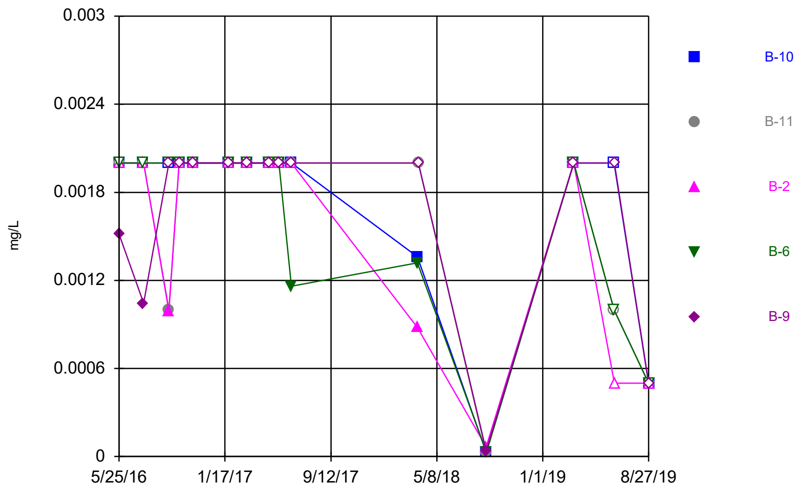
Constituent: Thallium, total Analysis Run 12/8/2019 11:48 AM View: Descriptive

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Time Series

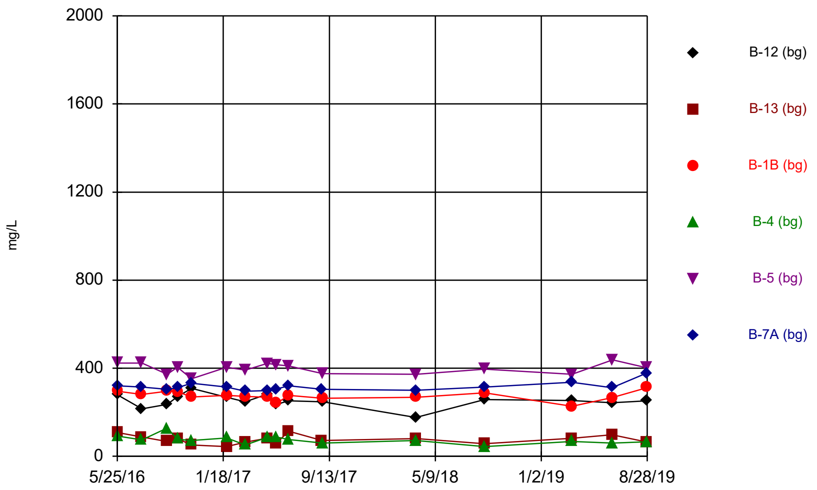


Constituent: Thallium, total Analysis Run 12/8/2019 11:48 AM View: Descriptive

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

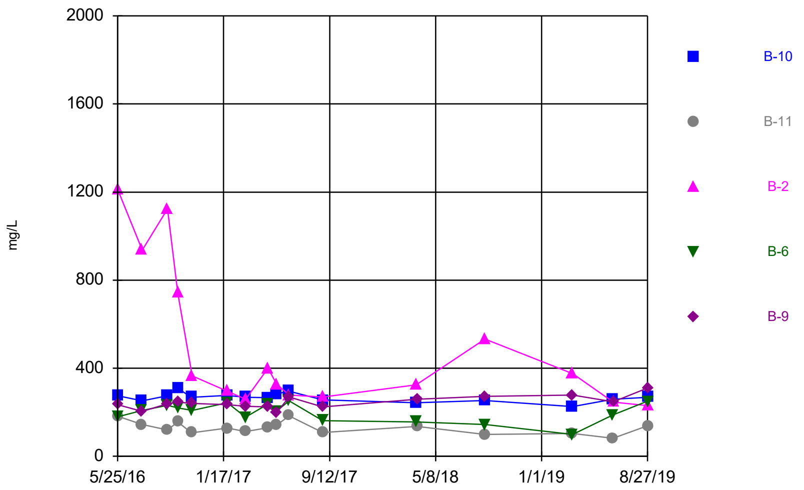
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 11:49 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

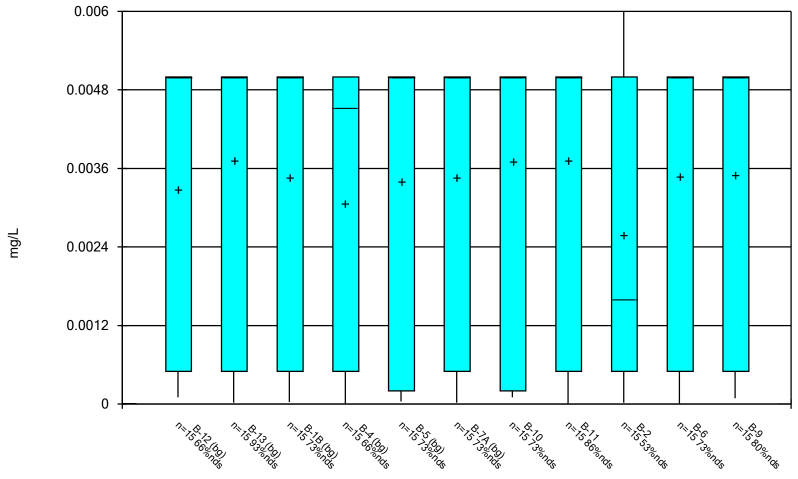
Time Series



Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 11:49 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

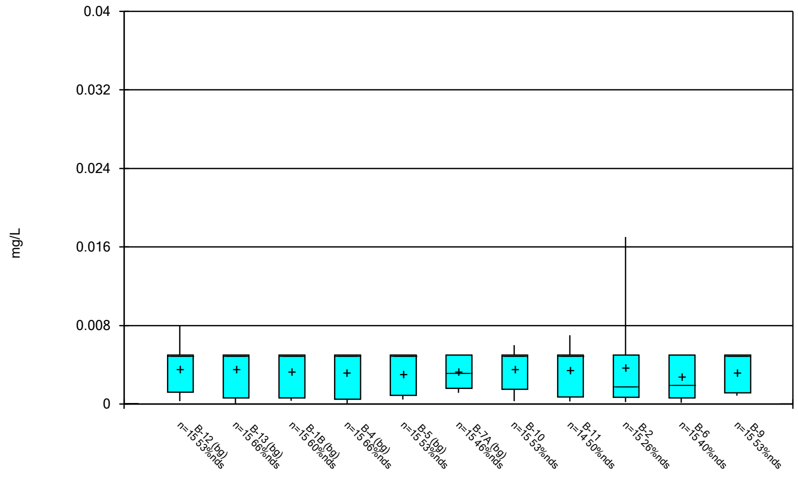
Box & Whiskers Plot



Constituent: Antimony, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

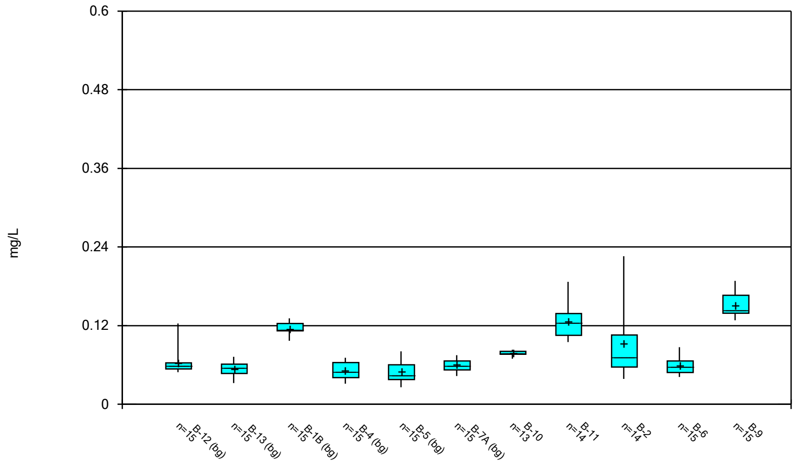
Box & Whiskers Plot



Constituent: Arsenic, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

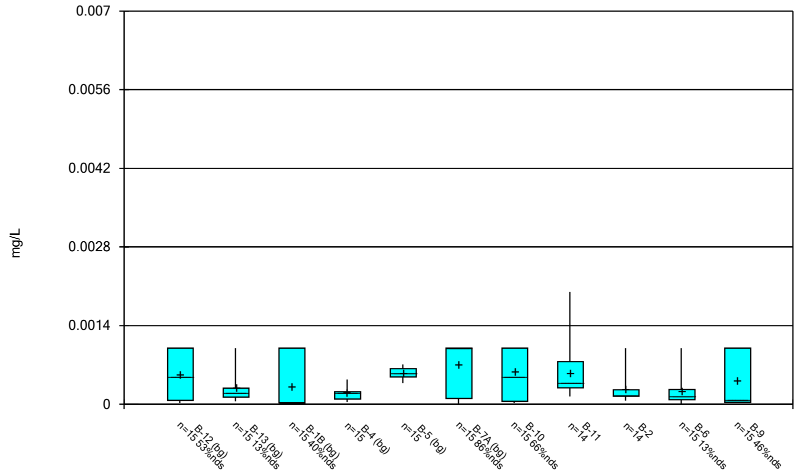
Box & Whiskers Plot



Constituent: Barium, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

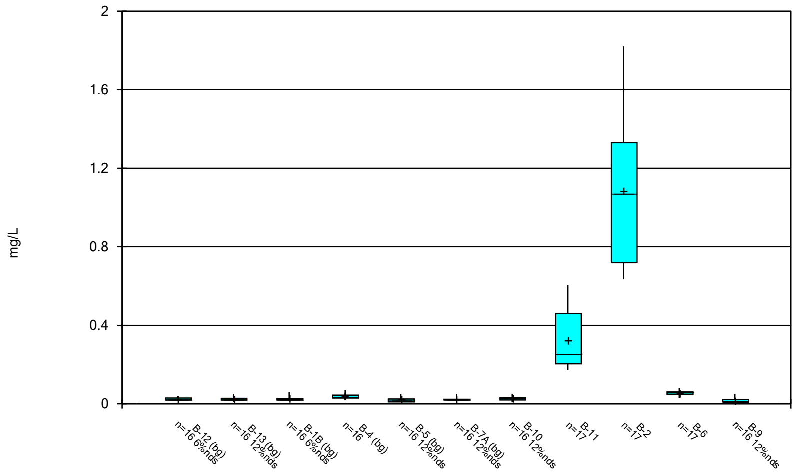
Box & Whiskers Plot



Constituent: Beryllium, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

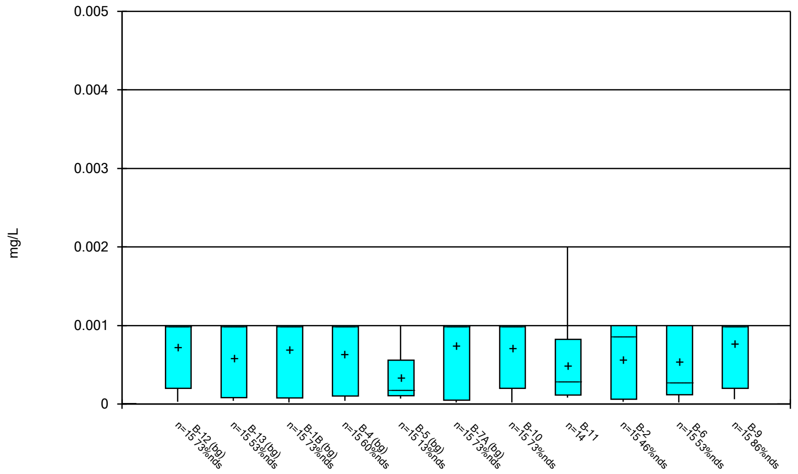
Box & Whiskers Plot



Constituent: Boron, total Analysis Run 12/8/2019 11:50 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

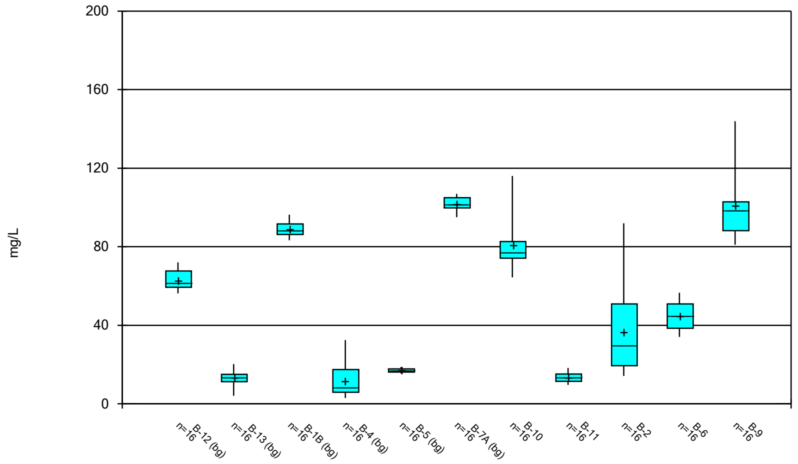
Box & Whiskers Plot



Constituent: Cadmium, total Analysis Run 12/8/2019 11:50 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

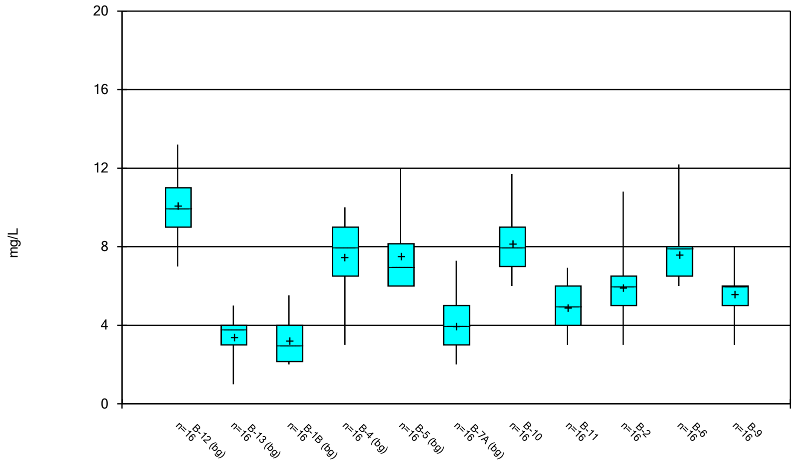
Box & Whiskers Plot



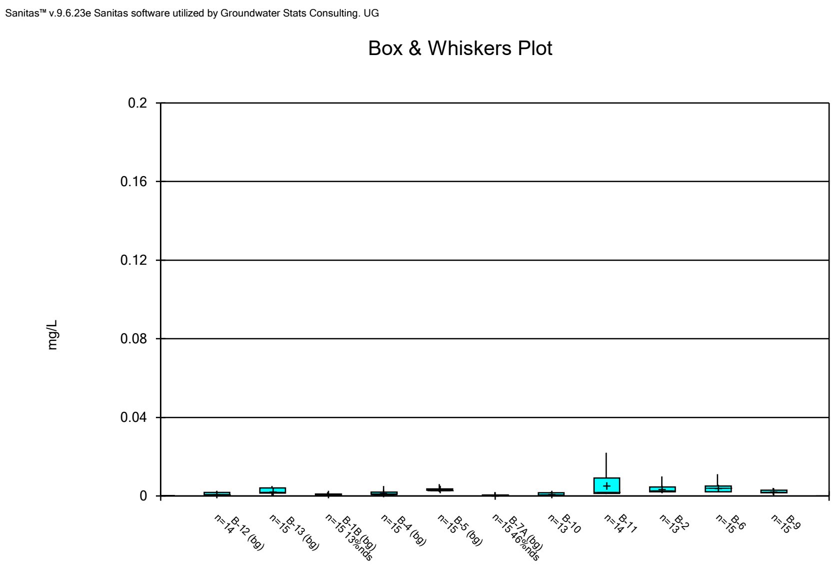
Constituent: Calcium, total Analysis Run 12/8/2019 11:50 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

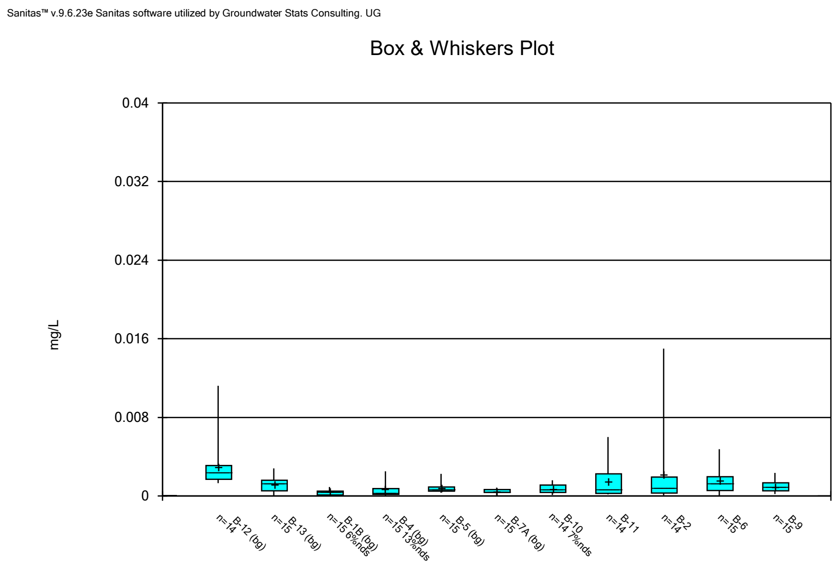
Box & Whiskers Plot



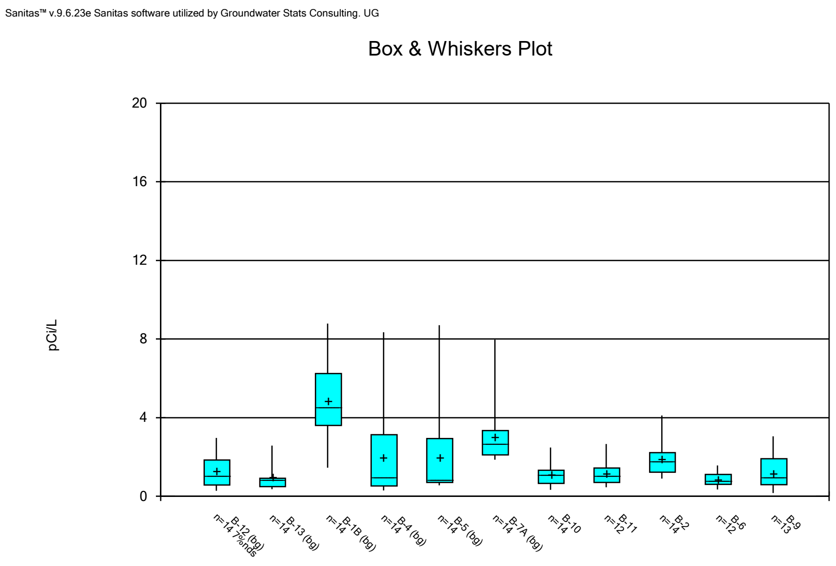
Constituent: Chloride, total Analysis Run 12/8/2019 11:50 AM View: Descriptive
Flint Creek LF Client: Geosyntec Data: Flint Creek LF



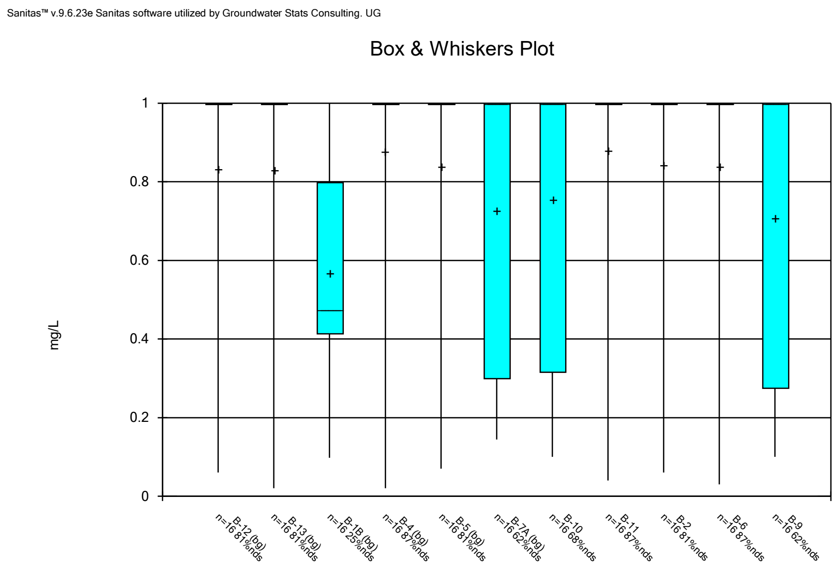
Constituent: Chromium, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF



Constituent: Cobalt, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF



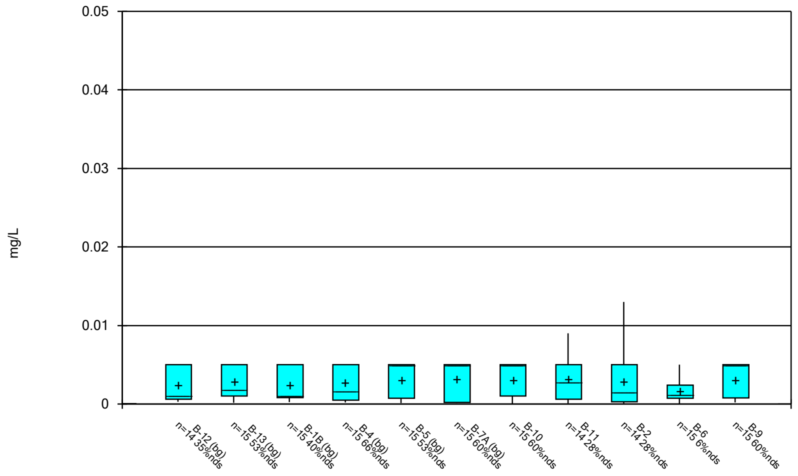
Constituent: Combined Radium 226 + 228   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF



Constituent: Fluoride, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

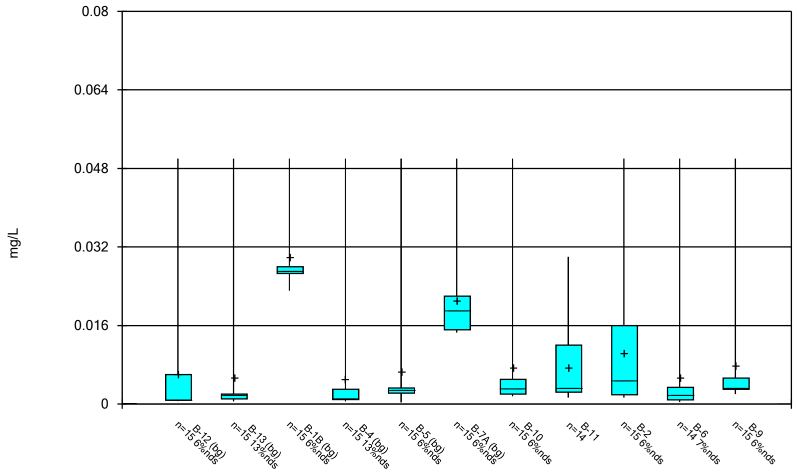


Constituent: Lead, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

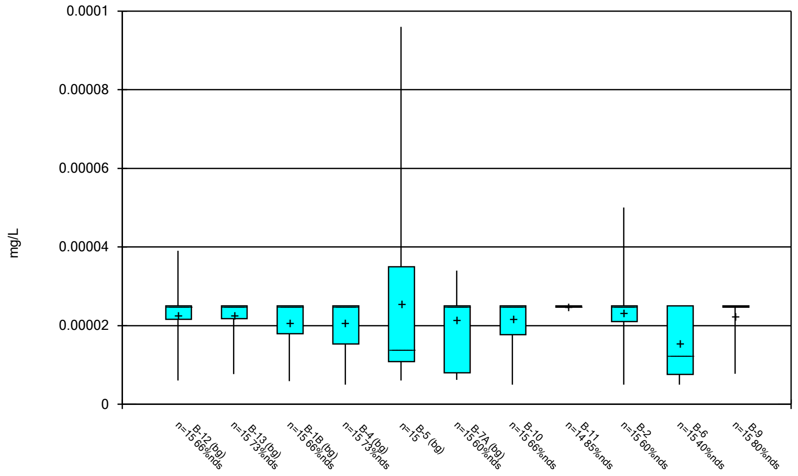


Constituent: Lithium, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

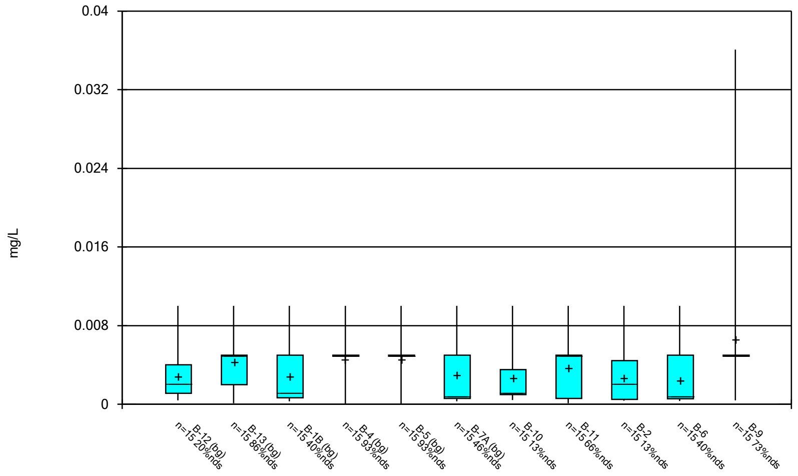


Constituent: Mercury, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

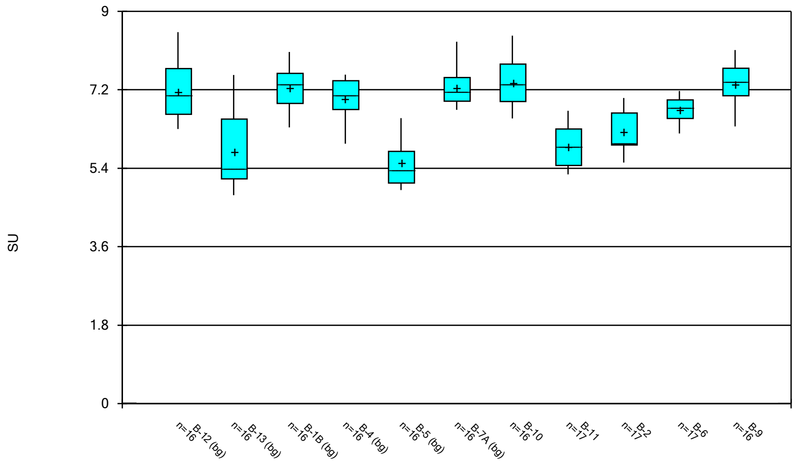


Constituent: Molybdenum, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

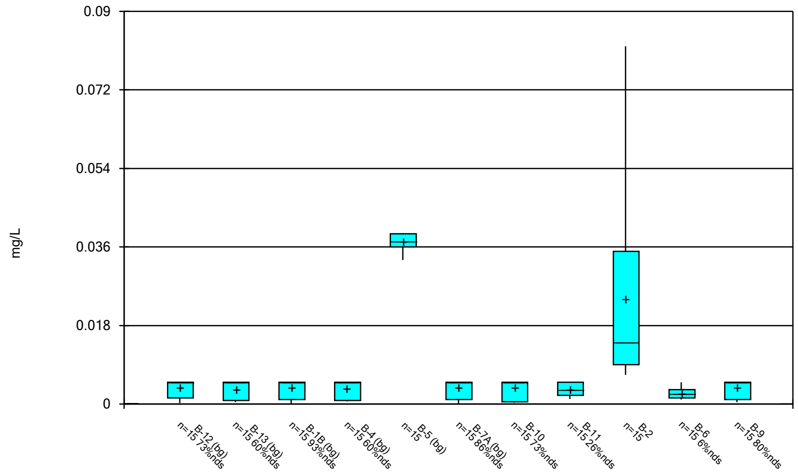


Constituent: pH, field   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

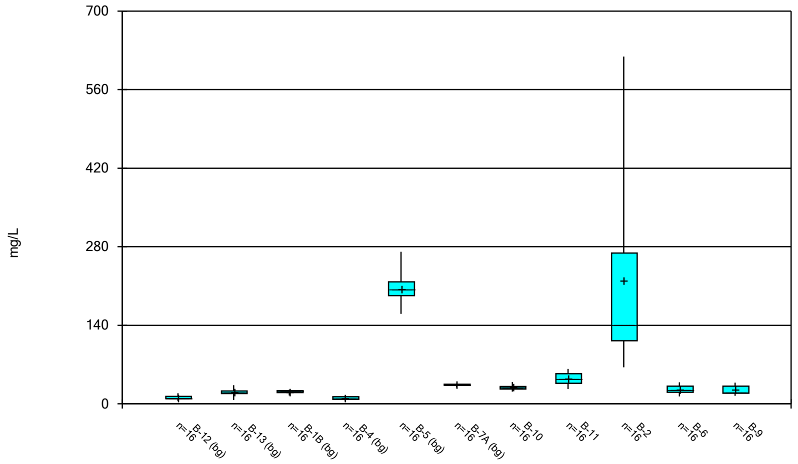


Constituent: Selenium, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

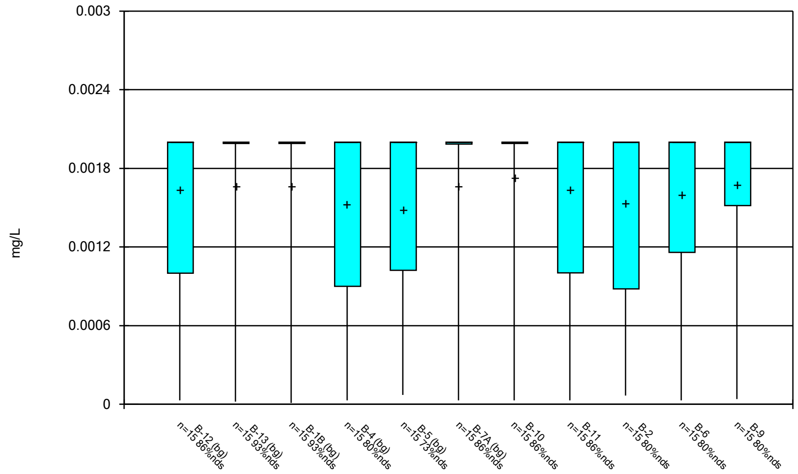


Constituent: Sulfate, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot

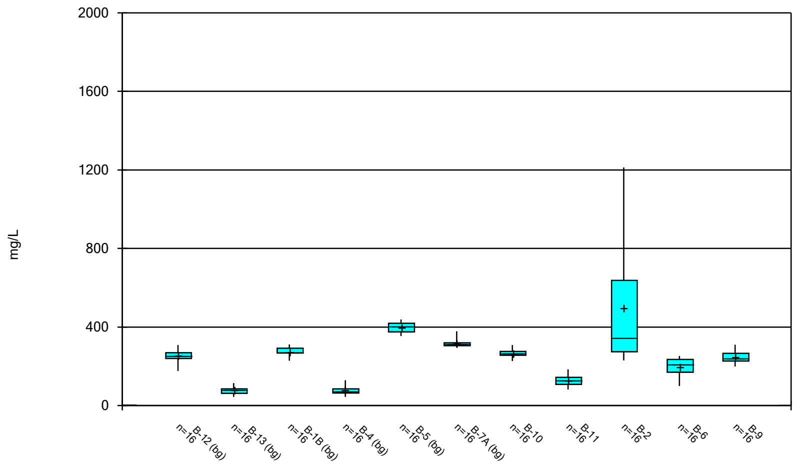


Constituent: Thallium, total   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 11:50 AM   View: Descriptive

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Outlier Summary

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 4:03 PM

	B-11 Arsenic, total (mg/L)	B-10 Barium, total (mg/L)	B-11 Barium, total (mg/L)	B-2 Barium, total (mg/L)	B-11 Beryllium, total (mg/L)	B-2 Beryllium, total (mg/L)	B-11 Cadmium, total (mg/L)	B-12 Chromium, total (mg/L)	B-10 Chromium, total (mg/L)	B-11 Chromium, total (mg/L)
9/14/2016	0.032 (o)	0.102 (o)	0.494 (o)		0.006 (o)		0.004 (o)		0.016 (o)	0.108 (o)
10/5/2016										
10/7/2016										
11/7/2016		0.103 (o)							0.037 (o)	
11/8/2016				0.543 (o)		0.003 (o)		0.022 (o)		
3/7/2017										
5/15/2017										
5/16/2017										
6/10/2019										
6/11/2019										

	B-2 Chromium, total (mg/L)	B-12 Cobalt, total (mg/L)	B-10 Cobalt, total (mg/L)	B-11 Cobalt, total (mg/L)	B-2 Cobalt, total (mg/L)	B-11 Combined Radium 226 + 228 (pCi/L)	B-6 Combined Radium 226 + 228 (pCi/L)	B-9 Combined Radium 226 + 228 (pCi/L)	B-12 Lead, total (mg/L)	B-11 Lead, total (mg/L)
9/14/2016	0.026 (o)			0.025 (o)		8.05 (o)				0.049 (o)
10/5/2016							7.58 (o)			
10/7/2016										
11/7/2016			0.005 (o)							
11/8/2016	0.037 (o)	0.023 (o)			0.031 (o)				0.015 (o)	
3/7/2017						12.993 (o)				
5/15/2017							13.943 (o)			
5/16/2017								9.472 (o)		
6/10/2019										
6/11/2019										

	B-2 Lead, total (mg/L)	B-12 Lithium, total (mg/L)	B-13 Lithium, total (mg/L)	B-1B Lithium, total (mg/L)	B-4 Lithium, total (mg/L)	B-5 Lithium, total (mg/L)	B-7A Lithium, total (mg/L)	B-10 Lithium, total (mg/L)	B-11 Lithium, total (mg/L)	B-2 Lithium, total (mg/L)
9/14/2016									0.079 (o)	
10/5/2016										
10/7/2016										
11/7/2016										
11/8/2016	0.026 (o)									
3/7/2017										
5/15/2017										
5/16/2017										
6/10/2019		<0.1 (o)	<0.1 (o)	<0.1 (o)			<0.1 (o)	<0.1 (o)		
6/11/2019					<0.1 (o)	<0.1 (o)				<0.1 (o)

Outlier Summary

Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/8/2019, 4:03 PM

	B-6 Lithium, total (mg/L)	B-9 Lithium, total (mg/L)	B-11 Mercury, total (mg/L)
9/14/2016			9.7E-05 (o)
10/5/2016			
10/7/2016	0.016 (o)		
11/7/2016			
11/8/2016			
3/7/2017			
5/15/2017			
5/16/2017			
6/10/2019	<0.1 (o)		
6/11/2019		<0.1 (o)	

Outlier Analysis - Upgradient Wells

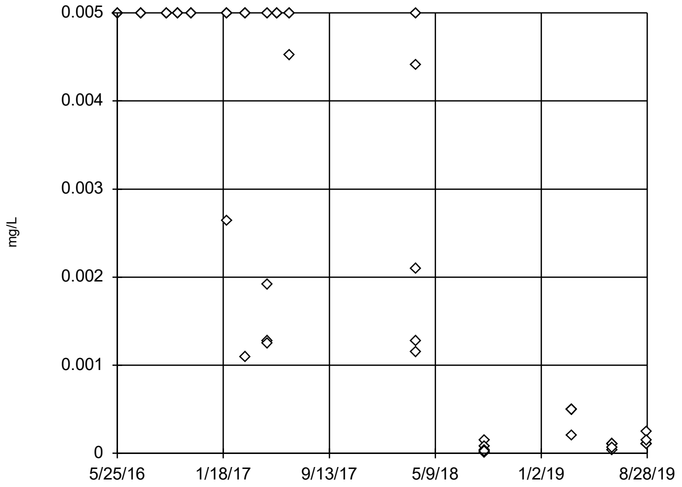
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 8:54 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	B-12,B-13,B-1B,B-...	n/a	n/a	n/a w/combined bg	NP	90	0.003399	0.002182	unknown	ShapiroFrancia
Arsenic, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.003352	0.002093	x^(1/3)	ShapiroFrancia
Barium, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.06563	0.02628	ln(x)	ShapiroFrancia
Beryllium, total (mg/L)	B-12,B-13,B-1B,B-...	n/a	n/a	n/a w/combined bg	NP	90	0.0004374	0.000376	unknown	ShapiroFrancia
Boron, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	96	0.02597	0.01193	ln(x)	ShapiroFrancia
Cadmium, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.0006192	0.0004441	ln(x)	ShapiroFrancia
Chromium, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.001853	0.002537	ln(x)	ShapiroFrancia
Cobalt, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.00127	0.002686	ln(x)	ShapiroFrancia
Combined Radium 226 + 228 (pCi/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	84	2.348	2.13	ln(x)	ShapiroFrancia
Lead, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.002921	0.002495	ln(x)	ShapiroFrancia
Lithium, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.01234	0.01467	ln(x)	ShapiroFrancia
Mercury, total (mg/L)	**B-12,B-13,B-1B,B-...**	**Yes**	**0.000096**	**n/a w/combined bg**	**NP**	**90**	**0.0000223**	**0.0000119**	**x^(1/3)**	**ShapiroFrancia**
Molybdenum, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.003703	0.002569	sqrt(x)	ShapiroFrancia
Selenium, total (mg/L)	**B-12,B-13,B-1B,B-...**	**Yes**	**0.00004,0.00004**	**n/a w/combined bg**	**NP**	**90**	**0.009233**	**0.01278**	**ln(x)**	**ShapiroFrancia**
Thallium, total (mg/L)	B-12,B-13,B-1B,B-...	No	n/a	n/a w/combined bg	NP	90	0.001608	0.0006799	normal	ShapiroFrancia

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found.
Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

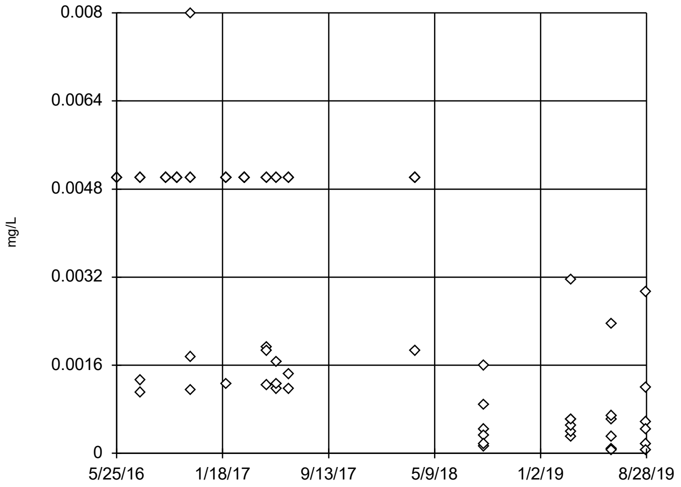
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Antimony, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found.
Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

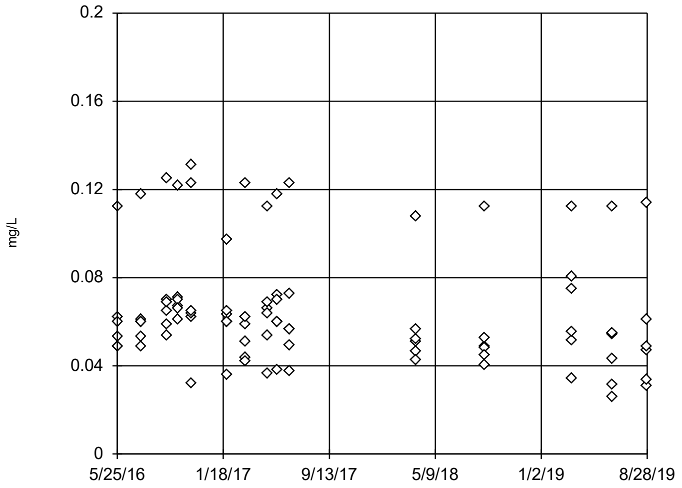
High cutoff = 0.04979, low cutoff = -0.0007662, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

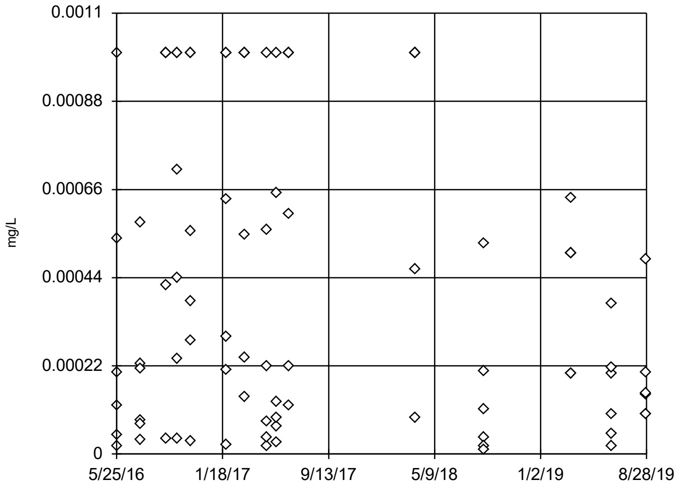
High cutoff = 0.2042, low cutoff = 0.0168, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found.
Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

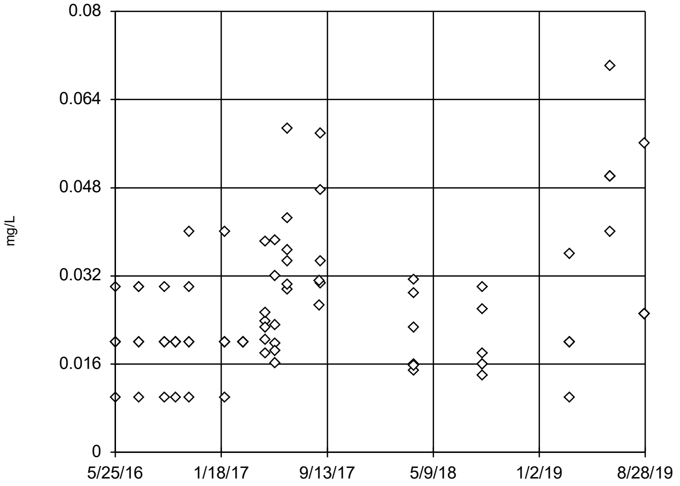
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Beryllium, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 96

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

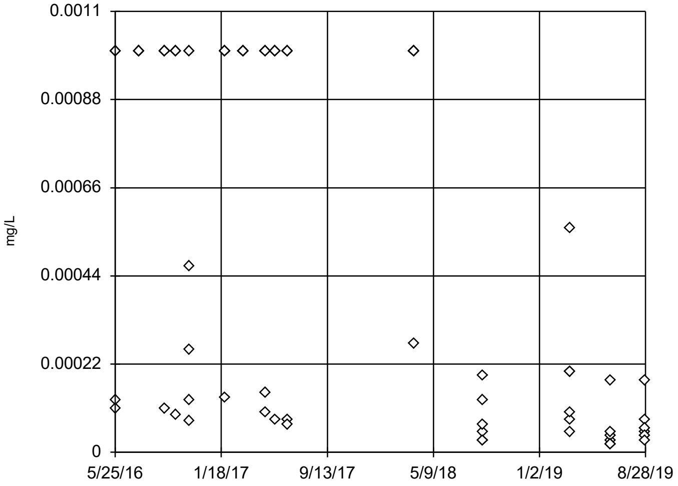
High cutoff = 0.1034, low cutoff = 0.005832, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

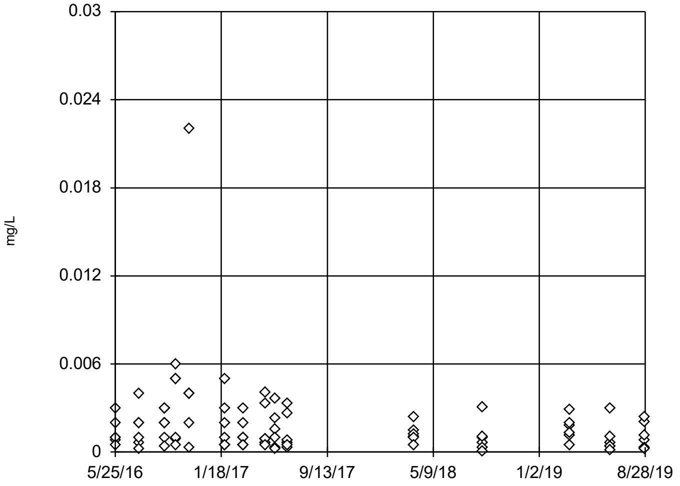
High cutoff = 1, low cutoff = 1.0e-7, based on IQR multiplier of 3.

Constituent: Cadmium, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

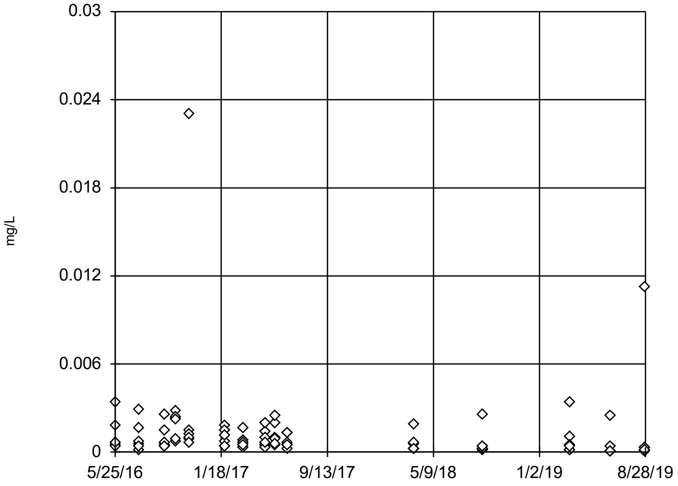
High cutoff = 0.3139, low cutoff = 0.000003987, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

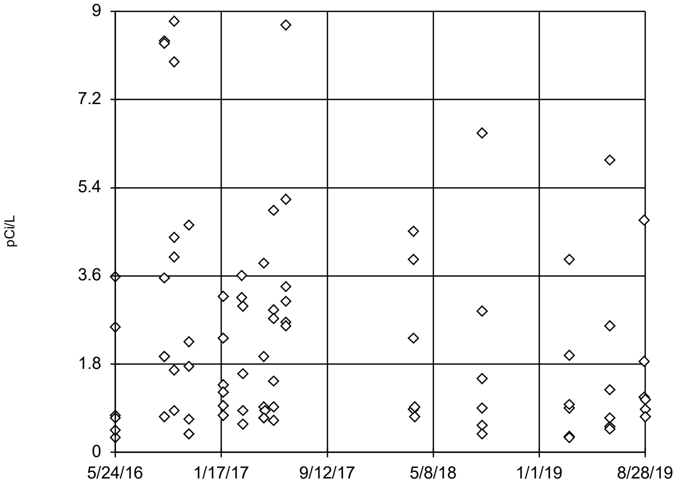
High cutoff = 0.1107, low cutoff = 0.0000046, based on IQR multiplier of 3.

Constituent: Cobalt, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 84

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 291.2, low cutoff = 0.008248, based on IQR multiplier of 3.

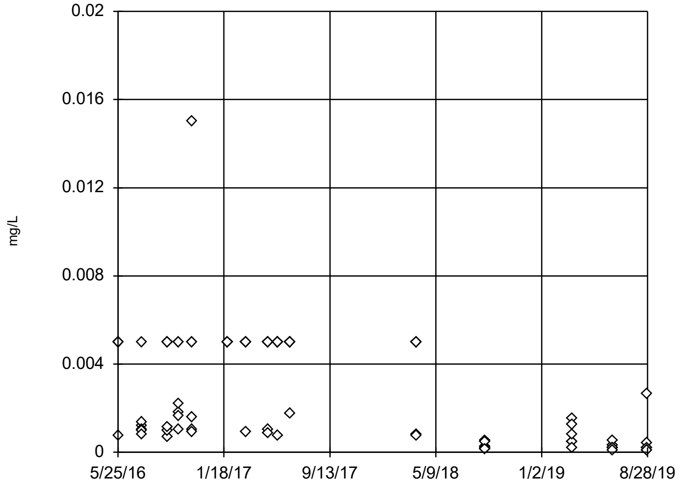
Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradi

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 1.453, low cutoff = 0.000002597, based on IQR multiplier of 3.

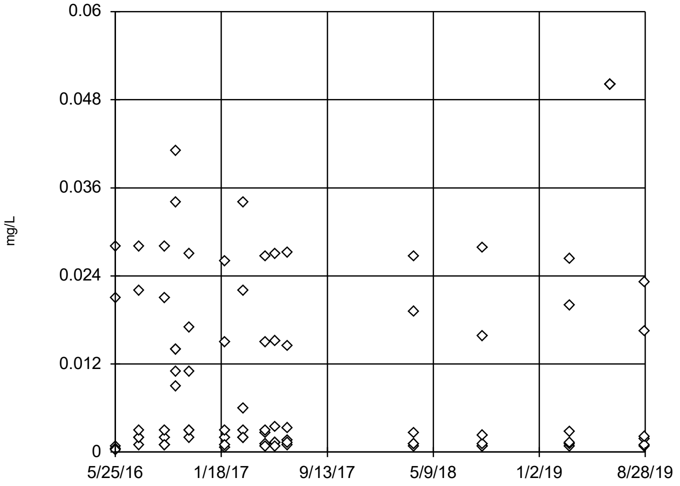
Constituent: Lead, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 156.1, low cutoff = 1.6e-7, based on IQR multiplier of 3.

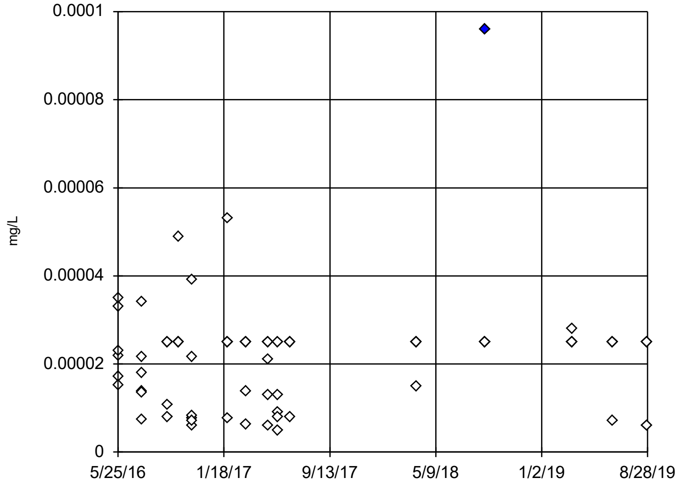
Constituent: Lithium, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

Outlier is drawn as solid. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.00008502, low cutoff = 8.8e-7, based on IQR multiplier of 3.

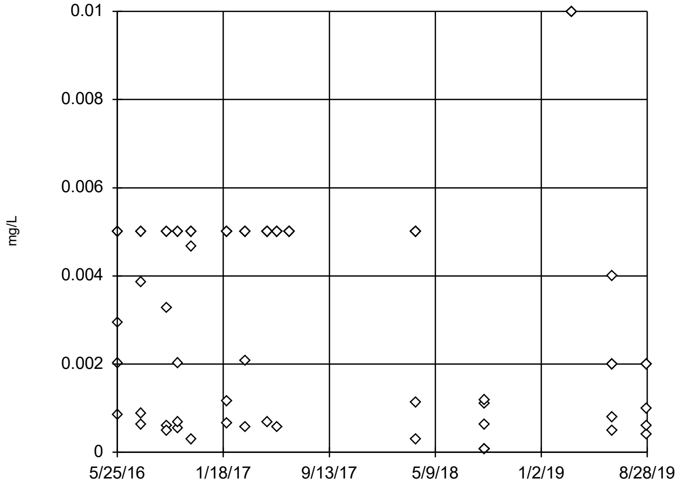
Constituent: Mercury, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.03439, low cutoff = -0.006766, based on IQR multiplier of 3.

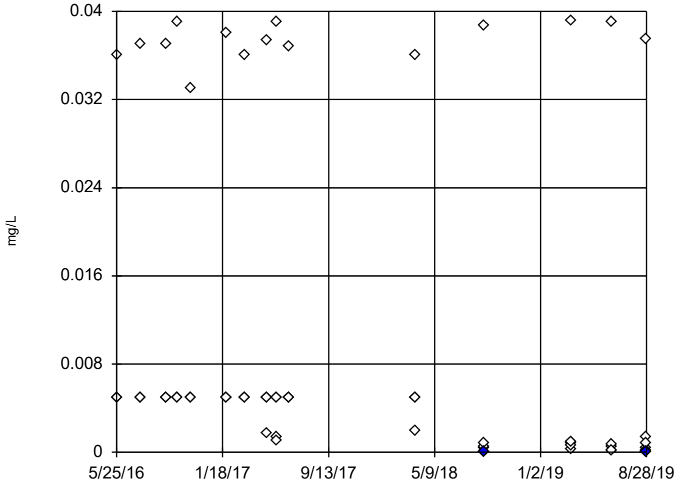
Constituent: Molybdenum, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

Outliers are drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.1733, low cutoff = 0.00004426, based on IQR multiplier of 3.

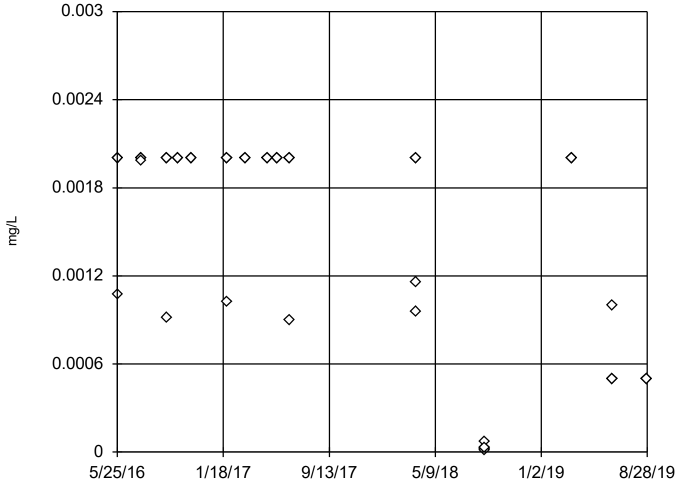
Constituent: Selenium, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening, Pooled Background

B-12,B-13,B-1B,B-4,B-5,B-7A



n = 90

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.004852, low cutoff = -0.001803, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/8/2019 8:53 AM View: Outlier Tests - Upgradient

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Outlier Analysis - Appendix III All Results (No Significant)

Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/8/2019, 9:32 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Calcium, total (mg/L)	B-12 (bg)	No	n/a	n/a	NP	14	63.47	5.376	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-13 (bg)	No	n/a	n/a	NP	14	13.11	4.659	x^2	ShapiroWilk
Calcium, total (mg/L)	B-1B (bg)	No	n/a	n/a	NP	14	88.73	3.541	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-4 (bg)	No	n/a	n/a	NP	14	13.04	8.545	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-5 (bg)	No	n/a	n/a	NP	14	17.01	0.9534	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-7A (bg)	No	n/a	n/a	NP	14	101.3	3.479	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-10	No	n/a	n/a	NP	14	81.76	13.22	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-11	No	n/a	n/a	NP	14	13.04	2.356	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-2	No	n/a	n/a	NP	14	39.34	21.74	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-6	No	n/a	n/a	NP	14	44.62	7.541	normal	ShapiroWilk
Calcium, total (mg/L)	B-9	No	n/a	n/a	NP	14	99.17	16.89	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-12 (bg)	No	n/a	n/a	NP	14	10.23	1.557	normal	ShapiroWilk
Chloride, total (mg/L)	B-13 (bg)	No	n/a	n/a	NP	14	3.609	0.934	x^2	ShapiroWilk
Chloride, total (mg/L)	B-1B (bg)	No	n/a	n/a	NP	14	3.346	1.116	sqrt(x)	ShapiroWilk
Chloride, total (mg/L)	B-4 (bg)	No	n/a	n/a	NP	14	8.085	1.549	x^4	ShapiroWilk
Chloride, total (mg/L)	B-5 (bg)	No	n/a	n/a	NP	14	7.664	1.743	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-7A (bg)	No	n/a	n/a	NP	14	4.194	1.195	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-10	No	n/a	n/a	NP	14	8.17	1.496	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-11	No	n/a	n/a	NP	14	5.14	1.157	x^2	ShapiroWilk
Chloride, total (mg/L)	B-2	No	n/a	n/a	NP	14	6.263	1.546	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-6	No	n/a	n/a	NP	14	7.669	1.547	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-9	No	n/a	n/a	NP	14	5.921	1.066	normal	ShapiroWilk
Fluoride, total (mg/L)	B-12 (bg)	n/a	n/a	n/a	NP	14	0.8751	0.3186	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-13 (bg)	n/a	n/a	n/a	NP	14	0.8737	0.3232	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-1B (bg)	No	n/a	n/a	NP	14	0.5929	0.2885	sqrt(x)	ShapiroWilk
Fluoride, total (mg/L)	B-4 (bg)	n/a	n/a	n/a	NP	14	0.93	0.2619	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-5 (bg)	n/a	n/a	n/a	NP	14	0.8816	0.3035	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-7A (bg)	No	n/a	n/a	NP	14	0.8019	0.3265	ln(x)	ShapiroWilk
Fluoride, total (mg/L)	B-10	No	n/a	n/a	NP	14	0.783	0.3594	ln(x)	ShapiroWilk
Fluoride, total (mg/L)	B-11	n/a	n/a	n/a	NP	14	0.9314	0.2566	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-2	n/a	n/a	n/a	NP	14	0.8883	0.2877	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-6	n/a	n/a	n/a	NP	14	0.8862	0.2893	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-9	No	n/a	n/a	NP	14	0.7281	0.3827	ln(x)	ShapiroWilk
pH, field (SU)	B-12 (bg)	No	n/a	n/a	NP	14	7.19	0.7119	ln(x)	ShapiroWilk
pH, field (SU)	B-13 (bg)	No	n/a	n/a	NP	14	5.729	0.8643	ln(x)	ShapiroWilk
pH, field (SU)	B-1B (bg)	No	n/a	n/a	NP	14	7.281	0.5005	x^4	ShapiroWilk
pH, field (SU)	B-4 (bg)	No	n/a	n/a	NP	14	7.026	0.3862	x^5	ShapiroWilk
pH, field (SU)	B-5 (bg)	No	n/a	n/a	NP	14	5.549	0.5654	ln(x)	ShapiroWilk
pH, field (SU)	B-7A (bg)	No	n/a	n/a	NP	14	7.183	0.3105	ln(x)	ShapiroWilk
pH, field (SU)	B-10	No	n/a	n/a	NP	14	7.37	0.6385	ln(x)	ShapiroWilk
pH, field (SU)	B-11	No	n/a	n/a	NP	15	5.902	0.4841	ln(x)	ShapiroWilk
pH, field (SU)	B-2	No	n/a	n/a	NP	15	6.252	0.4681	ln(x)	ShapiroWilk
pH, field (SU)	B-6	No	n/a	n/a	NP	15	6.749	0.2825	x^6	ShapiroWilk
pH, field (SU)	B-9	No	n/a	n/a	NP	14	7.321	0.5186	x^4	ShapiroWilk
Sulfate, total (mg/L)	B-12 (bg)	No	n/a	n/a	NP	14	11.08	3.662	sqrt(x)	ShapiroWilk
Sulfate, total (mg/L)	B-13 (bg)	No	n/a	n/a	NP	14	20.67	7.419	x^2	ShapiroWilk
Sulfate, total (mg/L)	B-1B (bg)	No	n/a	n/a	NP	14	21.66	2.876	x^4	ShapiroWilk
Sulfate, total (mg/L)	B-4 (bg)	No	n/a	n/a	NP	14	9.979	2.9	x^2	ShapiroWilk
Sulfate, total (mg/L)	B-5 (bg)	No	n/a	n/a	NP	14	200	19.34	x^3	ShapiroWilk
Sulfate, total (mg/L)	B-7A (bg)	No	n/a	n/a	NP	14	33.16	1.747	x^6	ShapiroWilk
Sulfate, total (mg/L)	B-10	No	n/a	n/a	NP	14	29.63	4.368	x^(1/3)	ShapiroWilk
Sulfate, total (mg/L)	B-11	No	n/a	n/a	NP	14	43.11	10.09	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	B-2	No	n/a	n/a	NP	14	240.9	178.9	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	B-6	No	n/a	n/a	NP	14	25.34	7.606	sqrt(x)	ShapiroWilk
Sulfate, total (mg/L)	B-9	No	n/a	n/a	NP	14	22.71	6.675	ln(x)	ShapiroWilk

Outlier Analysis - Appendix III All Results (No Significant)

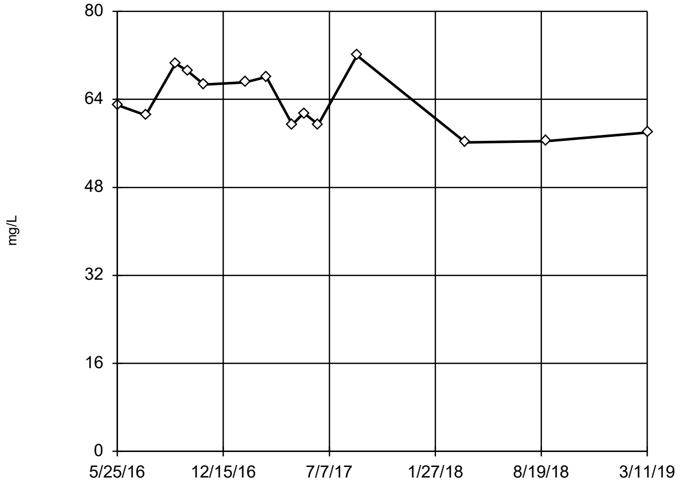
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 9:32 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Total Dissolved Solids [TDS] (mg/L)	B-12 (bg)	No	n/a	n/a	NP	14	252.4	31.73	x^3	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-13 (bg)	No	n/a	n/a	NP	14	75.14	19.83	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-1B (bg)	No	n/a	n/a	NP	14	272.6	19.73	x^6	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-4 (bg)	No	n/a	n/a	NP	14	76.79	20.03	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-5 (bg)	No	n/a	n/a	NP	14	395.5	23.14	x^4	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-7A (bg)	No	n/a	n/a	NP	14	312.1	12.01	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-10	No	n/a	n/a	NP	14	267.7	21.01	normal	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-11	No	n/a	n/a	NP	14	132.3	27.26	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-2	No	n/a	n/a	NP	14	531.6	332.5	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-6	No	n/a	n/a	NP	14	194.9	43.59	x^2	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-9	No	n/a	n/a	NP	14	239.4	24.16	sqrt(x)	ShapiroWilk

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-12 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

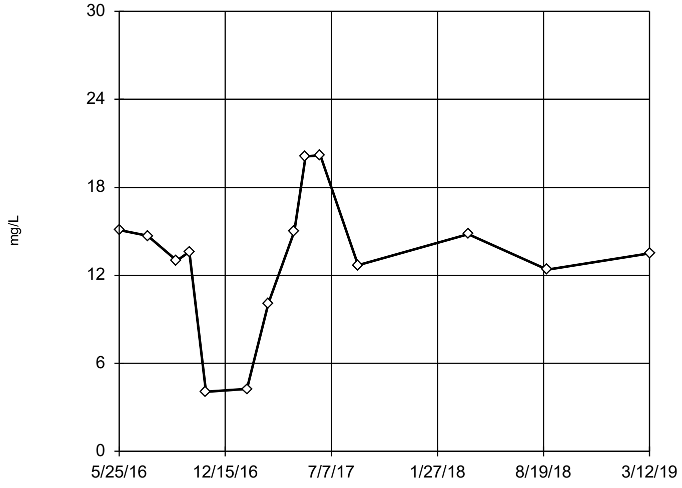
High cutoff = 109.8, low cutoff = 36.69, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/8/2019 9:28 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-13 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

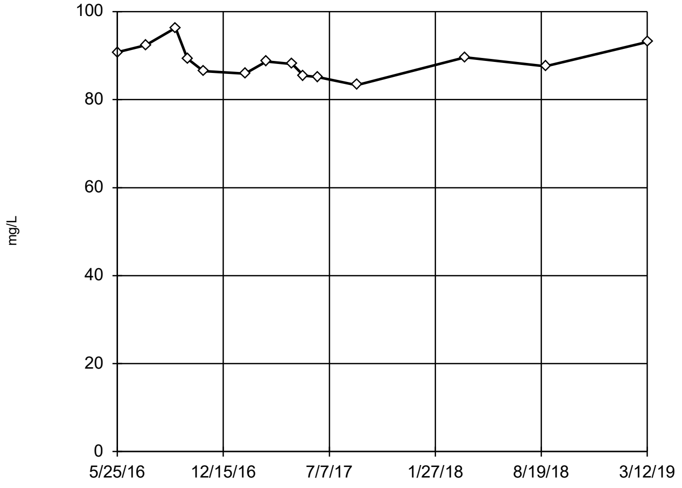
High cutoff = 22.86, low cutoff = -12.96, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/8/2019 9:28 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-1B (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

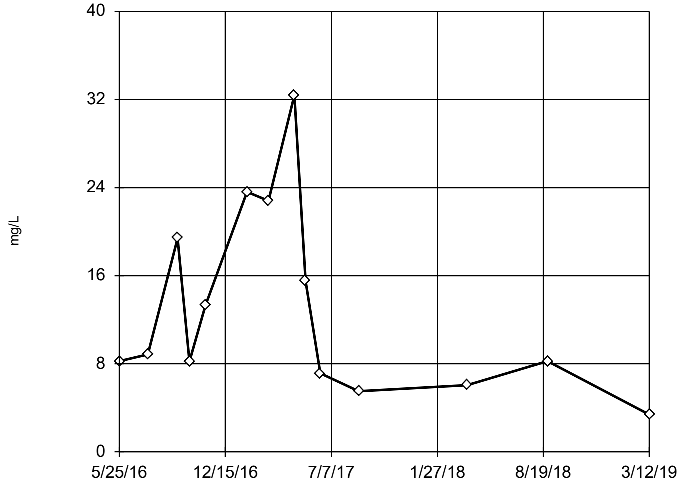
High cutoff = 111.8, low cutoff = 70.19, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/8/2019 9:28 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-4 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

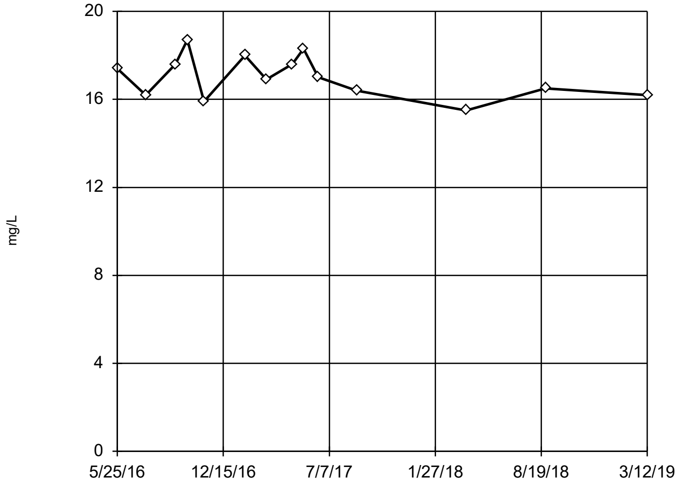
High cutoff = 688.9, low cutoff = 0.2007, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/8/2019 9:28 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-5 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

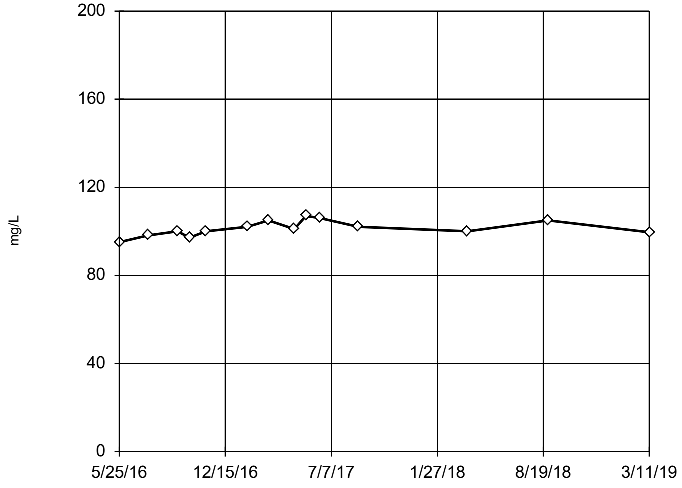
High cutoff = 23.61, low cutoff = 12.21, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-7A (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

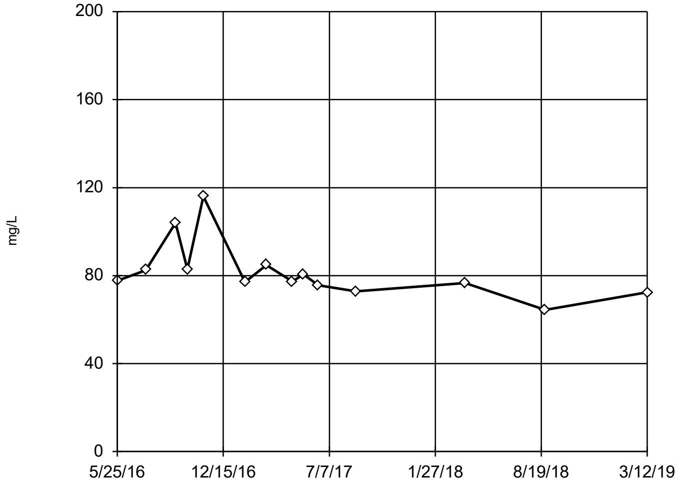
High cutoff = 125.9, low cutoff = 82.47, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

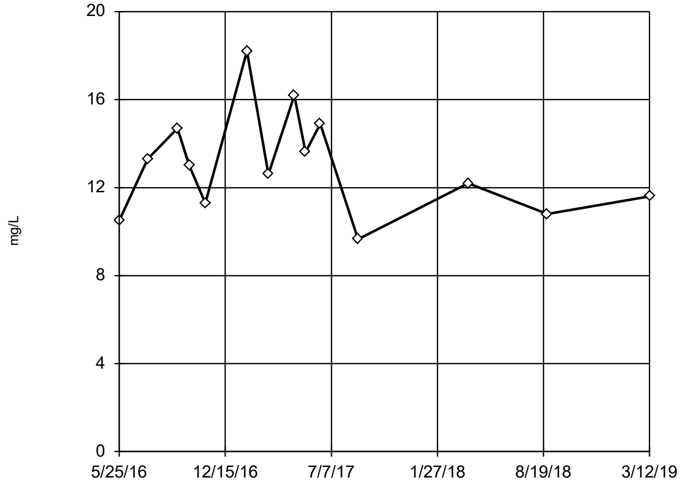
High cutoff = 121, low cutoff = 51.39, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

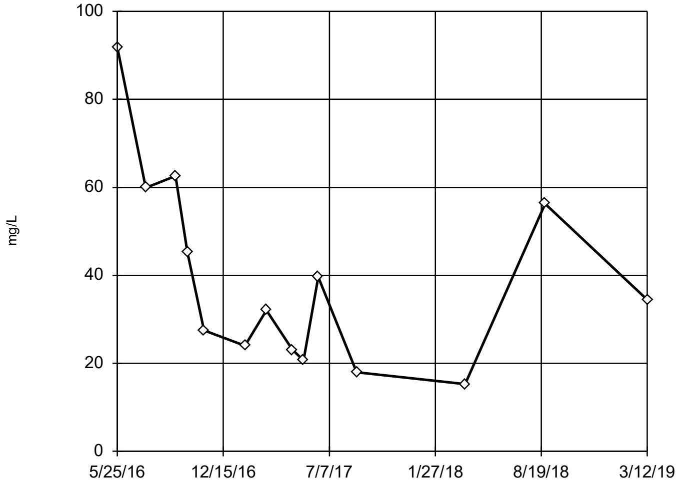
High cutoff = 35.58, low cutoff = 4.595, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

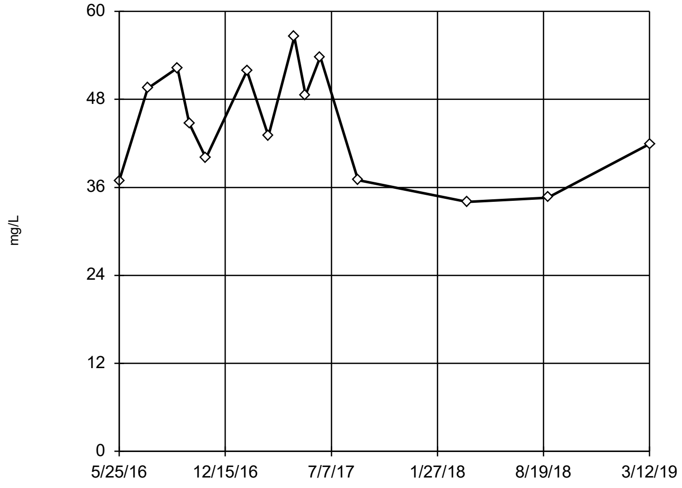
High cutoff = 1088, low cutoff = 1.168, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 14

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

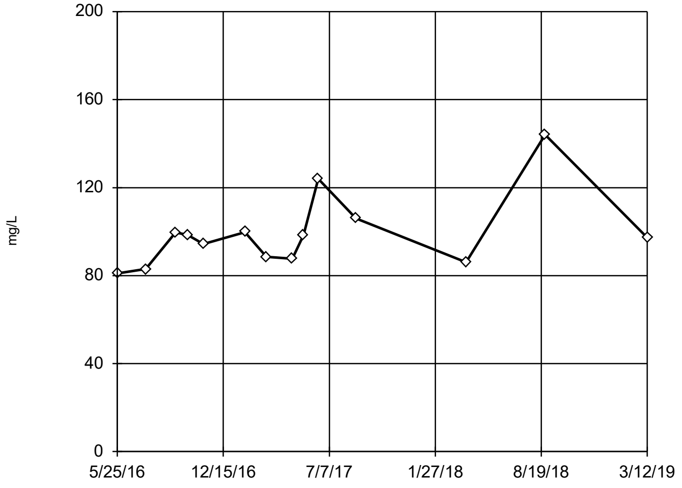
High cutoff = 97.55, low cutoff = -8.5, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

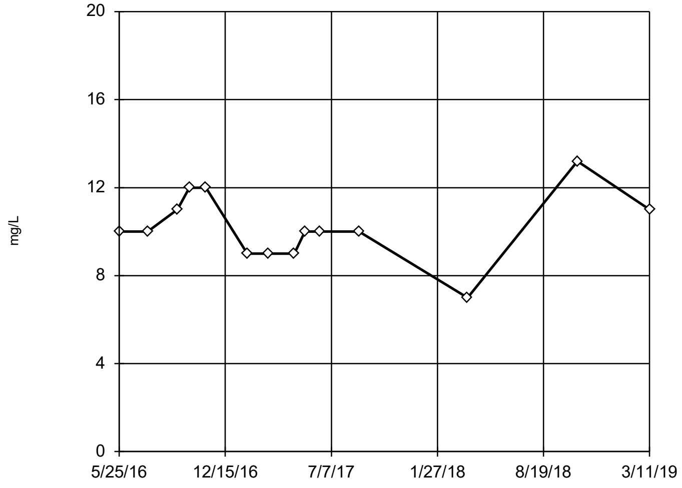
High cutoff = 170.6, low cutoff = 52.4, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-12 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

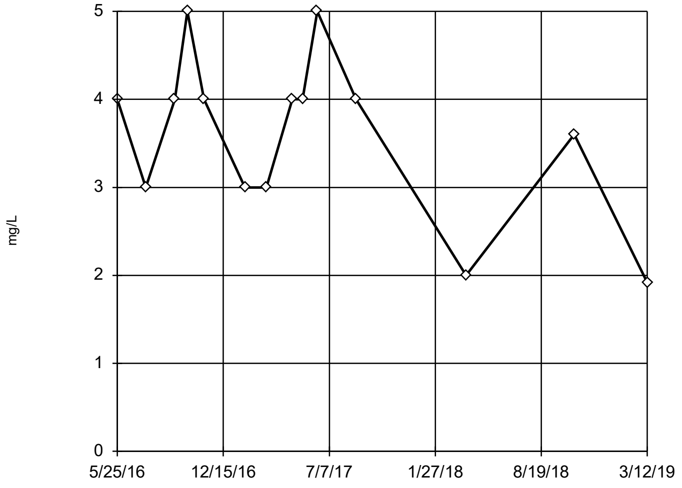
High cutoff = 19, low cutoff = 1.5, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-13 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

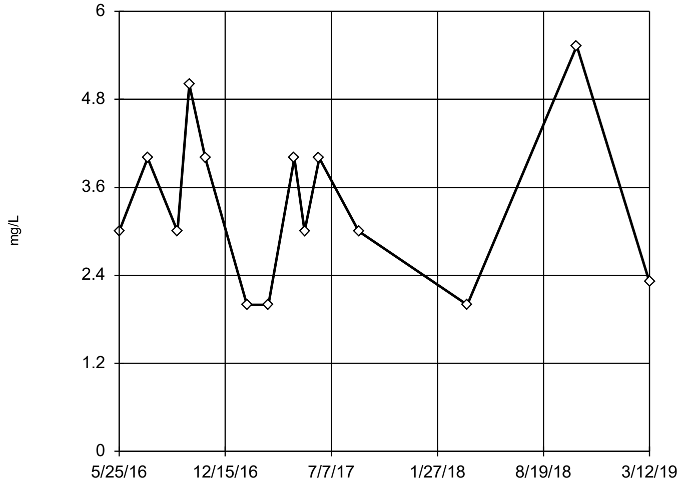
High cutoff = 6.083, low cutoff = -3.464, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-1B (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

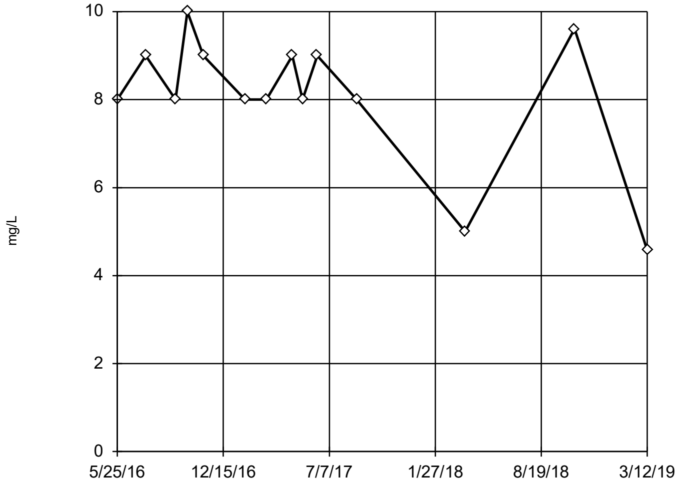
High cutoff = 12.95, low cutoff = -0.01738, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-4 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

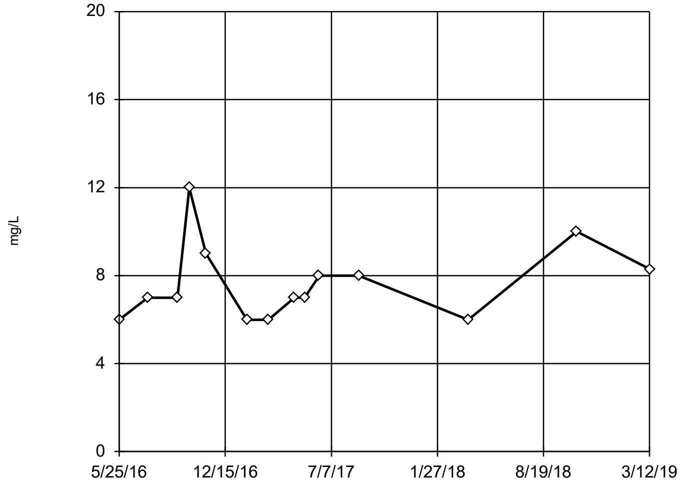
High cutoff = 10.87, low cutoff = -7.579, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-5 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

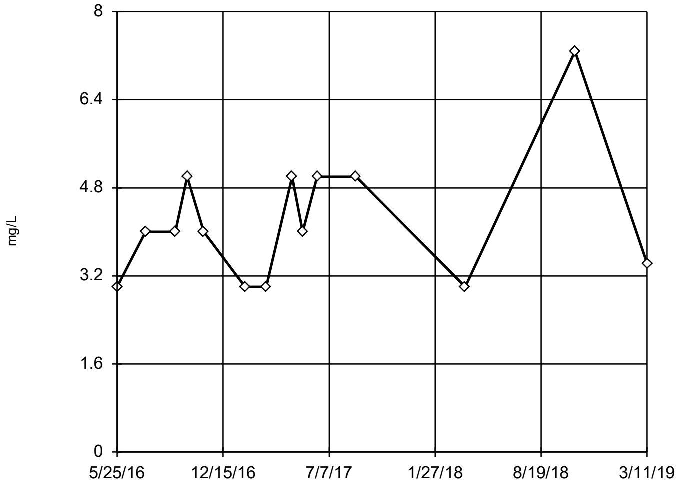
High cutoff = 25.83, low cutoff = 2.007, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-7A (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

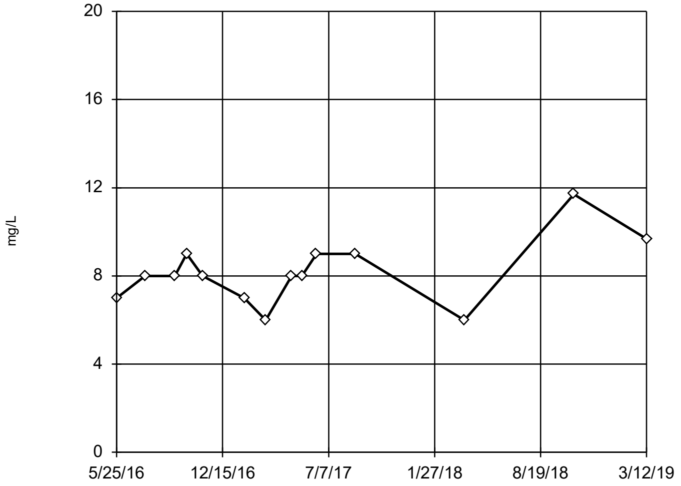
High cutoff = 23.15, low cutoff = 0.648, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

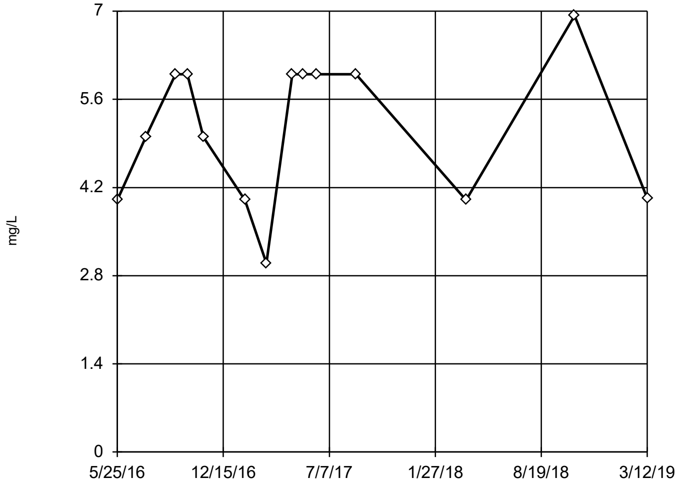
High cutoff = 19.13, low cutoff = 3.294, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 14

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

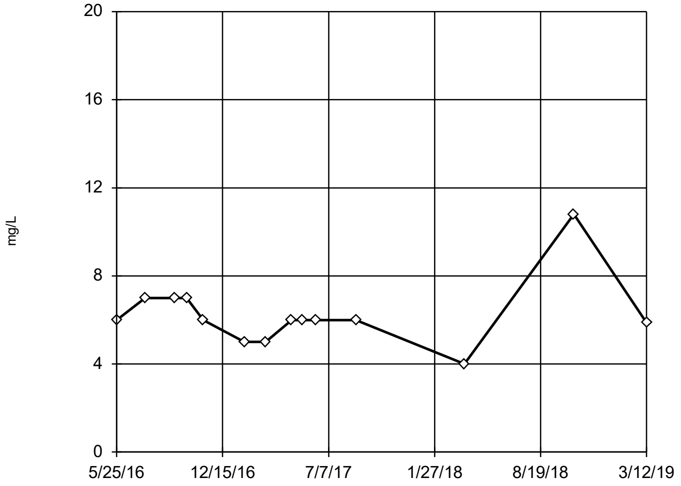
High cutoff = 9.798, low cutoff = -6.633, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

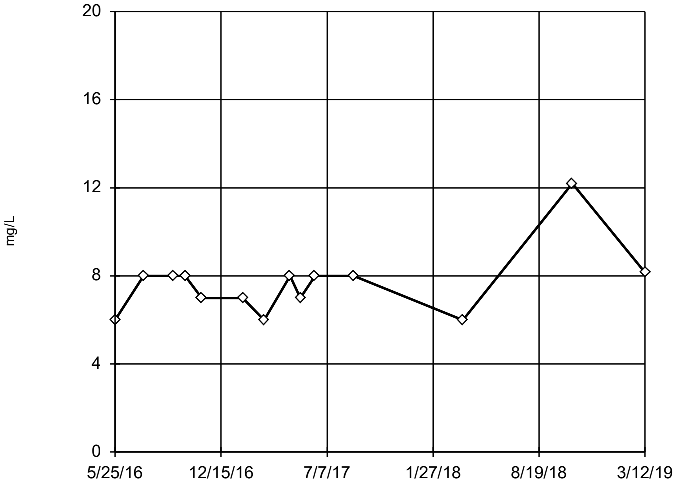
High cutoff = 15.06, low cutoff = 2.52, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

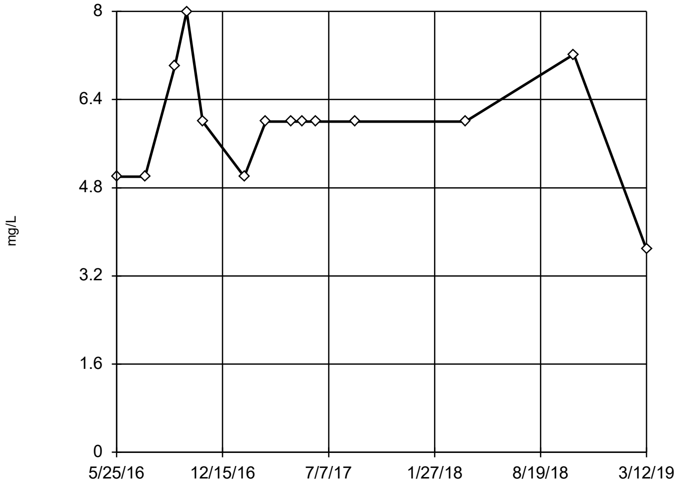
High cutoff = 15.05, low cutoff = 3.445, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 14

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

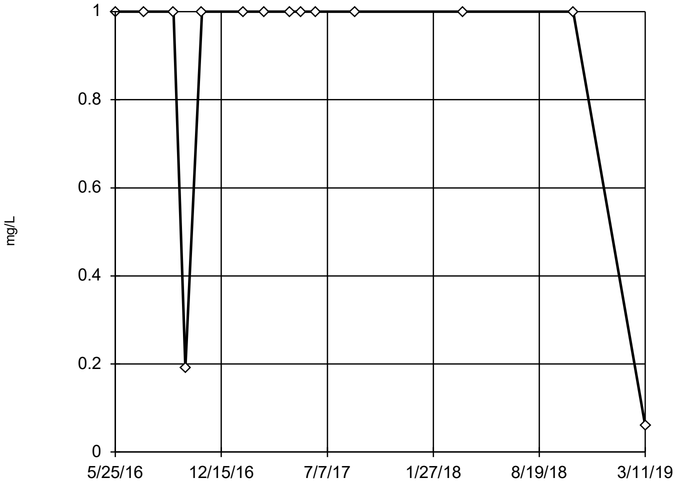
High cutoff = 11, low cutoff = 0.5, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-12 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

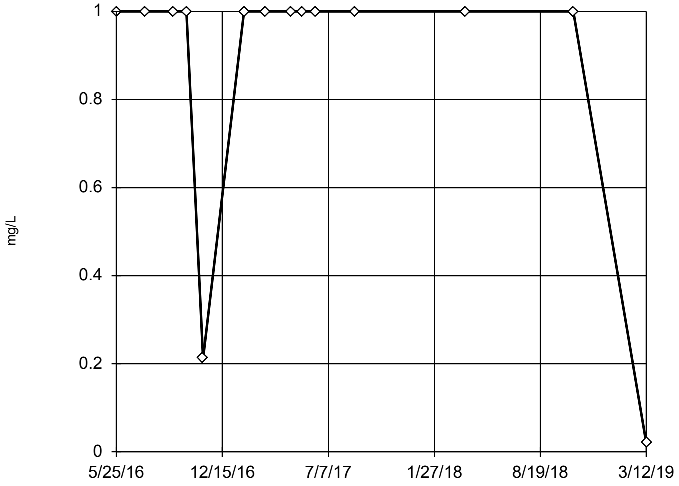
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-13 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

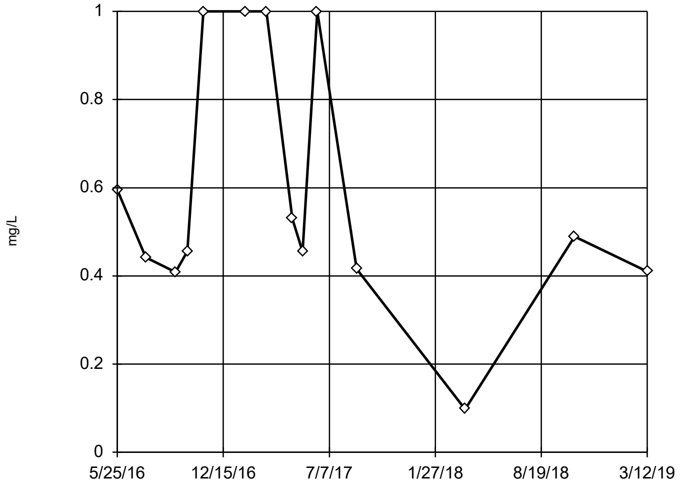
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-1B (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

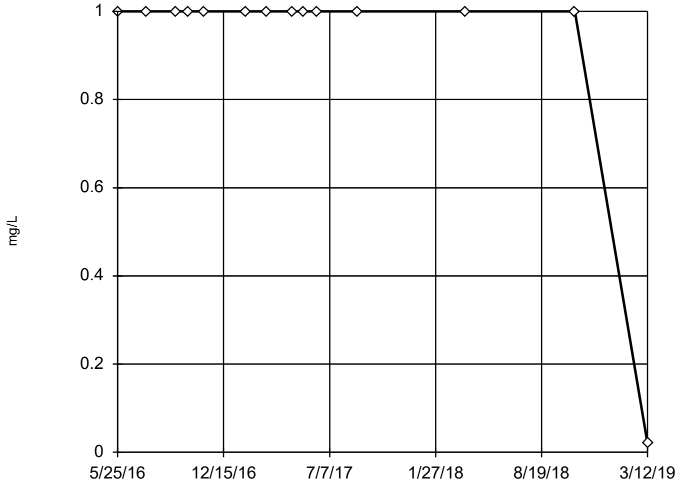
High cutoff = 4.293, low cutoff = -0.1844, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-4 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

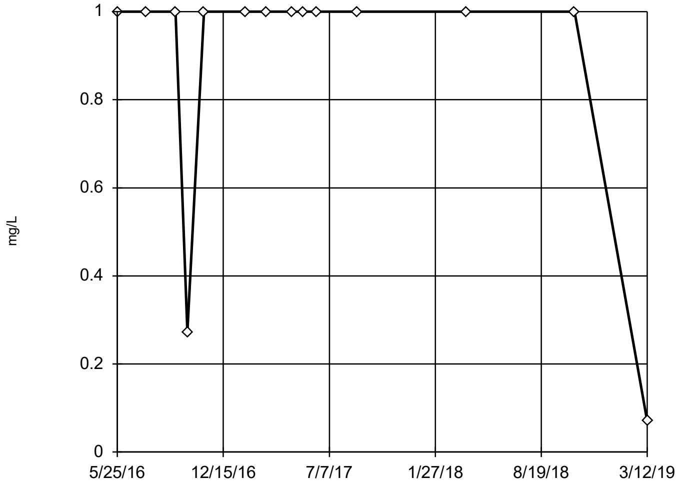
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-5 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

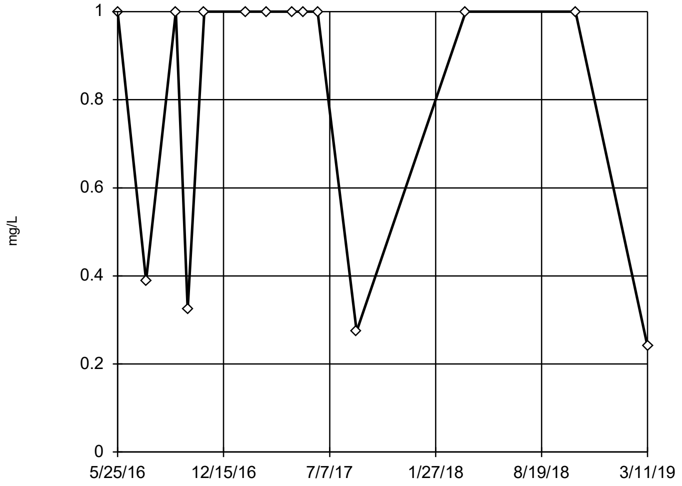
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-7A (bg)



n = 14

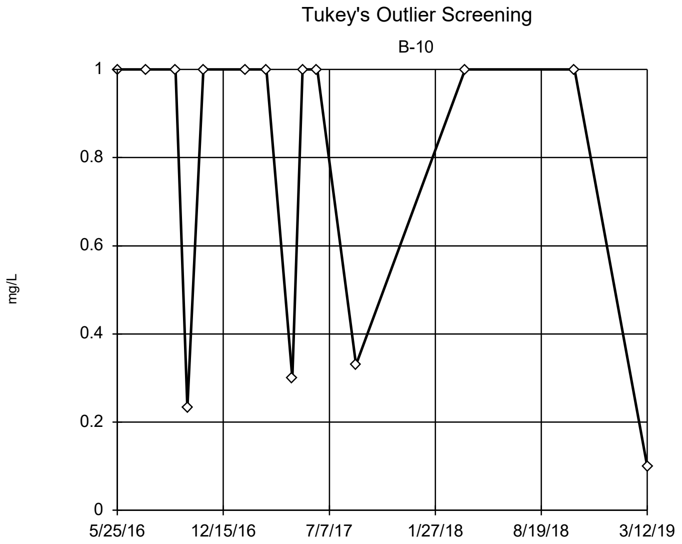
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 22.38, low cutoff = 0.01585, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

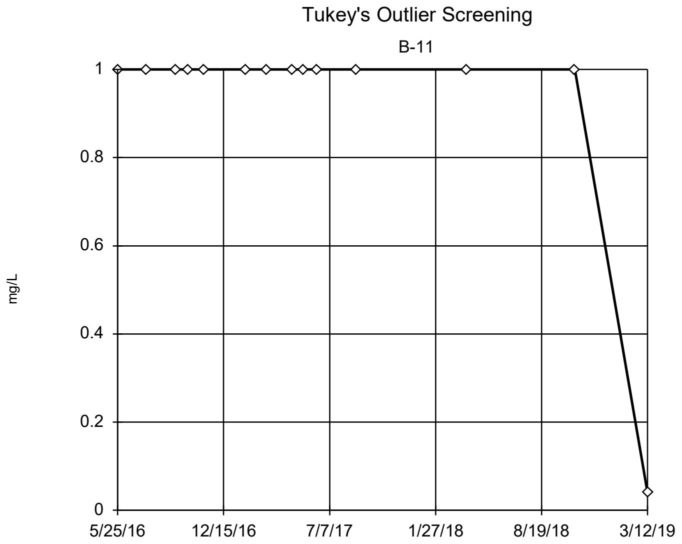
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 32.04, low cutoff = 0.009825, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

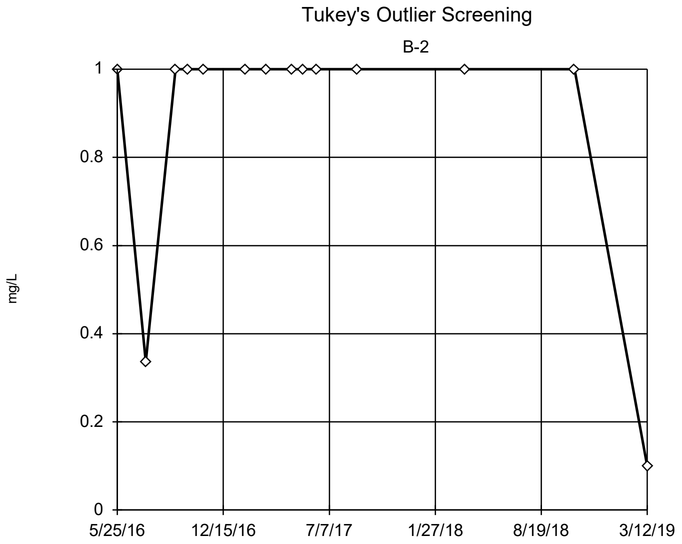
No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

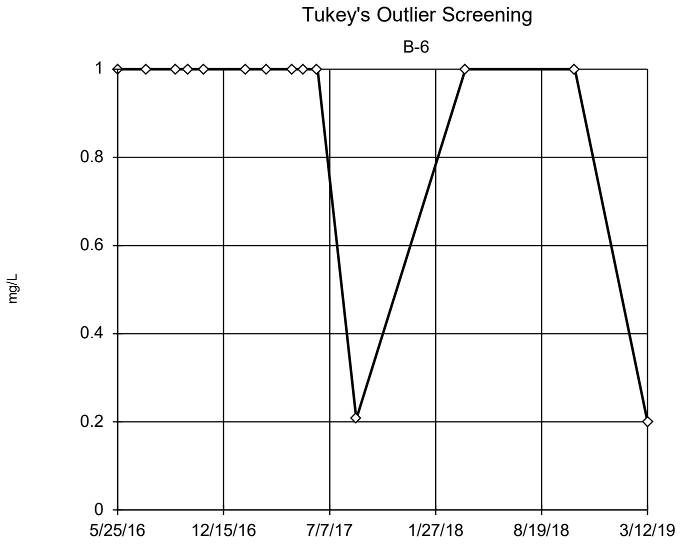
No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

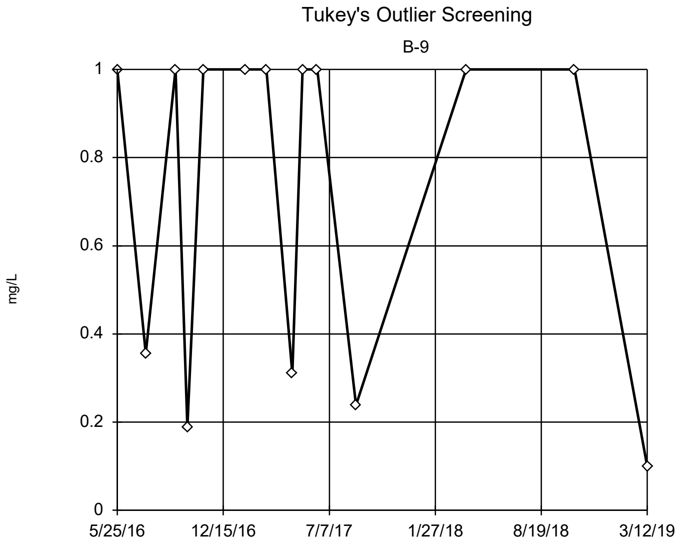
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

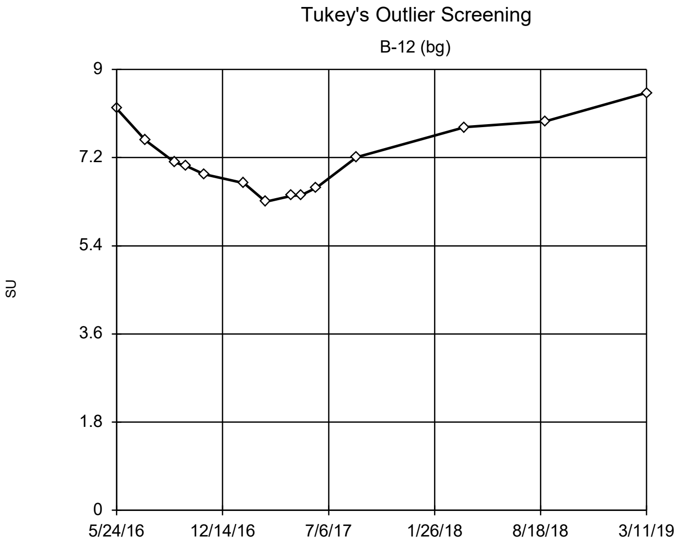
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 49.62, low cutoff = 0.005485, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

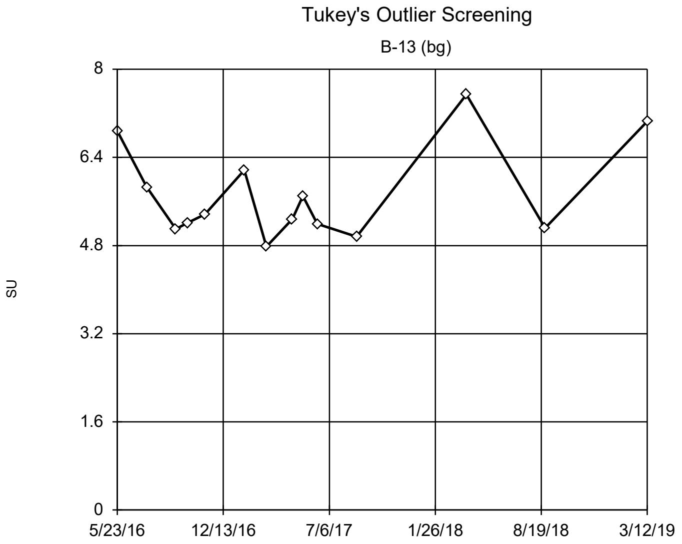
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 13.94, low cutoff = 3.681, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

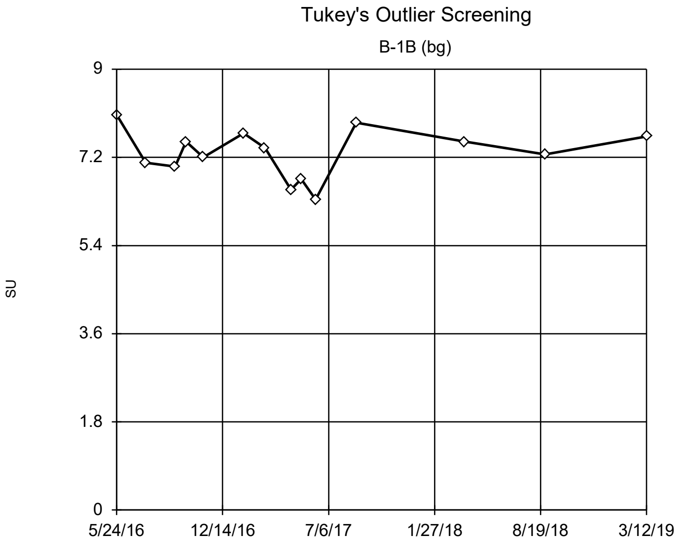
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 13.5, low cutoff = 2.465, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

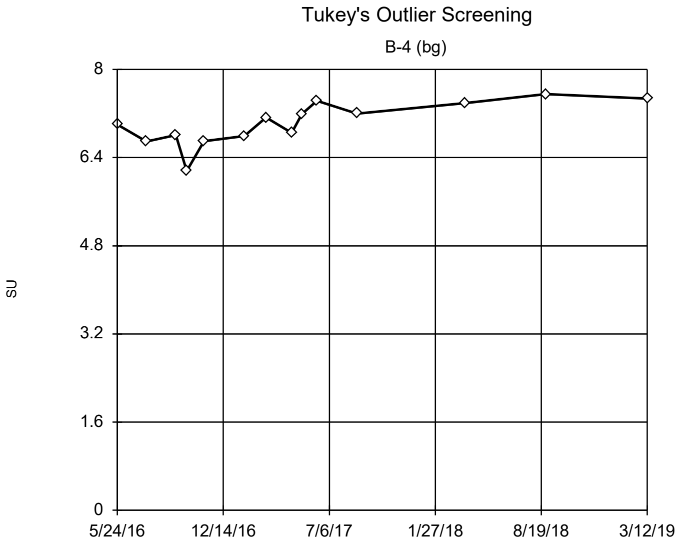
No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.153, low cutoff = -6.031, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG


Tukey's Outlier Screening

B-4 (bg)

n = 14

No outliers found. Tukey's method selected by user.

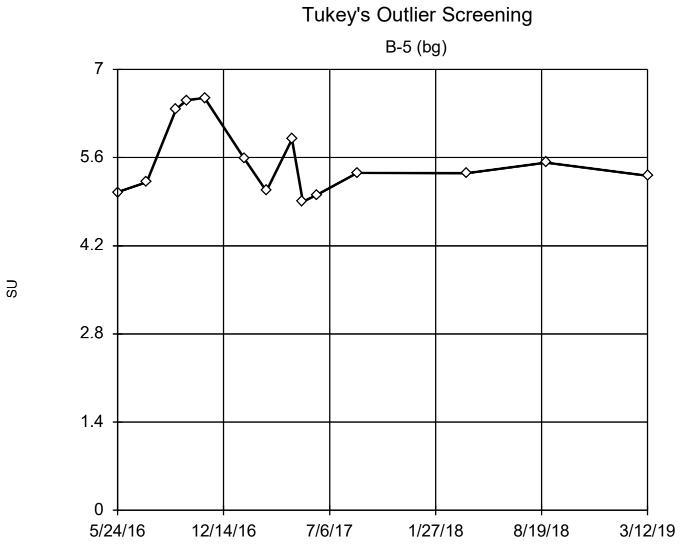
Data were x^5 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.615, low cutoff = -6.449, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG


Tukey's Outlier Screening

B-5 (bg)

n = 14

No outliers found. Tukey's method selected by user.

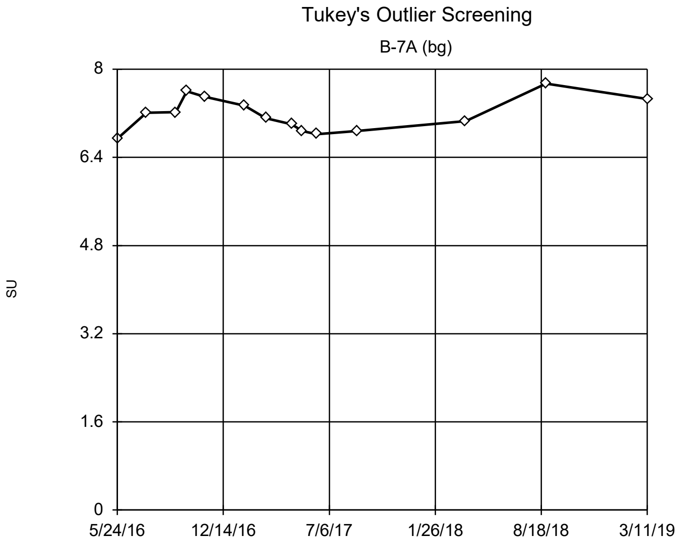
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 10.87, low cutoff = 2.852, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG


Tukey's Outlier Screening

B-7A (bg)

n = 14

No outliers found. Tukey's method selected by user.

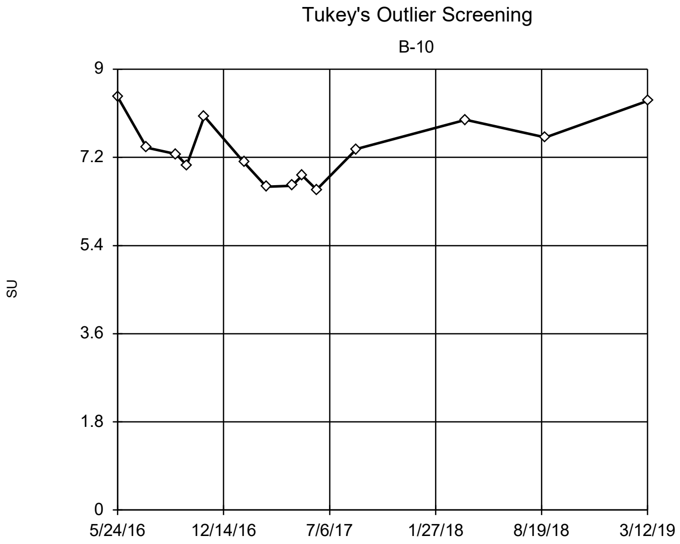
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.612, low cutoff = 5.354, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG


Tukey's Outlier Screening

B-10

n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 13.51, low cutoff = 3.986, based on IQR multiplier of 3.

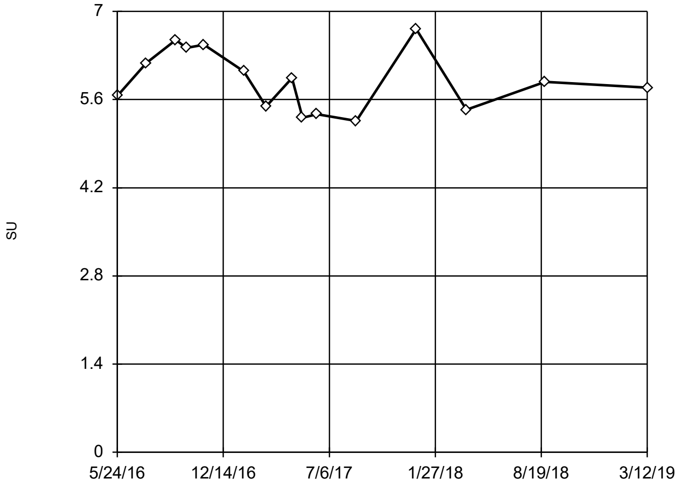
Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

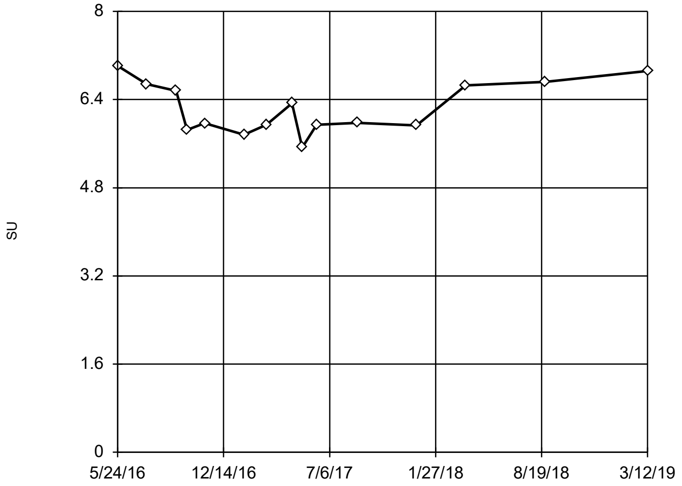
High cutoff = 10.55, low cutoff = 3.31, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

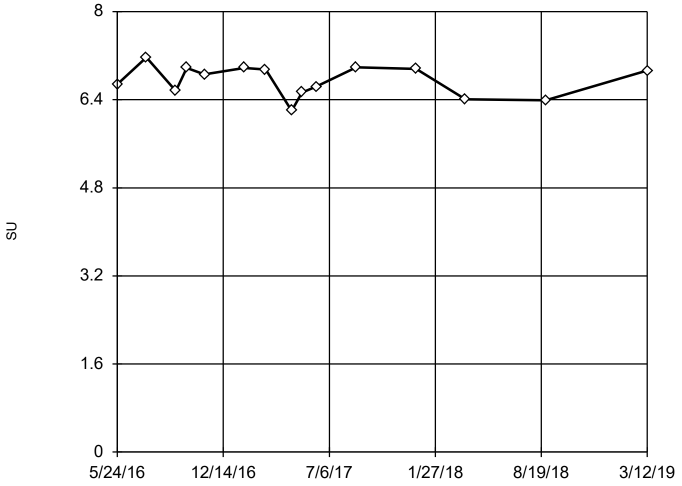
High cutoff = 9.549, low cutoff = 4.148, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

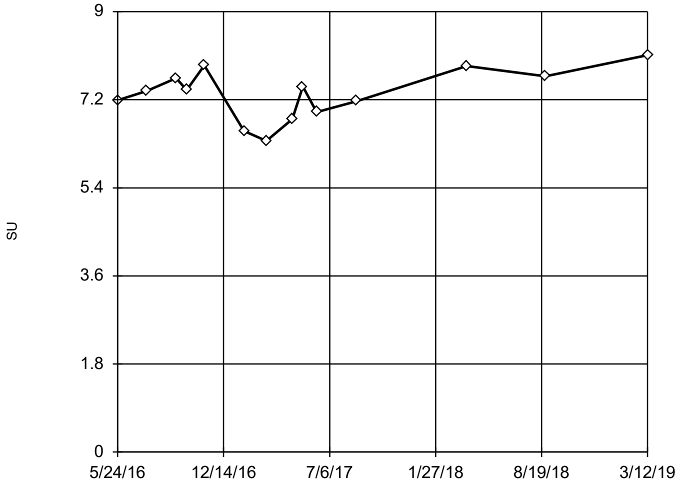
High cutoff = 7.827, low cutoff = -5.768, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 14

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

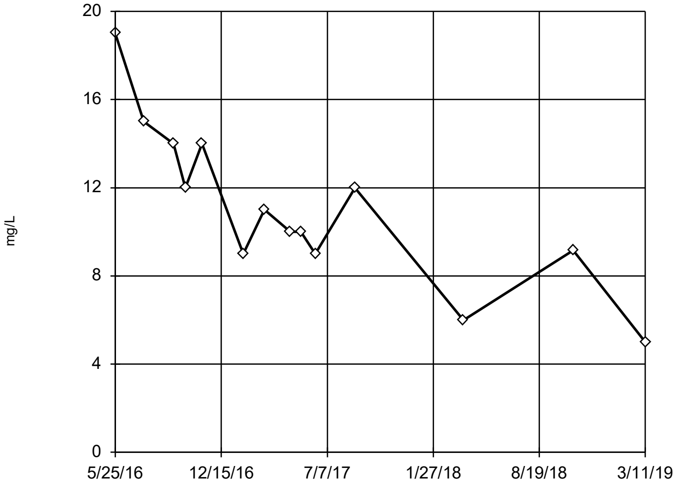
High cutoff = 9.458, low cutoff = -6.76, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-12 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 35.6, low cutoff = 0.6007, based on IQR multiplier of 3.

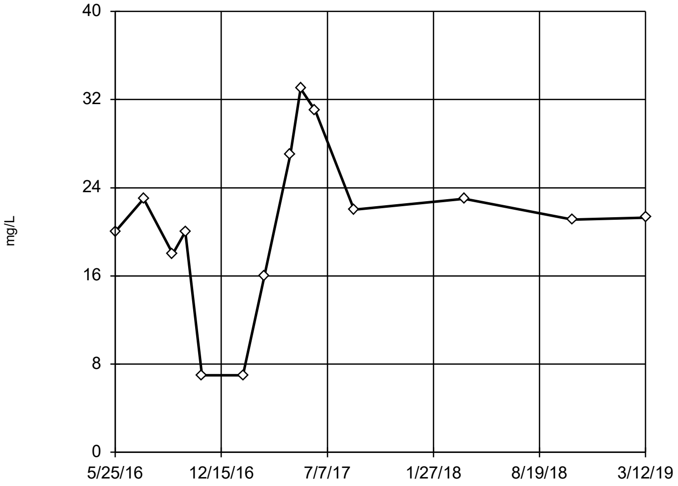
Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-13 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 40.57, low cutoff = -26.96, based on IQR multiplier of 3.

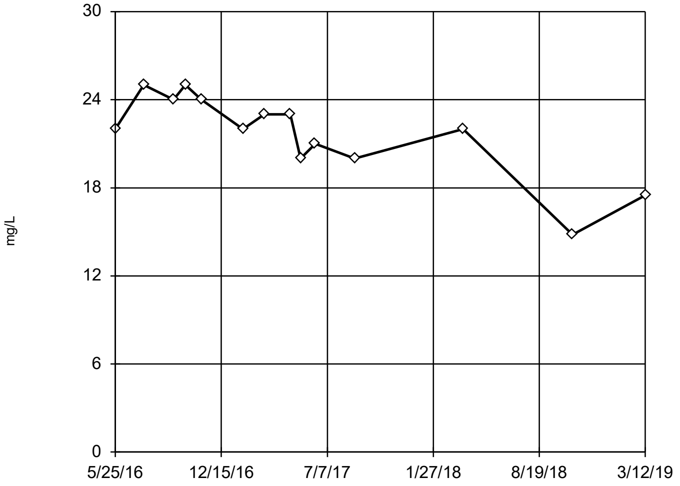
Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-1B (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 30.34, low cutoff = -24.42, based on IQR multiplier of 3.

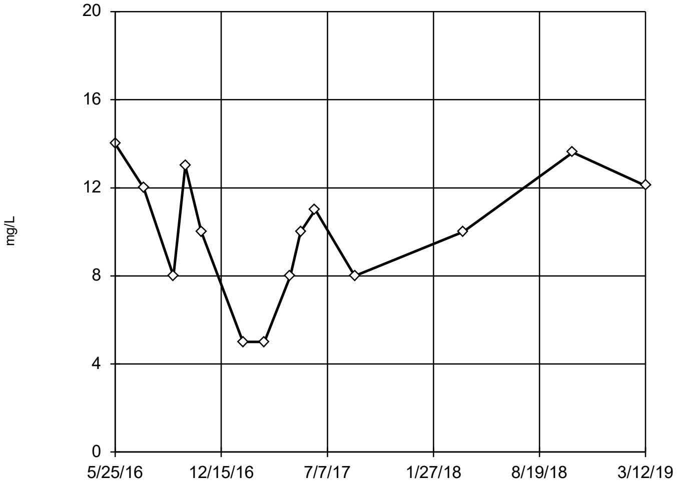
Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-4 (bg)



n = 14

No outliers found. Tukey's method selected by user.

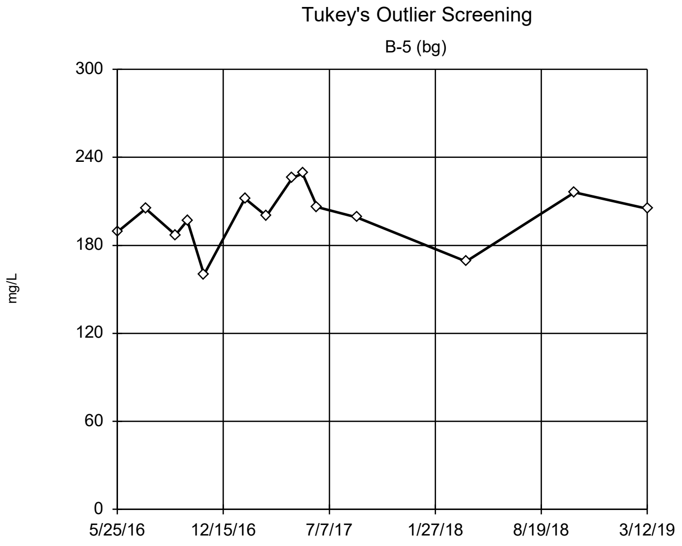
Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 20.95, low cutoff = -14.73, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

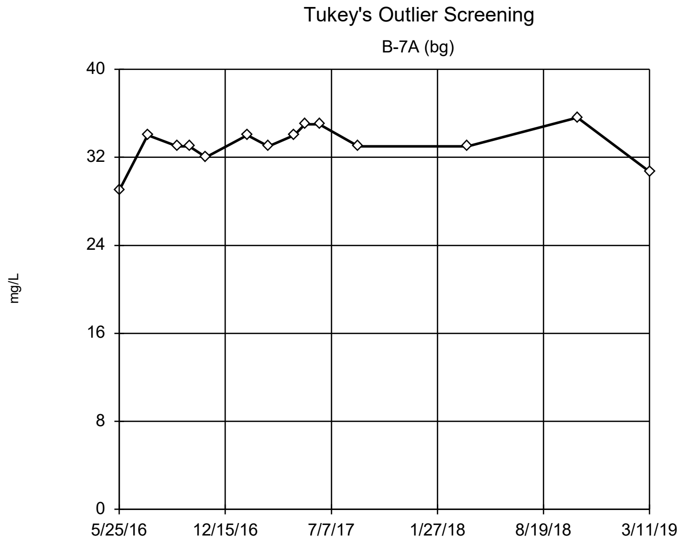
No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

High cutoff = 268.1, low cutoff = -141.4, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

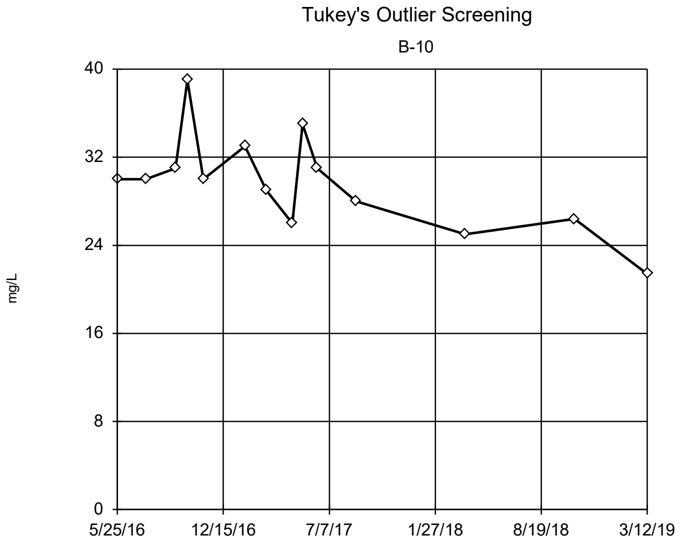
No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 38.42, low cutoff = -26.47, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

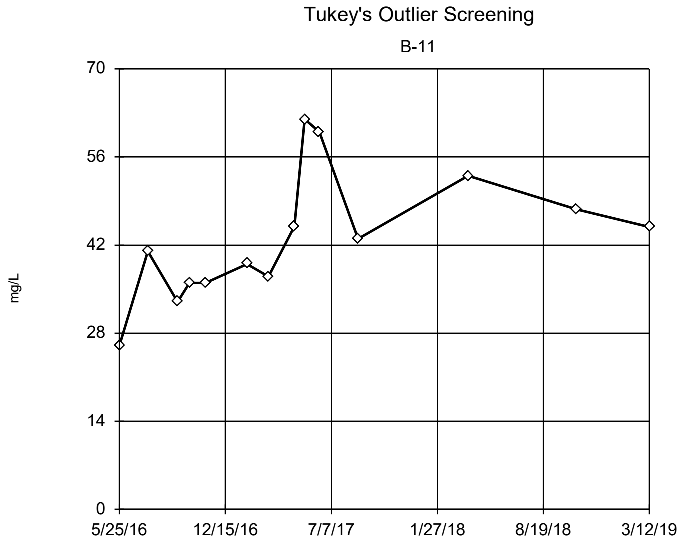
No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 54.34, low cutoff = 13.09, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

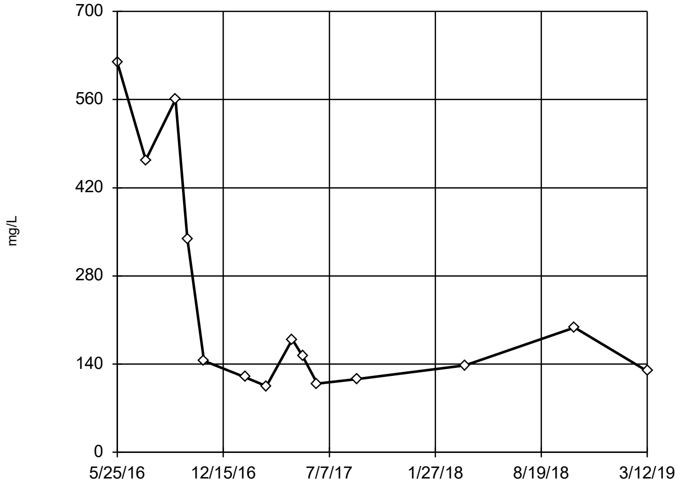
High cutoff = 137, low cutoff = 13.21, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

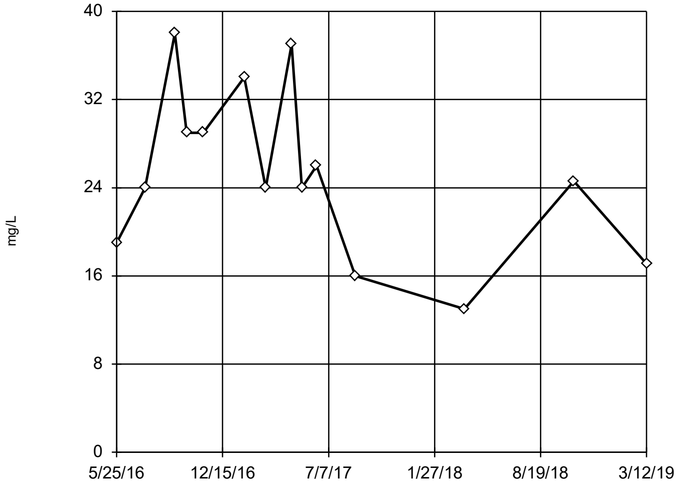
High cutoff = 15256, low cutoff = 3.054, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

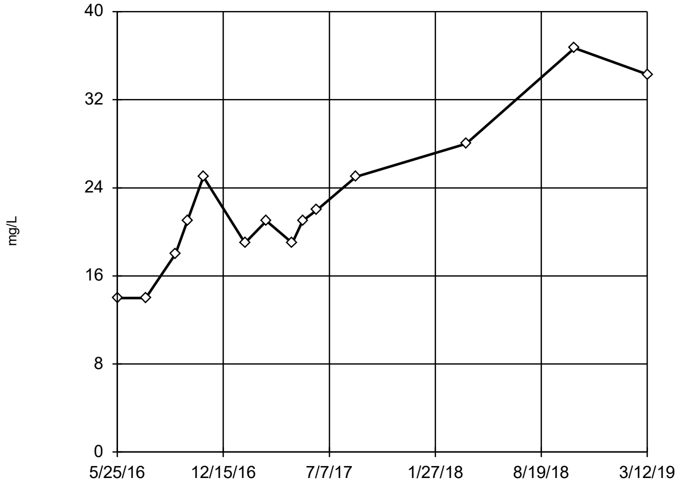
High cutoff = 93.92, low cutoff = 0.02691, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

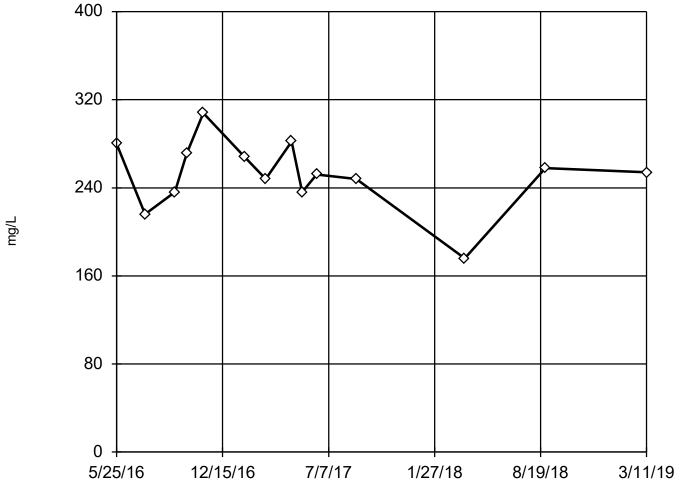
High cutoff = 77.47, low cutoff = 6.315, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-12 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

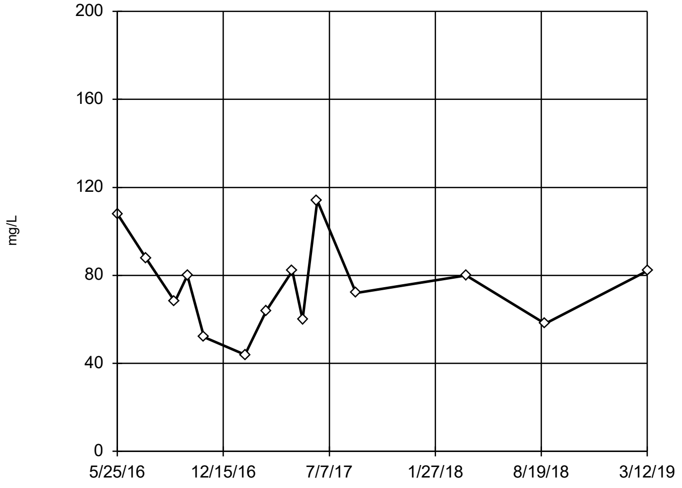
High cutoff = 353.8, low cutoff = -216.9, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:28 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-13 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

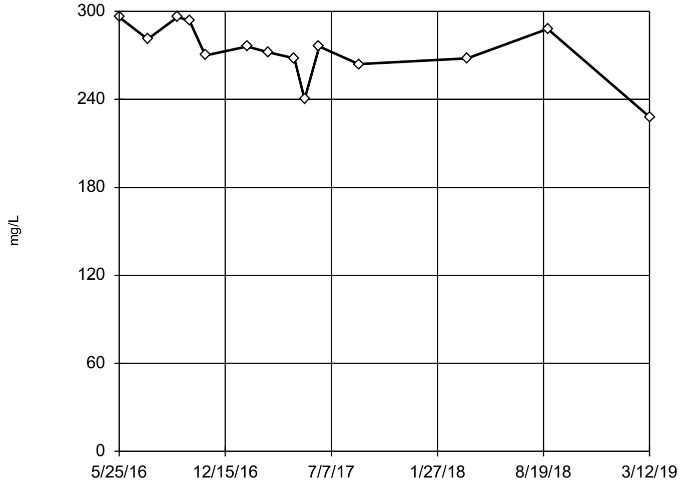
High cutoff = 253.6, low cutoff = 19.76, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:28 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-1B (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

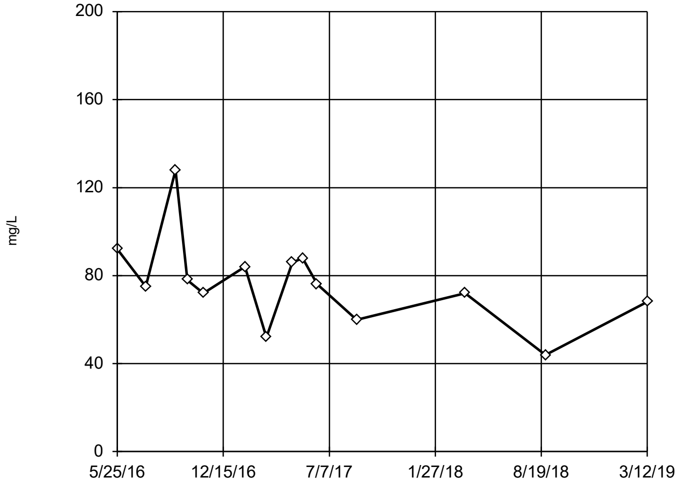
High cutoff = 333.2, low cutoff = -272.2, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:28 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-4 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

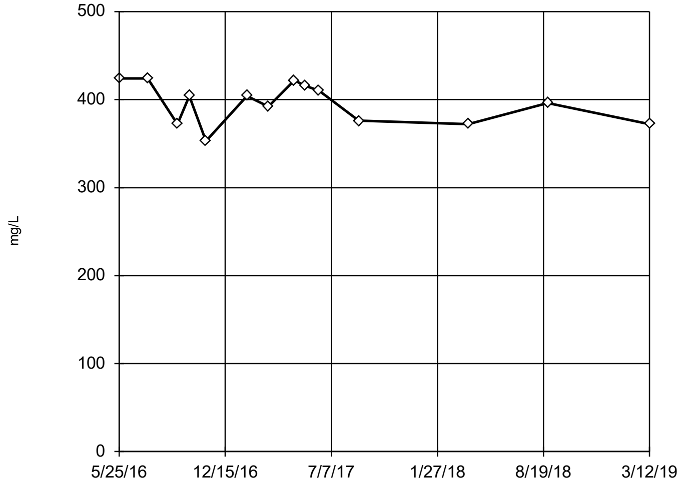
High cutoff = 219.8, low cutoff = 25.28, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:28 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-5 (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

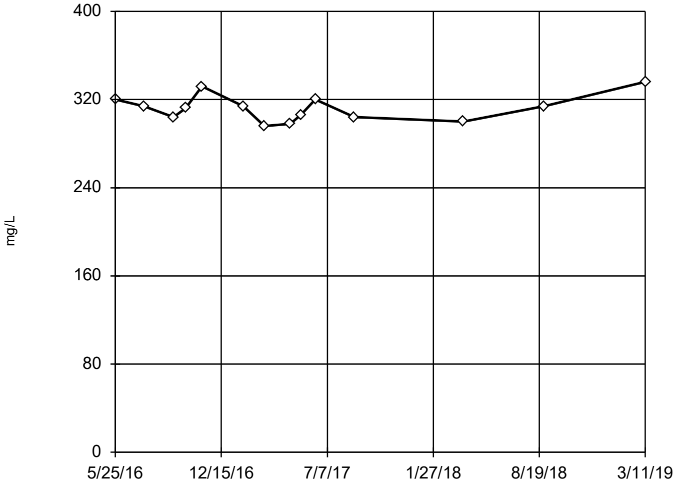
High cutoff = 506.6, low cutoff = -355.1, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:29 AM   View: Outlier Tests - App III
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-7A (bg)



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

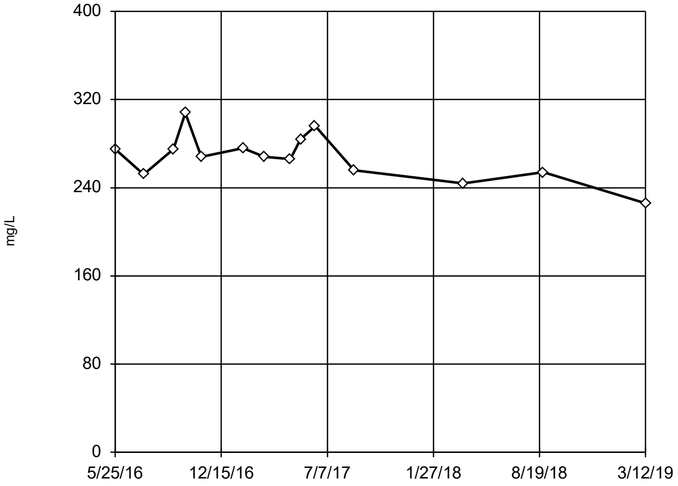
High cutoff = 380.7, low cutoff = 253.8, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:29 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 14

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

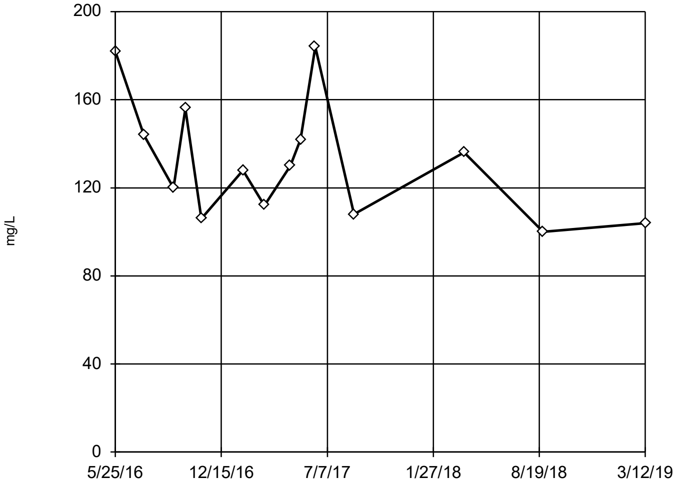
High cutoff = 361, low cutoff = 172, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:29 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

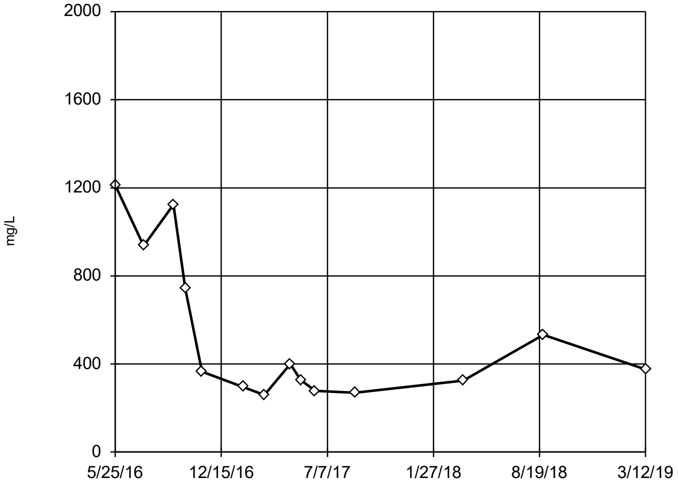
High cutoff = 412, low cutoff = 38.92, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:29 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 14

No outliers found. Tukey's method selected by user.

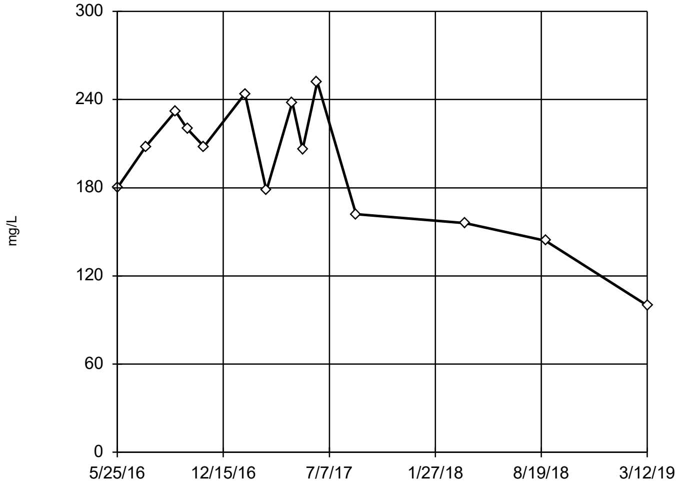
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 20379, low cutoff = 11.72, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:29 AM View: Outlier Tests - App III
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Tukey's Outlier Screening

B-6



n = 14

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

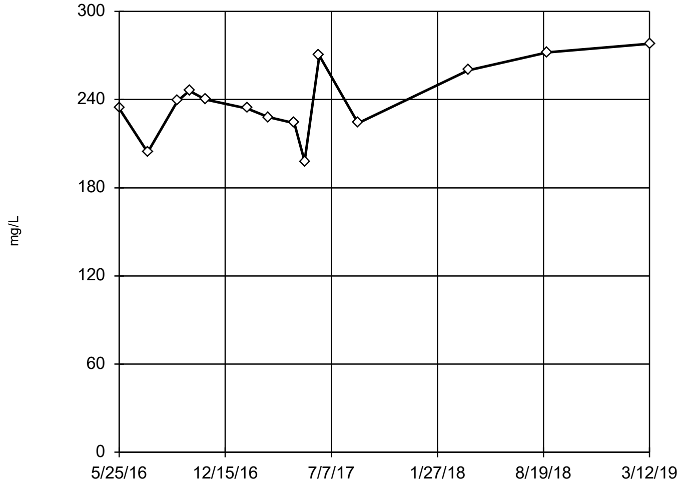
High cutoff = 380.9, low cutoff = -254.1, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:29 AM   View: Outlier Tests - App III

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Tukey's Outlier Screening

B-9



n = 14

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 408.5, low cutoff = 121.7, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:29 AM   View: Outlier Tests - App III

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Outlier Analysis - Downgradient Wells Appendix IV - Significant Results

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 9:16 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Barium, total (mg/L)	**B-10**	**Yes**	**0.102,0.103**	**9/14/2016,11/7/2016**	**NP**	**15**	**0.08112**	**0.00929**	**ln(x)**	**ShapiroWilk**
Barium, total (mg/L)	**B-11**	**Yes**	**0.494**	**9/14/2016**	**NP**	**15**	**0.1516**	**0.09779**	**ln(x)**	**ShapiroWilk**
Beryllium, total (mg/L)	**B-2**	**Yes**	**0.003**	**11/8/2016**	**NP**	**15**	**0.0004499**	**0.0007519**	**ln(x)**	**ShapiroWilk**
Calcium, total (mg/L)	**B-10**	**Yes**	**116**	**11/7/2016**	**NP**	**16**	**80.99**	**12.61**	**ln(x)**	**ShapiroWilk**
Lithium, total (mg/L)	**B-9**	**Yes**	**0.05**	**6/11/2019**	**NP**	**15**	**0.007772**	**0.01221**	**ln(x)**	**ShapiroWilk**
Mercury, total (mg/L)	**B-2**	**Yes**	**0.00000946,0.00005,0.000005**	**7/19/2016,11/8/2016,8/27/2018**	**NP**	**15**	**0.00002334**	**0.00001**	**sqrt(x)**	**ShapiroWilk**

Outlier Analysis - Downgradient Wells Appendix IV - All Results

Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/8/2019, 9:16 AM

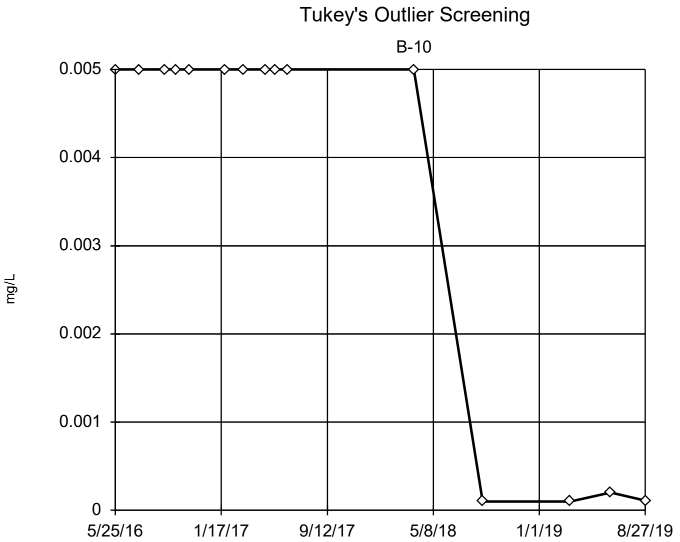
Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Antimony, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.003701	0.00223	ln(x)	ShapiroWilk
Antimony, total (mg/L)	B-11	n/a	n/a	n/a	NP	15	0.003713	0.002194	unknown	ShapiroWilk
Antimony, total (mg/L)	B-2	n/a	n/a	n/a	NP	15	0.002585	0.002257	unknown	ShapiroWilk
Antimony, total (mg/L)	B-6	n/a	n/a	n/a	NP	15	0.003473	0.002259	unknown	ShapiroWilk
Antimony, total (mg/L)	B-9	n/a	n/a	n/a	NP	15	0.003506	0.002205	unknown	ShapiroWilk
Arsenic, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.003564	0.002058	x^3	ShapiroWilk
Arsenic, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.005357	0.0077	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.003648	0.004383	ln(x)	ShapiroWilk
Arsenic, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.002773	0.00205	x^(1/3)	ShapiroWilk
Arsenic, total (mg/L)	B-9	No	n/a	n/a	NP	15	0.003242	0.001958	ln(x)	ShapiroWilk
Barium, total (mg/L)	**B-10**	**Yes**	**0.102,0.103**	**9/14/2016,11/7/2016**	**NP**	**15**	**0.08112**	**0.00929**	**ln(x)**	**ShapiroWilk**
Barium, total (mg/L)	**B-11**	**Yes**	**0.494**	**9/14/2016**	**NP**	**15**	**0.1516**	**0.09779**	**ln(x)**	**ShapiroWilk**
Barium, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.122	0.1292	ln(x)	ShapiroWilk
Barium, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.05925	0.01295	ln(x)	ShapiroWilk
Barium, total (mg/L)	B-9	No	n/a	n/a	NP	15	0.1505	0.01778	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.0005733	0.0004399	x^(1/3)	ShapiroWilk
Beryllium, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.0009123	0.001483	ln(x)	ShapiroWilk
Beryllium, total (mg/L)	**B-2**	**Yes**	**0.003**	**11/8/2016**	**NP**	**15**	**0.0004499**	**0.0007519**	**ln(x)**	**ShapiroWilk**
Beryllium, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.0002347	0.0002642	x^(1/3)	ShapiroWilk
Beryllium, total (mg/L)	B-9	No	n/a	n/a	NP	15	0.0004197	0.0004528	ln(x)	ShapiroWilk
Boron, total (mg/L)	B-10	No	n/a	n/a	NP	16	0.02647	0.01148	sqrt(x)	ShapiroWilk
Boron, total (mg/L)	B-11	No	n/a	n/a	NP	17	0.3189	0.1446	ln(x)	ShapiroWilk
Boron, total (mg/L)	B-2	No	n/a	n/a	NP	17	1.087	0.3474	sqrt(x)	ShapiroWilk
Boron, total (mg/L)	B-6	No	n/a	n/a	NP	17	0.05445	0.01159	normal	ShapiroWilk
Boron, total (mg/L)	B-9	No	n/a	n/a	NP	16	0.01546	0.01114	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	B-10	n/a	n/a	n/a	NP	15	0.0007142	0.0004279	unknown	ShapiroWilk
Cadmium, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.0007317	0.001043	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.0005712	0.0004635	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.0005437	0.0004471	ln(x)	ShapiroWilk
Cadmium, total (mg/L)	B-9	n/a	n/a	n/a	NP	15	0.0007693	0.0003975	unknown	ShapiroWilk
Calcium, total (mg/L)	**B-10**	**Yes**	**116**	**11/7/2016**	**NP**	**16**	**80.99**	**12.61**	**ln(x)**	**ShapiroWilk**
Calcium, total (mg/L)	B-11	No	n/a	n/a	NP	16	13.43	2.462	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-2	No	n/a	n/a	NP	16	36.28	21.91	ln(x)	ShapiroWilk
Calcium, total (mg/L)	B-6	No	n/a	n/a	NP	16	44.95	7.134	x^2	ShapiroWilk
Calcium, total (mg/L)	B-9	No	n/a	n/a	NP	16	101	17.3	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-10	No	n/a	n/a	NP	16	8.164	1.452	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-11	No	n/a	n/a	NP	16	4.918	1.243	normal	ShapiroWilk
Chloride, total (mg/L)	B-2	No	n/a	n/a	NP	16	5.928	1.72	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-6	No	n/a	n/a	NP	16	7.571	1.501	ln(x)	ShapiroWilk
Chloride, total (mg/L)	B-9	No	n/a	n/a	NP	16	5.599	1.333	x^2	ShapiroWilk
Chromium, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.004406	0.009828	ln(x)	ShapiroWilk
Chromium, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.01224	0.02725	ln(x)	ShapiroWilk
Chromium, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.007344	0.01025	ln(x)	ShapiroWilk
Chromium, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.004085	0.002403	ln(x)	ShapiroWilk
Chromium, total (mg/L)	B-9	No	n/a	n/a	NP	15	0.002271	0.001024	sqrt(x)	ShapiroWilk
Cobalt, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.001008	0.001189	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.003008	0.006331	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.00414	0.008361	ln(x)	ShapiroWilk
Cobalt, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.001522	0.001193	sqrt(x)	ShapiroWilk
Cobalt, total (mg/L)	B-9	No	n/a	n/a	NP	15	0.0009714	0.00059	sqrt(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	B-10	No	n/a	n/a	NP	14	1.113	0.5527	x^(1/3)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	B-11	No	n/a	n/a	NP	14	2.516	3.581	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	B-2	No	n/a	n/a	NP	14	1.922	0.9752	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	B-6	No	n/a	n/a	NP	14	2.274	3.821	ln(x)	ShapiroWilk
Combined Radium 226 + 228 (pCi/L)	B-9	No	n/a	n/a	NP	14	1.776	2.355	ln(x)	ShapiroWilk

Outlier Analysis - Downgradient Wells Appendix IV - All Results

Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/8/2019, 9:16 AM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	N	Mean	Std. Dev.	Distribution	Normality Test
Fluoride, total (mg/L)	B-10	No	n/a	n/a	NP	16	0.7545	0.38	ln(x)	ShapiroWilk
Fluoride, total (mg/L)	B-11	n/a	n/a	n/a	NP	16	0.88	0.3279	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-2	n/a	n/a	n/a	NP	16	0.8435	0.3408	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-6	n/a	n/a	n/a	NP	16	0.8398	0.3464	unknown	ShapiroWilk
Fluoride, total (mg/L)	B-9	No	n/a	n/a	NP	16	0.7077	0.394	ln(x)	ShapiroWilk
Lead, total (mg/L)	B-10	n/a	n/a	n/a	NP	15	0.00312	0.002162	unknown	ShapiroWilk
Lead, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.006196	0.01214	ln(x)	ShapiroWilk
Lead, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.004373	0.006874	ln(x)	ShapiroWilk
Lead, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.00171	0.00145	sqrt(x)	ShapiroWilk
Lead, total (mg/L)	B-9	No	n/a	n/a	NP	15	0.003002	0.00222	ln(x)	ShapiroWilk
Lithium, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.007401	0.01239	ln(x)	ShapiroWilk
Lithium, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.01221	0.0203	ln(x)	ShapiroWilk
Lithium, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.01027	0.01351	ln(x)	ShapiroWilk
Lithium, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.006166	0.01269	ln(x)	ShapiroWilk
Lithium, total (mg/L)	**B-9**	**Yes**	**0.05**	**6/11/2019**	**NP**	**15**	**0.007772**	**0.01221**	**ln(x)**	**ShapiroWilk**
Mercury, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.00002178	0.000005834	x^2	ShapiroWilk
Mercury, total (mg/L)	B-11	n/a	n/a	n/a	NP	15	0.00002973	0.00001861	unknown	ShapiroWilk
Mercury, total (mg/L)	**B-2**	**Yes**	**0.00000946,0.00005,0.000005**	**7/19/2016,11/8/2016,8/27/2018**	**NP**	**15**	**0.00002334**	**0.00001**	**sqrt(x)**	**ShapiroWilk**
Mercury, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.00001544	0.000008342	ln(x)	ShapiroWilk
Mercury, total (mg/L)	B-9	n/a	n/a	n/a	NP	15	0.00002244	0.000005506	unknown	ShapiroWilk
Molybdenum, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.002665	0.003203	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.003715	0.002668	sqrt(x)	ShapiroWilk
Molybdenum, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.002644	0.002729	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.002431	0.002802	ln(x)	ShapiroWilk
Molybdenum, total (mg/L)	B-9	n/a	n/a	n/a	NP	15	0.006527	0.008516	unknown	ShapiroWilk
pH, field (SU)	B-10	No	n/a	n/a	NP	16	7.365	0.5946	ln(x)	ShapiroWilk
pH, field (SU)	B-11	No	n/a	n/a	NP	17	5.895	0.4542	ln(x)	ShapiroWilk
pH, field (SU)	B-2	No	n/a	n/a	NP	17	6.24	0.4454	ln(x)	ShapiroWilk
pH, field (SU)	B-6	No	n/a	n/a	NP	17	6.742	0.2669	x^6	ShapiroWilk
pH, field (SU)	B-9	No	n/a	n/a	NP	16	7.337	0.4942	x^4	ShapiroWilk
Selenium, total (mg/L)	B-10	No	n/a	n/a	NP	15	0.003767	0.002118	ln(x)	ShapiroWilk
Selenium, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.003293	0.001377	x^(1/3)	ShapiroWilk
Selenium, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.02412	0.02155	ln(x)	ShapiroWilk
Selenium, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.002494	0.001205	x^(1/3)	ShapiroWilk
Selenium, total (mg/L)	B-9	n/a	n/a	n/a	NP	15	0.003847	0.001984	unknown	ShapiroWilk
Sulfate, total (mg/L)	B-10	No	n/a	n/a	NP	16	29.18	4.246	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	B-11	No	n/a	n/a	NP	16	44.83	10.53	x^(1/3)	ShapiroWilk
Sulfate, total (mg/L)	B-2	No	n/a	n/a	NP	16	219.9	176.2	ln(x)	ShapiroWilk
Sulfate, total (mg/L)	B-6	No	n/a	n/a	NP	16	25.78	7.641	sqrt(x)	ShapiroWilk
Sulfate, total (mg/L)	B-9	No	n/a	n/a	NP	16	24.54	7.965	ln(x)	ShapiroWilk
Thallium, total (mg/L)	B-10	n/a	n/a	n/a	NP	15	0.001726	0.0006219	unknown	ShapiroWilk
Thallium, total (mg/L)	B-11	No	n/a	n/a	NP	15	0.001635	0.000662	normal	ShapiroWilk
Thallium, total (mg/L)	B-2	No	n/a	n/a	NP	15	0.001529	0.0007166	sqrt(x)	ShapiroWilk
Thallium, total (mg/L)	B-6	No	n/a	n/a	NP	15	0.001601	0.0006496	normal	ShapiroWilk
Thallium, total (mg/L)	B-9	No	n/a	n/a	NP	15	0.001673	0.0006346	x^2	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-10	No	n/a	n/a	NP	16	267.3	19.66	sqrt(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-11	No	n/a	n/a	NP	16	129.5	28.4	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-2	No	n/a	n/a	NP	16	494.9	325.4	ln(x)	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-6	No	n/a	n/a	NP	16	197.9	42.93	x^2	ShapiroWilk
Total Dissolved Solids [TDS] (mg/L)	B-9	No	n/a	n/a	NP	16	244.3	28.59	ln(x)	ShapiroWilk

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

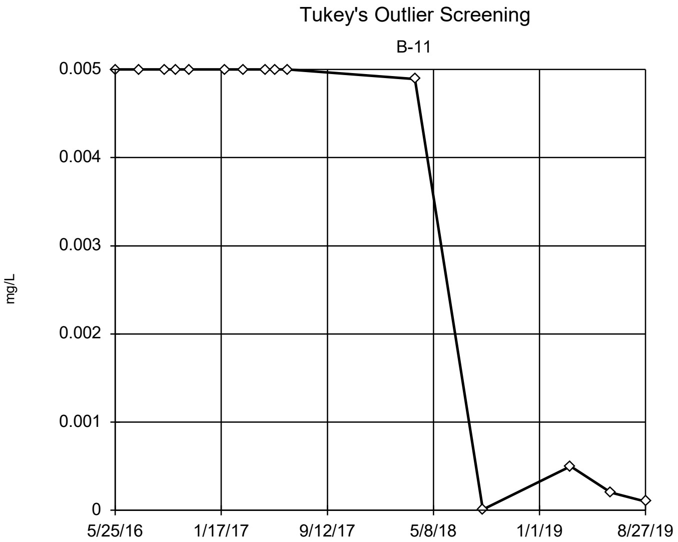
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 78.12, low cutoff = 1.3e-8, based on IQR multiplier of 3.

Constituent: Antimony, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

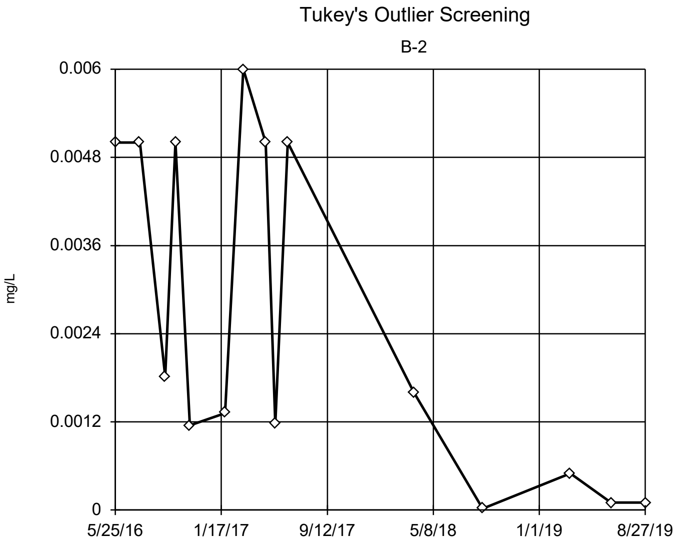
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Antimony, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

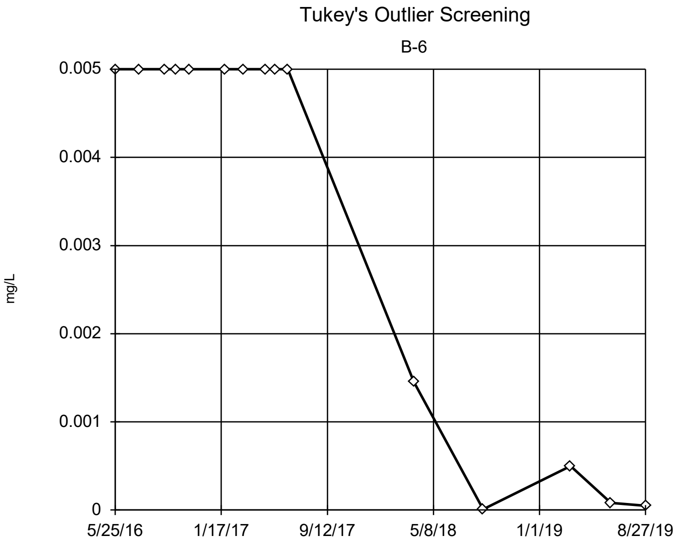
No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Antimony, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

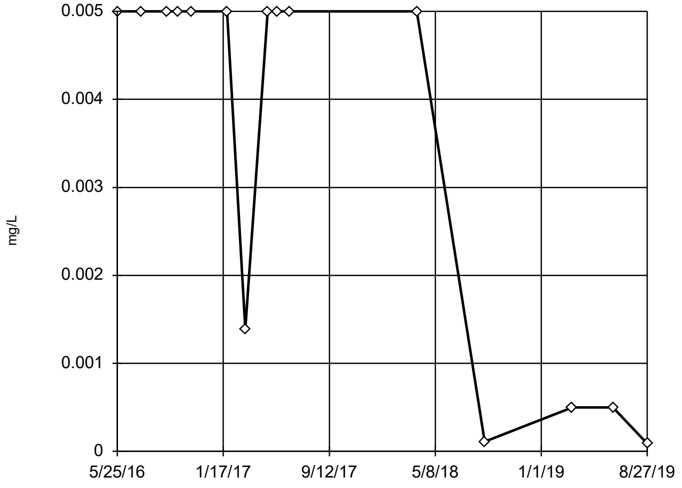
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Antimony, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

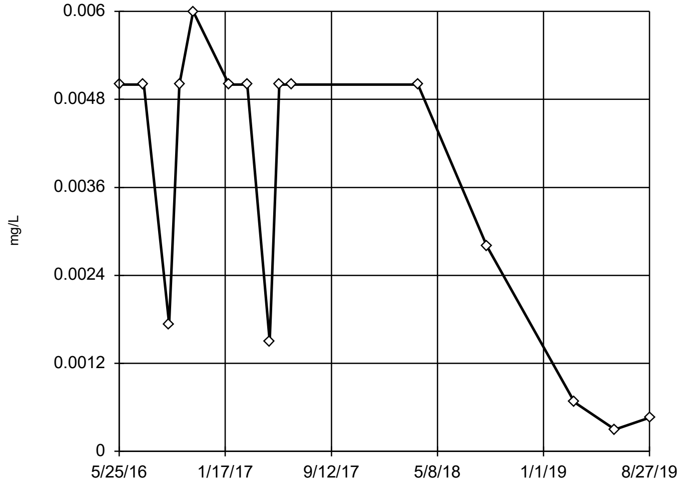
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Antimony, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

No outliers found. Tukey's method selected by user.

Data were cube transformed to achieve best W statistic (graph shown in original units).

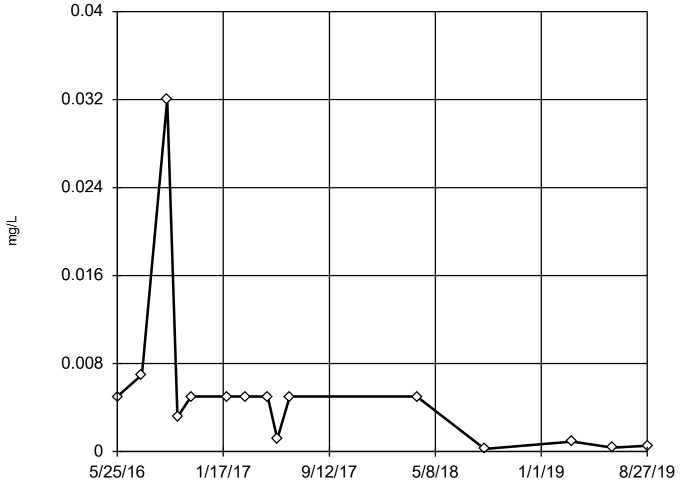
High cutoff = 0.007883, low cutoff = -0.007124, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

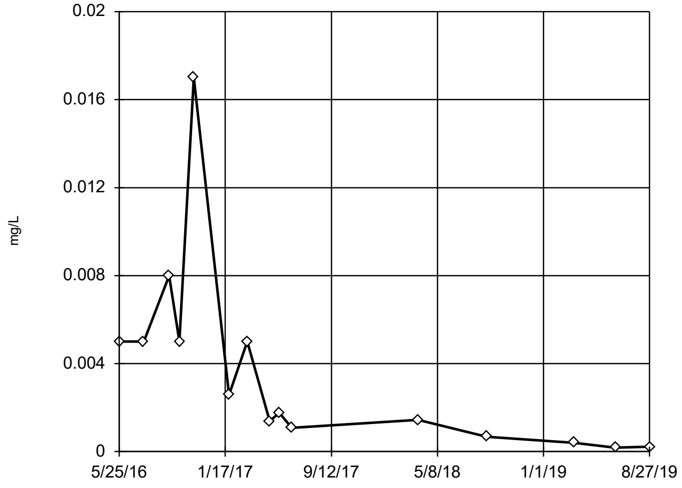
High cutoff = 0.8573, low cutoff = 0.000005249, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

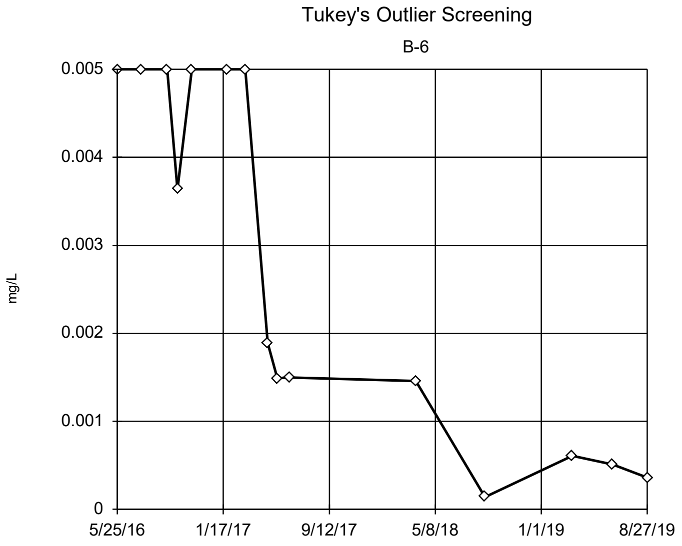
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 2.078, low cutoff = 0.000001612, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

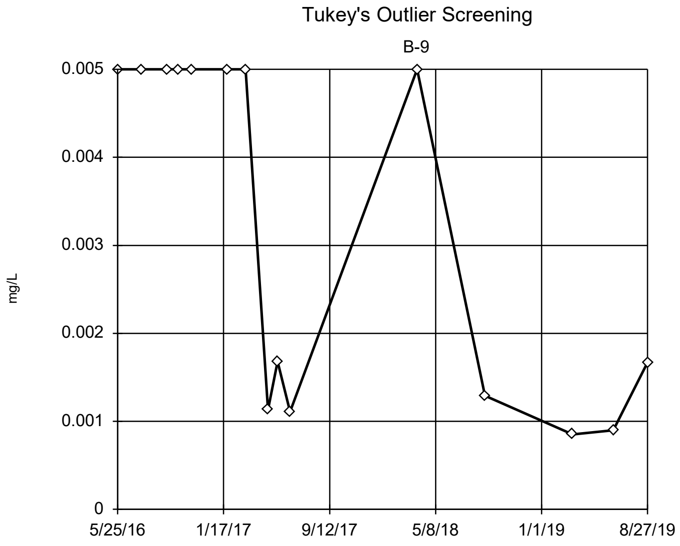
No outliers found.
Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.07926, low cutoff = -0.005246, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

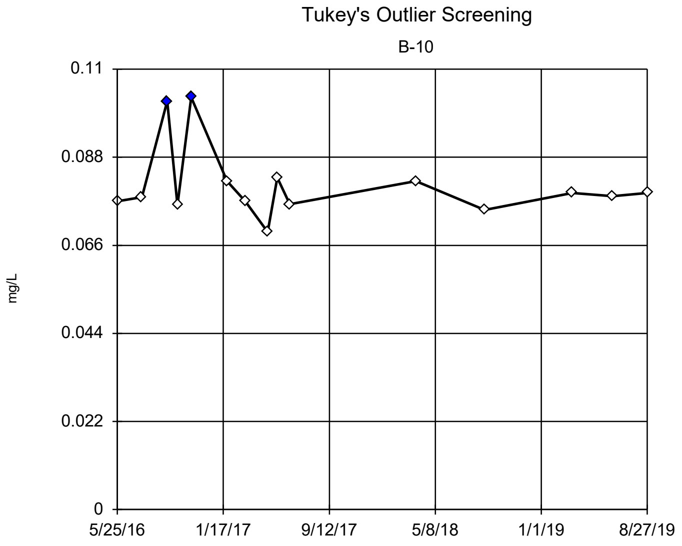
No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.4332, low cutoff = 0.00001304, based on IQR multiplier of 3.

Constituent: Arsenic, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

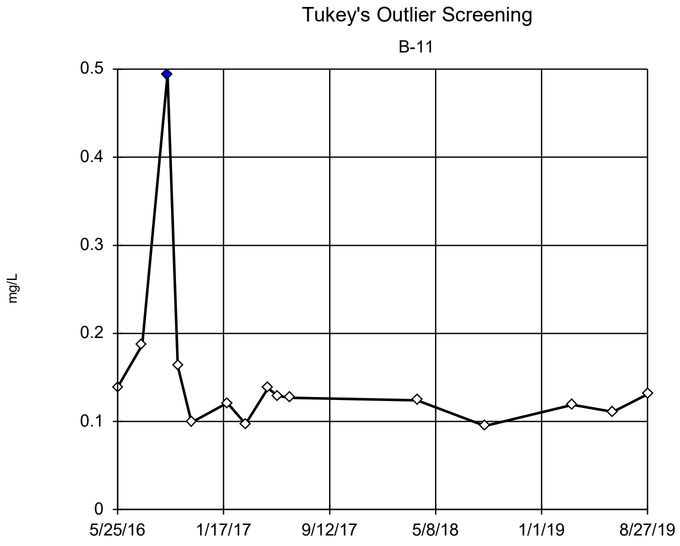
Outliers are drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.102, low cutoff = 0.06131, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

Outlier is drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

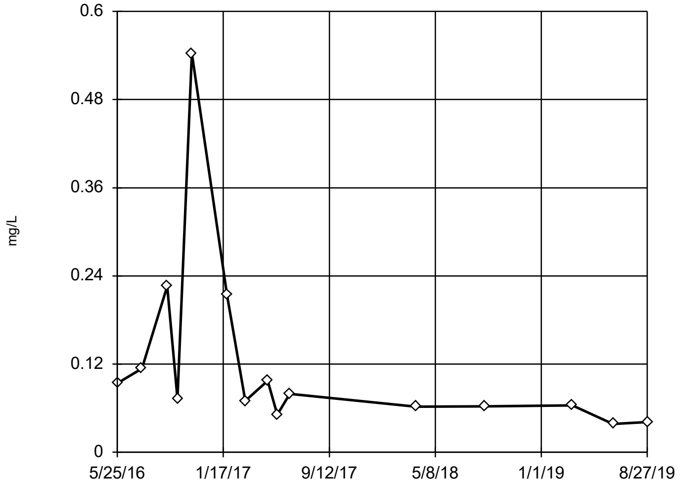
High cutoff = 0.273, low cutoff = 0.05653, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

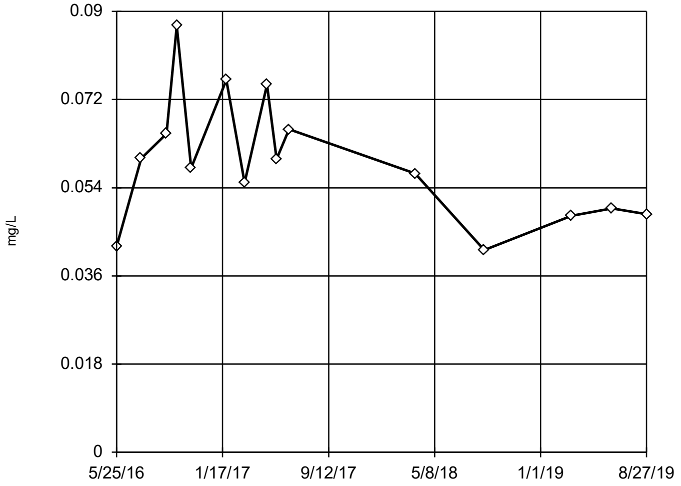
High cutoff = 0.7019, low cutoff = 0.0101, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

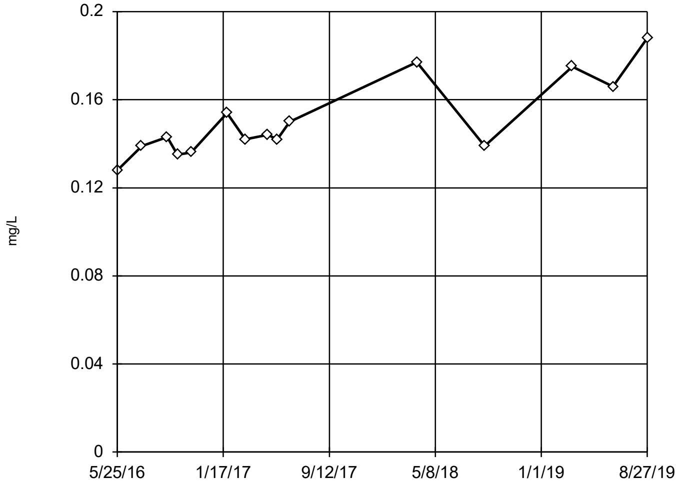
High cutoff = 0.1646, low cutoff = 0.01947, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

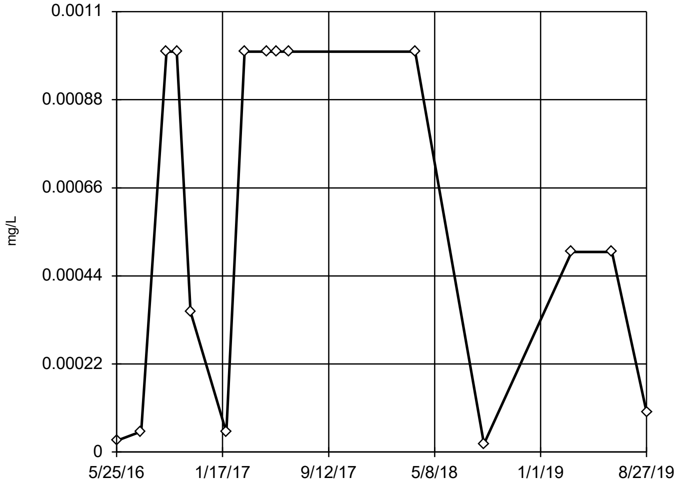
High cutoff = 0.2827, low cutoff = 0.08161, based on IQR multiplier of 3.

Constituent: Barium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

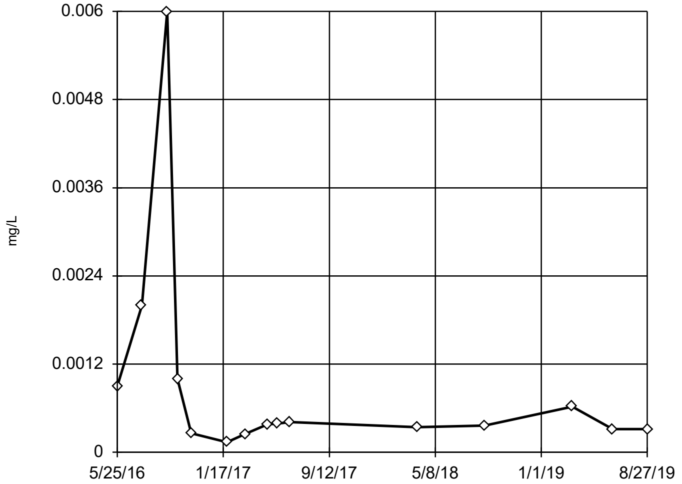
High cutoff = 0.024, low cutoff = -0.003462, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

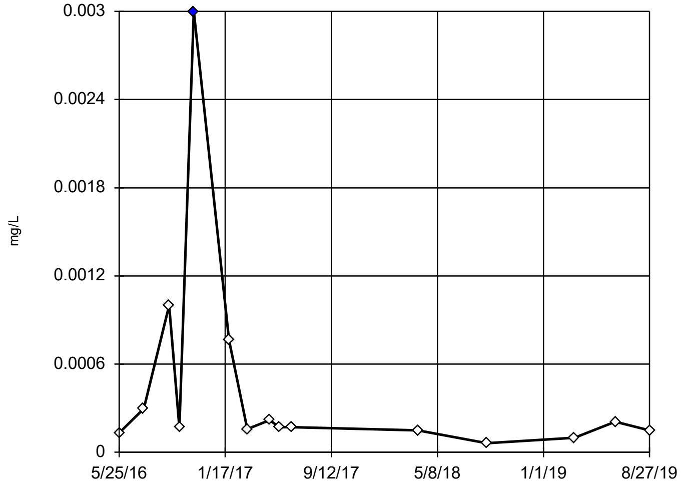
High cutoff = 0.02078, low cutoff = 0.00001368, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

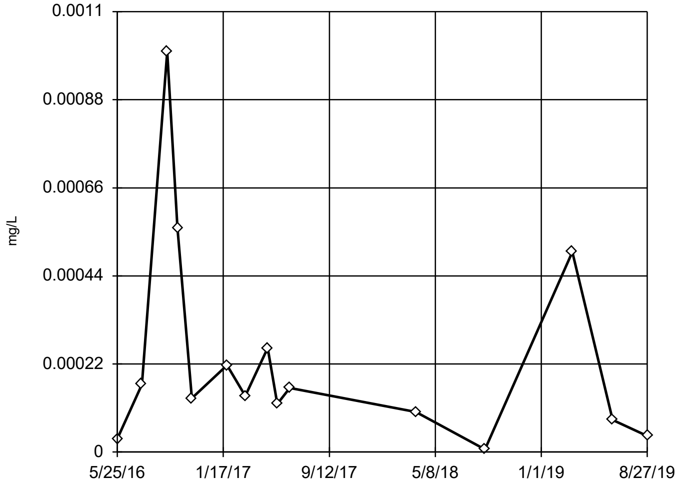
High cutoff = 0.002361, low cutoff = 0.00001876, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

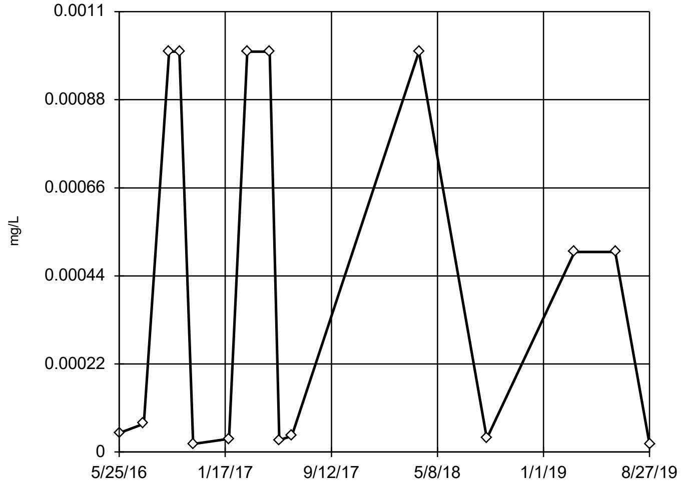
High cutoff = 0.002002, low cutoff = -0.00000699, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

No outliers found. Tukey's method selected by user.

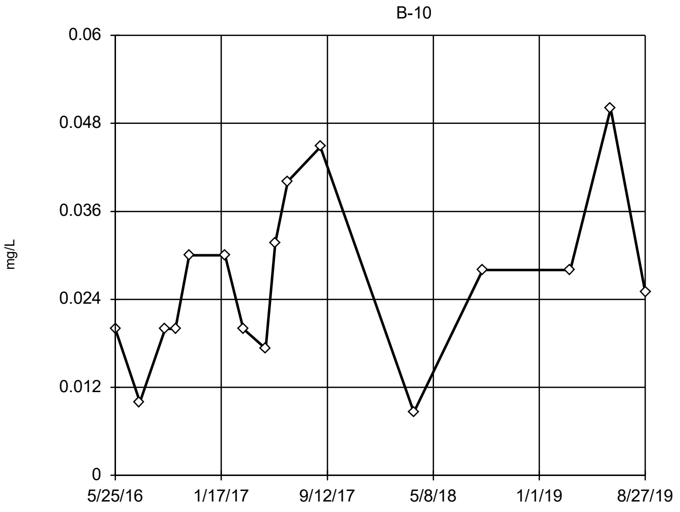
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 27.23, low cutoff = 1.2e-9, based on IQR multiplier of 3.

Constituent: Beryllium, total Analysis Run 12/8/2019 9:05 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 16

No outliers found. Tukey's method selected by user.

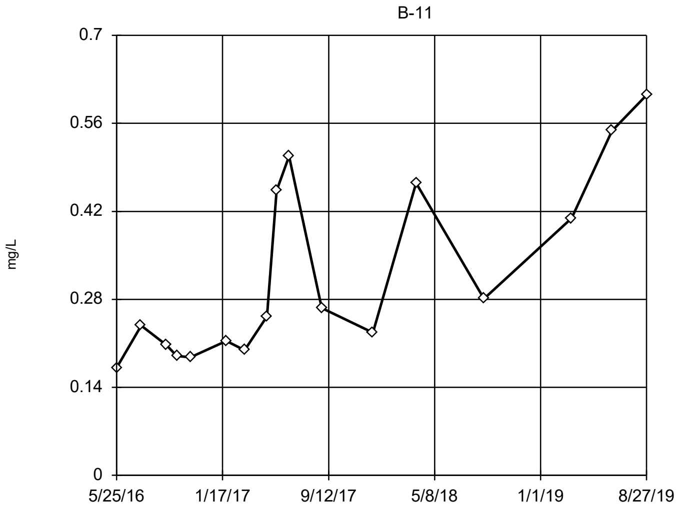
Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.07738, low cutoff = 0.00151, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 17

No outliers found. Tukey's method selected by user.

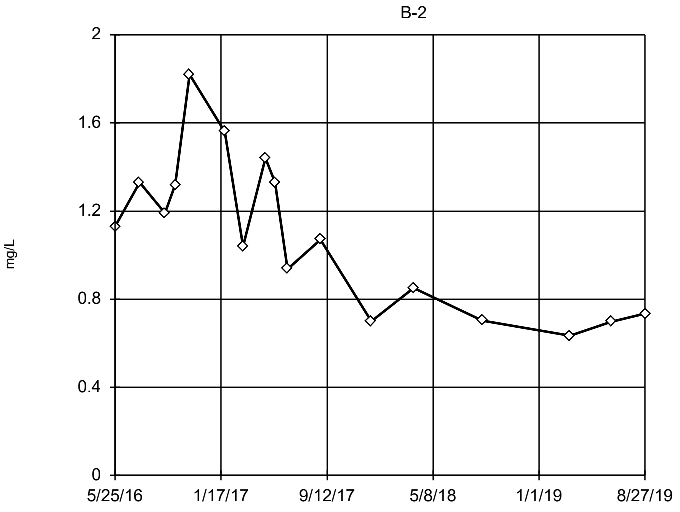
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 5.307, low cutoff = 0.01755, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 17

No outliers found. Tukey's method selected by user.

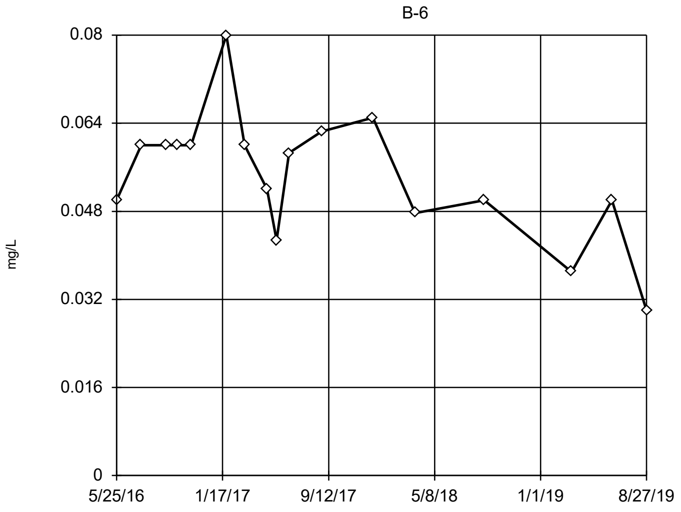
Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 4.286, low cutoff = -0.004819, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 17

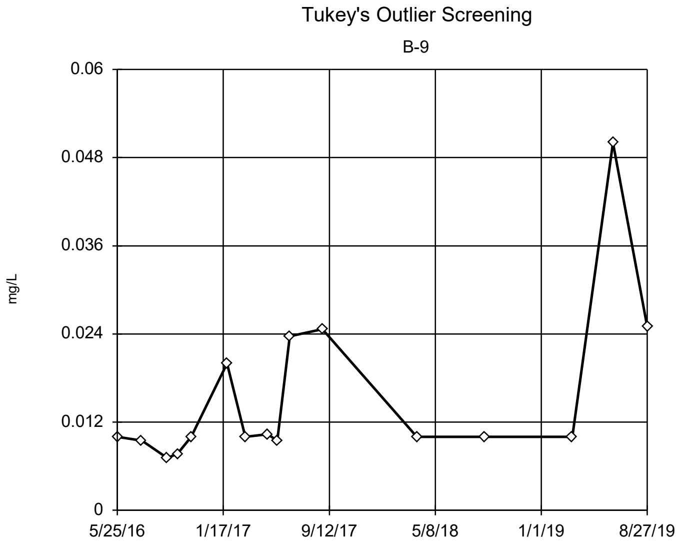
No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.09345, low cutoff = 0.0154, based on IQR multiplier of 3.

Constituent: Boron, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

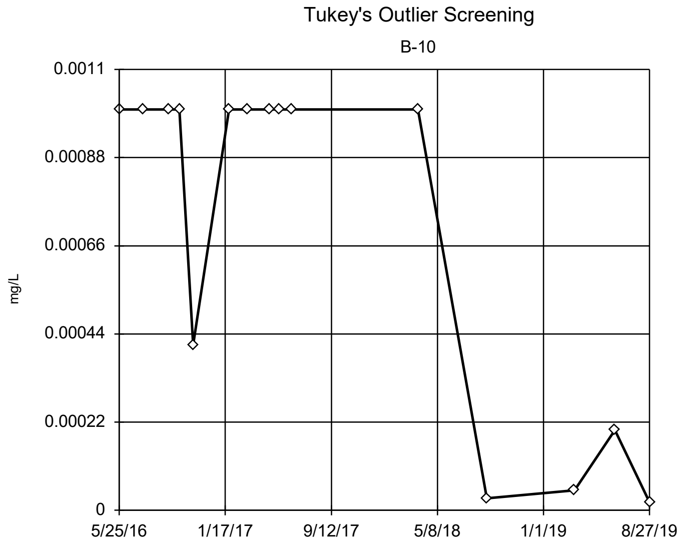
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.2432, low cutoff = 0.0008716, based on IQR multiplier of 3.

Constituent: Boron, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

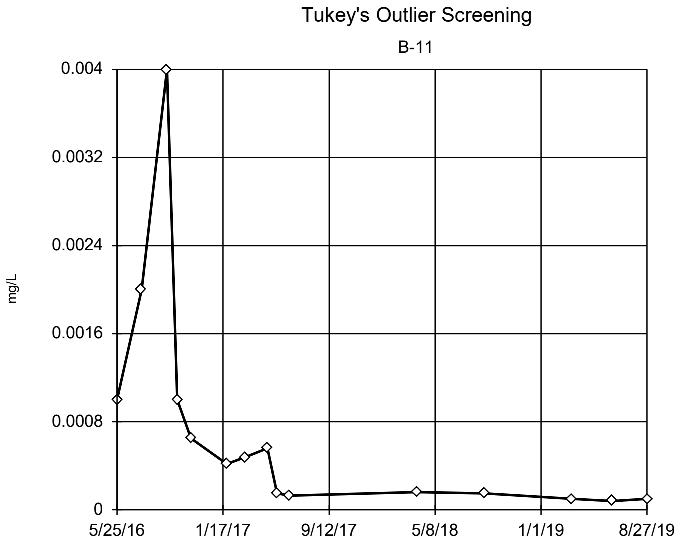
No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Cadmium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

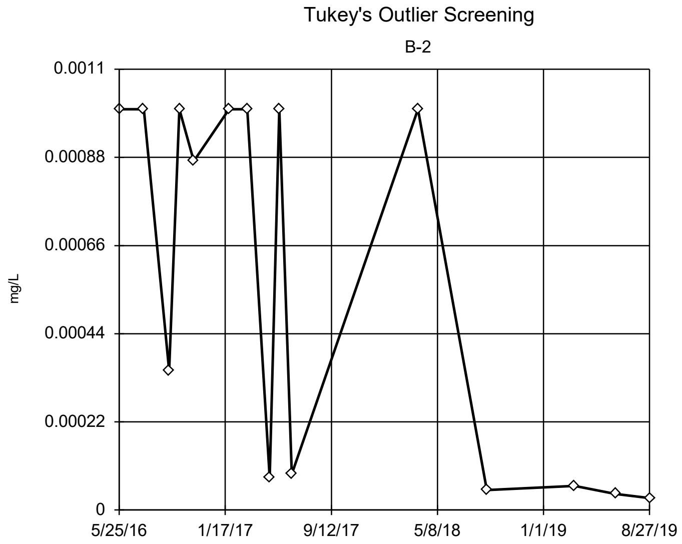
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.4552, low cutoff = 2.9e-7, based on IQR multiplier of 3.

Constituent: Cadmium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

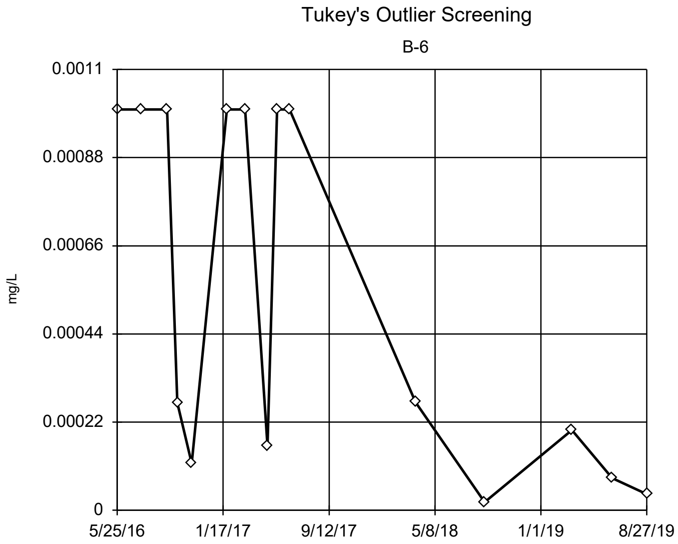
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 4.63, low cutoff = 1.3e-8, based on IQR multiplier of 3.

Constituent: Cadmium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

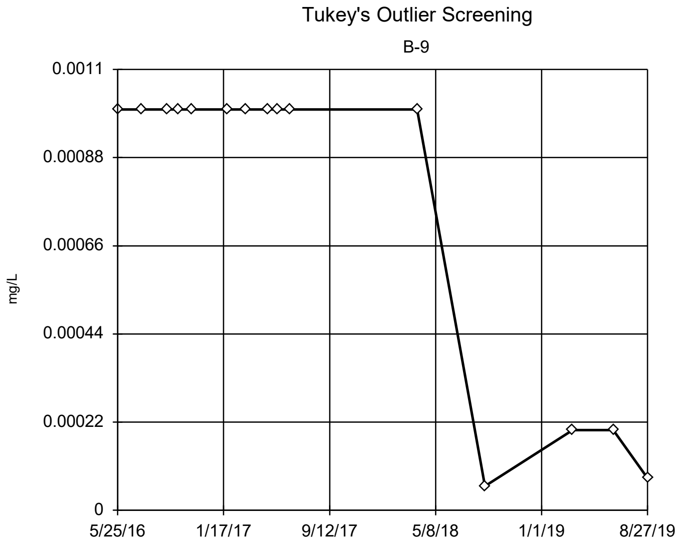
No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.6299, low cutoff = 1.9e-7, based on IQR multiplier of 3.

Constituent: Cadmium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

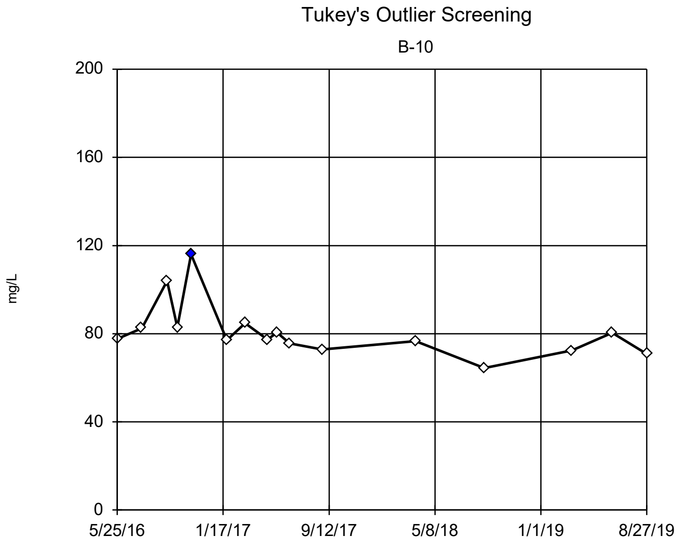
No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Cadmium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

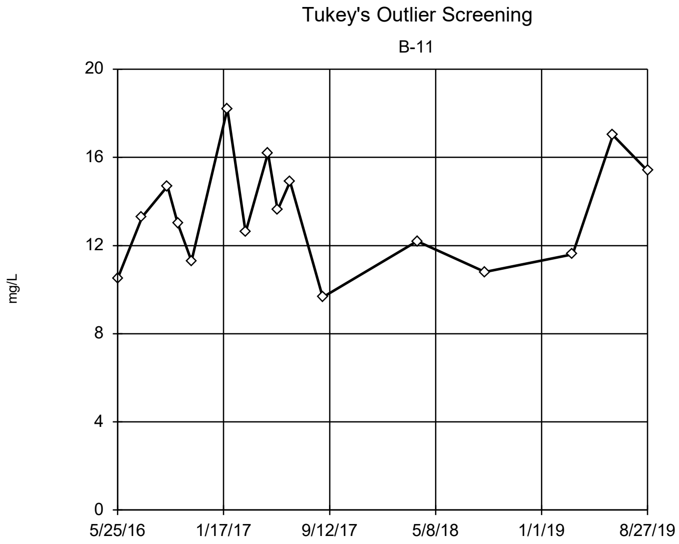
Outlier is drawn as solid.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 114.6, low cutoff = 53.55, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

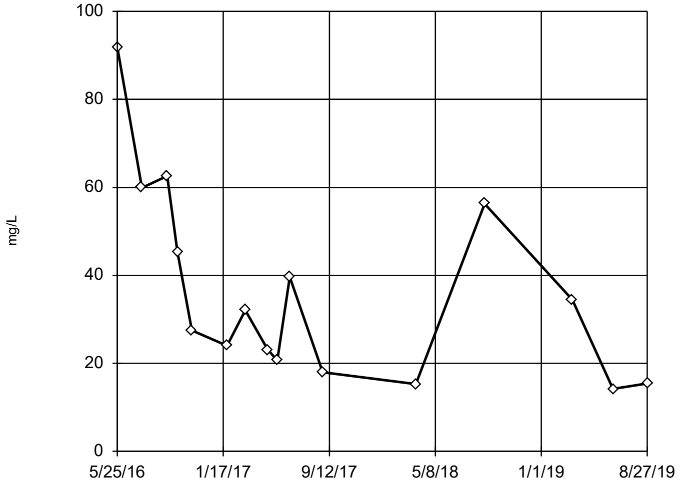
High cutoff = 35.08, low cutoff = 4.943, based on IQR multiplier of 3.

Constituent: Calcium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

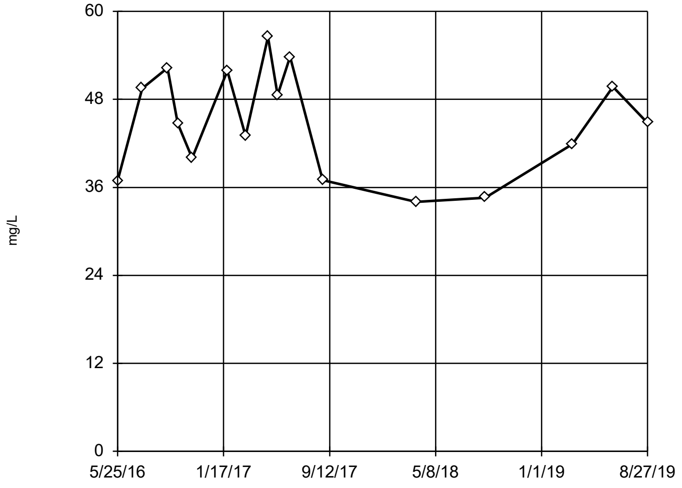
High cutoff = 904.4, low cutoff = 1.078, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 16

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

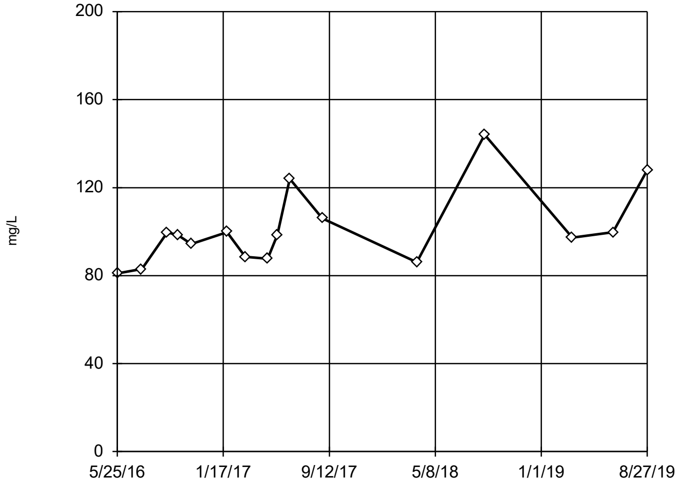
High cutoff = 76.64, low cutoff = -42.52, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

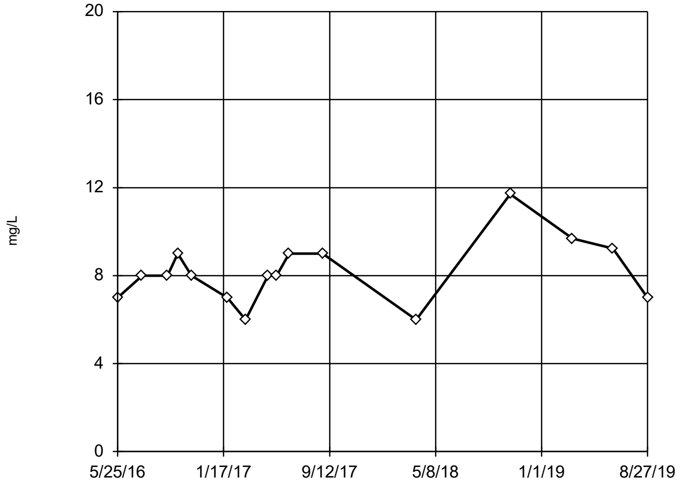
High cutoff = 163.7, low cutoff = 55.36, based on IQR multiplier of 3.

Constituent: Calcium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 16

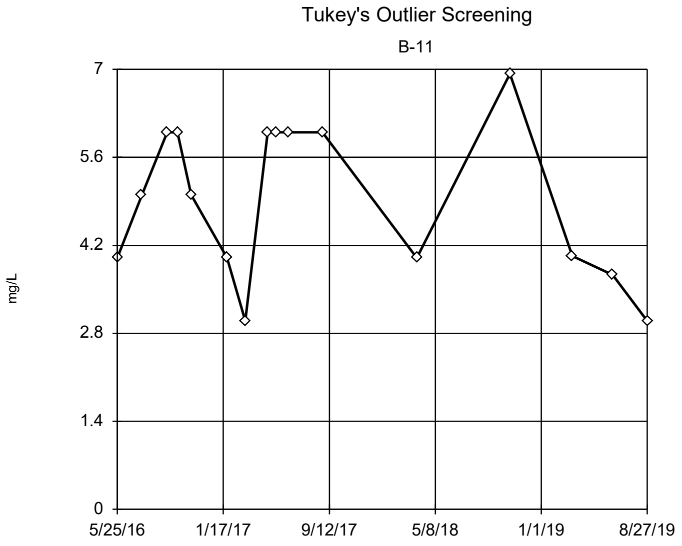
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 19.13, low cutoff = 3.294, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

No outliers found. Tukey's method selected by user.

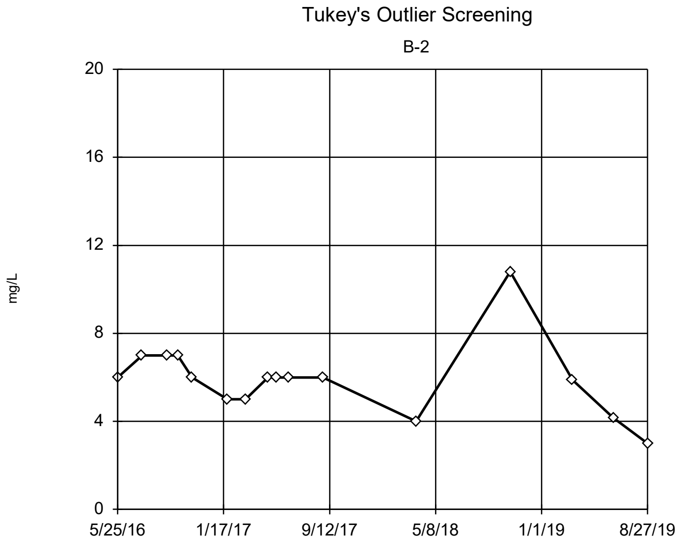
Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 12, low cutoff = -2, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

No outliers found. Tukey's method selected by user.

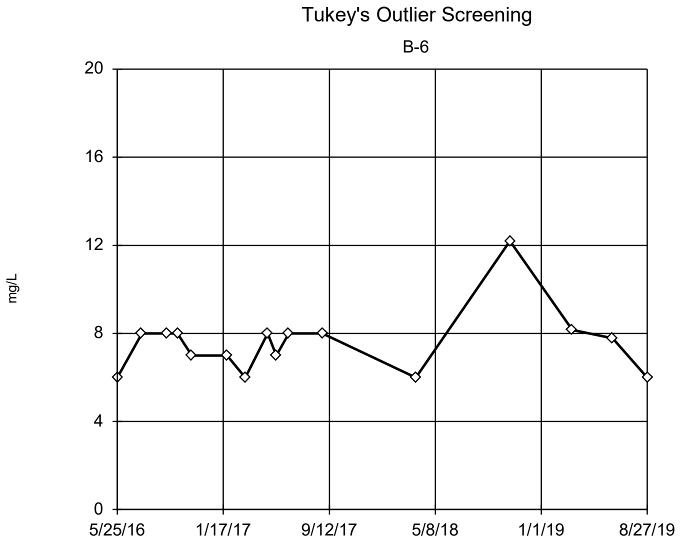
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 14.11, low cutoff = 2.296, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

No outliers found. Tukey's method selected by user.

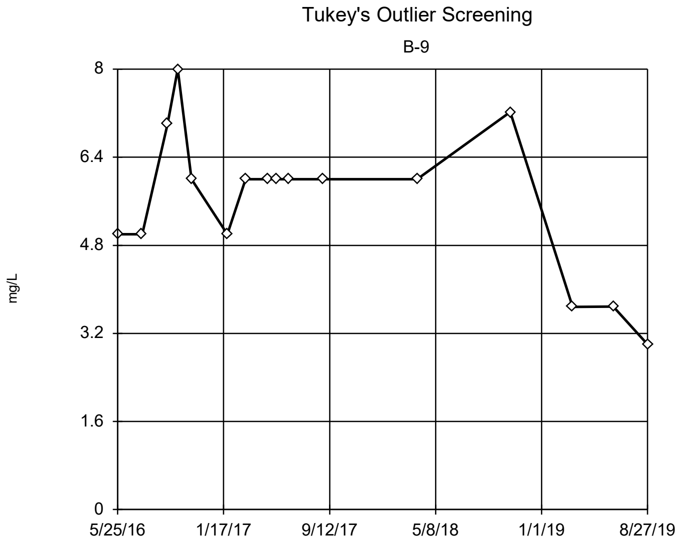
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 15.05, low cutoff = 3.445, based on IQR multiplier of 3.

Constituent: Chloride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 8.307, low cutoff = -2.828, based on IQR multiplier of 3.

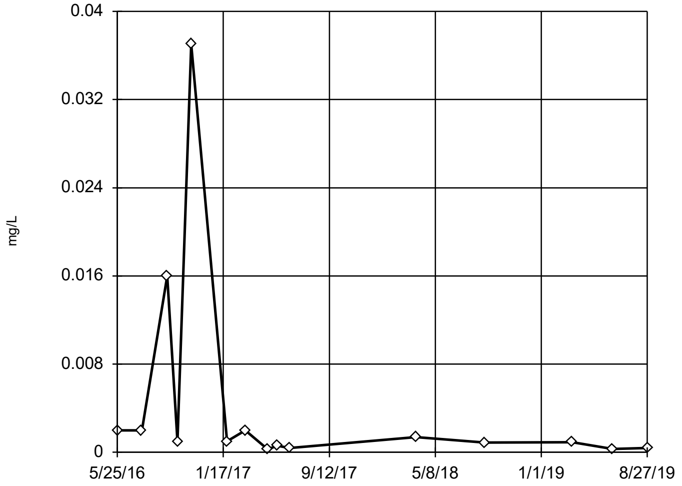
Constituent: Chloride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

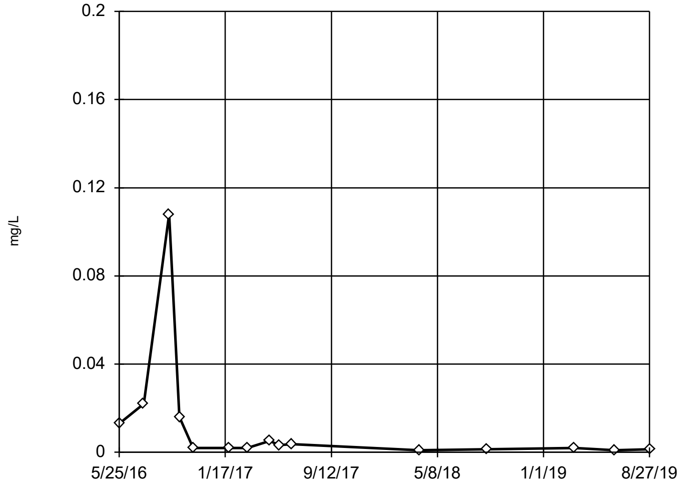
High cutoff = 0.2697, low cutoff = 0.000002892, based on IQR multiplier of 3.

Constituent: Chromium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App I
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

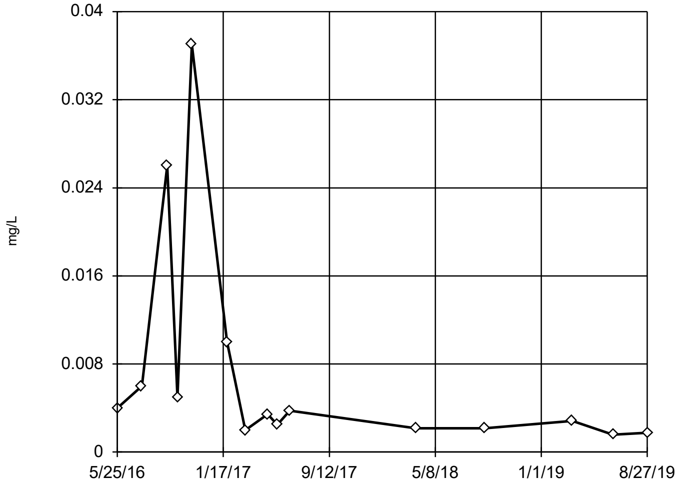
High cutoff = 11.35, low cutoff = 0.000001557, based on IQR multiplier of 3.

Constituent: Chromium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App I
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

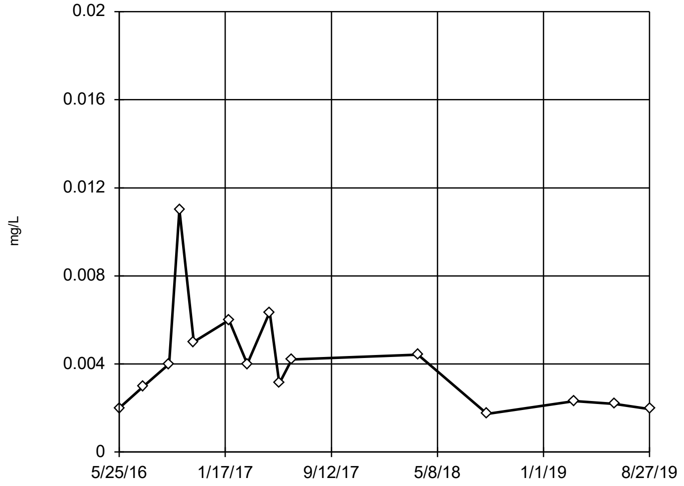
High cutoff = 0.1304, low cutoff = 0.00009892, based on IQR multiplier of 3.

Constituent: Chromium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App I
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

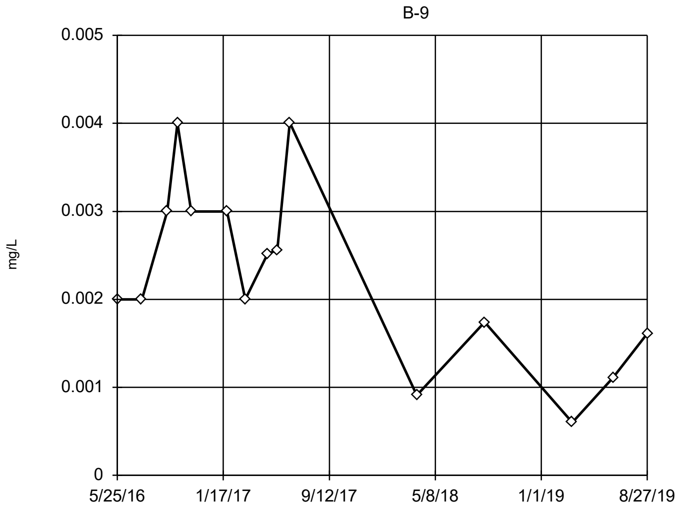
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.06033, low cutoff = 0.0001807, based on IQR multiplier of 3.

Constituent: Chromium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App I
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 15

No outliers found. Tukey's method selected by user.

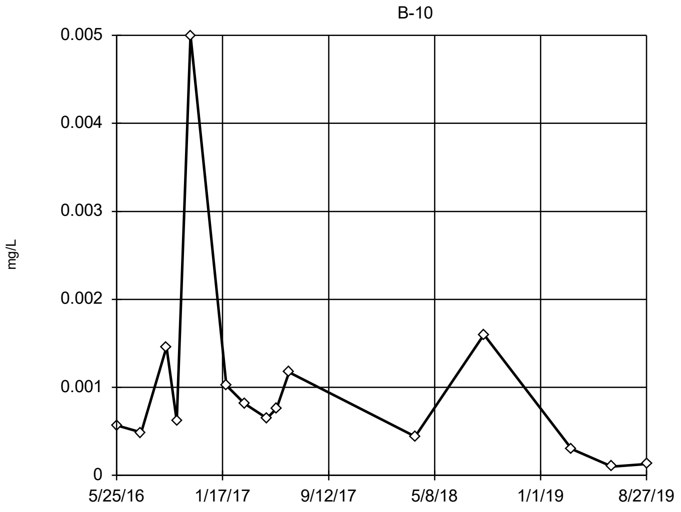
Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.009745, low cutoff = -0.00001457, based on IQR multiplier of 3.

Constituent: Chromium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App I
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 15

No outliers found. Tukey's method selected by user.

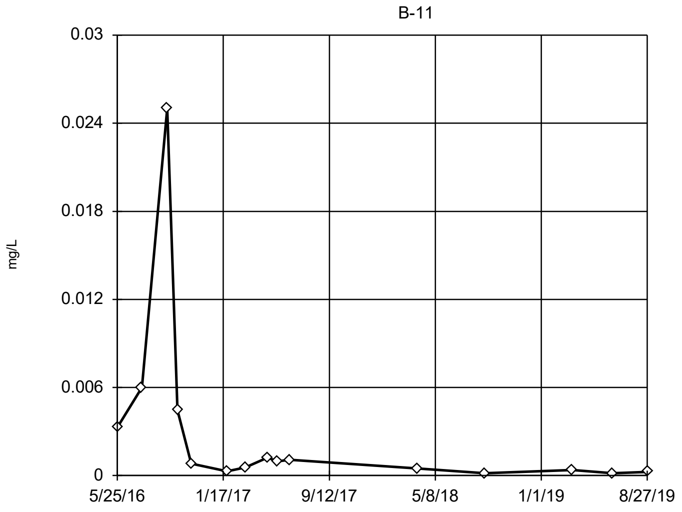
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.022, low cutoff = 0.0000234, based on IQR multiplier of 3.

Constituent: Cobalt, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 15

No outliers found. Tukey's method selected by user.

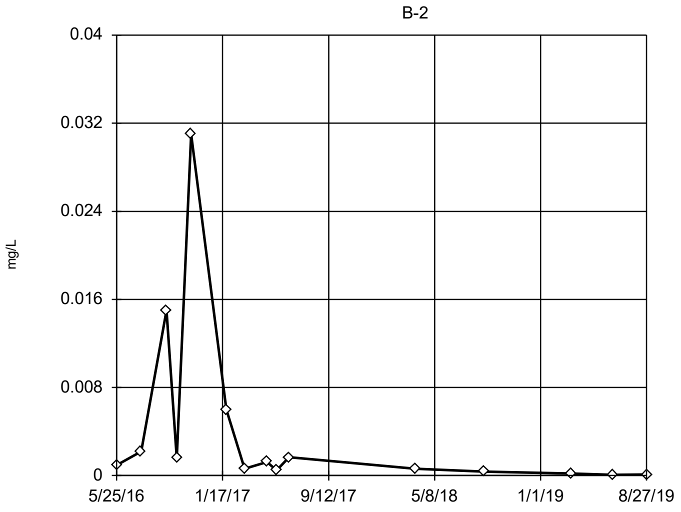
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 4.927, low cutoff = 1.9e-7, based on IQR multiplier of 3.

Constituent: Cobalt, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

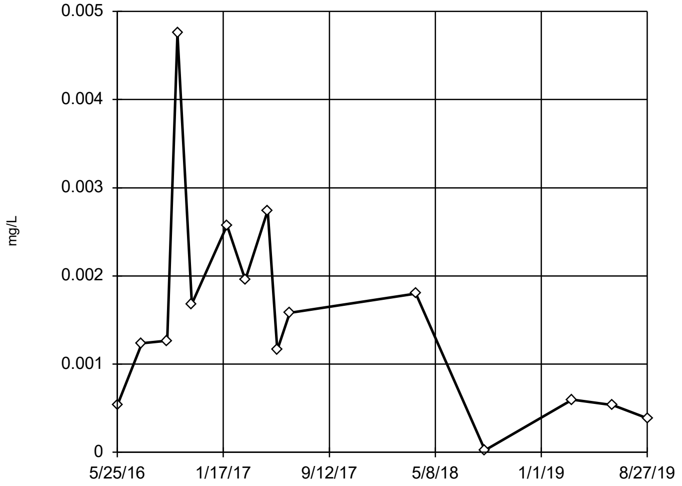
High cutoff = 0.4495, low cutoff = 0.000001806, based on IQR multiplier of 3.

Constituent: Cobalt, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01154, low cutoff = -0.001603, based on IQR multiplier of 3.

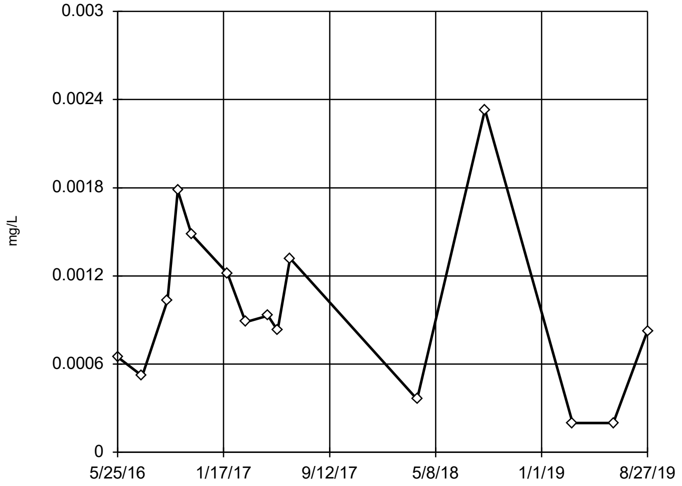
Constituent: Cobalt, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.005912, low cutoff = -0.0003149, based on IQR multiplier of 3.

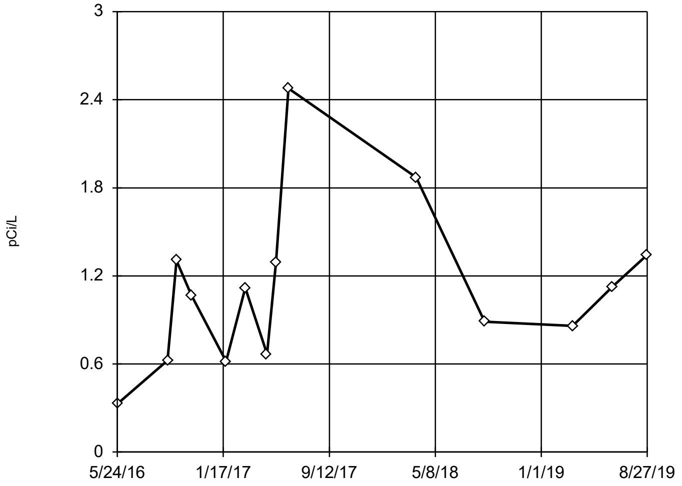
Constituent: Cobalt, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 14

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 5.822, low cutoff = 0.004392, based on IQR multiplier of 3.

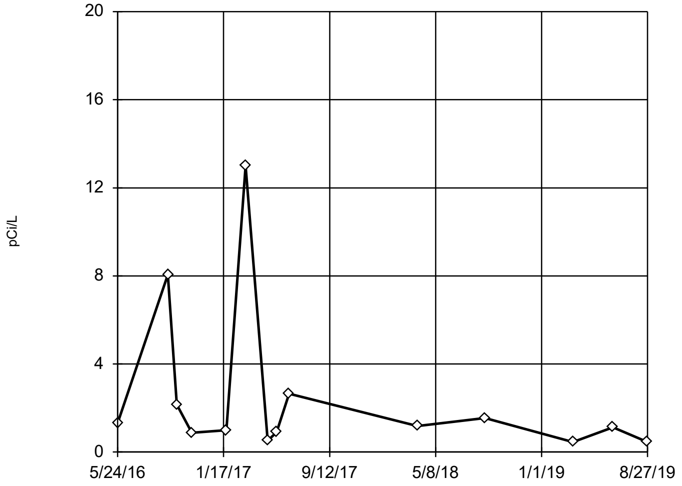
Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgra

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 14

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

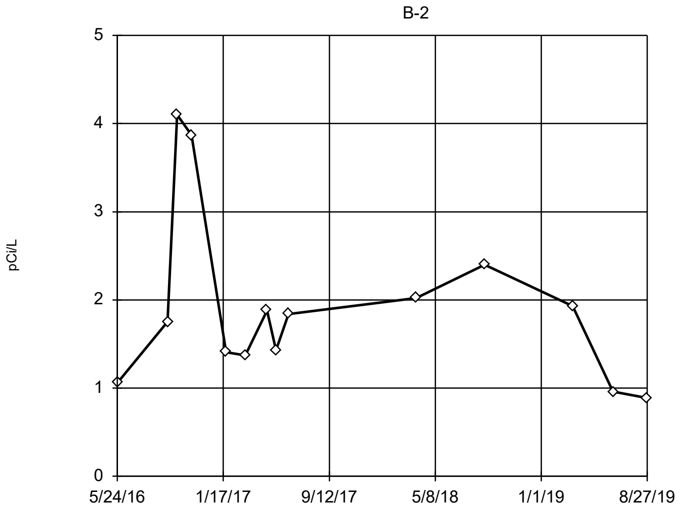
High cutoff = 110, low cutoff = 0.01457, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgra

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 14

No outliers found. Tukey's method selected by user.

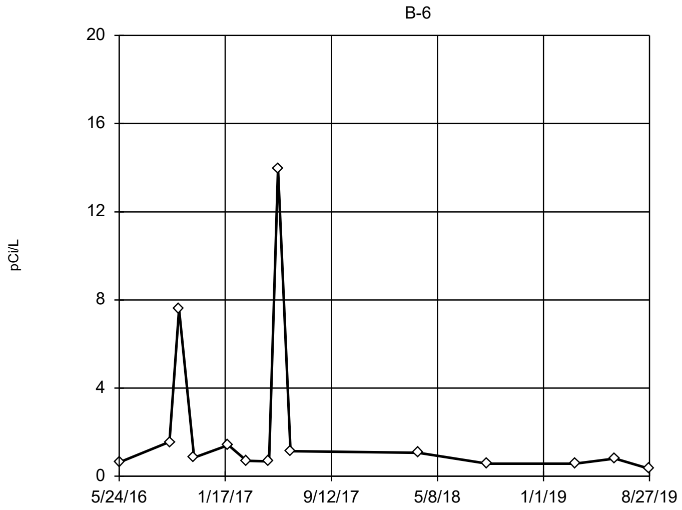
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 13.4, low cutoff = 0.1981, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgra
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 14

No outliers found. Tukey's method selected by user.

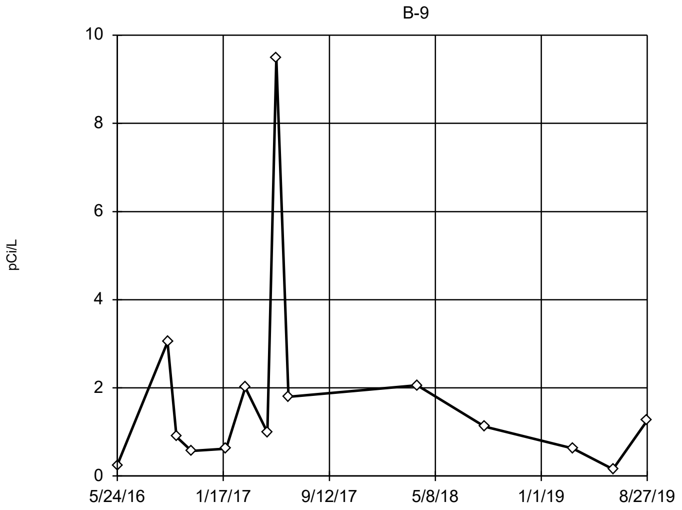
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 22.74, low cutoff = 0.03898, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgra
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 14

No outliers found. Tukey's method selected by user.

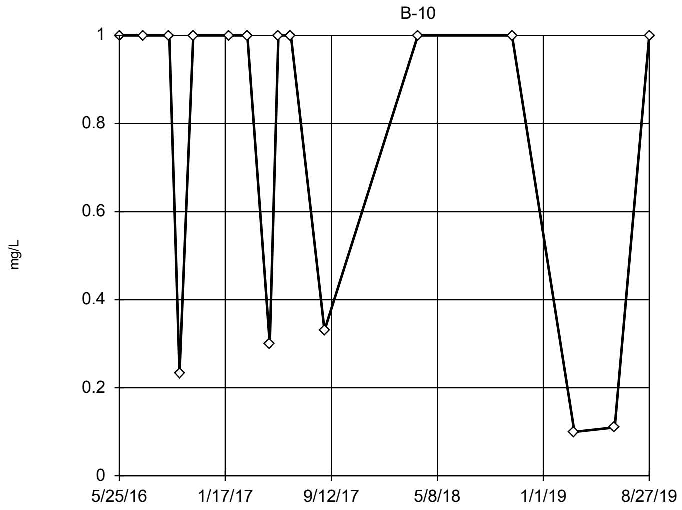
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 82.14, low cutoff = 0.01469, based on IQR multiplier of 3.

Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgra
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

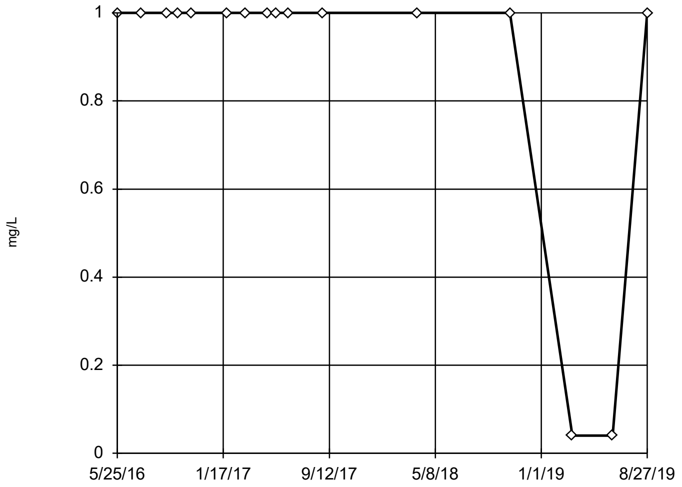
High cutoff = 32.04, low cutoff = 0.009825, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 16

No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

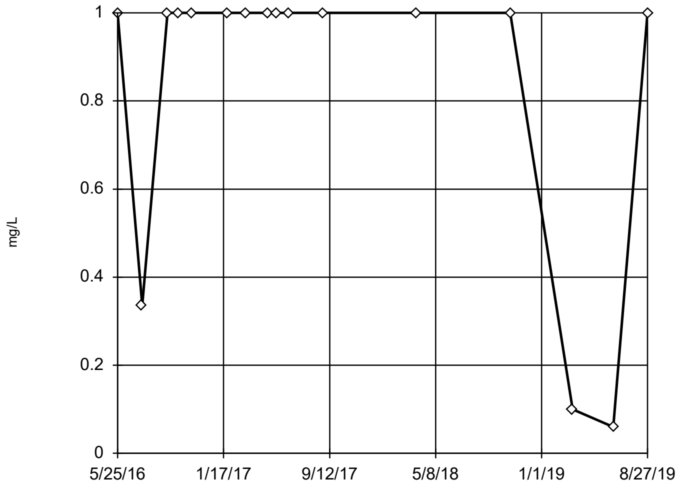
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 16

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

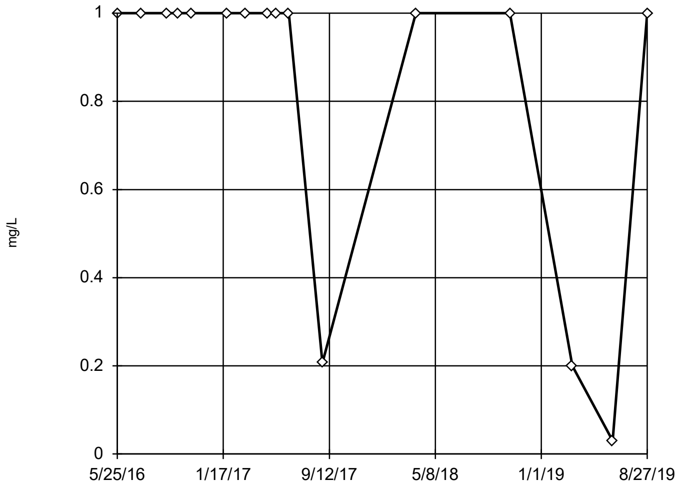
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 16

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

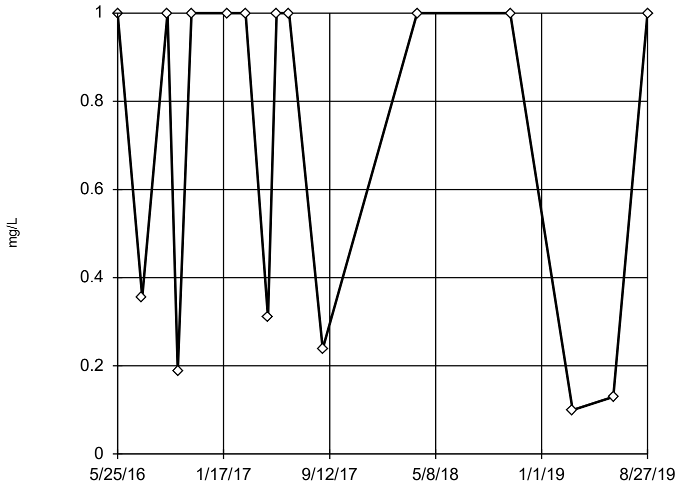
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

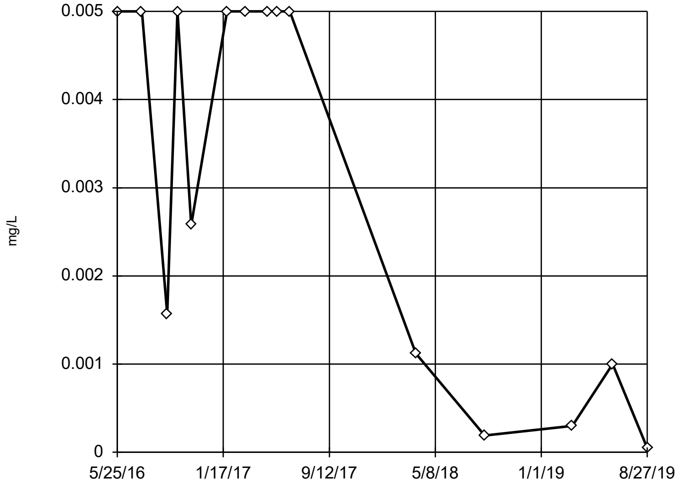
High cutoff = 49.62, low cutoff = 0.005485, based on IQR multiplier of 3.

Constituent: Fluoride, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

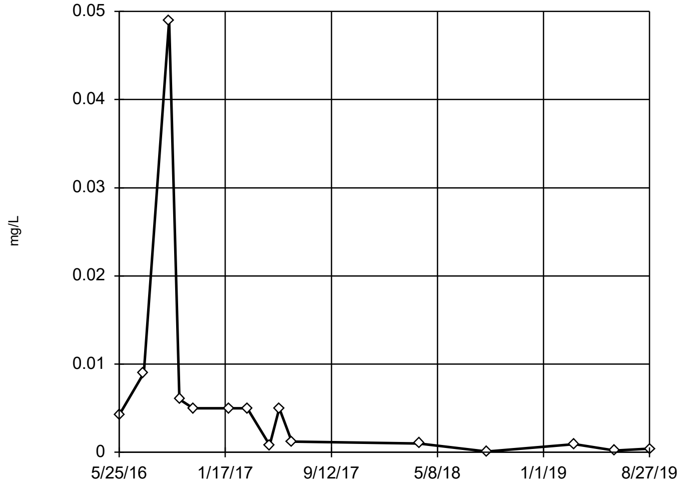
The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Lead, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

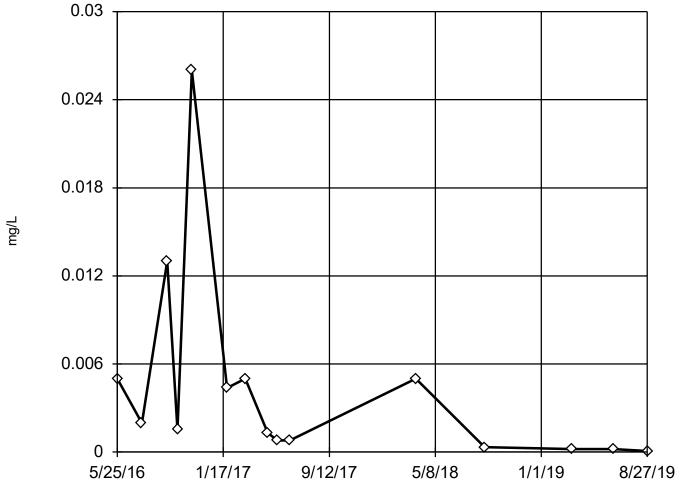
High cutoff = 1.093, low cutoff = 0.000003797, based on IQR multiplier of 3.

Constituent: Lead, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

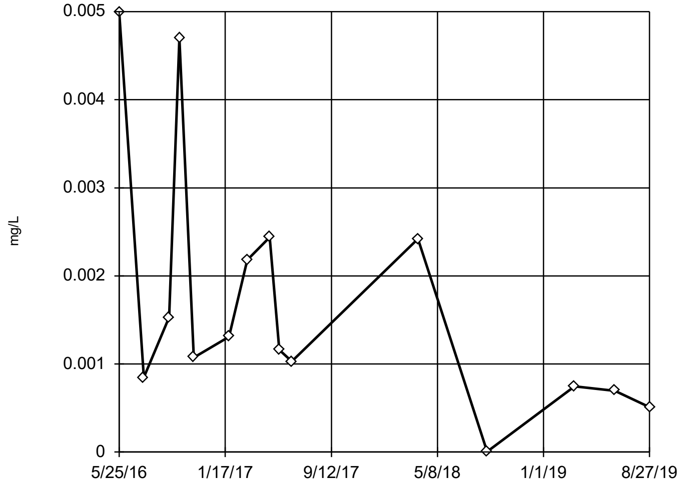
High cutoff = 17.08, low cutoff = 9.7e-8, based on IQR multiplier of 3.

Constituent: Lead, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

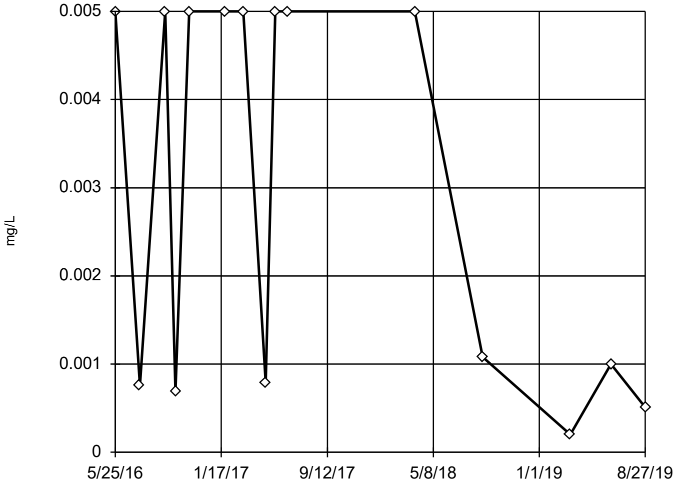
High cutoff = 0.01316, low cutoff = -0.001458, based on IQR multiplier of 3.

Constituent: Lead, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

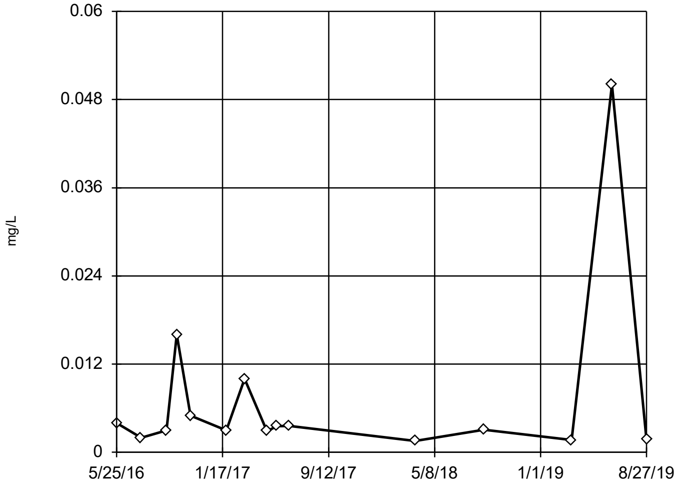
High cutoff = 1.446, low cutoff = 0.000002614, based on IQR multiplier of 3.

Constituent: Lead, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

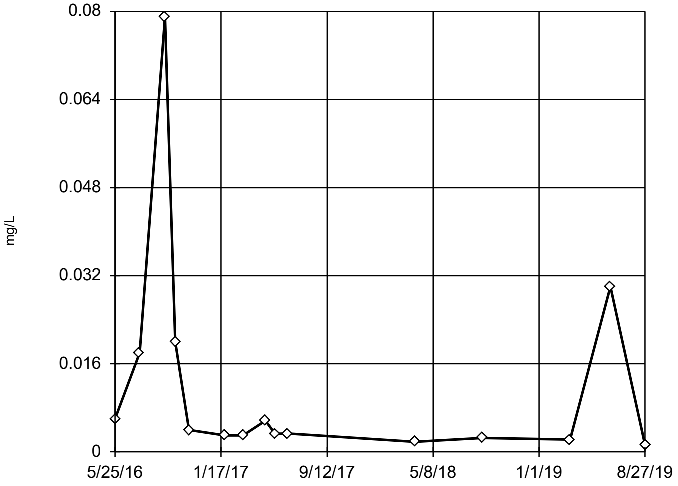
High cutoff = 0.07813, low cutoff = 0.000128, based on IQR multiplier of 3.

Constituent: Lithium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

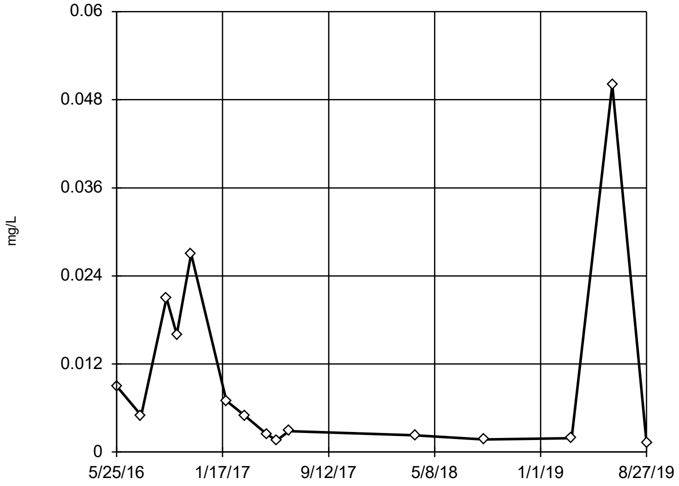
High cutoff = 6.331, low cutoff = 0.00000725, based on IQR multiplier of 3.

Constituent: Lithium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

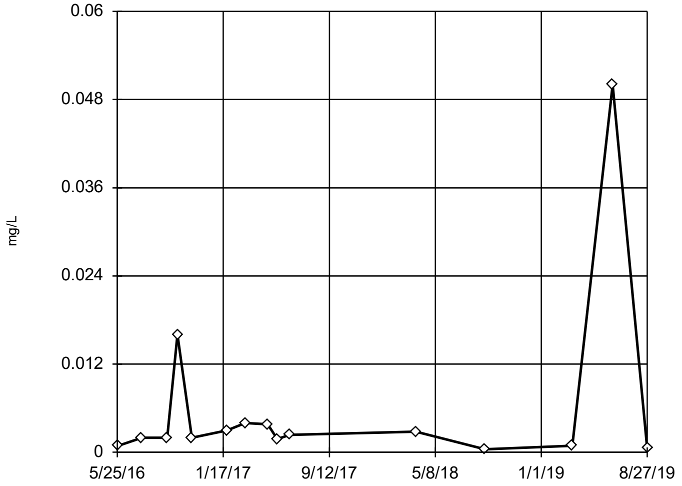
High cutoff = 9.863, low cutoff = 0.00000305, based on IQR multiplier of 3.

Constituent: Lithium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

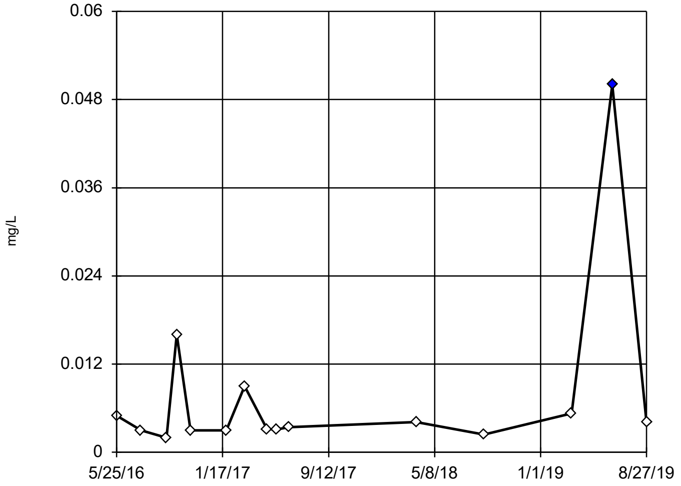
High cutoff = 0.286, low cutoff = 0.00001196, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

Outlier is drawn as solid. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

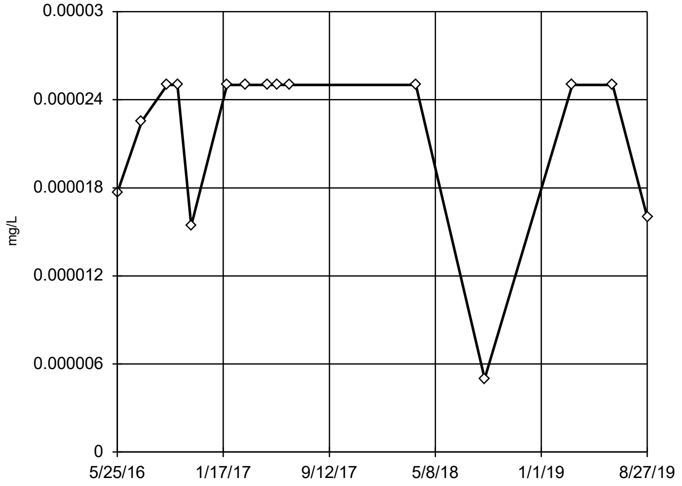
High cutoff = 0.02879, low cutoff = 0.0005503, based on IQR multiplier of 3.

Constituent: Lithium, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

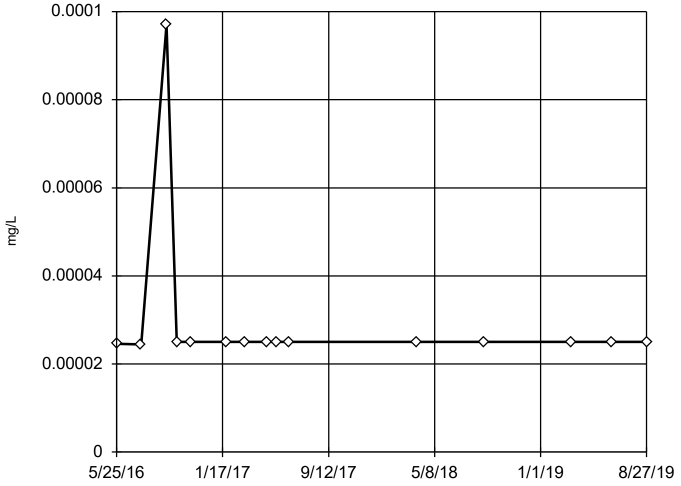
High cutoff = 0.00003954, low cutoff = -0.00002502, based on IQR multiplier of 3.

Constituent: Mercury, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

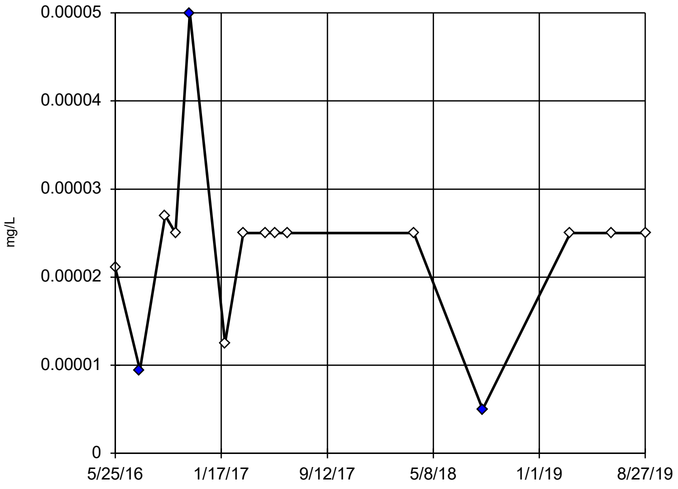
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

Outliers are drawn as solid.
Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

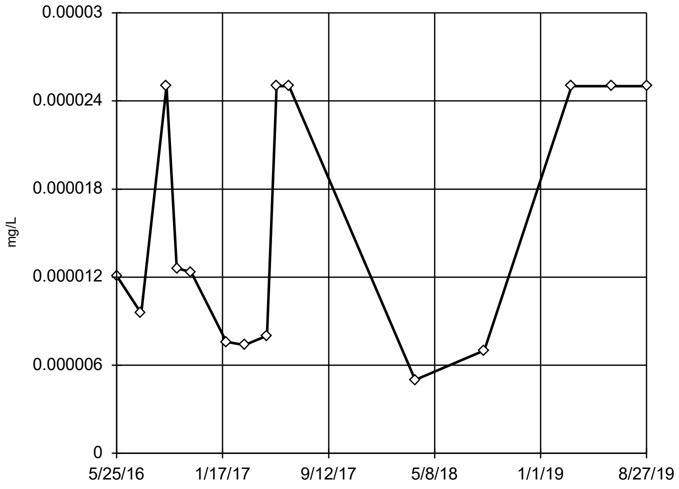
High cutoff = 0.00003885, low cutoff = 0.00001127, based on IQR multiplier of 3.

Constituent: Mercury, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

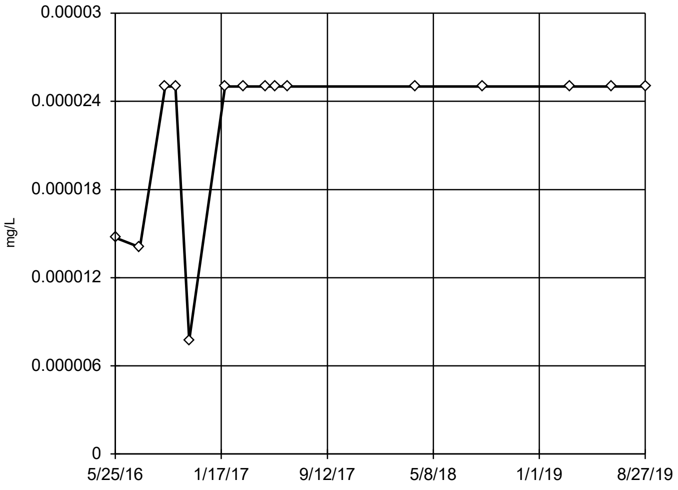
High cutoff = 0.0008934, low cutoff = 2.1e-7, based on IQR multiplier of 3.

Constituent: Mercury, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

No outliers found.
Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

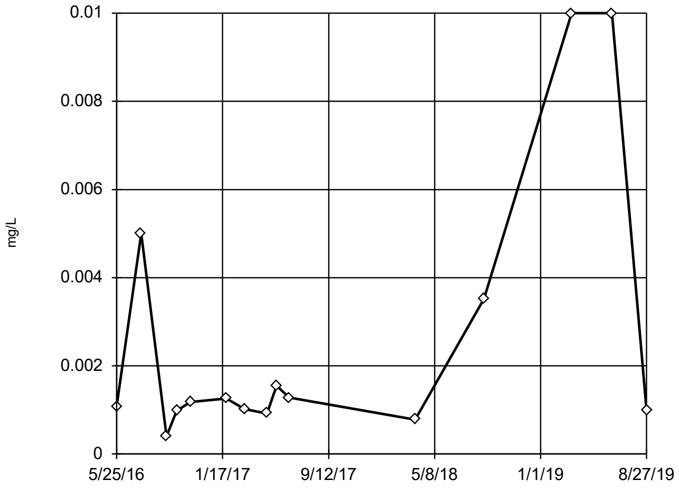
The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Mercury, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

No outliers found.
Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

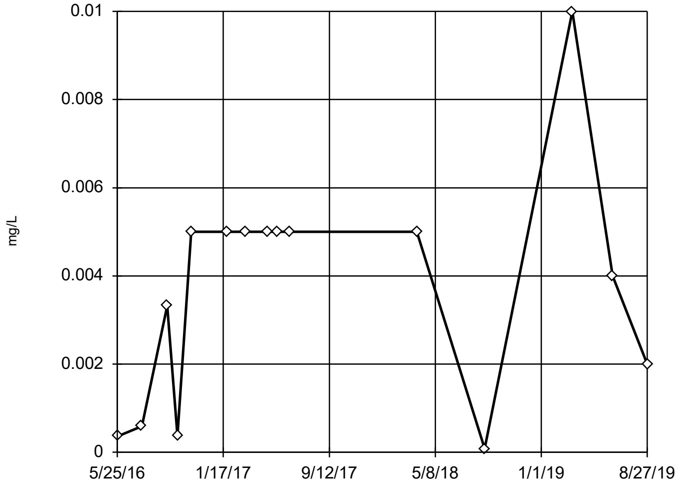
High cutoff = 0.162, low cutoff = 0.00002135, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 15

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

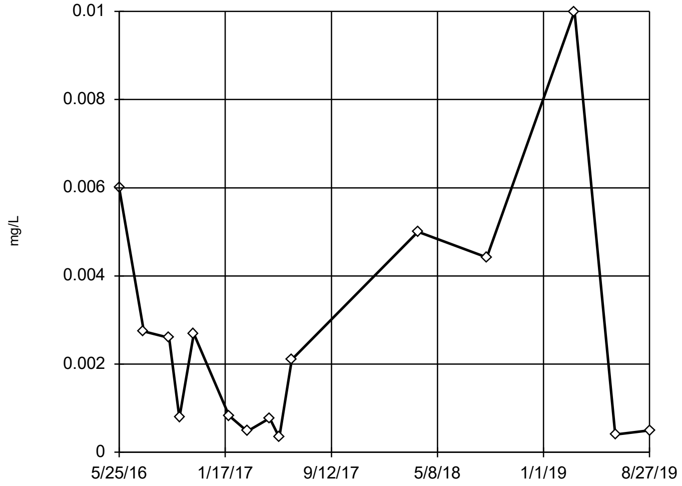
High cutoff = 0.04409, low cutoff = -0.01322, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

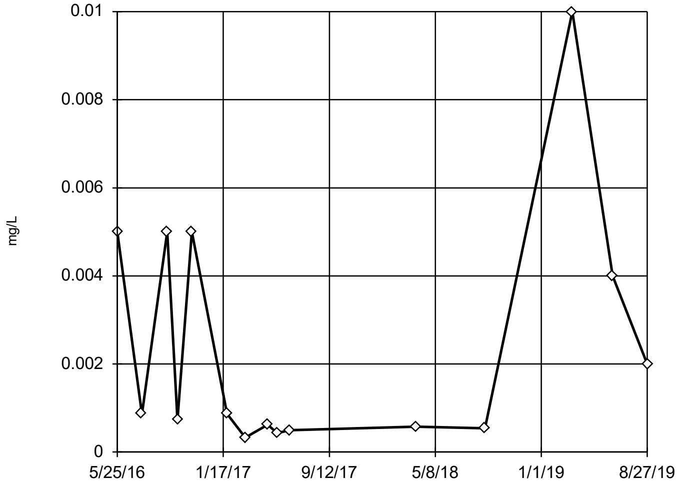
High cutoff = 3.053, low cutoff = 7.2e-7, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 15

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

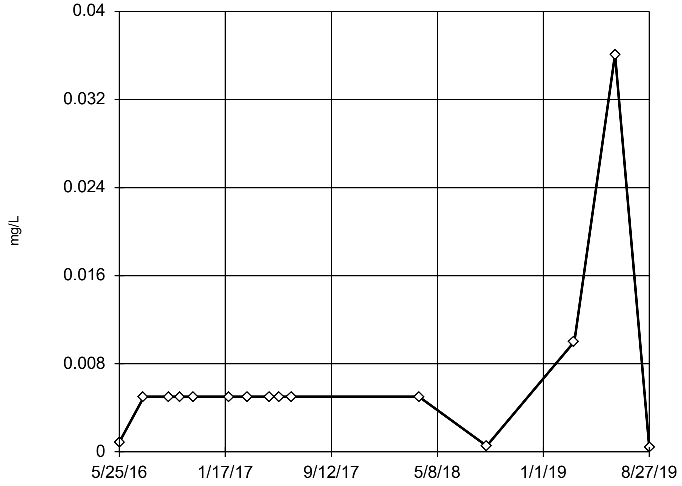
High cutoff = 3.969, low cutoff = 6.8e-7, based on IQR multiplier of 3.

Constituent: Molybdenum, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 15

No outliers found. Tukey's method selected by user.

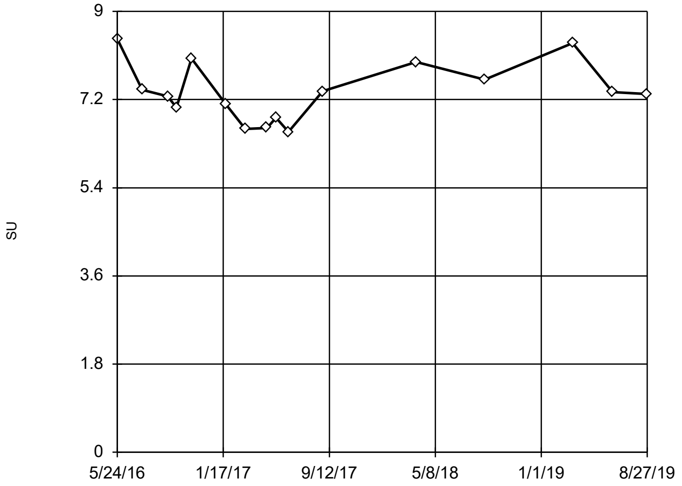
Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Molybdenum, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Tukey's Outlier Screening

B-10



n = 16

No outliers found. Tukey's method selected by user.

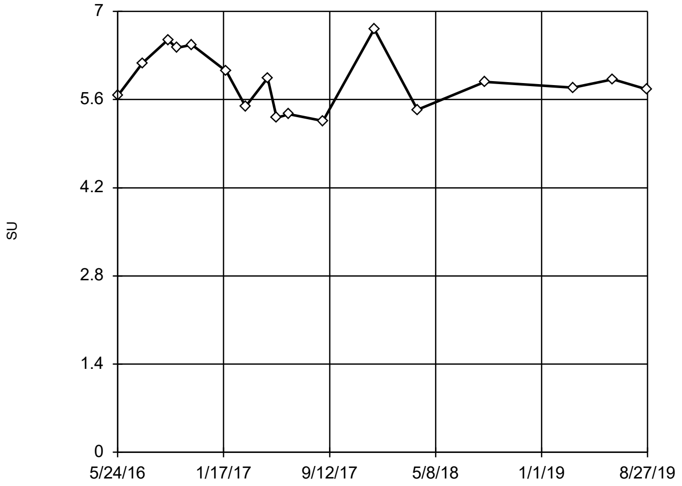
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 11.03, low cutoff = 4.895, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Tukey's Outlier Screening

B-11



n = 17

No outliers found. Tukey's method selected by user.

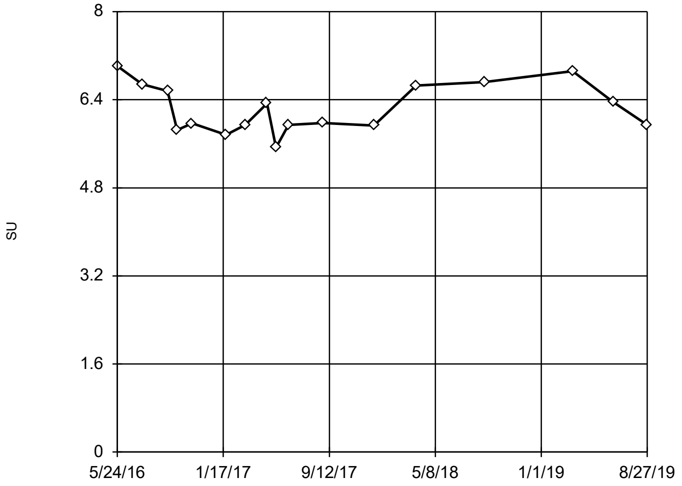
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.645, low cutoff = 3.569, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Tukey's Outlier Screening

B-2



n = 17

No outliers found. Tukey's method selected by user.

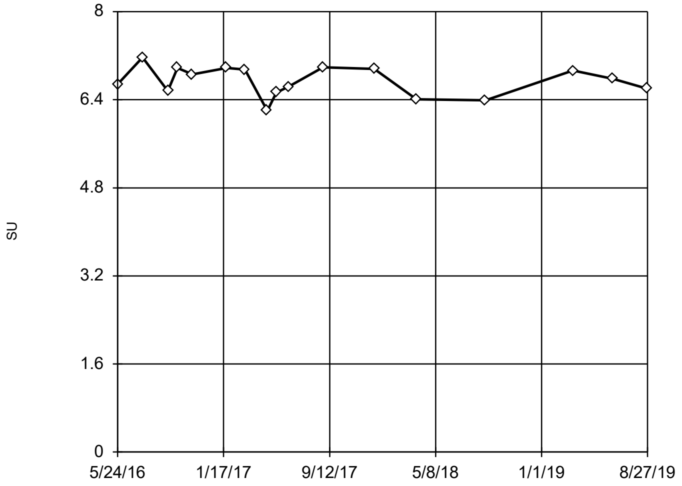
Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9.468, low cutoff = 4.181, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Tukey's Outlier Screening

B-6



n = 17

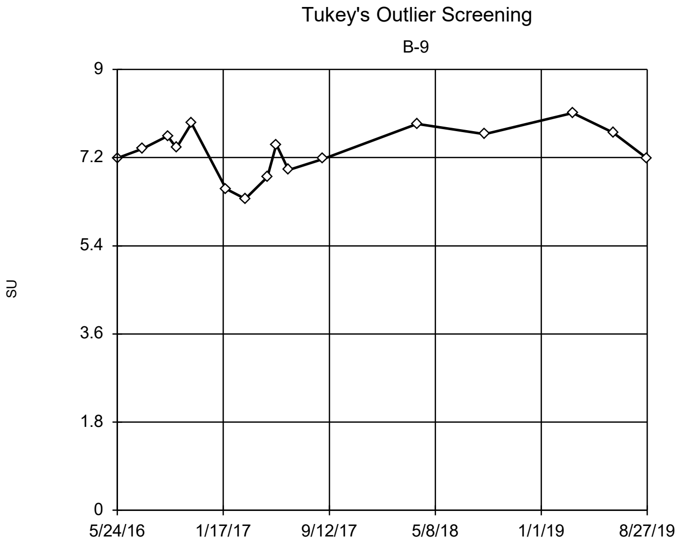
No outliers found. Tukey's method selected by user.

Data were x^6 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7.786, low cutoff = -5.56, based on IQR multiplier of 3.

Constituent: pH, field   Analysis Run 12/8/2019 9:06 AM   View: Outlier Tests - Downgradient - App IV
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

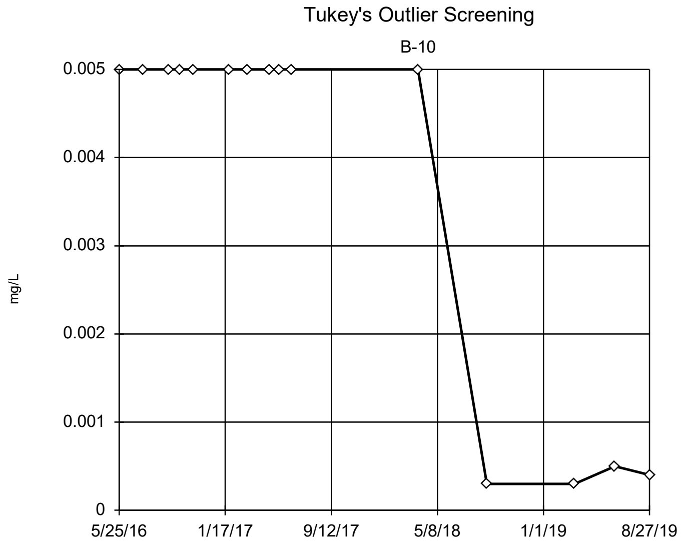
No outliers found. Tukey's method selected by user.

Data were x^4 transformed to achieve best W statistic (graph shown in original units).

High cutoff = 9, low cutoff = -4.879, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

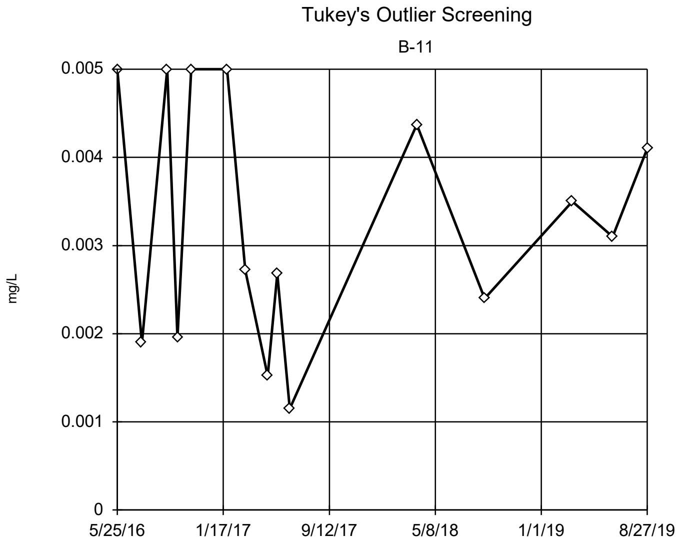
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 5, low cutoff = 5.0e-7, based on IQR multiplier of 3.

Constituent: Selenium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

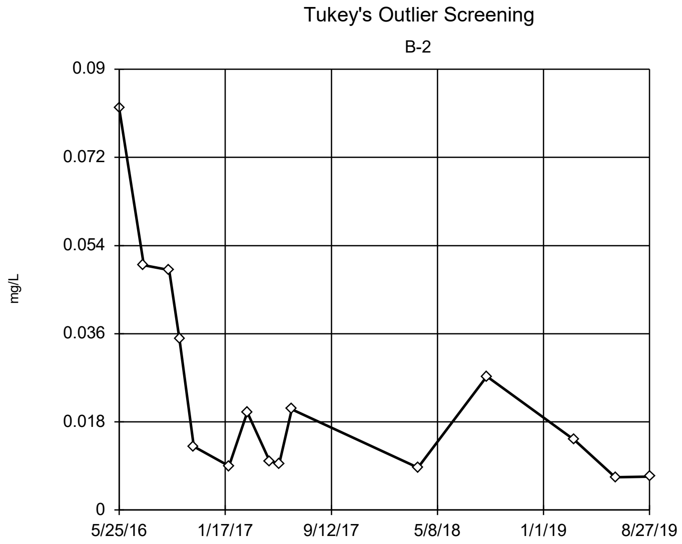
No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.02947, low cutoff = -0.000002123, based on IQR multiplier of 3.

Constituent: Selenium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

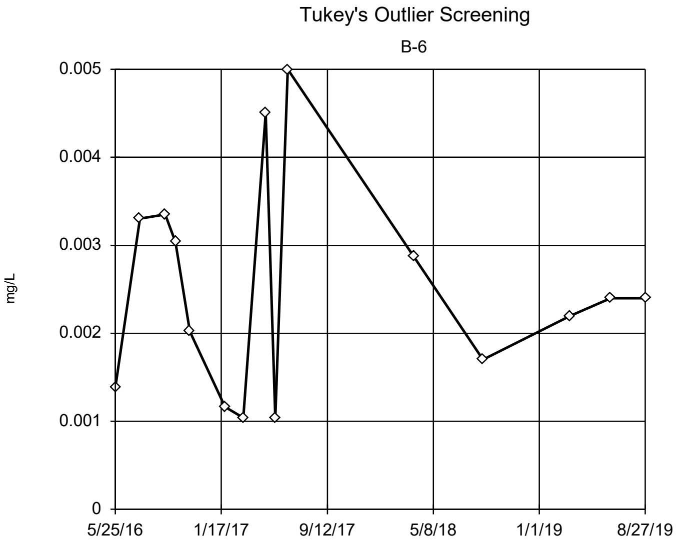
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 2.058, low cutoff = 0.000153, based on IQR multiplier of 3.

Constituent: Selenium, total Analysis Run 12/8/2019 9:06 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

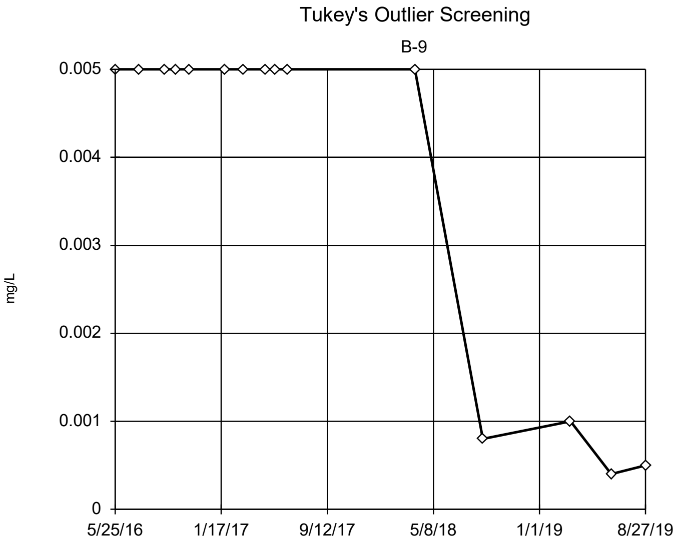
No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.01786, low cutoff = -1.1e-9, based on IQR multiplier of 3.

Constituent: Selenium, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

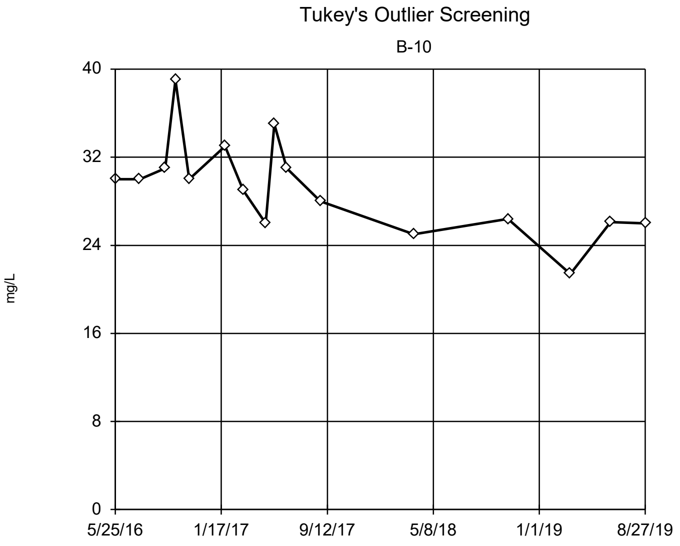
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because both the lower and upper quartiles represent reporting limits.

Constituent: Selenium, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

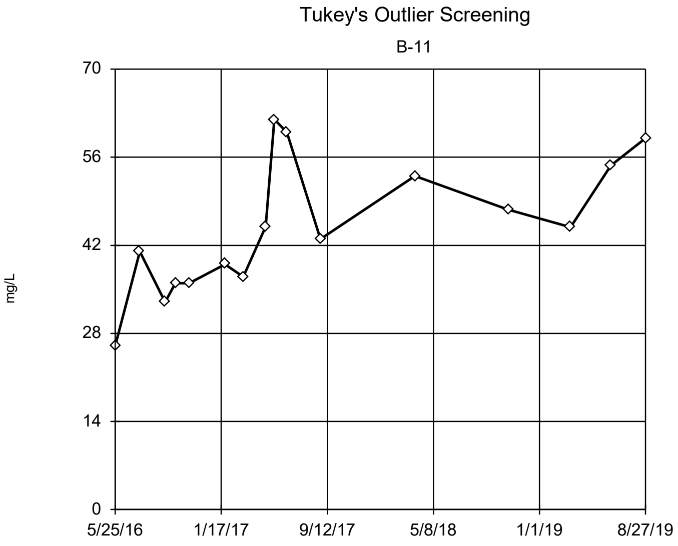
No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 52.24, low cutoff = 15.46, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 16

No outliers found. Tukey's method selected by user.

Data were cube root transformed to achieve best W statistic (graph shown in original units).

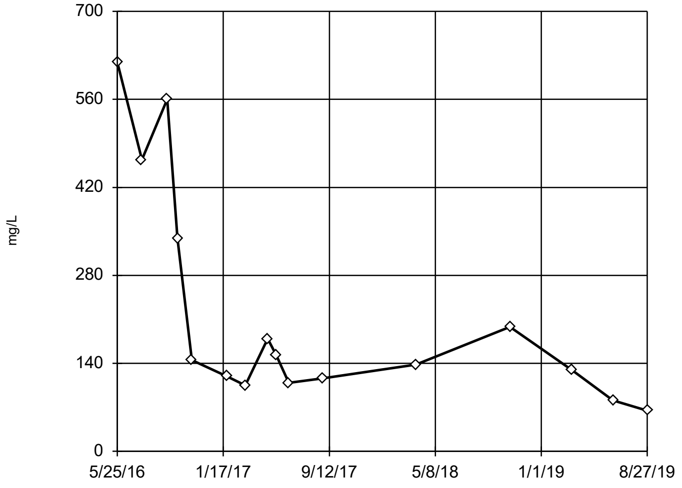
High cutoff = 136.9, low cutoff = 7.299, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

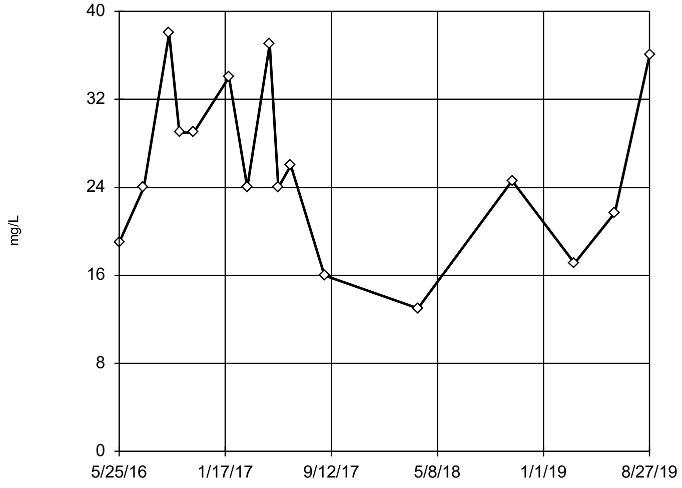
High cutoff = 3169, low cutoff = 9.193, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6



n = 16

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

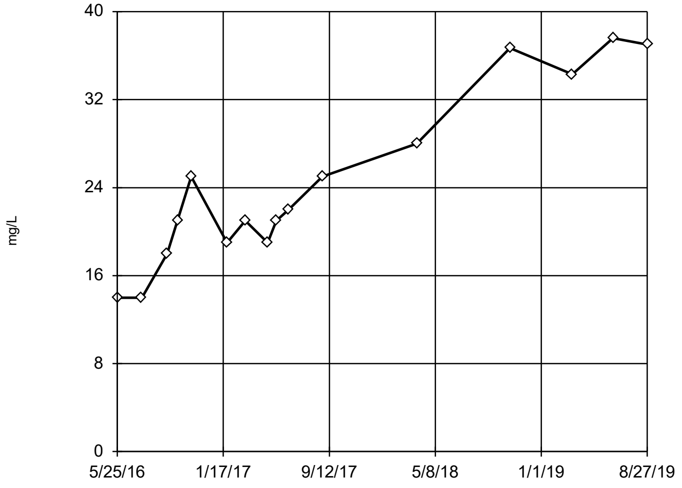
High cutoff = 79.32, low cutoff = 1.465, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-9



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

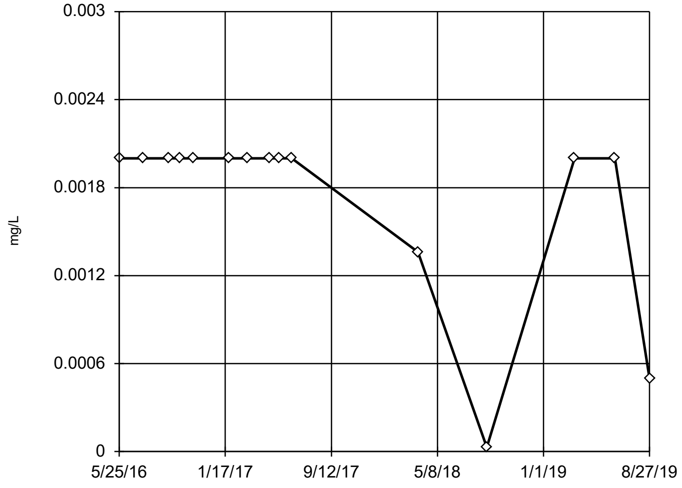
High cutoff = 134.5, low cutoff = 4.379, based on IQR multiplier of 3.

Constituent: Sulfate, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 15

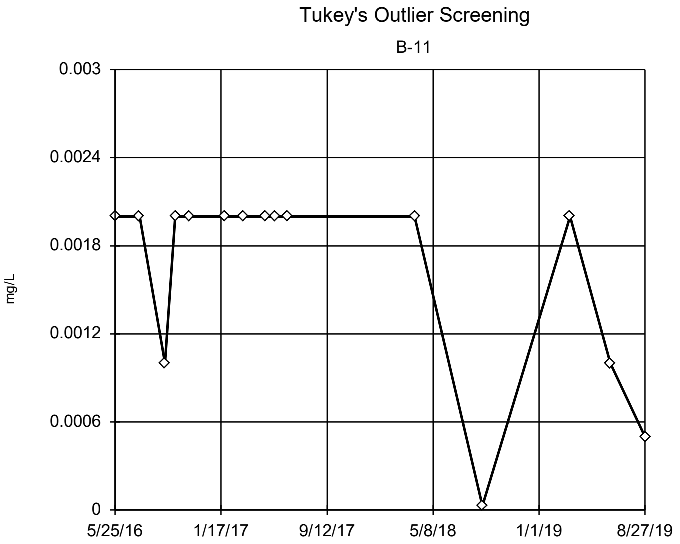
No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

The results were invalidated, because the lower and upper quartiles are equal.

Constituent: Thallium, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

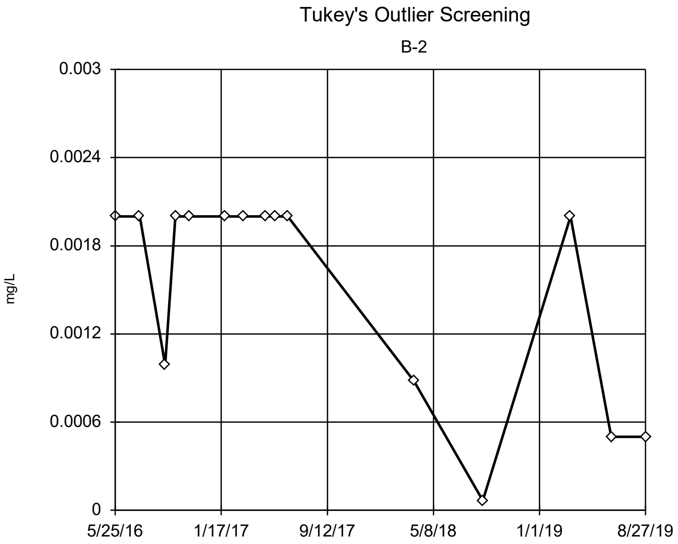
No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.004997, low cutoff = -0.001996, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

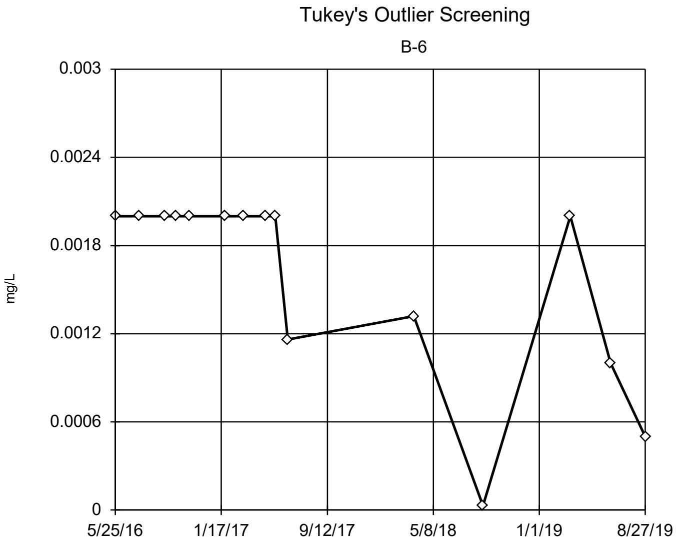
No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

High cutoff = 0.00808, low cutoff = -0.0002404, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

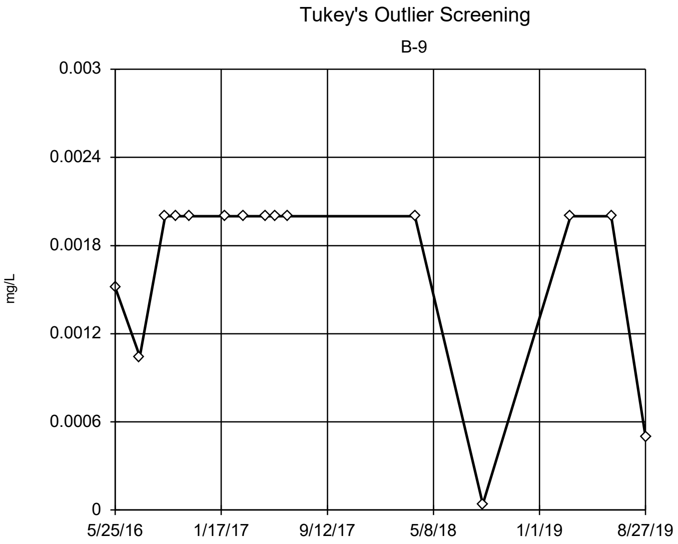
No outliers found. Tukey's method selected by user.

Ladder of Powers transformations did not improve normality; analysis run on raw data.

High cutoff = 0.00452, low cutoff = -0.00136, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG



n = 15

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

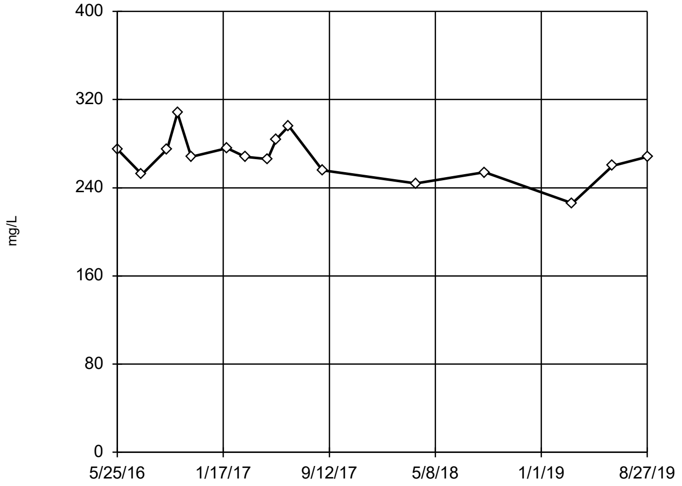
High cutoff = 0.003018, low cutoff = -0.001676, based on IQR multiplier of 3.

Constituent: Thallium, total Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgradient - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-10



n = 16

No outliers found. Tukey's method selected by user.

Data were square root transformed to achieve best W statistic (graph shown in original units).

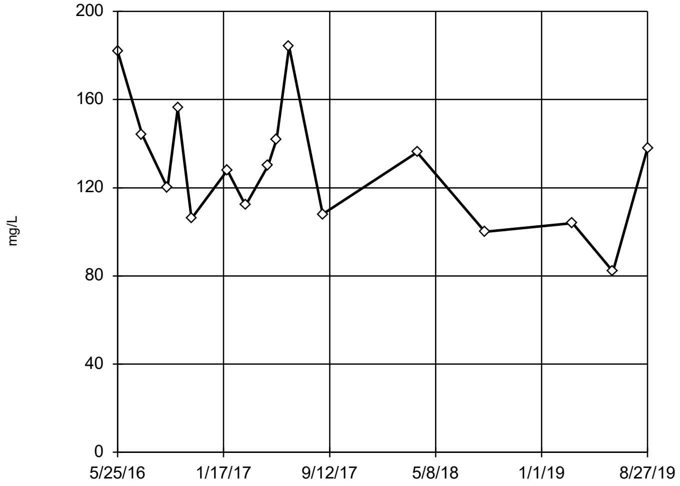
High cutoff = 341.8, low cutoff = 198.3, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgra
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-11



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

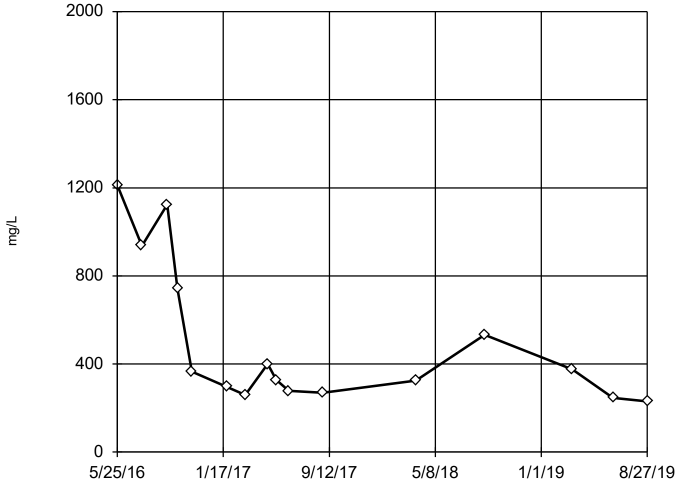
High cutoff = 341.4, low cutoff = 44.82, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgra
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-2



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 7557, low cutoff = 22.76, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgra
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Tukey's Outlier Screening

B-6

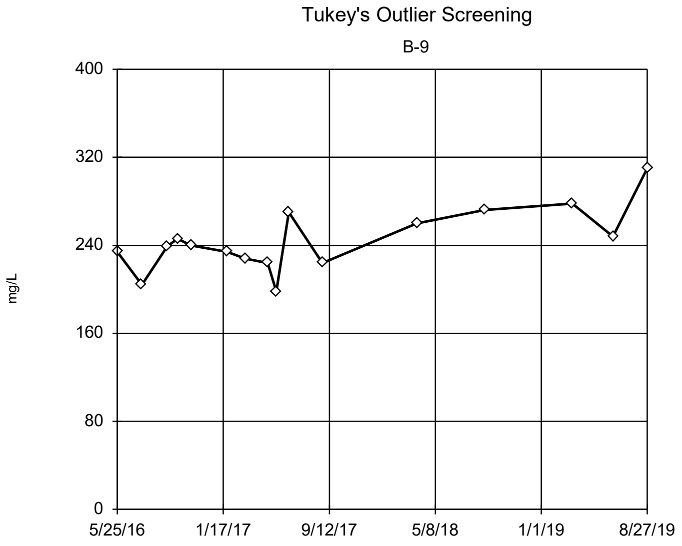
n = 16

No outliers found. Tukey's method selected by user.

Data were square transformed to achieve best W statistic (graph shown in original units).

High cutoff = 366.1, low cutoff = -223.3, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgra
Flint Creek LF Client: Geosyntec Data: Flint Creek LF



n = 16

No outliers found. Tukey's method selected by user.

Data were natural log transformed to achieve best W statistic (graph shown in original units).

High cutoff = 427, low cutoff = 140.2, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/8/2019 9:07 AM View: Outlier Tests - Downgra

Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Mann-Whitney - Significant Results

Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/8/2019, 9:35 AM

Constituent	Well	Calc.	0.01	Sig.	Method
Calcium, total (mg/L)	**B-10**	**-2.758**	**Yes**	**Yes**	**Mann-W**
Sulfate, total (mg/L)	**B-10**	**-2.631**	**Yes**	**Yes**	**Mann-W**
Sulfate, total (mg/L)	**B-9**	**2.708**	**Yes**	**Yes**	**Mann-W**
Total Dissolved Solids [TDS] (mg/L)	**B-10**	**-2.622**	**Yes**	**Yes**	**Mann-W**
Total Dissolved Solids [TDS] (mg/L)	**B-6**	**-2.902**	**Yes**	**Yes**	**Mann-W**

Mann-Whitney - All Results

Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/8/2019, 9:35 AM

Constituent	Well	Calc.	0.01	Sig.	Method
Calcium, total (mg/L)	B-12 (bg)	-1.487	No	No	Mann-W
Calcium, total (mg/L)	B-13 (bg)	-0.6364	No	No	Mann-W
Calcium, total (mg/L)	B-1B (bg)	-0.07071	No	No	Mann-W
Calcium, total (mg/L)	B-4 (bg)	-2.548	No	No	Mann-W
Calcium, total (mg/L)	B-5 (bg)	-2.126	No	No	Mann-W
Calcium, total (mg/L)	B-7A (bg)	0.07118	No	No	Mann-W
Calcium, total (mg/L)	**B-10**	**-2.758**	**Yes**	**Yes**	**Mann-W**
Calcium, total (mg/L)	B-11	-2.192	No	No	Mann-W
Calcium, total (mg/L)	B-2	-1.202	No	No	Mann-W
Calcium, total (mg/L)	B-6	-2.475	No	No	Mann-W
Calcium, total (mg/L)	B-9	0.7778	No	No	Mann-W
Chloride, total (mg/L)	B-12 (bg)	0.2913	No	No	Mann-W
Chloride, total (mg/L)	B-13 (bg)	-1.777	No	No	Mann-W
Chloride, total (mg/L)	B-1B (bg)	-0.5812	No	No	Mann-W
Chloride, total (mg/L)	B-4 (bg)	-1.341	No	No	Mann-W
Chloride, total (mg/L)	B-5 (bg)	0.7964	No	No	Mann-W
Chloride, total (mg/L)	B-7A (bg)	0.3658	No	No	Mann-W
Chloride, total (mg/L)	B-10	1.311	No	No	Mann-W
Chloride, total (mg/L)	B-11	0.2962	No	No	Mann-W
Chloride, total (mg/L)	B-2	-0.5923	No	No	Mann-W
Chloride, total (mg/L)	B-6	1.189	No	No	Mann-W
Chloride, total (mg/L)	B-9	-0.07589	No	No	Mann-W
Fluoride, total (mg/L)	B-12 (bg)	-0.9282	No	No	Mann-W
Fluoride, total (mg/L)	B-13 (bg)	-0.9282	No	No	Mann-W
Fluoride, total (mg/L)	B-1B (bg)	-2.074	No	No	Mann-W
Fluoride, total (mg/L)	B-4 (bg)	-1.739	No	No	Mann-W
Fluoride, total (mg/L)	B-5 (bg)	-0.9282	No	No	Mann-W
Fluoride, total (mg/L)	B-7A (bg)	-1.506	No	No	Mann-W
Fluoride, total (mg/L)	B-10	-1.151	No	No	Mann-W
Fluoride, total (mg/L)	B-11	-1.739	No	No	Mann-W
Fluoride, total (mg/L)	B-2	-0.9282	No	No	Mann-W
Fluoride, total (mg/L)	B-6	-2.437	No	No	Mann-W
Fluoride, total (mg/L)	B-9	-1.071	No	No	Mann-W
pH, field (SU)	B-12 (bg)	2.192	No	No	Mann-W
pH, field (SU)	B-13 (bg)	0.3536	No	No	Mann-W
pH, field (SU)	B-1B (bg)	1.416	No	No	Mann-W
pH, field (SU)	B-4 (bg)	2.475	No	No	Mann-W
pH, field (SU)	B-5 (bg)	-0.07071	No	No	Mann-W
pH, field (SU)	B-7A (bg)	0.5663	No	No	Mann-W
pH, field (SU)	B-10	1.626	No	No	Mann-W
pH, field (SU)	B-11	-0.6736	No	No	Mann-W
pH, field (SU)	B-2	1.165	No	No	Mann-W
pH, field (SU)	B-6	-0.1839	No	No	Mann-W
pH, field (SU)	B-9	1.626	No	No	Mann-W
Sulfate, total (mg/L)	B-12 (bg)	-1.847	No	No	Mann-W
Sulfate, total (mg/L)	B-13 (bg)	0.5676	No	No	Mann-W
Sulfate, total (mg/L)	B-1B (bg)	-2.426	No	No	Mann-W
Sulfate, total (mg/L)	B-4 (bg)	0.6428	No	No	Mann-W
Sulfate, total (mg/L)	B-5 (bg)	-0.2832	No	No	Mann-W
Sulfate, total (mg/L)	B-7A (bg)	-0.3637	No	No	Mann-W
Sulfate, total (mg/L)	**B-10**	**-2.631**	**Yes**	**Yes**	**Mann-W**
Sulfate, total (mg/L)	B-11	1.345	No	No	Mann-W
Sulfate, total (mg/L)	B-2	-0.9192	No	No	Mann-W
Sulfate, total (mg/L)	B-6	-2.346	No	No	Mann-W
Sulfate, total (mg/L)	**B-9**	**2.708**	**Yes**	**Yes**	**Mann-W**

Mann-Whitney - All Results

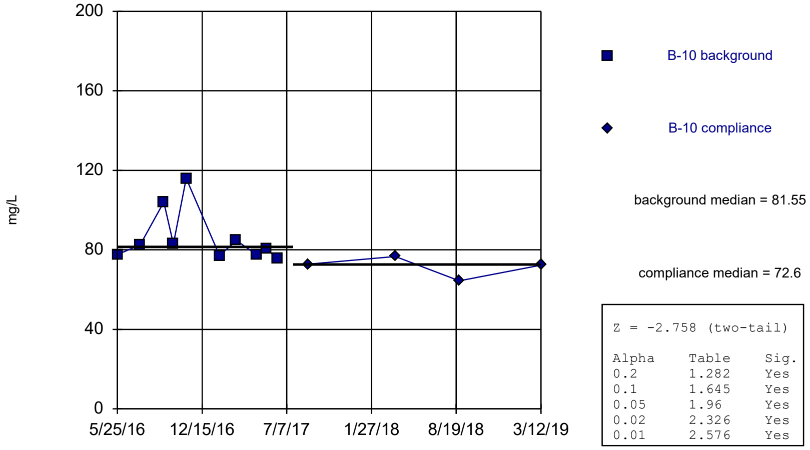
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 9:35 AM

Constituent	Well	Calc.	0.01	Sig.	Method
Total Dissolved Solids [TDS] (mg/L)	B-12 (bg)	-0.9921	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	B-13 (bg)	-0.2126	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	B-1B (bg)	-1.561	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	B-4 (bg)	-2.407	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	B-5 (bg)	-1.78	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	B-7A (bg)	0	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	**B-10**	**-2.622**	**Yes**	**Yes**	**Mann-W**
Total Dissolved Solids [TDS] (mg/L)	B-11	-2.051	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	B-2	-0.7778	No	No	Mann-W
Total Dissolved Solids [TDS] (mg/L)	**B-6**	**-2.902**	**Yes**	**Yes**	**Mann-W**
Total Dissolved Solids [TDS] (mg/L)	B-9	1.559	No	No	Mann-W

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

B-10



background median = 81.55

compliance median = 72.6

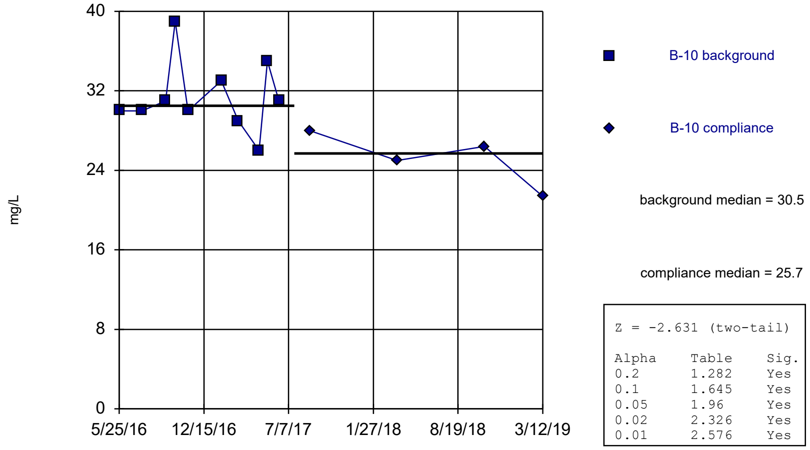
```
Z = -2.758 (two-tail)

Alpha     Table     Sig.
0.2       1.282     Yes
0.1       1.645     Yes
0.05      1.96      Yes
0.02      2.326     Yes
0.01      2.576     Yes
```

Constituent: Calcium, total   Analysis Run 12/8/2019 9:34 AM   View: Mann Whitney
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

B-10



background median = 30.5

compliance median = 25.7

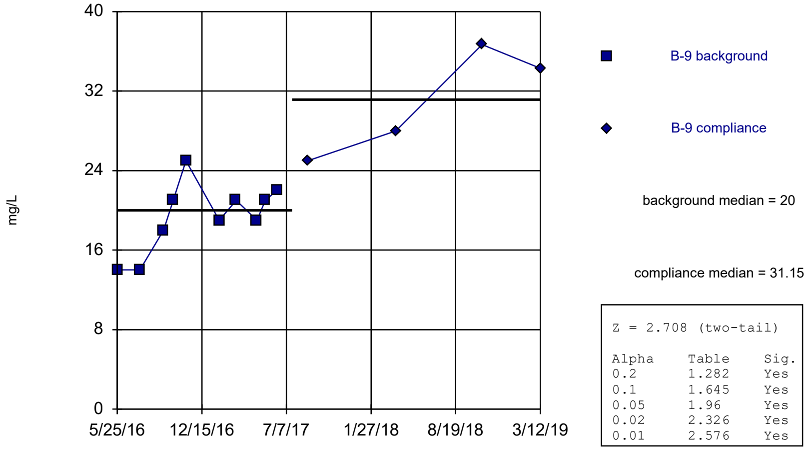
```
Z = -2.631 (two-tail)

Alpha     Table     Sig.
0.2       1.282     Yes
0.1       1.645     Yes
0.05      1.96      Yes
0.02      2.326     Yes
0.01      2.576     Yes
```

Constituent: Sulfate, total   Analysis Run 12/8/2019 9:34 AM   View: Mann Whitney
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

B-9



background median = 20

compliance median = 31.15

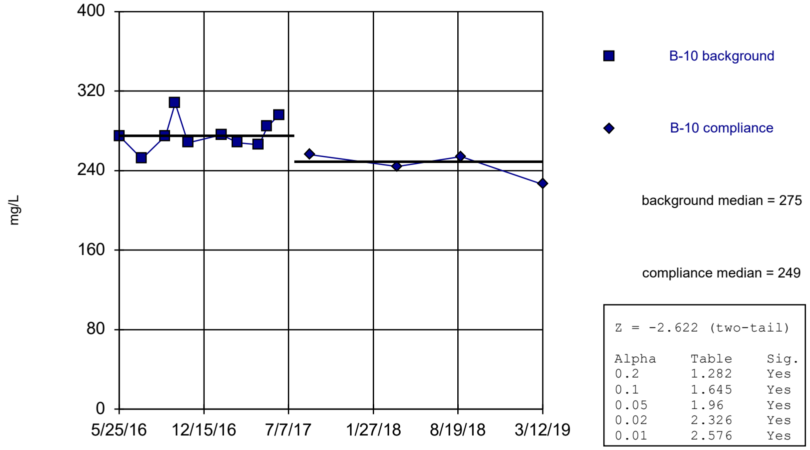
```
Z = 2.708 (two-tail)

Alpha     Table     Sig.
0.2       1.282     Yes
0.1       1.645     Yes
0.05      1.96      Yes
0.02      2.326     Yes
0.01      2.576     Yes
```

Constituent: Sulfate, total   Analysis Run 12/8/2019 9:34 AM   View: Mann Whitney
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

B-10



background median = 275

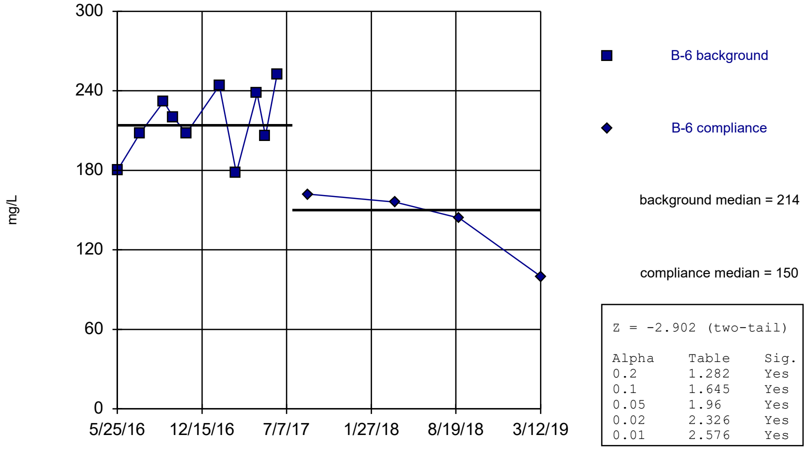
compliance median = 249

```
Z = -2.622 (two-tail)

Alpha     Table     Sig.
0.2       1.282     Yes
0.1       1.645     Yes
0.05      1.96      Yes
0.02      2.326     Yes
0.01      2.576     Yes
```

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:34 AM   View: Mann Whitney
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Mann-Whitney (Wilcoxon Rank Sum)

B-6



```
Z = -2.902 (two-tail)

Alpha    Table    Sig.
0.2      1.282    Yes
0.1      1.645    Yes
0.05     1.96     Yes
0.02     2.326    Yes
0.01     2.576    Yes
```

Constituent: Total Dissolved Solids [TDS]   Analysis Run 12/8/2019 9:34 AM   View: Mann Whitney
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Intrawell Prediction Limit Summary

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/24/2019, 9:43 AM

Constituent	Well	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Calcium, total (mg/L)	B-12	75.49	n/a	14	63.47	5.376	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-13	23.53	n/a	14	13.11	4.659	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-1B	96.65	n/a	14	88.73	3.541	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-4	32.15	n/a	14	13.04	8.545	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-5	19.15	n/a	14	17.01	0.9534	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-7A	109.1	n/a	14	101.3	3.479	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-10	111.9	n/a	14	9.017	0.6971	0	None	sqrt(x)	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-11	18.31	n/a	14	13.04	2.356	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-2	87.96	n/a	14	39.34	21.74	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-6	61.48	n/a	14	44.62	7.541	0	None	No	0.001504	Param Intra 1 of 2
Calcium, total (mg/L)	B-9	136.9	n/a	14	99.17	16.89	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-12	13.71	n/a	14	10.23	1.557	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-13	5.697	n/a	14	3.609	0.934	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-1B	5.842	n/a	14	3.346	1.116	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-4	10.83	n/a	14	67.59	22.27	0	None	x^2	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-5	11.56	n/a	14	7.664	1.743	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-7A	6.865	n/a	14	4.194	1.195	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-10	11.52	n/a	14	8.17	1.496	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-11	7.726	n/a	14	5.14	1.157	0	None	No	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-2	9.825	n/a	14	2.487	0.2896	0	None	sqrt(x)	0.001504	Param Intra 1 of 2
Chloride, total (mg/L)	B-6	12.2	n/a	14	n/a	n/a	0	n/a	n/a	0.008612	NP Intra (normality) 1 of 2
Chloride, total (mg/L)	B-9	8.306	n/a	14	5.921	1.066	0	None	No	0.001504	Param Intra 1 of 2
Fluoride, total (mg/L)	B-12	1	n/a	14	n/a	n/a	85.71	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-13	1	n/a	14	n/a	n/a	85.71	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-1B	0.7071	n/a	14	0.43	0.1239	28.57	Kaplan-Meier	No	0.001504	Param Intra 1 of 2
Fluoride, total (mg/L)	B-4	1	n/a	14	n/a	n/a	92.86	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-5	1	n/a	14	n/a	n/a	85.71	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-7A	1	n/a	14	n/a	n/a	71.43	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-10	1	n/a	14	n/a	n/a	71.43	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-11	1	n/a	14	n/a	n/a	92.86	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-2	1	n/a	14	n/a	n/a	85.71	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-6	0.2066	n/a	14	n/a	n/a	92.86	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
Fluoride, total (mg/L)	B-9	1	n/a	14	n/a	n/a	64.29	n/a	n/a	0.008612	NP Intra (NDs) 1 of 2
pH, field (SU)	B-12	8.782	5.598	14	7.19	0.7119	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-13	7.662	3.797	14	5.729	0.8643	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-1B	8.4	6.162	14	7.281	0.5005	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-4	7.889	6.162	14	7.026	0.3862	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-5	6.814	4.285	14	5.549	0.5654	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-7A	7.877	6.488	14	7.183	0.3105	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-10	8.798	5.942	14	7.37	0.6385	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-11	6.964	4.84	15	5.902	0.4841	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-2	7.278	5.226	15	6.252	0.4681	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-6	7.368	6.129	15	6.749	0.2825	0	None	No	0.000752	Param Intra 1 of 2
pH, field (SU)	B-9	8.481	6.162	14	7.321	0.5186	0	None	No	0.000752	Param Intra 1 of 2
Sulfate, total (mg/L)	B-12	19.27	n/a	14	11.08	3.662	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-13	37.26	n/a	14	20.67	7.419	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-1B	28.09	n/a	14	21.66	2.876	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-4	16.46	n/a	14	9.979	2.9	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-5	243.3	n/a	14	200	19.34	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-7A	37.07	n/a	14	33.16	1.747	0	None	No	0.001504	Param Intra 1 of 2

Intrawell Prediction Limit Summary

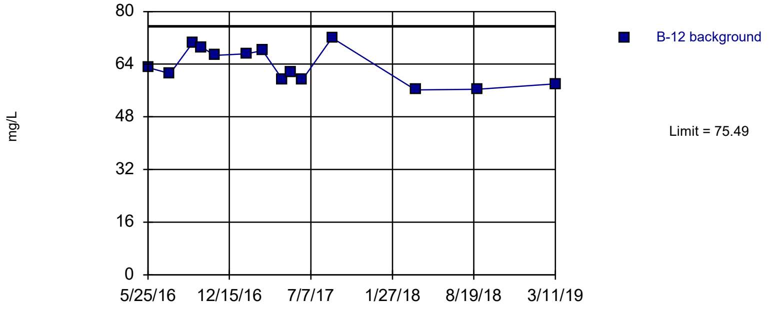
Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/24/2019, 9:43 AM

Constituent	Well	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Sulfate, total (mg/L)	B-10	39.39	n/a	14	29.63	4.368	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-11	65.67	n/a	14	43.11	10.09	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-2	803	n/a	14	5.276	0.6315	0	None	ln(x)	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-6	42.34	n/a	14	25.34	7.606	0	None	No	0.001504	Param Intra 1 of 2
Sulfate, total (mg/L)	B-9	37.64	n/a	14	22.71	6.675	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-12	323.3	n/a	14	252.4	31.73	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-13	119.5	n/a	14	75.14	19.83	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-1B	316.8	n/a	14	272.6	19.73	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-4	121.6	n/a	14	76.79	20.03	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-5	447.2	n/a	14	395.5	23.14	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-7A	339	n/a	14	312.1	12.01	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-10	314.7	n/a	14	267.7	21.01	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-11	193.2	n/a	14	132.3	27.26	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-2	1409	n/a	14	7.823	1.515	0	None	x^(1/3)	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-6	292.3	n/a	14	194.9	43.59	0	None	No	0.001504	Param Intra 1 of 2
Total Dissolved Solids [TDS] (mg/L)	B-9	293.4	n/a	14	239.4	24.16	0	None	No	0.001504	Param Intra 1 of 2

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-12 (bg)



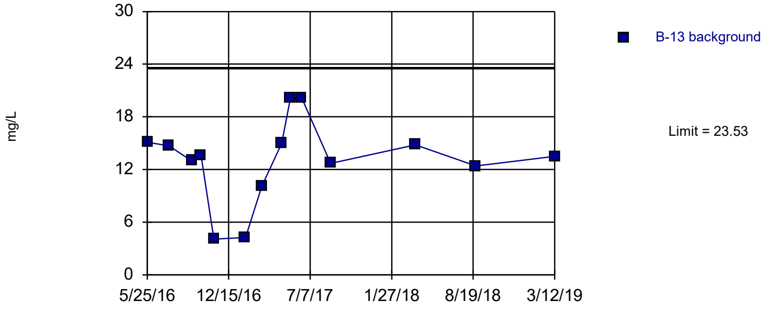
Background Data Summary: Mean=63.47, Std. Dev.=5.376, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9304, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-13 (bg)



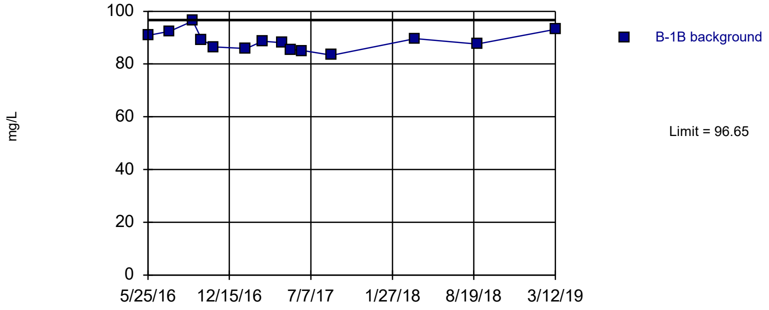
Background Data Summary: Mean=13.11, Std. Dev.=4.659, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8857, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-1B (bg)



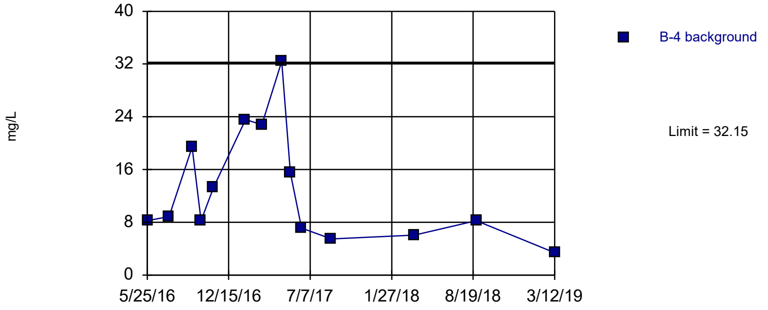
Background Data Summary: Mean=88.73, Std. Dev.=3.541, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9715, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-4 (bg)



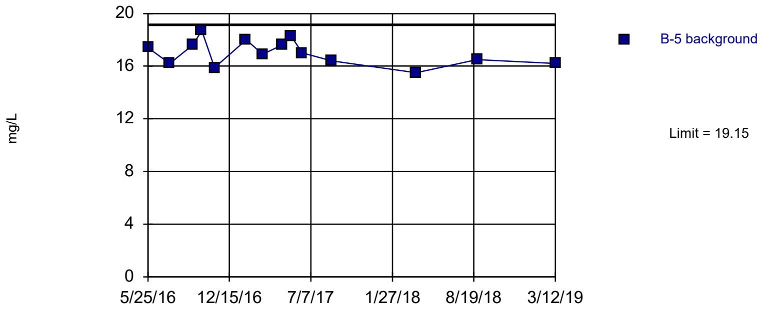
Background Data Summary: Mean=13.04, Std. Dev.=8.545, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8778, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-5 (bg)



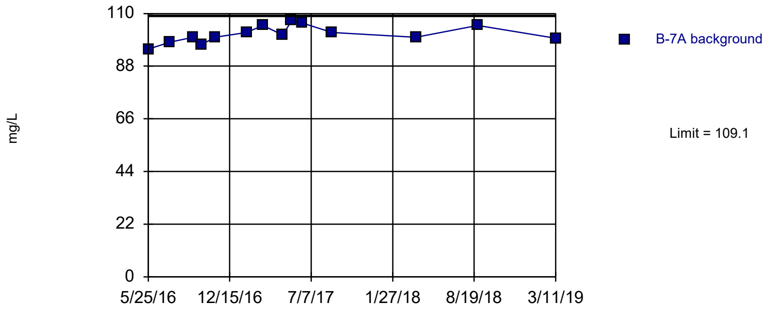
Background Data Summary: Mean=17.01, Std. Dev.=0.9534, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9715, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-7A (bg)



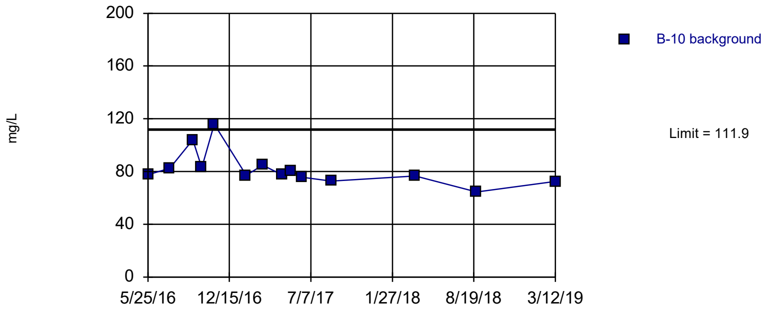
Background Data Summary: Mean=101.3, Std. Dev.=3.479, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9601, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-10



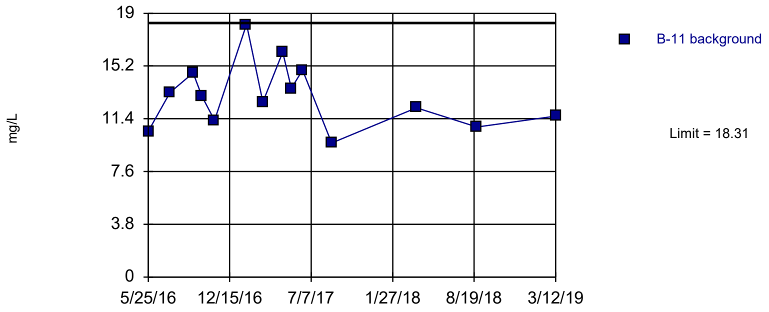
Background Data Summary (based on square root transformation): Mean=9.017, Std. Dev.=0.6971, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8359, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-11



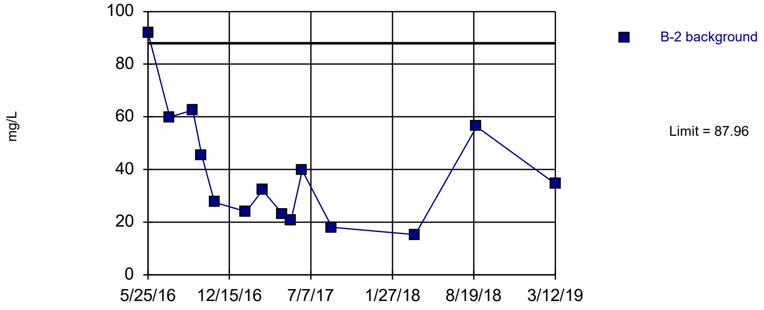
Background Data Summary: Mean=13.04, Std. Dev.=2.356, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9637, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-2



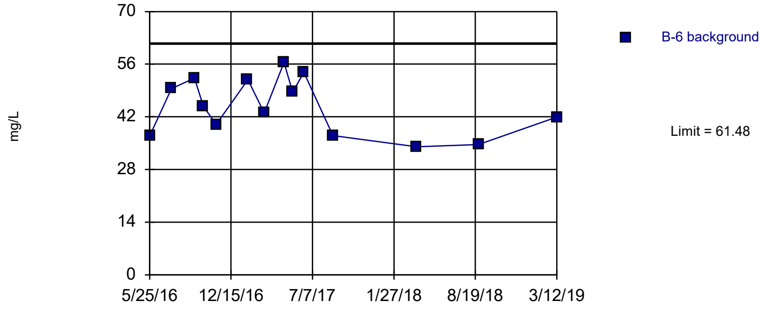
Background Data Summary: Mean=39.34, Std. Dev.=21.74, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8965, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-6



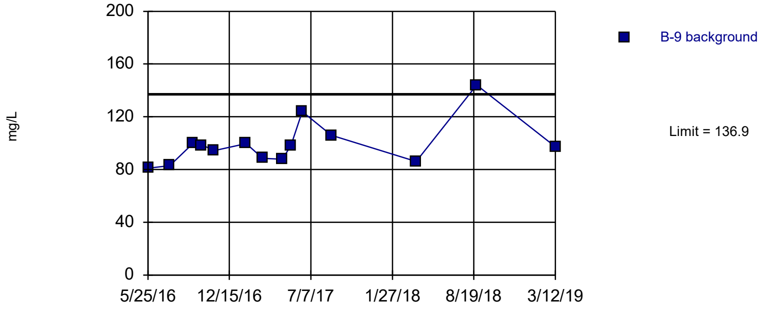
Background Data Summary: Mean=44.62, Std. Dev.=7.541, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9402, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-9



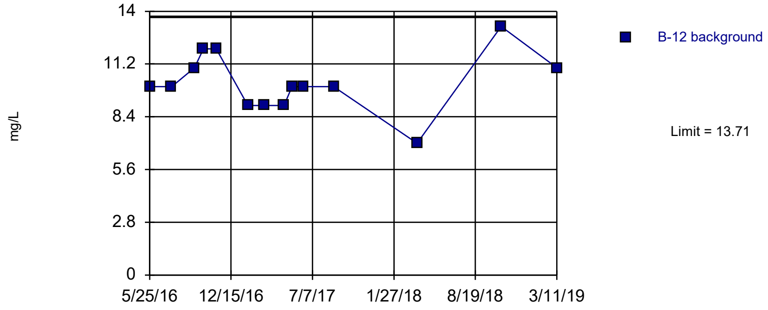
Background Data Summary: Mean=99.17, Std. Dev.=16.89, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8298, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Calcium, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-12 (bg)



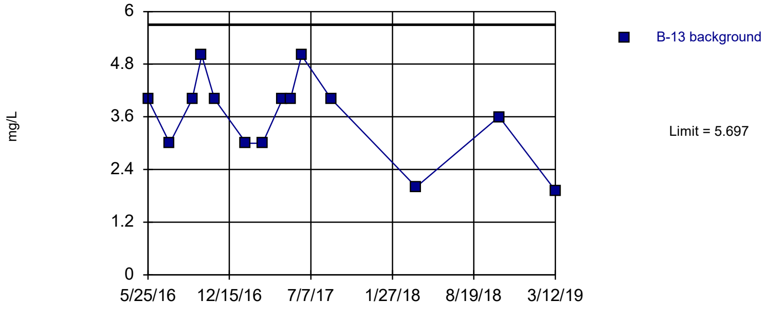
Background Data Summary: Mean=10.23, Std. Dev.=1.557, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9508, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-13 (bg)



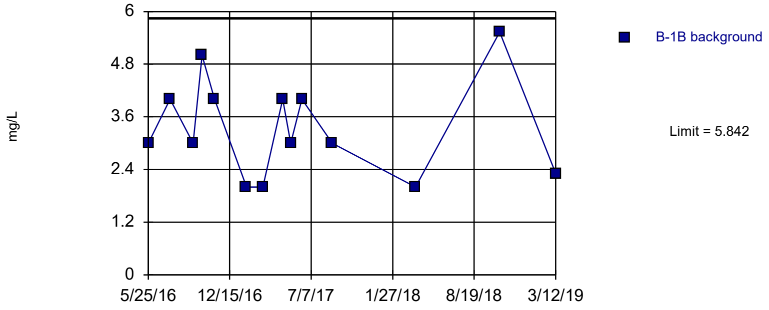
Background Data Summary: Mean=3.609, Std. Dev.=0.934, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8984, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-1B (bg)



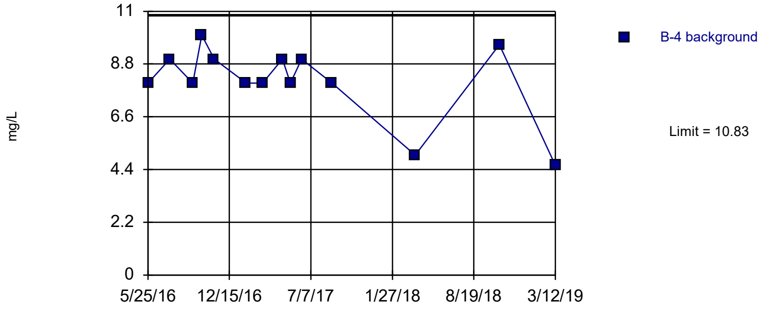
Background Data Summary: Mean=3.346, Std. Dev.=1.116, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9111, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-4 (bg)



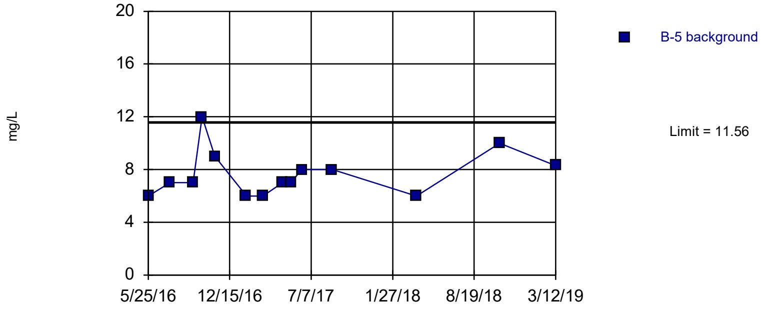
Background Data Summary (based on square transformation): Mean=67.59, Std. Dev.=22.27, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8593, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-5 (bg)



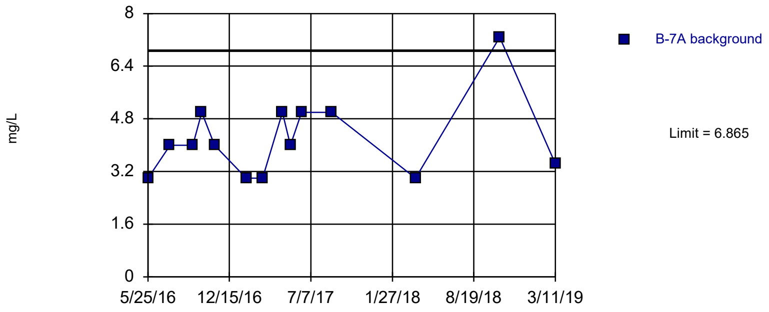
Background Data Summary: Mean=7.664, Std. Dev.=1.743, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8593, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-7A (bg)



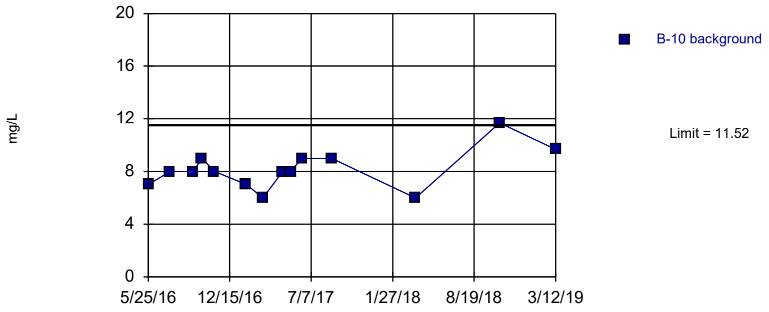
Background Data Summary: Mean=4.194, Std. Dev.=1.195, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8442, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-10



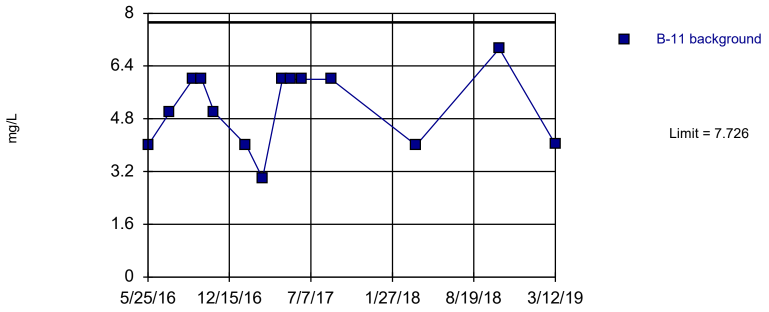
Background Data Summary: Mean=8.17, Std. Dev.=1.496, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9256, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-11



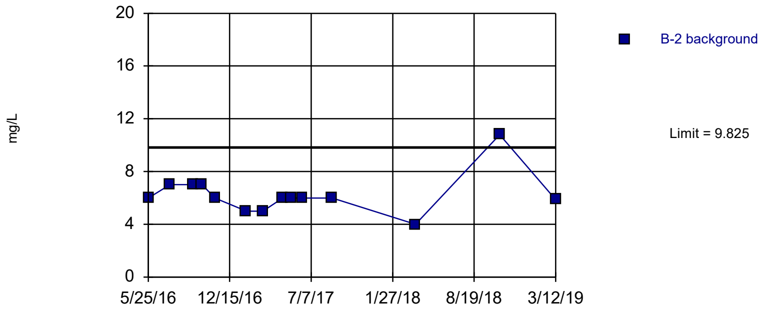
Background Data Summary: Mean=5.14, Std. Dev.=1.157, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8838, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-2



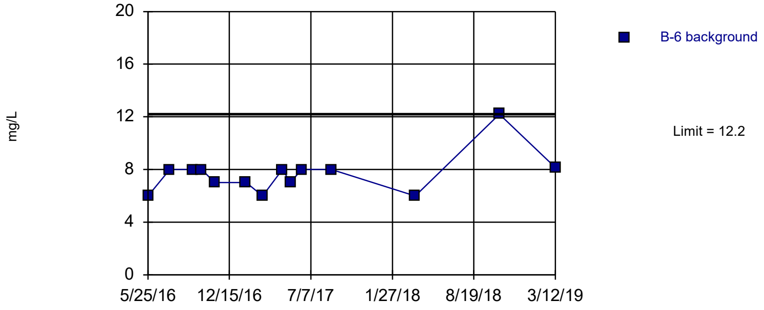
Background Data Summary (based on square root transformation): Mean=2.487, Std. Dev.=0.2896, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8315, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, B-6



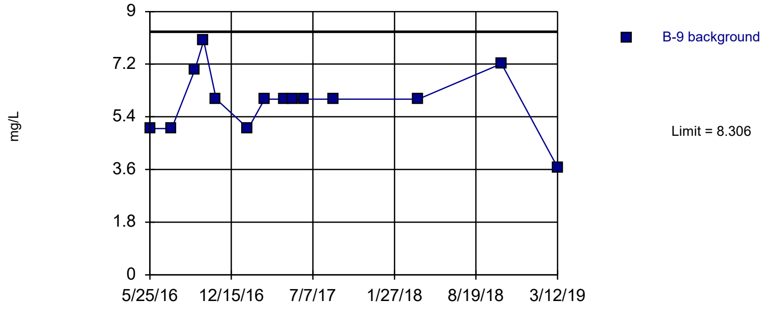
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 14 background values. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-9



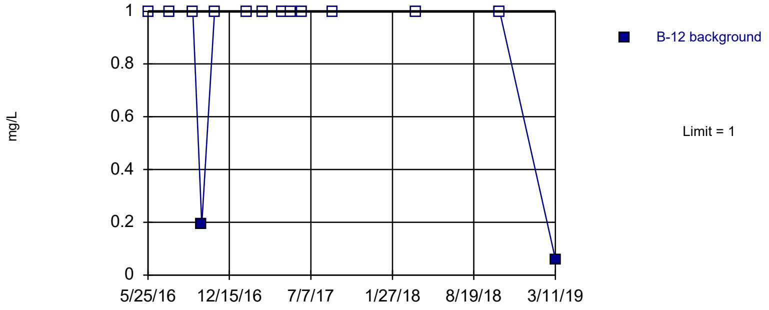
Background Data Summary: Mean=5.921, Std. Dev.=1.066, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9146, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Chloride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-12 (bg)



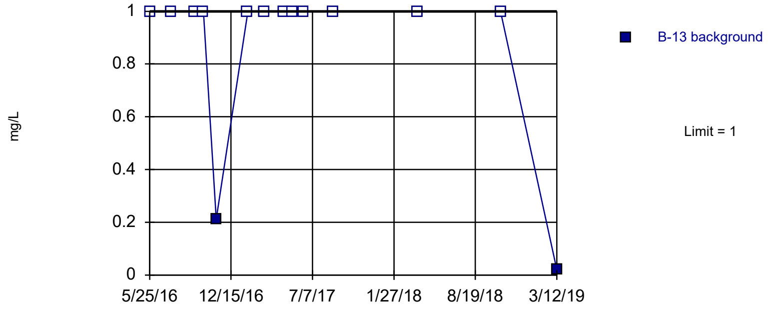
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 85.71% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-13 (bg)



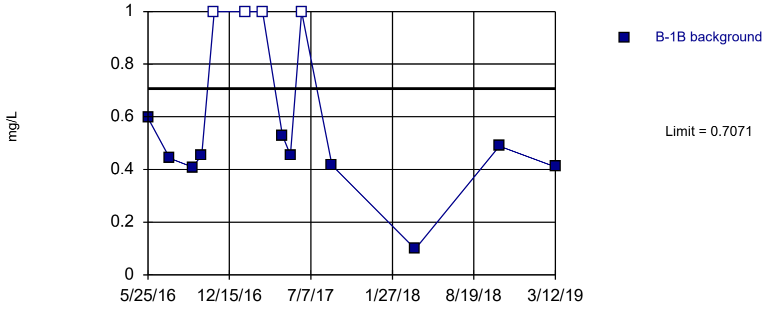
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 85.71% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, B-1B (bg)



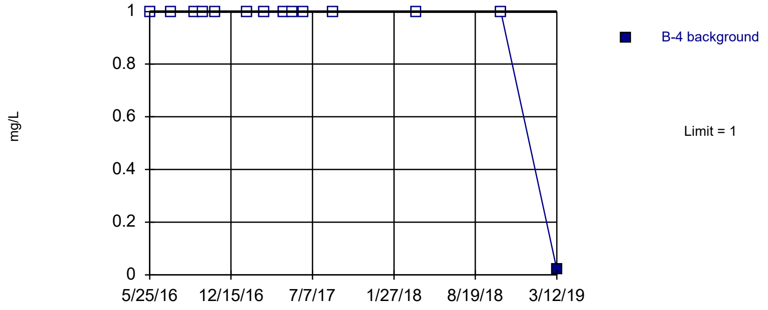
Background Data Summary (after Kaplan-Meier Adjustment): Mean=0.43, Std. Dev.=0.1239, n=14, 28.57% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8263, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-4 (bg)



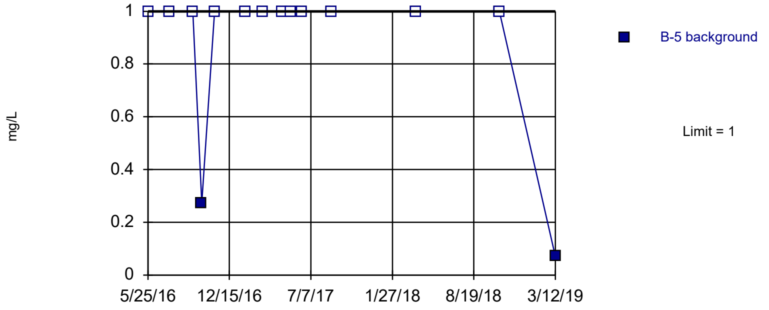
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 92.86% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-5 (bg)



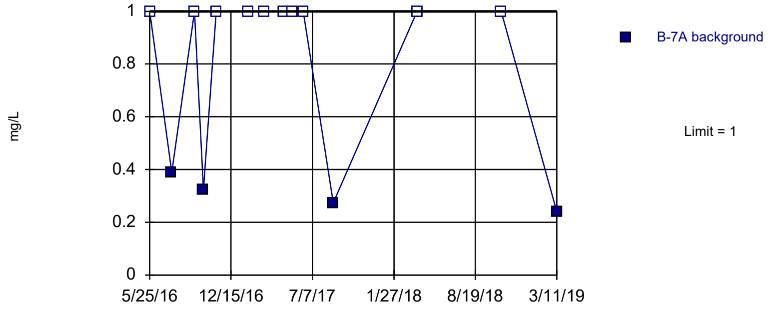
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 85.71% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-7A (bg)



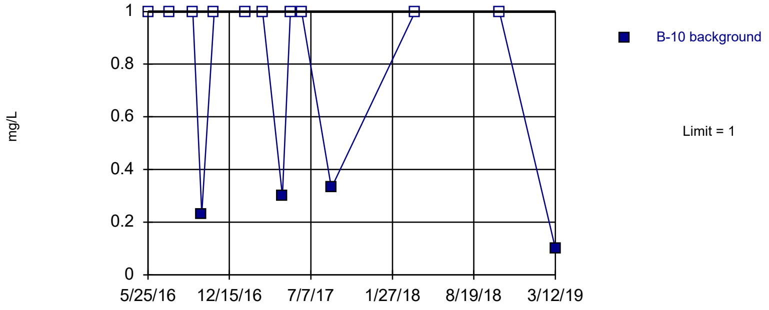
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 71.43% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-10



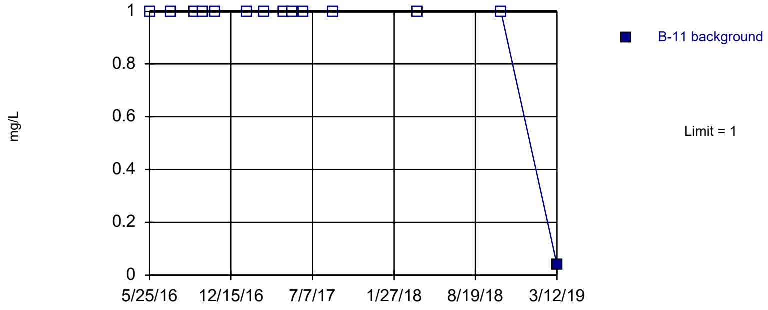
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 71.43% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-11



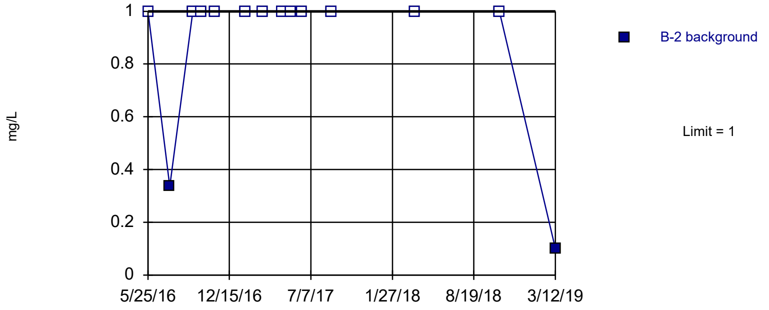
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 92.86% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-2



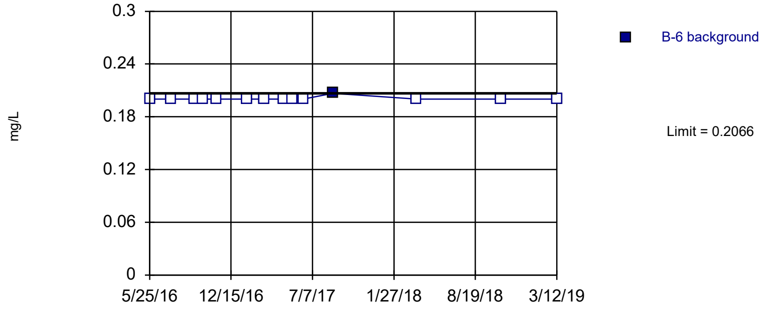
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 85.71% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-6



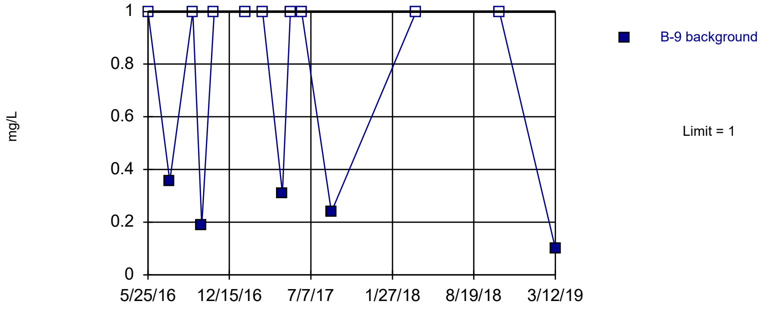
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 92.86% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total Analysis Run 12/24/2019 9:39 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, B-9



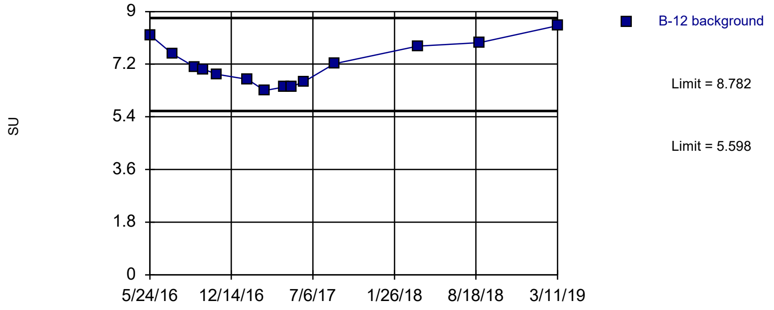
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 14 background values. 64.29% NDs. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Fluoride, total   Analysis Run 12/24/2019 9:39 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-12 (bg)



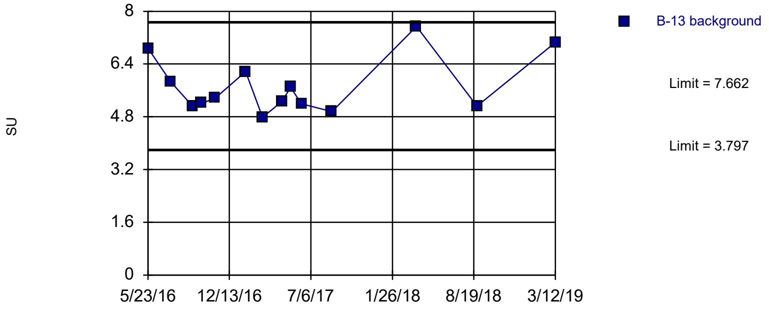
Background Data Summary: Mean=7.19, Std. Dev.=0.7119, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.935, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/24/2019 9:39 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-13 (bg)



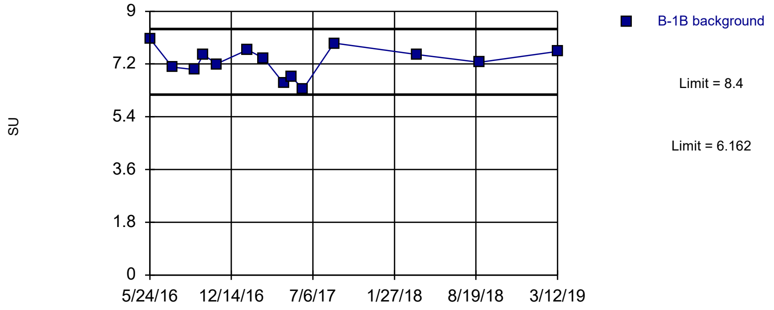
Background Data Summary: Mean=5.729, Std. Dev.=0.8643, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8605, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/24/2019 9:39 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-1B (bg)



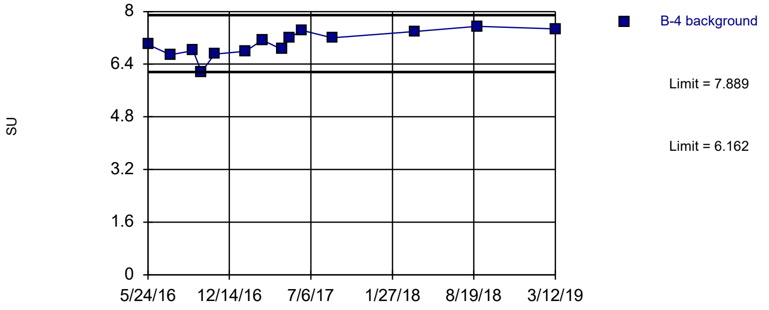
Background Data Summary: Mean=7.281, Std. Dev.=0.5005, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9765, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/24/2019 9:39 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-4 (bg)



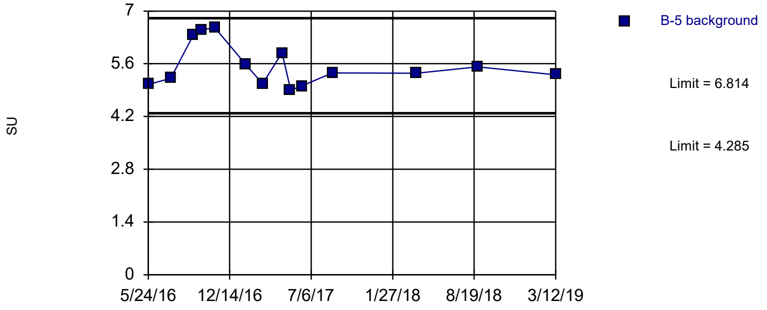
Background Data Summary: Mean=7.026, Std. Dev.=0.3862, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9438, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/24/2019 9:39 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-5 (bg)



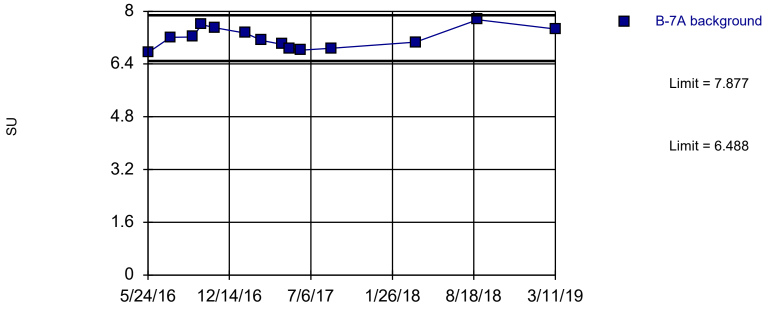
Background Data Summary: Mean=5.549, Std. Dev.=0.5654, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8679, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/24/2019 9:40 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-7A (bg)



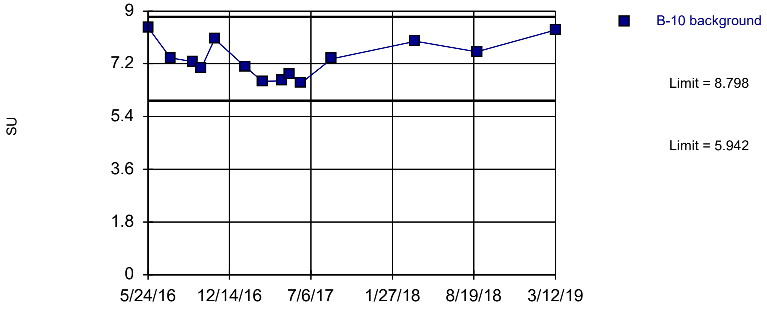
Background Data Summary: Mean=7.183, Std. Dev.=0.3105, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9601, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/24/2019 9:40 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-10



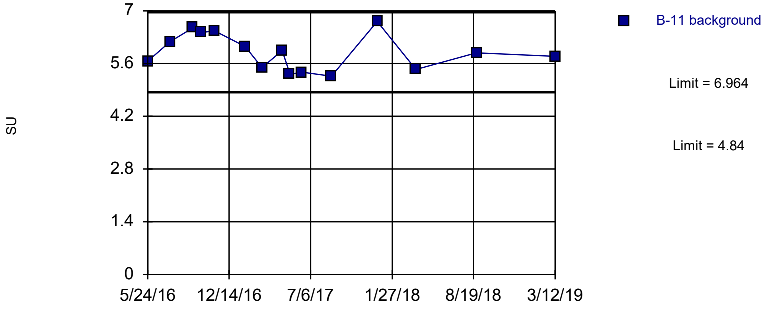
Background Data Summary: Mean=7.37, Std. Dev.=0.6385, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9365, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field   Analysis Run 12/24/2019 9:40 AM   View: PLs - Intrawell
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-11



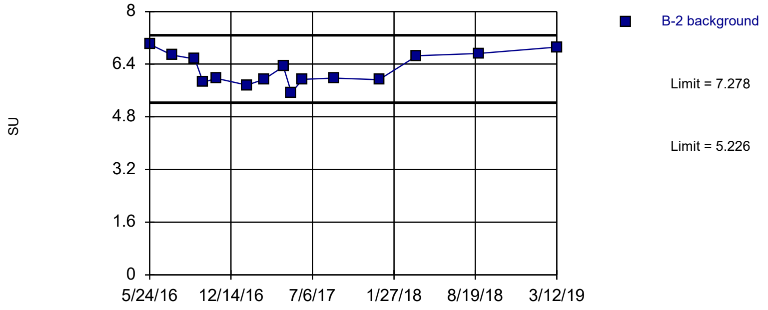
Background Data Summary: Mean=5.902, Std. Dev.=0.4841, n=15. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9382, critical = 0.835. Kappa = 2.193 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-2



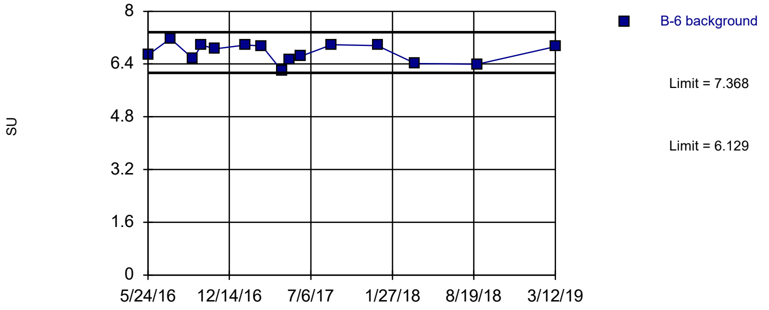
Background Data Summary: Mean=6.252, Std. Dev.=0.4681, n=15. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9105, critical = 0.835. Kappa = 2.193 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-6



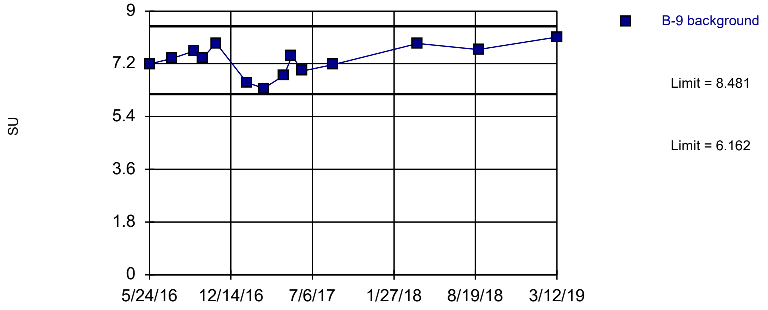
Background Data Summary: Mean=6.749, Std. Dev.=0.2825, n=15. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9252, critical = 0.835. Kappa = 2.193 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-9



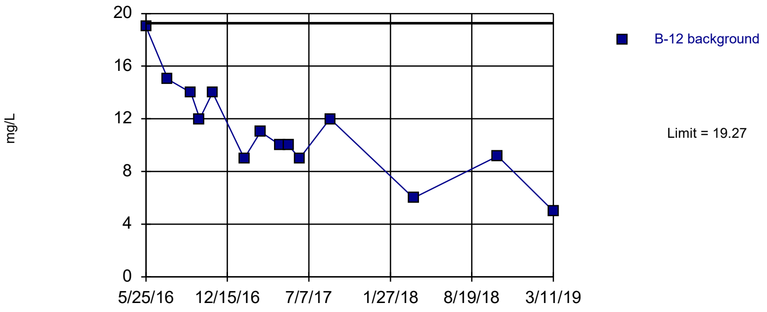
Background Data Summary: Mean=7.321, Std. Dev.=0.5186, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9709, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: pH, field Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-12 (bg)



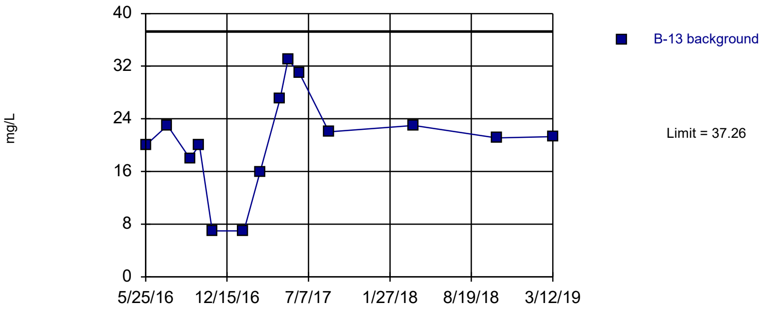
Background Data Summary: Mean=11.08, Std. Dev.=3.662, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9682, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-13 (bg)



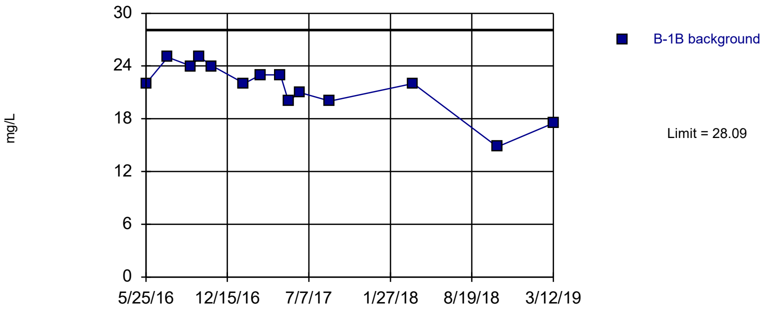
Background Data Summary: Mean=20.67, Std. Dev.=7.419, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9262, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-1B (bg)



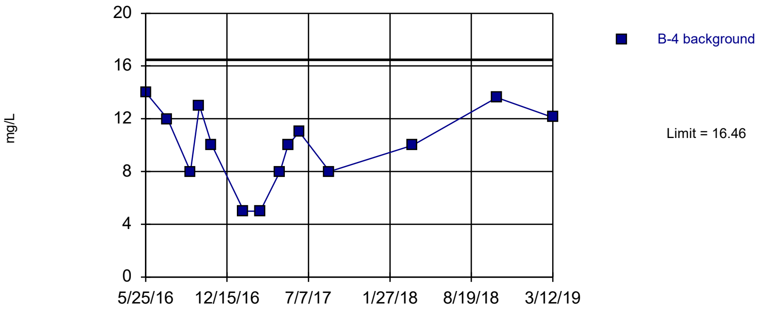
Background Data Summary: Mean=21.66, Std. Dev.=2.876, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9061, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-4 (bg)

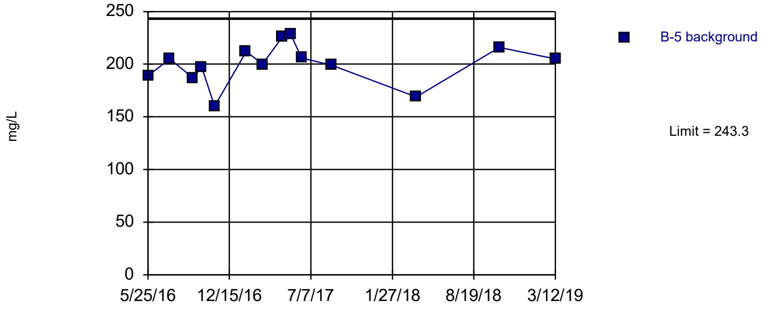


Background Data Summary: Mean=9.979, Std. Dev.=2.9, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9359, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Prediction Limit

Intrawell Parametric, B-5 (bg)

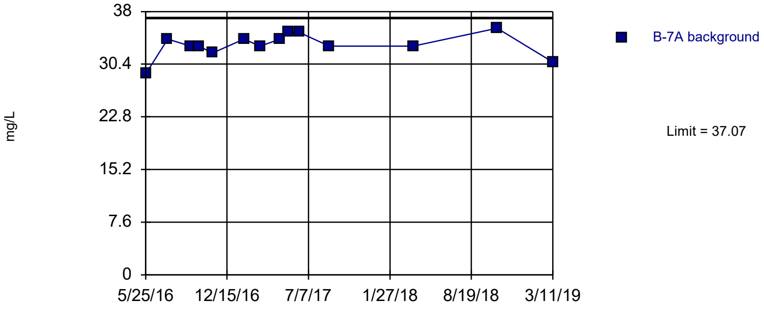


Background Data Summary: Mean=200, Std. Dev.=19.34, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9533, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Prediction Limit

Intrawell Parametric, B-7A (bg)

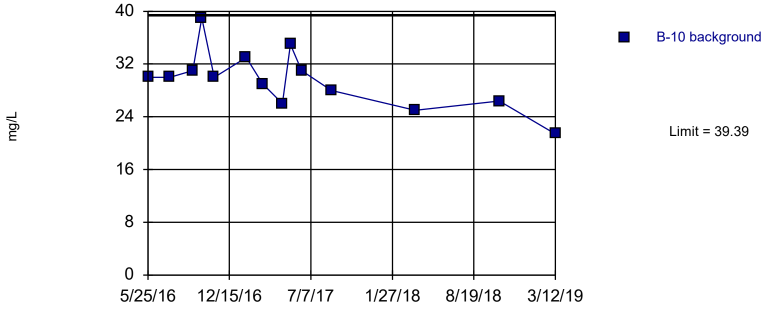


Background Data Summary: Mean=33.16, Std. Dev.=1.747, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9096, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Prediction Limit

Intrawell Parametric, B-10

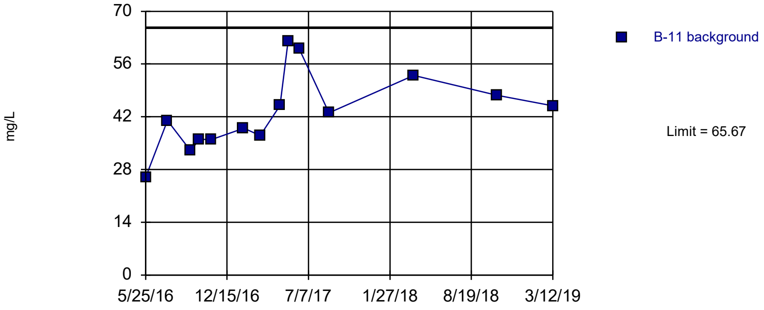


Background Data Summary: Mean=29.63, Std. Dev.=4.368, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9757, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Prediction Limit

Intrawell Parametric, B-11



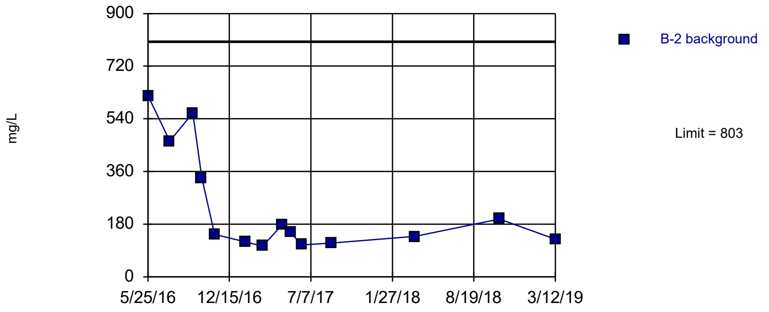
Background Data Summary: Mean=43.11, Std. Dev.=10.09, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9595, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-2



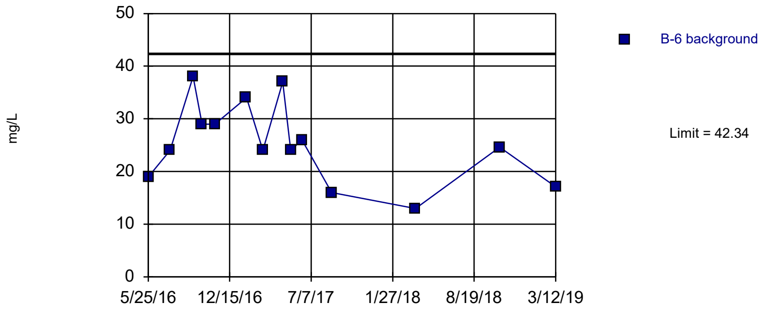
Background Data Summary (based on natural log transformation): Mean=5.276, Std. Dev.=0.6315, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8327, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-6



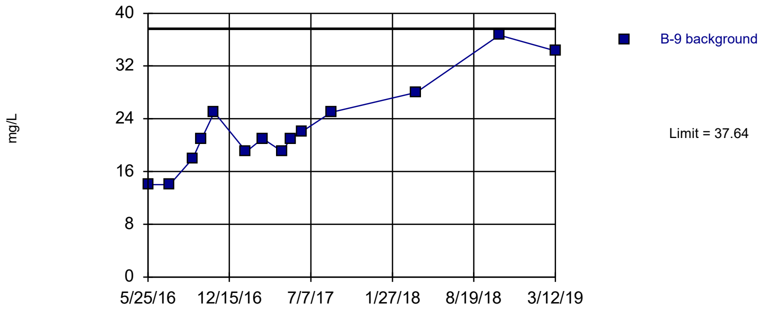
Background Data Summary: Mean=25.34, Std. Dev.=7.606, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9576, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-9



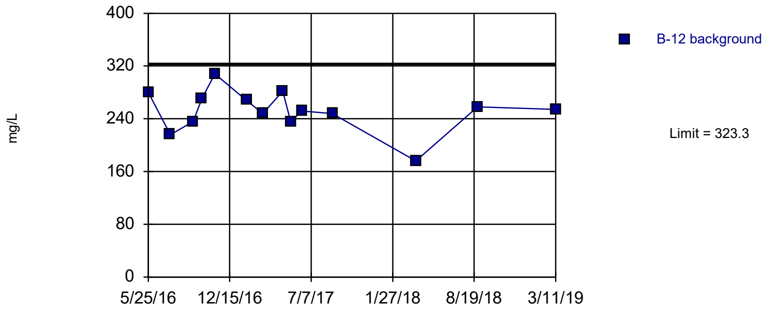
Background Data Summary: Mean=22.71, Std. Dev.=6.675, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9143, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Sulfate, total Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-12 (bg)



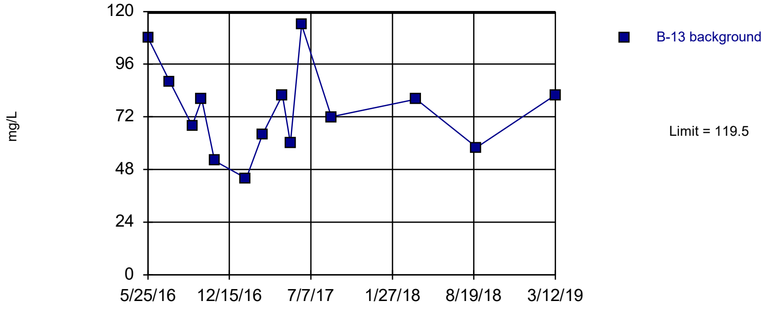
Background Data Summary: Mean=252.4, Std. Dev.=31.73, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9513, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-13 (bg)



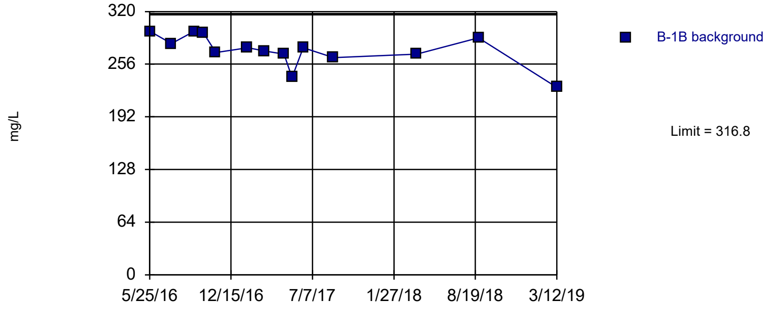
Background Data Summary: Mean=75.14, Std. Dev.=19.83, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9584, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-1B (bg)



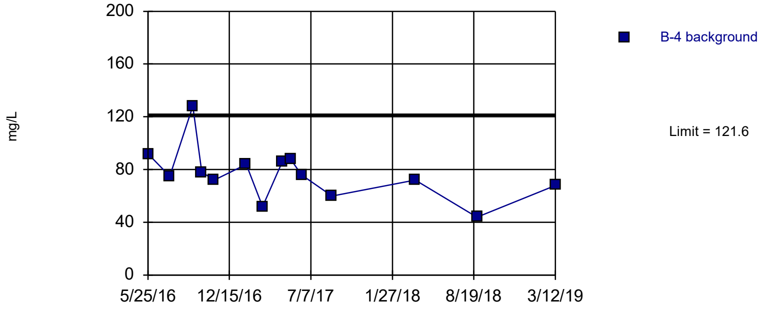
Background Data Summary: Mean=272.6, Std. Dev.=19.73, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8983, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-4 (bg)



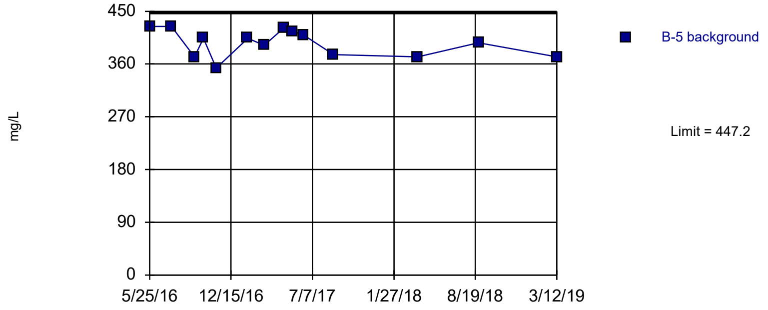
Background Data Summary: Mean=76.79, Std. Dev.=20.03, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9249, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-5 (bg)



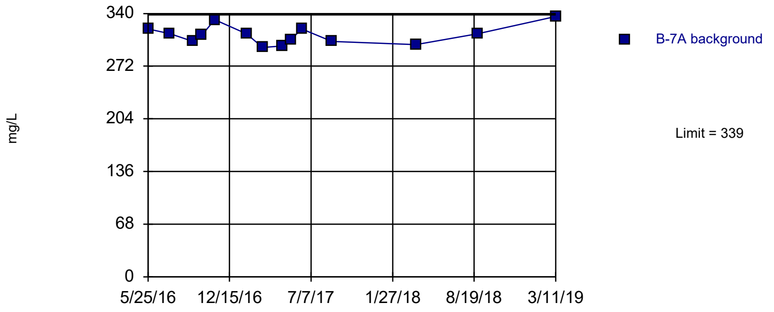
Background Data Summary: Mean=395.5, Std. Dev.=23.14, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.921, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-7A (bg)



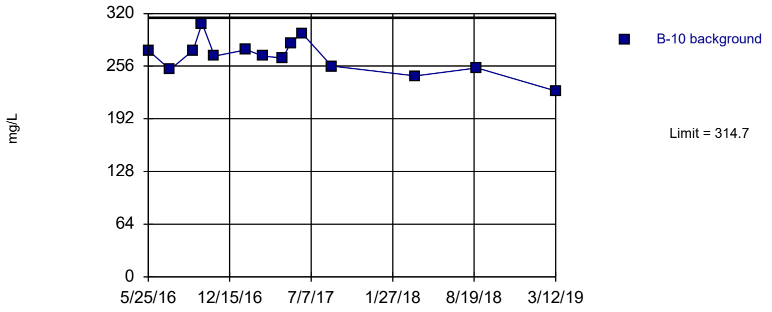
Background Data Summary: Mean=312.1, Std. Dev.=12.01, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9386, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-10



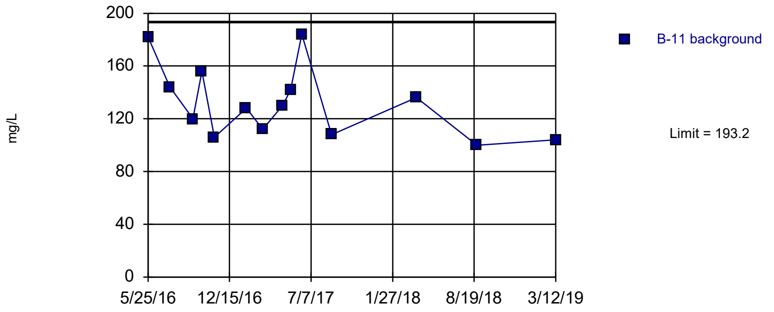
Background Data Summary: Mean=267.7, Std. Dev.=21.01, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.984, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-11



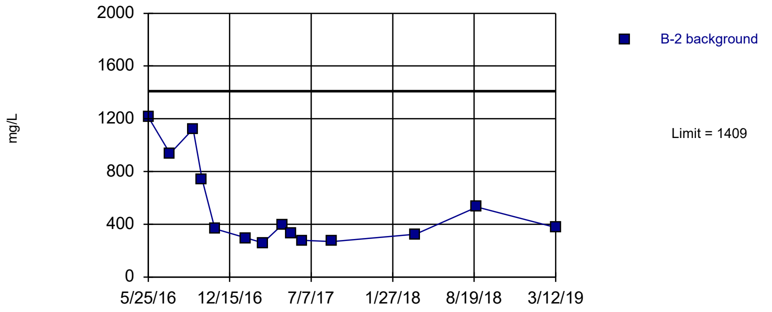
Background Data Summary: Mean=132.3, Std. Dev.=27.26, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9087, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, B-2

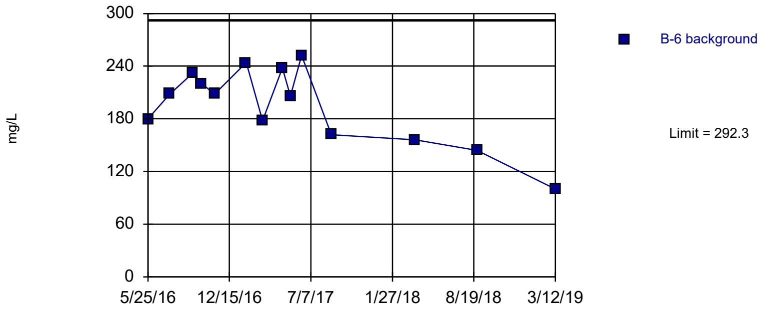


Background Data Summary (based on cube root transformation): Mean=7.823, Std. Dev.=1.515, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8281, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Prediction Limit

Intrawell Parametric, B-6

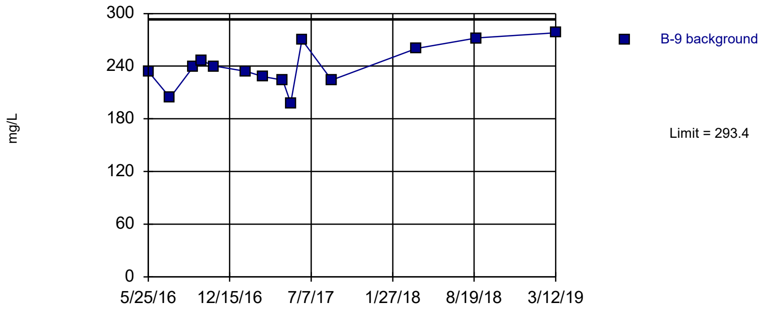


Background Data Summary: Mean=194.9, Std. Dev.=43.59, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9486, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Prediction Limit

Intrawell Parametric, B-9



Background Data Summary: Mean=239.4, Std. Dev.=24.16, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9559, critical = 0.825. Kappa = 2.236 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504. Assumes 1 future value.

Constituent: Total Dissolved Solids [TDS] Analysis Run 12/24/2019 9:40 AM View: PLs - Intrawell
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Trend Test Summary Table - All Results

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 12:02 PM

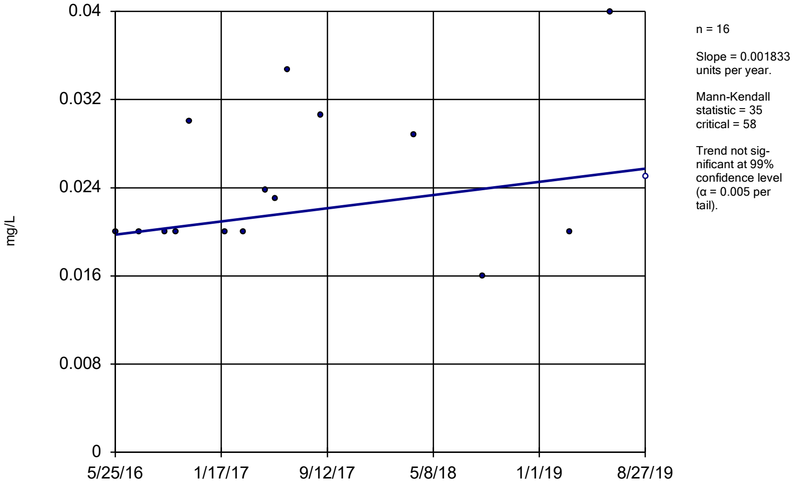
Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	B-12 (bg)	0.001833	35	58	No	16	6.25	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-13 (bg)	0.001928	25	58	No	16	12.5	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-1B (bg)	0.0004874	32	58	No	16	6.25	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-4 (bg)	0.007867	44	58	No	16	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-5 (bg)	0.004951	43	58	No	16	12.5	n/a	n/a	0.01	NP
Boron, total (mg/L)	B-7A (bg)	0	12	58	No	16	12.5	n/a	n/a	0.01	NP

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

B-12 (bg)



n = 16

Slope = 0.001833 units per year.

Mann-Kendall statistic = 35 critical = 58

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 12/8/2019 12:02 PM   View: Trend Tests

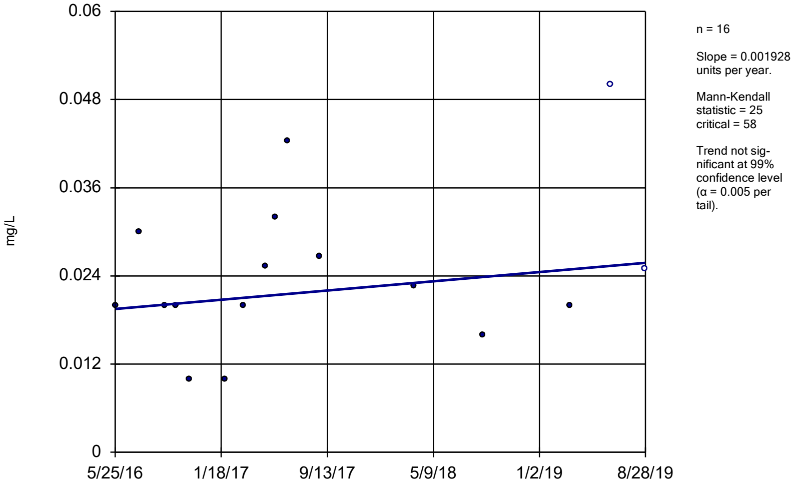
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

B-13 (bg)



n = 16

Slope = 0.001928 units per year.

Mann-Kendall statistic = 25 critical = 58

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total   Analysis Run 12/8/2019 12:02 PM   View: Trend Tests

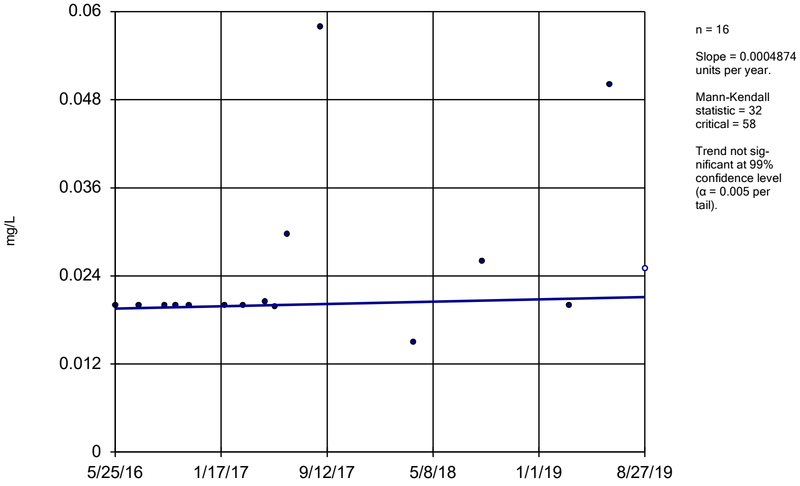
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Sen's Slope Estimator

B-1B (bg)



n = 16

Slope = 0.0004874 units per year.

Mann-Kendall statistic = 32 critical = 58

Trend not significant at 99% confidence level (α = 0.005 per tail).

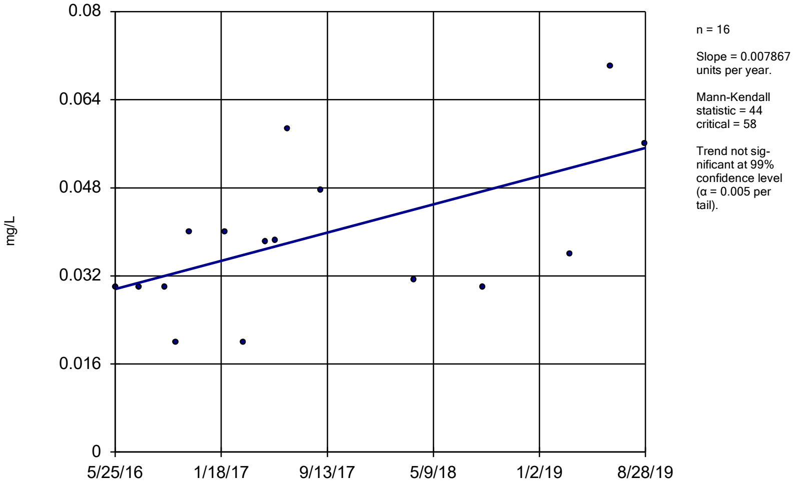
Constituent: Boron, total   Analysis Run 12/8/2019 12:02 PM   View: Trend Tests

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

B-4 (bg)



n = 16

Slope = 0.007867 units per year.

Mann-Kendall statistic = 44 critical = 58

Trend not significant at 99% confidence level (α = 0.005 per tail).

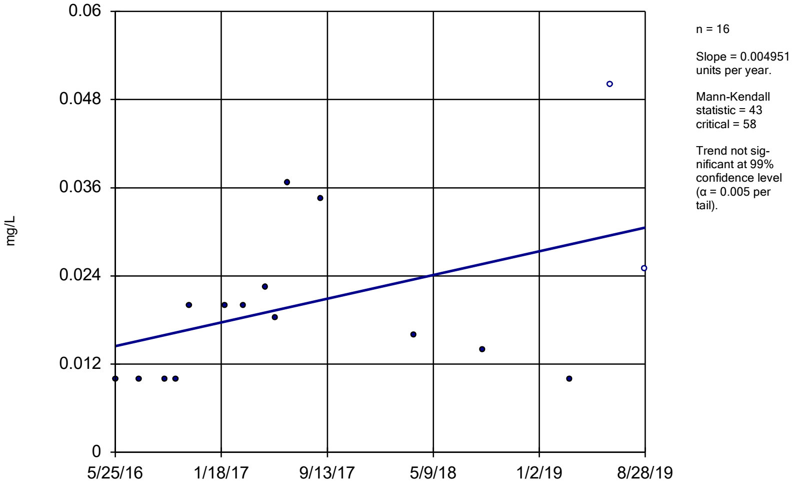
Constituent: Boron, total   Analysis Run 12/8/2019 12:02 PM   View: Trend Tests

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

B-5 (bg)

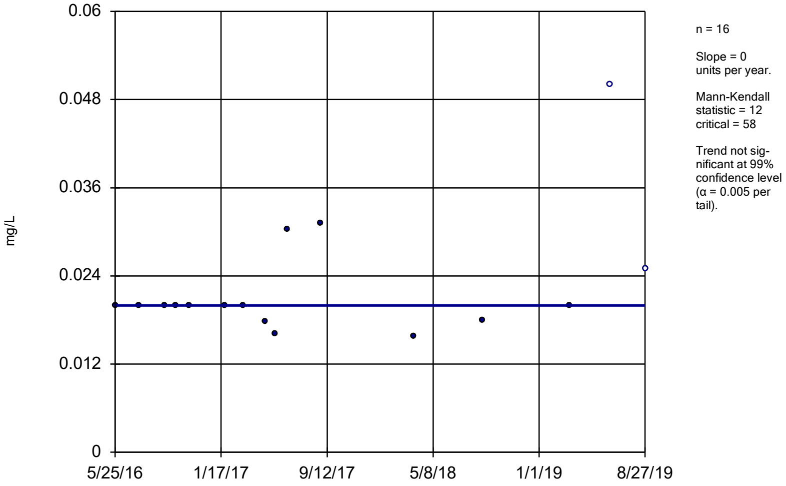


Constituent: Boron, total Analysis Run 12/8/2019 12:02 PM View: Trend Tests
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Sen's Slope Estimator

B-7A (bg)



Constituent: Boron, total Analysis Run 12/8/2019 12:02 PM View: Trend Tests
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Interwell Prediction Limit Summary

Flint Creek LF Client: Geosyntec Data: Flint Creek LF Printed 12/8/2019, 11:47 AM

Constituent	Well	Upper Lim.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	n/a	0.0588	n/a	84	n/a	n/a	0	n/a	n/a	0.0002746	NP (normality) 1 of 2

Tolerance Limit Summary Table

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 3:50 PM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.005	90	n/a	n/a	74.44	n/a	n/a	0.009888	NP Inter(normality)
Arsenic, total (mg/L)	n/a	0.008	90	n/a	n/a	57.78	n/a	n/a	0.009888	NP Inter(normality)
Barium, total (mg/L)	n/a	0.131	90	n/a	n/a	0	n/a	n/a	0.009888	NP Inter(normality)
Beryllium, total (mg/L)	n/a	0.001	90	n/a	n/a	32.22	n/a	n/a	0.009888	NP Inter(normality)
Cadmium, total (mg/L)	n/a	0.001	90	n/a	n/a	57.78	n/a	n/a	0.009888	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.005071	89	0.1085	0.03253	10.11	None	x^(1/3)	0.05	Inter
Cobalt, total (mg/L)	n/a	0.005202	89	-7.438	1.12	3.371	None	ln(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	n/a	9.419	84	0.4635	0.9102	1.19	None	ln(x)	0.05	Inter
Fluoride, total (mg/L)	n/a	1	96	n/a	n/a	69.79	n/a	n/a	0.007269	NP Inter(normality)
Lead, total (mg/L)	n/a	0.005	89	n/a	n/a	51.69	n/a	n/a	0.01041	NP Inter(normality)
Lithium, total (mg/L)	n/a	0.05	90	n/a	n/a	8.889	n/a	n/a	0.009888	NP Inter(normality)
Mercury, total (mg/L)	n/a	0.000096	90	n/a	n/a	56.67	n/a	n/a	0.009888	NP Inter(normality)
Molybdenum, total (mg/L)	n/a	0.01	90	n/a	n/a	63.33	n/a	n/a	0.009888	NP Inter(normality)
Selenium, total (mg/L)	n/a	0.0392	90	n/a	n/a	62.22	n/a	n/a	0.009888	NP Inter(normality)
Thallium, total (mg/L)	n/a	0.002	90	n/a	n/a	85.56	n/a	n/a	0.009888	NP Inter(NDs)

FLINT CREEK LANDFILL GWPS				
Constituent Name	**MCL**	**CCR-Rule Specified**	**Background Limit**	**GWPS**
Antimony, Total (mg/L)	0.006		0.005	0.006
Arsenic, Total (mg/L)	0.01		0.008	0.01
Barium, Total (mg/L)	2		0.13	2
Beryllium, Total (mg/L)	0.004		0.001	0.004
Cadmium, Total (mg/L)	0.005		0.001	0.005
Chromium, Total (mg/L)	0.1		0.0051	0.1
Cobalt, Total (mg/L)	n/a	0.006	0.0052	0.006
Combined Radium, Total (pCi/L)	5		9.42	9.42
Fluoride, Total (mg/L)	4		1	4
Lead, Total (mg/L)	0.015		0.005	0.015
Lithium, Total (mg/L)	n/a	0.04	0.05	0.05
Mercury, Total (mg/L)	0.002		0.000096	0.002
Molybdenum, Total (mg/L)	n/a	0.1	0.01	0.1
Selenium, Total (mg/L)	0.05		0.039	0.05
Thallium, Total (mg/L)	0.002		0.002	0.002

**Grey cell indicates ACL is higher than MCL.*

**MCL = Maximum Contaminant Level*

**GWPS = Groundwater Protection Standard*

Confidence Interval Summary Table - All Results (No Significant)

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 12:00 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	B-10	0.005	0.00011	0.006	No	15	0.003701	0.00223	73.33	None	No	0.01	NP (normality)
Antimony, total (mg/L)	B-11	0.005	0.0002	0.006	No	15	0.003713	0.002194	86.67	None	No	0.01	NP (NDs)
Antimony, total (mg/L)	B-2	0.005	0.0001	0.006	No	15	0.002585	0.002257	53.33	None	No	0.01	NP (Cohens/xfrm)
Antimony, total (mg/L)	B-6	0.005	0.00008	0.006	No	15	0.003473	0.002259	73.33	None	No	0.01	NP (normality)
Antimony, total (mg/L)	B-9	0.005	0.0005	0.006	No	15	0.003506	0.002205	80	None	No	0.01	NP (NDs)
Arsenic, total (mg/L)	B-10	0.006	0.00067	0.01	No	15	0.003564	0.002058	53.33	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	B-11	0.007	0.00055	0.01	No	14	0.003454	0.002312	50	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	B-2	0.008	0.0004	0.01	No	15	0.003648	0.004383	26.67	None	No	0.01	NP (Cohens/xfrm)
Arsenic, total (mg/L)	B-6	0.005	0.00051	0.01	No	15	0.002773	0.00205	40	None	No	0.01	NP (normality)
Arsenic, total (mg/L)	B-9	0.005	0.00111	0.01	No	15	0.003242	0.001958	53.33	None	No	0.01	NP (normality)
Barium, total (mg/L)	B-10	0.08048	0.07518	2	No	13	0.07783	0.003569	0	None	No	0.01	Param.
Barium, total (mg/L)	B-11	0.145	0.1093	2	No	14	0.1271	0.02521	0	None	No	0.01	Param.
Barium, total (mg/L)	B-2	0.1157	0.05487	2	No	14	0.09198	0.05817	0	None	ln(x)	0.01	Param.
Barium, total (mg/L)	B-6	0.06802	0.05048	2	No	15	0.05925	0.01295	0	None	No	0.01	Param.
Barium, total (mg/L)	B-9	0.1621	0.1385	2	No	15	0.1505	0.01778	0	None	sqrt(x)	0.01	Param.
Beryllium, total (mg/L)	B-10	0.001	0.00004915	0.004	No	15	0.0005733	0.0004399	66.67	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	B-11	0.0006942	0.0002667	0.004	No	14	0.0005489	0.0004836	0	None	ln(x)	0.01	Param.
Beryllium, total (mg/L)	B-2	0.0002973	0.0001312	0.004	No	14	0.0002677	0.0002699	0	None	No	0.01	NP (normality)
Beryllium, total (mg/L)	B-6	0.0003454	0.00007015	0.004	No	15	0.0002347	0.0002642	13.33	None	sqrt(x)	0.01	Param.
Beryllium, total (mg/L)	B-9	0.001	0.00003	0.004	No	15	0.0004197	0.0004528	46.67	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	B-10	0.001	0.00005	0.005	No	15	0.0007142	0.0004279	73.33	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	B-11	0.0007086	0.0001489	0.005	No	14	0.0004982	0.000539	0	None	x^(1/3)	0.01	Param.
Cadmium, total (mg/L)	B-2	0.001	0.00005	0.005	No	15	0.0005712	0.0004635	46.67	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	B-6	0.001	0.00008	0.005	No	15	0.0005437	0.0004471	53.33	None	No	0.01	NP (normality)
Cadmium, total (mg/L)	B-9	0.001	0.0002	0.005	No	15	0.0007693	0.0003975	86.67	None	No	0.01	NP (NDs)
Chromium, total (mg/L)	B-10	0.001492	0.000521	0.1	No	13	0.001006	0.0006529	0	None	No	0.01	Param.
Chromium, total (mg/L)	B-11	0.006423	0.001484	0.1	No	14	0.005403	0.006635	0	None	ln(x)	0.01	Param.
Chromium, total (mg/L)	B-2	0.004987	0.002054	0.1	No	13	0.003628	0.002327	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	B-6	0.005371	0.002526	0.1	No	15	0.004085	0.002403	0	None	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	B-9	0.002965	0.001577	0.1	No	15	0.002271	0.001024	0	None	No	0.01	Param.
Cobalt, total (mg/L)	B-10	0.001046	0.0003992	0.006	No	14	0.0007224	0.0004563	7.143	None	No	0.01	Param.
Cobalt, total (mg/L)	B-11	0.002024	0.0003276	0.006	No	14	0.001437	0.001816	0	None	x^(1/3)	0.01	Param.
Cobalt, total (mg/L)	B-2	0.002961	0.000286	0.006	No	14	0.002221	0.003977	0	None	x^(1/3)	0.01	Param.
Cobalt, total (mg/L)	B-6	0.00233	0.000713	0.006	No	15	0.001522	0.001193	0	None	No	0.01	Param.
Cobalt, total (mg/L)	B-9	0.001371	0.0005716	0.006	No	15	0.0009714	0.00059	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-10	1.505	0.722	9.42	No	14	1.113	0.5527	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-11	1.711	0.6529	9.42	No	12	1.182	0.674	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-2	2.499	1.255	9.42	No	14	1.922	0.9752	0	None	sqrt(x)	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-6	1.145	0.5735	9.42	No	12	0.8594	0.3644	0	None	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	B-9	1.803	0.5641	9.42	No	13	1.184	0.8331	0	None	No	0.01	Param.
Fluoride, total (mg/L)	B-10	1	0.2319	4	No	16	0.7545	0.38	68.75	None	No	0.01	NP (normality)
Fluoride, total (mg/L)	B-11	1	0.04	4	No	16	0.88	0.3279	87.5	None	No	0.01	NP (NDs)
Fluoride, total (mg/L)	B-2	1	0.3361	4	No	16	0.8435	0.3408	81.25	None	No	0.01	NP (NDs)
Fluoride, total (mg/L)	B-6	1	0.2066	4	No	16	0.8398	0.3464	87.5	None	No	0.01	NP (NDs)
Fluoride, total (mg/L)	B-9	1	0.1884	4	No	16	0.7077	0.394	62.5	None	No	0.01	NP (normality)
Lead, total (mg/L)	B-10	0.005	0.0003	0.015	No	15	0.00312	0.002162	60	None	No	0.01	NP (normality)
Lead, total (mg/L)	B-11	0.006	0.000416	0.015	No	14	0.003139	0.002792	28.57	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	B-2	0.005	0.0002	0.015	No	14	0.002829	0.003513	28.57	None	No	0.01	NP (Cohens/xfrm)
Lead, total (mg/L)	B-6	0.002459	0.0006731	0.015	No	15	0.00171	0.00145	6.667	None	sqrt(x)	0.01	Param.
Lead, total (mg/L)	B-9	0.005	0.000693	0.015	No	15	0.003002	0.00222	60	None	No	0.01	NP (normality)
Lithium, total (mg/L)	B-10	0.01	0.00169	0.05	No	15	0.007401	0.01239	6.667	None	No	0.01	NP (normality)
Lithium, total (mg/L)	B-11	0.00899	0.002358	0.05	No	14	0.00744	0.008724	0	None	ln(x)	0.01	Param.
Lithium, total (mg/L)	B-2	0.01161	0.002431	0.05	No	15	0.01027	0.01351	6.667	None	ln(x)	0.01	Param.
Lithium, total (mg/L)	B-6	0.0038	0.0008463	0.05	No	14	0.005464	0.01287	7.143	None	No	0.01	NP (normality)
Lithium, total (mg/L)	B-9	0.009	0.00241	0.05	No	15	0.007772	0.01221	6.667	None	No	0.01	NP (normality)

Confidence Interval Summary Table - All Results (No Significant)

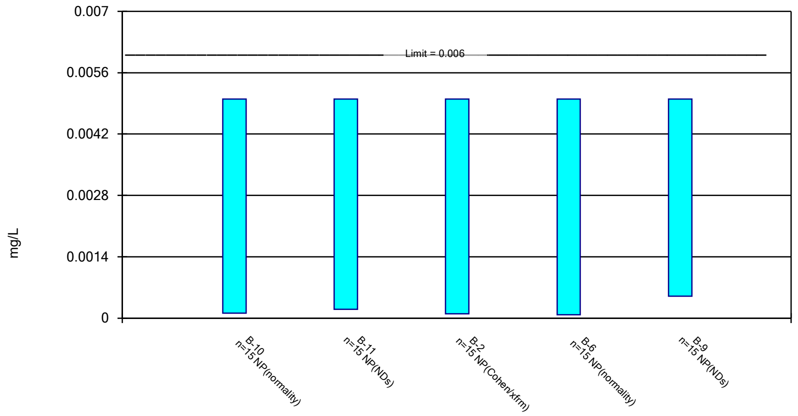
Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF   Printed 12/8/2019, 12:00 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Mercury, total (mg/L)	B-10	0.000025	0.000016	0.002	No	15	0.00002178	0.000005834	66.67	None	No	0.01	NP (normality)
Mercury, total (mg/L)	B-11	0.000025	0.00002458	0.002	No	14	0.00002493	1.8e-7	85.71	None	No	0.01	NP (NDs)
Mercury, total (mg/L)	B-2	0.000027	0.00001252	0.002	No	15	0.00002334	0.00001	60	None	No	0.01	NP (normality)
Mercury, total (mg/L)	B-6	0.000025	0.00000738	0.002	No	15	0.00001544	0.000008342	40	None	No	0.01	NP (normality)
Mercury, total (mg/L)	B-9	0.000025	0.00001472	0.002	No	15	0.00002244	0.000005506	80	None	No	0.01	NP (NDs)
Molybdenum, total (mg/L)	B-10	0.005	0.00092	0.1	No	15	0.002665	0.003203	13.33	None	No	0.01	NP (normality)
Molybdenum, total (mg/L)	B-11	0.01	0.0003706	0.1	No	15	0.003715	0.002668	66.67	None	No	0.01	NP (normality)
Molybdenum, total (mg/L)	B-2	0.00388	0.000828	0.1	No	15	0.002644	0.002729	13.33	None	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	B-6	0.005	0.0005	0.1	No	15	0.002431	0.002802	40	None	No	0.01	NP (normality)
Molybdenum, total (mg/L)	B-9	0.01	0.0008719	0.1	No	15	0.006527	0.008516	73.33	None	No	0.01	NP (normality)
Selenium, total (mg/L)	B-10	0.005	0.0004	0.05	No	15	0.003767	0.002118	73.33	None	No	0.01	NP (normality)
Selenium, total (mg/L)	B-11	0.00476	0.002361	0.05	No	15	0.003293	0.001377	26.67	Cohen`s	No	0.01	Param.
Selenium, total (mg/L)	B-2	0.03288	0.01037	0.05	No	15	0.02412	0.02155	0	None	x^(1/3)	0.01	Param.
Selenium, total (mg/L)	B-6	0.003311	0.001678	0.05	No	15	0.002494	0.001205	6.667	None	No	0.01	Param.
Selenium, total (mg/L)	B-9	0.005	0.0008	0.05	No	15	0.003847	0.001984	80	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-10	0.002	0.00136	0.002	No	15	0.001726	0.0006219	86.67	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-11	0.002	0.001	0.002	No	15	0.001635	0.000662	86.67	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-2	0.002	0.0005	0.002	No	15	0.001529	0.0007166	80	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-6	0.002	0.001	0.002	No	15	0.001601	0.0006496	80	None	No	0.01	NP (NDs)
Thallium, total (mg/L)	B-9	0.002	0.001044	0.002	No	15	0.001673	0.0006346	80	None	No	0.01	NP (NDs)

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

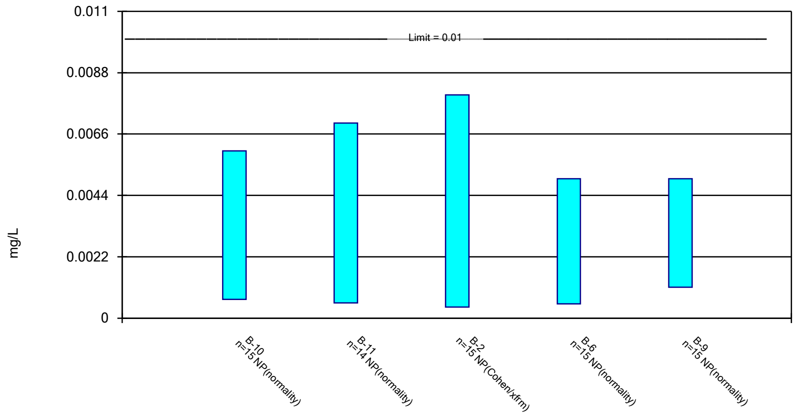


Constituent: Antimony, total Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

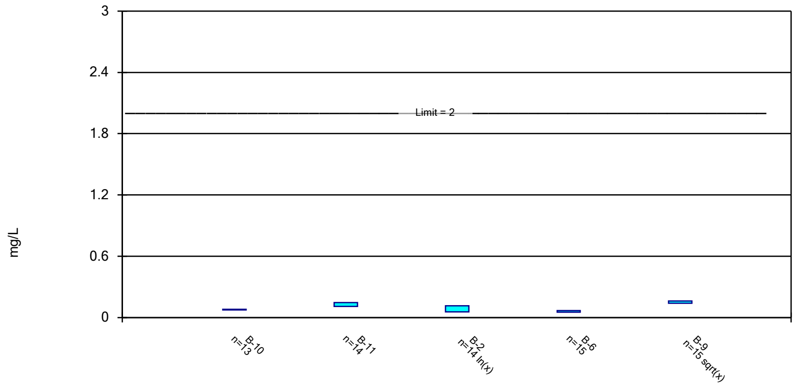


Constituent: Arsenic, total Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

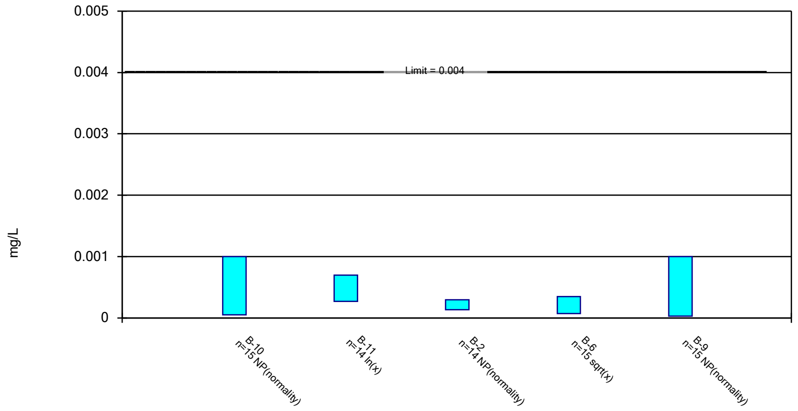


Constituent: Barium, total Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

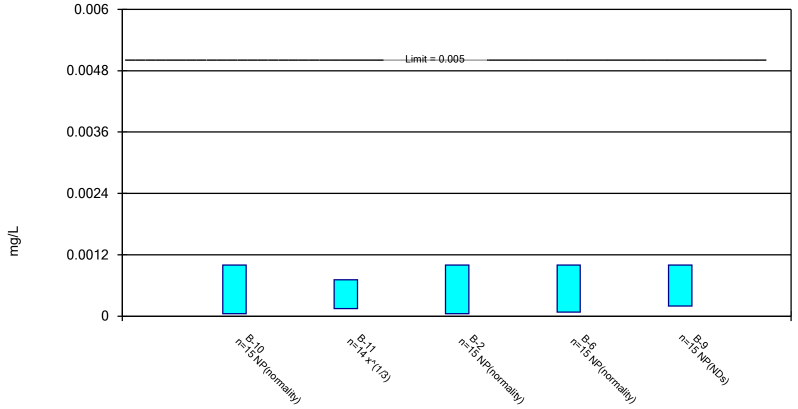


Constituent: Beryllium, total Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

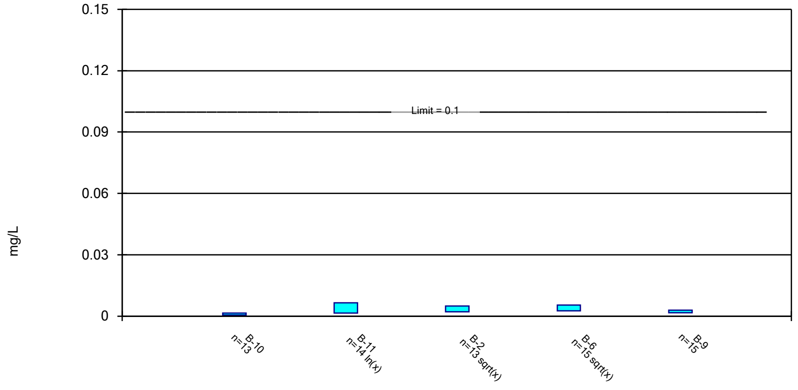


Constituent: Cadmium, total Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

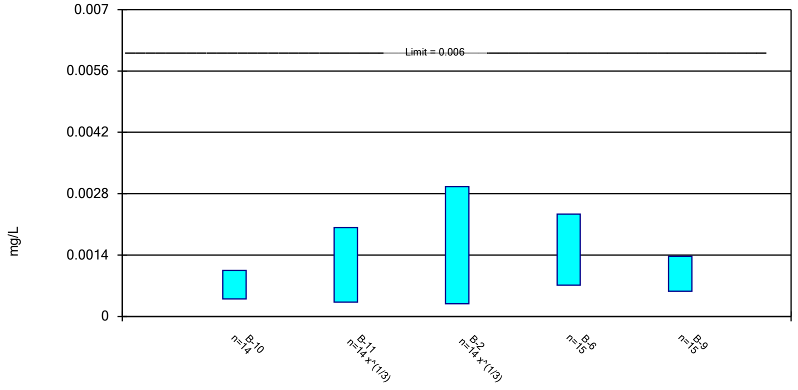


Constituent: Chromium, total Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

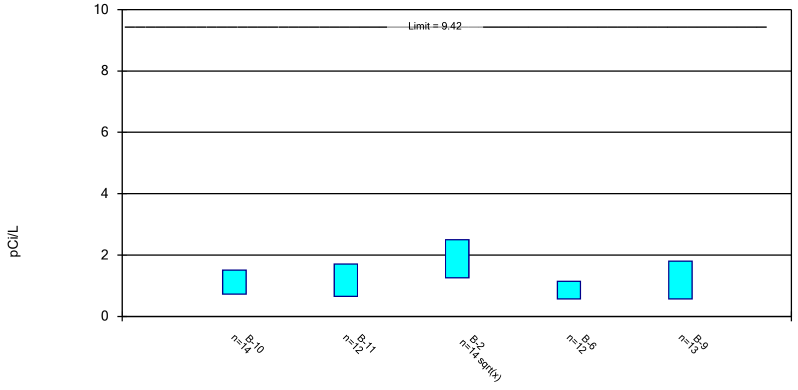


Constituent: Cobalt, total Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

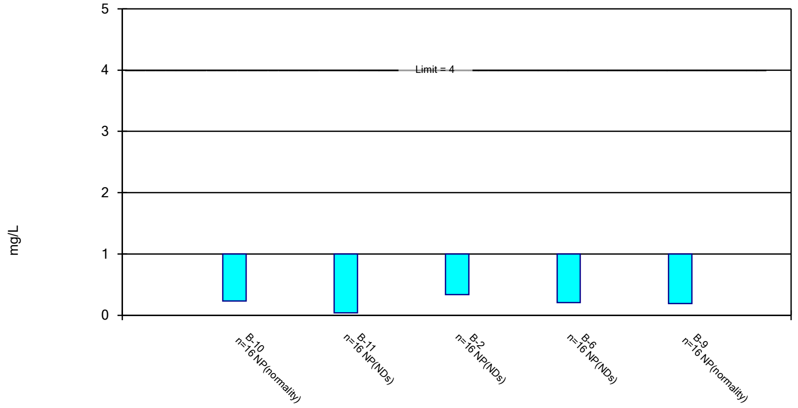


Constituent: Combined Radium 226 + 228 Analysis Run 12/8/2019 11:59 AM View: Confidence Intervals -
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

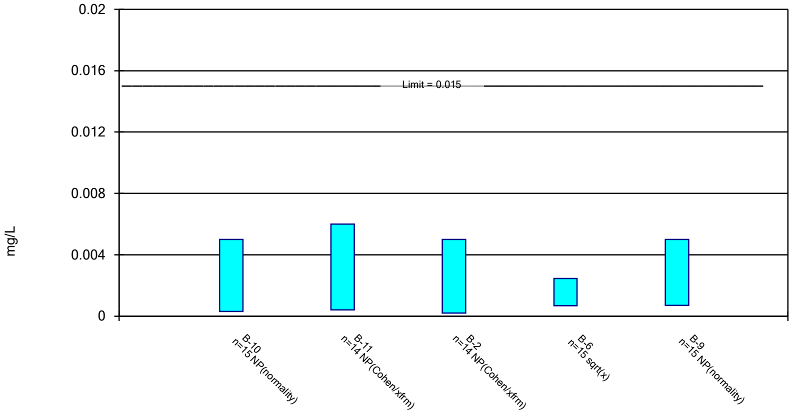


Constituent: Fluoride, total Analysis Run 12/8/2019 12:00 PM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

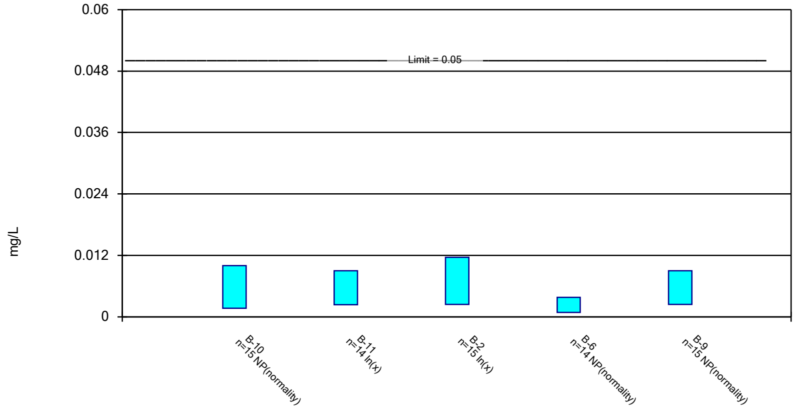


Constituent: Lead, total Analysis Run 12/8/2019 12:00 PM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

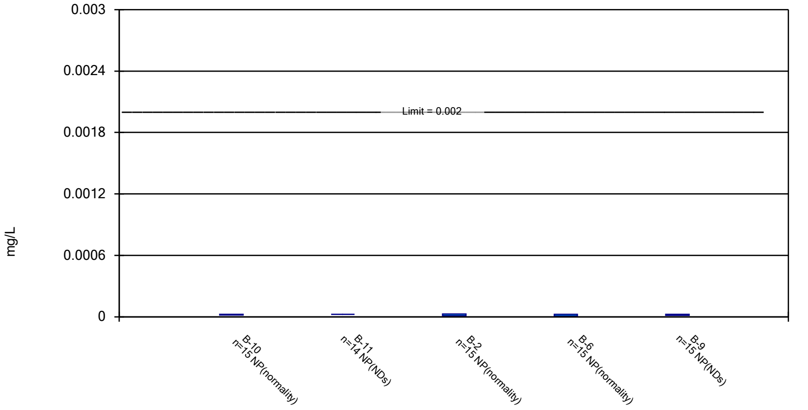


Constituent: Lithium, total Analysis Run 12/8/2019 12:00 PM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.

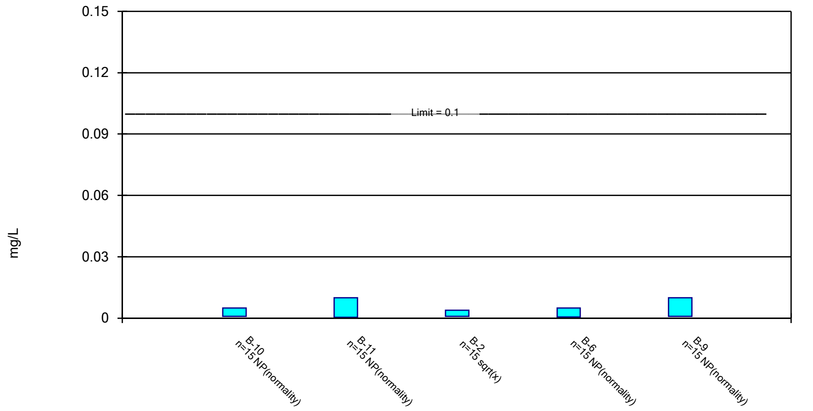


Constituent: Mercury, total Analysis Run 12/8/2019 12:00 PM View: Confidence Intervals - App IV
Flint Creek LF Client: Geosyntec Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



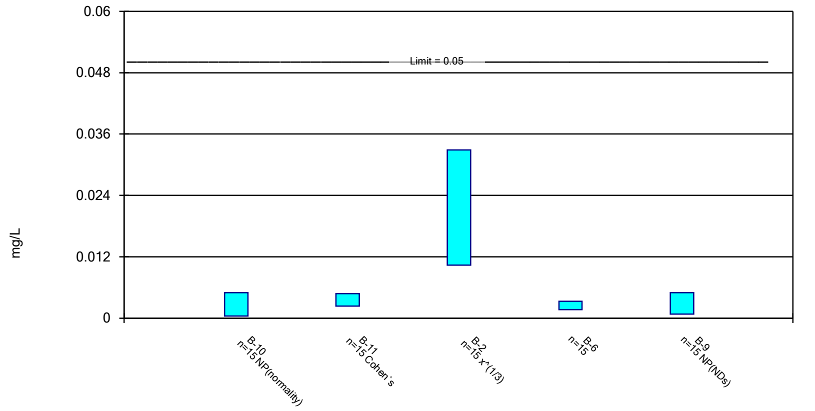
Constituent: Molybdenum, total   Analysis Run 12/8/2019 12:00 PM   View: Confidence Intervals - App IV

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.



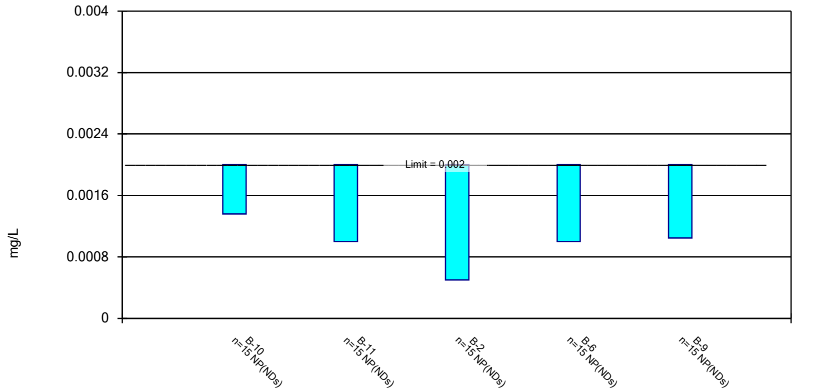
Constituent: Selenium, total   Analysis Run 12/8/2019 12:00 PM   View: Confidence Intervals - App IV

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Sanitas™ v.9.6.23e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01.



Constituent: Thallium, total   Analysis Run 12/8/2019 12:00 PM   View: Confidence Intervals - App IV

Flint Creek LF   Client: Geosyntec   Data: Flint Creek LF

Appendix F

Structural Stability Assessment Required at § 257.73(d)

STRUCTURAL STABILITY ASSESSMENT

CFR 257.73(d)

Primary Ash Pond

Flint Creek Plant
Gentry, Arkansas

October, 2016

Prepared for: Southwestern Electric Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

GERS-16-027

Structural Stability Assessment
CFR 257.73(d)
Flint Creek Plant
Primary Bottom Ash Pond

PREPARED BY Gary F Zych DATE 9/7/2016
Gary F. Zych, P.E.

REVIEWED BY DATE 9/19/16
Satyananda Chakrabarti, Ph.D., P.E.

APPROVED BY Gary F. Zych DATE 9/19/2016
Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering

Gary F. Zych
STATE OF ARKANSAS
No. 17243
GARY F. ZYCH
9/19/2016

I certify to the best of my knowledge, information and belief that the information contained in this structural stability assessment meets the requirements of 40 CFR 257.73(d)

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1.0 OBJECTIVE 257.73(d)

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.73(d) and document whether the design, construction, operations, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices. This is the initial assessment as per the Rule.

2.0 NAME AND DESCRIPTION OF CCR SURFACE IMPOUNDMENT

The Flint Creek Power Plant is located near the City of Gentry, Benton County, Arkansas.
It is owned and operated by Southwestern Electric Power Company (SWEPCO). The facility operates one surface impoundment for storing CCR called the Primary Ash Pond.

The Primary Ash Pond dam is a cross valley dam on a tributary to the Little Flint Creek. The dam is 45 feet high and has side slopes of 3H:1V. The downstream slope is partially submerged by the Little Flint Creek Reservoir.

3.0 STABLE FOUNDATION AND ABUTMENTS 257.73(d)(1)(i)

[Was the facility designed for and constructed on stable foundations and abutments? Describe any foundation improvements required as part of construction.]

Based on the design drawings, a foundation key was constructed along the centerline of the dam. The key was excavated 6-8 feet below existing ground. The construction specifications required the area beneath the extent of the dike to be stripped of all organics and vegetation. After stripping and prior to placing compacted fill, the specifications required proofrolling of the subgrade.

Based on recent subsurface investigations, the relative density and description of the foundation materials are adequate for this CCR unit.

4.0 SLOPE PROTECTION 257.73(d)(1)(ii)

[Describe the slope protection measures on the upstream and downstream slopes.]

The unit has been constructed with a layer of riprap on both the upstream slope and downstream slope for protection against erosion and wave action. The current condition of the riprap layer is adequate. The remaining sections of the slopes above the riprap is vegetated and maintained. Any erosion that may occur is repaired within a timely period.

5.0 EMBANKMENT CONSTRUCTION 257.73 (d)(1)(iii)

[Describe the specifications for compaction and/or recent boring to give a relative comparison of density.]

The design drawings show that the embankment materials were to be compacted to 90% Modified proctor density. Recent borings through the embankment indicate that the material is stiff and representative of compacted earthen materials.

6.0 VEGETATION CONTROL 257.73 (d)(1)(iv)

[Describe the maintenance plan for vegetative cover.]

The vegetative areas are mowed to facilitate inspections and maintain the growth of the vegetative layer; and prevent the growth of woody vegetation.

7.0 SPILLWAY SYSTEM 257.73(d)(1)(v)

[Describe the spillway system and its capacity to pass the Inflow Design Flood as per its Hazard Classification.]

The spillway system consists of a primary weir box and pipe for normal operations and an open channel spillway to pass flood events. The CCR unit has a Low Hazard rating and design flood is the 100-year flood. The facility can safely pass this flood as well as the full PMF without overtopping the dam crest.

8.0 BURIED HYDRAULIC STRUCTURES 257.73 (d)(1)(vi)

[Describe the condition of the sections of any hydraulic structure that in buried beneath and/or in the embankment.]

There are no pipes that are part of the spillway system that are buried within or beneath the embankment.

9.0 SUDDEN DRAWDOWN 257.73 (d)(1)(vii)

[If the downstream slope is susceptible to inundation, discuss the stability due to a sudden drawdown.]

The downslope is partially inundated by the Little Flint Creek reservoir. The reservoir is used to supply the power plant with a source of water for operations. The principal/emergency spillway is a concrete overflow section that is only activated during large precipitation events. The overflow section has only operated 2 times since the construction of the dam. The pool level is maintained by the plant via pumps for the operation of the plant. The reservoir area and volume is large compared to the pump capacity of the plant. Therefore, the condition for a sudden drawdown of the reservoir is not feasible. The dam for the primary bottom ash pond was designed for the normal fluctuations of the Little Flint Creek Reservoir.

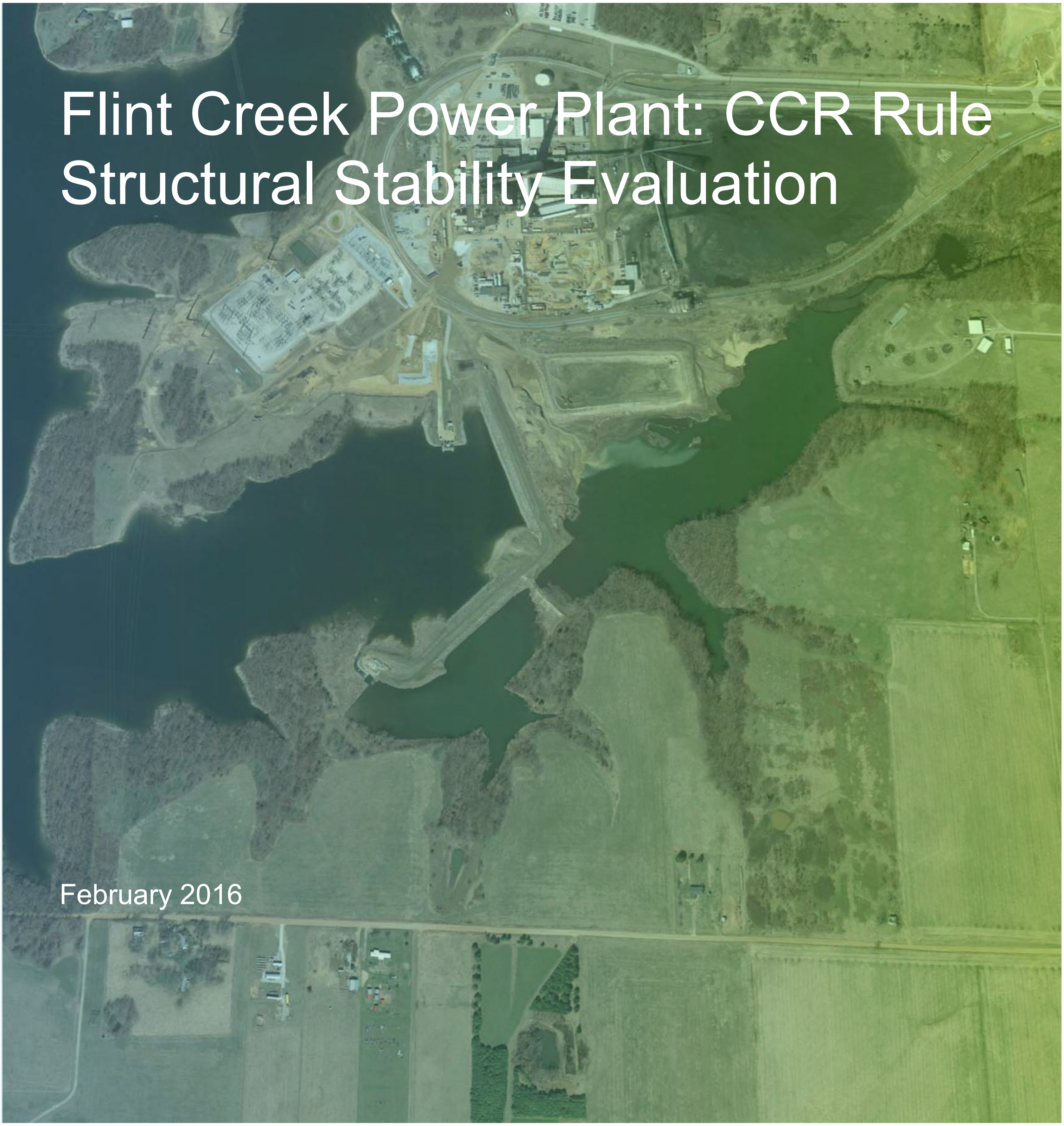
Appendix G

Safety Factor Assessment Required at § 257.73(e)

Submitted to
American Electric Power
1 Riverside Plaza
Columbus, OH 43215-2372

Submitted by
AECOM
277 West Nationwide Blvd
Columbus, OH 43215

Flint Creek Power Plant: CCR Rule Structural Stability Evaluation



February 2016

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Acronyms

AEP – American Electric Power

ASCE – American Society of Civil Engineers

CCR – Coal Combustion Residuals

CH – fat clay

CIU – isotropically consolidated undrained

CL – lean clay

El – Elevation (in feet MSL)

ETTL – ETTL Engineers & Consultants, Inc.

FoS – Factor of Safety

GC – clayey gravel

IBC – International Building Code

k_h – pseudostatic coefficient

MSL – Mean Sea Level

pcf – pounds per cubic foot

PGA – Peak Ground Acceleration

PMF – Probable Maximum Flood

psf – pounds per square foot

$\sigma_1 - \sigma_3$ – maximum deviator stress

σ_1 / σ_3 – maximum ratio of principal effective stresses

SC – clayey sand

S_{MS} – maximum earthquake spectral response acceleration

SPT – Standard Penetration Test

USEPA – United States Environmental Protection Agency

USGS – United States Geological Survey

1.0 Introduction and Background

This report presents the results of AECOM's review and independent analyses of the geotechnical investigation in *Flint Creek Power Station, Existing Ash Storage Ponds Embankment Investigation* prepared by ETTL Engineers & Consultants, Inc. (ETTL) on August 18, 2010. The Flint Creek Power Station is located at 21797 SWEPCO Plant Road in Benton County, Arkansas, near Gentry. The power plant is located on the northeast side of Lake Flint Creek, which serves as the cooling water source for the power plant. The Primary and Secondary Ash Ponds are located to the south of the plant on the east side of the Little Flint Creek Reservoir (see site plan on cover page). ETTL (2010) evaluated the subsurface stratigraphy within the limits of borings; evaluated the classification, strength and permeability characteristics of the embankment and foundation soils; and performed slope stability and seepage analyses of the existing embankments.

1.1 Purpose

AECOM was contracted to perform evaluations and verify that the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) rule's minimum requirements for structural stability are met for the following conditions in Section 257.73 for the Bottom Ash Complex (Primary and Secondary Ash Ponds) at the Flint Creek Power Plant near Gentry, Arkansas:

a. The calculated Factor of Safety (FoS) under the steady state, long term, maximum storage pool loading condition must equal or exceed 1.50;
b. The calculated FoS under the short term, surcharge pool loading condition must equal or exceed 1.40;
c. The calculated pseudostatic seismic FoS must equal or exceed 1.00;
d. For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction FoS (also known as post-earthquake slope stability FoS) must equal or exceed 1.20.

2.0 Evaluation of Analysis Parameters

AECOM conducted a review of *Flint Creek Power Station, Existing Ash Storage Ponds Embankment Investigation* (ETTL, 2010) for this study. Specifically, AECOM examined the existing geotechnical information and performed an assessment as to whether the information is sufficient to perform independent slope stability analyses, or whether additional investigation and laboratory analyses are required in order to complete the required analyses.

2.1 Soil Parameters

The fill material in the embankment consists primarily of stiff to very stiff lean clay (CL) or fat clay (CH) with gravel and medium dense clayey gravel (GC) or clayey sand (SC). The native soils underlying the fills are predominantly clayey gravel (GC) and hard lean clay (CL) with gravel over the limestone formation. ETTL performed three triaxial tests under drained and undrained conditions to obtain shear strength parameters at the site. In areas where triaxial tests could not be performed (areas with significant gravel), ETTL chose the average shear strength values of the fill and native soils based on soil types and Standard Penetration Test (SPT) blow count correlations. These results are shown in Table 1 below.

Table 1. Summary of Soil Test Results (ETTL, 2010)

Pond	Material Type	Effective Stress Parameters			Total Stress Parameters		
		Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Primary Ash Pond	Fill	129	24	460	129	14.1	575
	Native Soil	130	33	90	130	18.3	275
	Native Rock	148	38.5	1000	148	38.5	1000
Secondary Ash Pond	Fill	130	33.7	0	130	15.9	345
	Native Soil	130	33	90	130	18.3	275
	Native Rock	148	38.5	1000	148	38.5	1000

The results of the Isotropically Consolidated Undrained (CIU) triaxial tests were plotted by AECOM on p'-q and p-q plots (see Figures 1 and 2). Failure was defined using the maximum stress difference criteria (σ_1 - σ_3 or the maximum deviator stress), as the ETTL report does not contain sufficient data to also define failure using the maximum ratio of principal effective stresses during the triaxial test (σ_1 / σ_3 or maximum obliquity). Failure at maximum deviator stress was plotted as a single point for the two different material types (fill and residuum/native soil) present at both ponds. In reviewing Figures 1 and 2, AECOM found that the embankment fill and residuum soils all plotted consistently on a single failure envelope for both ponds, indicating that the two materials have similar shear strengths. This is not unexpected as the embankment fills are most likely well-compacted residuum. Appendix A presents the background and findings for the development of the design shear strengths. Table 2 provides a summary of the soil parameters selected by AECOM for our independent analyses.

Table 2. Summary of Soil Parameters Selected by AECOM

Pond	Material Type	Effective Stress Parameters			Total Stress Parameters		
		Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Primary and Secondary Ash Ponds	Fill and Native Soil	130	31	50	130	14	500
	Native Rock	148	38.5	1000	148	38.5	1000
	Riprap	130	40	0	130	40	0

For the slope stability analyses, ETTL reduced the shear strength parameters (shown in Table 1) by 15% in an attempt to accommodate potential variations in the soil as well as to compensate for the limited amount of data. AECOM has not typically reduced the shear strength data in the past based on sparse data and instead has used the peak shear strengths (as shown in Table 2) for our independent slope stability analyses. AECOM also included a 2 foot thick layer of riprap along the downstream face of the slope extending from the top of the dam to the toe. The riprap face was observed during the site visit as well as from aerial imagery in Google Earth. The parameters assumed for the riprap are provided in Table 2 and were developed using engineering judgment and experience. AECOM also reviewed ETTL's shear strength values for Native Rock, and found them to be somewhat conservative for weathered limestone. However, the strength of the Native Rock is unlikely to substantially affect the slope stability analyses, as most slip surfaces will be confined to the lower-strength fill and residuum.

ETTL used effective stress parameters for steady state and seismic conditions, and total stress parameters for drawdown conditions. AECOM agrees that effective stress parameters should be used in steady state conditions; however total stress parameters should be used in seismic conditions. Typically, seismic loading occurs rapidly enough that induced excess pore water pressures do not have time to dissipate and undrained conditions and soil strengths are applicable. An analysis of drawdown conditions is not required by the CCR Rule, and has not been performed by AECOM.

2.2 Water Levels

A summary of the water levels for this project is shown in Table 3. All elevations listed in this report are given in feet above mean sea level (MSL). Currently, neither pond is on the Arkansas Natural Resources Commission's (ANRC) list of dams, and therefore does not have a State hazard classification, which would determine the design inflow event. AEP has recently conducted a Hazard Classification for both ponds per the EPA CCR Rule and determined that both ponds classify as "Low" hazard, which would correspond to a 100-year flood event. That event and higher intensity storms up to the full (Probable Maximum Flood) PMF were analyzed in the latest hydraulic report available for the site (*the Hydraulic Analysis of Flint Creek Power Plant Ash Ponds* by Freese and Nichols (2011)). For conservatism, AEP has requested that the ponds be analyzed with the pool elevation corresponding to the 50% PMF event. The steady state pool elevations are based on normal operating levels reported by AEP. Seasonal variations in the lake level (tailwater) ranges from 1130 feet MSL in October through December to 1137 feet MSL in May. ETTL used 1140 feet MSL (spillway elevation) for the lake level in their analyses.

Table 3. Summary of Water Levels

Ash Pond	**Headwater (feet MSL)**		**Tailwater (feet MSL)**	
	Normal (Steady State)	**Flood (50% PMF)**	**Normal and Flood**	**Seasonal Lake Variation**
Primary Ash Pond	1146	1151.96	1130	1130 – 1137
Secondary Ash Pond	1143	1150.8	1130	1130 – 1137

Note: 100-year headwater elevations for the two ponds are 1149.48' and 1148.35' for the Primary and Secondary Ponds respectively.

2.3 Seismic Design Parameters and Liquefaction

ETTL determined that under the International Building Code methodology (IBC), the embankment soils are Site Class D (Stiff Soil Profile). In their seismic analyses, they used the IBC methodology to establish the maximum earthquake spectral response acceleration parameter, S_{MS}, equal to 0.217 for 10% probability of exceedance in 50 years. ETTL used the computer program, GSTABL7, to evaluate slope stability. Pseudostatic earthquake (seismic) analyses are performed in this program with the input of a pseudostatic coefficient. There are numerous references for selecting the pseudostatic coefficient, k_h, based on the Peak Ground Acceleration (PGA), with most ranging from 1/3 to 2/3. Since the USEPA CCR rule does not stipulate a value for k_h and since there is no formal, definitive reference on it, the selection of k_h can be left up to the experience of the user. Based on AECOM's past experiences and popular references such as Hynes-Griffin and Franklin (1984) and Kramer (1996), half of the PGA tends to be a reasonable estimate for the pseudostatic coefficient for earthen dams with a FoS greater than 1.0. Generally, AECOM does not use the S_{MS} as the pseudostatic coefficient for analyses; however ETTL's approach is on the conservative side.

Generally, clean sandy soils below the groundwater level are susceptible to liquefaction conditions during an earthquake. The embankment soils at the Flint Creek Power Station are predominantly clayey gravels (GC) and lean clays with gravel (CL) and AECOM agrees with ETTL that the liquefaction potential at the site is low. No further liquefaction analysis is required to show that the embankment and foundation materials are not susceptible to liquefaction under the design seismic event.

3.0 Site Visit

Mr. Colin Young, P.E. performed a brief walkdown of the site on August 21, 2015. Mr. Young was accompanied by Mr. Greg Carter, P.E. of AEP. The purpose of the walkdown was to verify whether any conditions to the ash pond dikes had changed since the ETTL study in 2010. It was verified that no changes had been made to the dikes during that time period from 2010 to August 2015 and that physical conditions of the dikes were substantially similar to those existing at the time of ETTL's study.

4.0 Geotechnical Analysis

AECOM performed stability analyses appropriate to determine if the impoundments meet the Section 257.73 stability criteria. The Primary and Secondary Ash Ponds were both analyzed for these purposes. Results are presented in the following sections.

4.1 Slope Stability Analyses

Slope stability analyses were conducted using the 2-dimensional limit equilibrium software, SLOPE/W (GEO-SLOPE International, Ltd., 2012). Circular failure surfaces were evaluated using Spencer's Method, which considers force and moment equilibrium. Non-circular slip surfaces are generally not applicable in mostly homogeneous soil profiles similar to the conditions at this site. The grid and radius, and entry and exit methods were both used to define the circular slip surfaces. The following load cases were considered per the CCR Rule Section 257.73:

1) Steady state, long term, maximum storage pool condition with a FoS requirement of 1.50;
2) Short term, surcharge pool condition (short term flood load) with a FoS requirement of 1.40, this was performed at the 50% PMF pool levels;

3) Pseudostatic seismic using horizontal ground accelerations from published USGS peak PGA for 2% probability of exceedance in 50 years (e.g. 2,475-yr return period) with a FoS requirement of 1.00;
4) Post-seismic or post-liquefaction condition for dikes constructed of soils susceptible to liquefaction with a FoS requirement of 1.20.

All of the above cases were analyzed except the post-seismic/post-liquefaction load case. As mentioned previously in Section 2.3 of this report, AECOM does not consider the site soils susceptible to liquefaction under the design seismic event.

The soil parameters used in the stability analyses are provided in Table 2. Per the IBC (2012) and ASCE 7-10 (2013), the site classification was evaluated based on the average blow count in the upper 100 feet of the soil profile. The most critical soil profile (exploratory boring with the thickest fill layer) was selected and an average SPT blow count per formational material was estimated (see Appendix B). The average blow count in the upper 100 feet is approximately 39, which corresponds to Site Class D (Stiff Soil Profile). Using the Site Class information and site coordinates of the ash ponds, the US Seismic Design Maps (USGS, 2008) web tool was used to obtain the base PGA. The design maps detailed report (USGS web tool output) is provided in Appendix B and shows that the base PGA was calculated to be 0.072. The plot shown in Figure 3 shows the upper bound relationship between the peak transverse base acceleration and the peak transverse crest acceleration as developed by Harder (1991) and presented in FHWA (2011). The crest PGA that corresponds to the 0.072 base PGA is equal to 0.27. Based on AECOM's past experiences and popular references such as Hynes-Griffin and Franklin (1984) and Kramer (1996), half of the PGA tends to be a reasonable estimate for the pseudostatic coefficient for earthen dams with a FoS greater than 1.0. The pseudostatic coefficient used in AECOM's analyses is 0.135 (50% of 0.27).

The slope stability cross sections were developed based on information from ETTL (2010), Freese and Nichols, Inc. (2011) and past AEP inspection reports. The top of dam for both the Primary and Secondary Dams is 1155 feet MSL with a crest width of 12 feet and side slopes of 3H:1V for the upstream and downstream faces. The fill material was assumed to be the maximum height at the center of the dam corresponding to 46 feet at the Primary Dam and 35 feet at the Secondary Dam. The soil profile used in AECOM's analyses was taken directly from the ETTL slope stability analyses (2010) and verified using the applicable boring logs (ETTL, 2010).

The graphical slope stability analysis results are provided in Figures 4 through 6 for the Primary Ash Pond and Figures 7 through 9 for the Secondary Ash Pond. A summary of the slope stability FoS results are shown in Table 4. Each analyzed case meets the rule's minimum FoS requirements.

Table 4. Slope Stability Results

Pond	Conditions	Water Level (feet MSL)		Pseudostatic Coefficient, k_h[a]	Figure Number	FoS[b]	FoS Required
		Head	Tail				
Primary Ash Pond	Steady State Max Storage Pool	1146	1130	0	4	1.66	1.50
	Surcharge Pool (50% PMF)	1151.96	1130	0	5	1.51	1.40
	Pseudostatic Seismic	1146	1130	0.135	6	1.05	1.00
Secondary Ash Pond	Steady State Max Storage Pool	1143	1130	0	7	1.76	1.50
	Surcharge Pool (50% PMF)	1150.80	1130	0	8	1.58	1.40
	Pseudostatic Seismic	1143	1130	0.135	9	1.19	1.00

Notes:

a) The pseudostatic coefficient is taken to be half of the crest PGA.
b) FoS reported in table is the lower of the two FoS calculated using entry and exit and grid and radius methods.

5.0 Summary and Conclusions

In reviewing the existing field and lab data as well as the stability and seepage analyses, AECOM concludes that there is sufficient data to conclude that the ash ponds meet the CCR rule stability criteria.

Using the full peak shear strength data, AECOM performed slope stability analyses of both the Primary and Secondary Ash Ponds for the following conditions: 1) long term, steady state maximum storage pool; 2) short term flood at 50% PMF; and 3) pseudostatic seismic. All conditions met minimum FoS criteria..

6.0 Certification

I, Colin Young, being a Registered Professional Engineer in good standing and in accordance with the State of Arkansas, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this report is true and correct and has been prepared in accordance with the accepted practice of engineering. I certify that the information contained in this report MEETS THE REQUIREMENTS of the Coal Combustion Residual (CCR) Rule, Section 257, specifically, Section 257.73 (e) for the specific requirements of the Periodic Safety Factory Assessments. This certification is for the Initial Assessment only and this certification does not certify that any other previous or future Periodic Assessments meet the requirements stated in Section 257.73 (e). This certification is for compliance with the section referenced and is not applicable for any other sections of the CCR Rule. Requirements within Section 257.73 that are not included within subsection 257.73 (e) are excluded from this certification. Exclusions within the reference section 257.73 (e), and within section 257.73 that pertains to all subsections, that are not covered by this certification include:

1. 257.73 (e)(2), Initial and each subsequent periodic safety factor assessment except the specific assessment being certified with this statement,
2. 257.73 (f), Timeframes for periodic and subsequent assessments, and
3. 257.70 (g), Recordkeeping.

These exclusions are not the responsibility of the certifying engineer and are outside the control of the certifying engineer.

Colin J. Young PE

Printed Name

No.16705
COLIN J. YOUNG

02-22-2016

7.0 Limitations

Some of the information in this report and on supporting figures, drawings, and calculations is based on information provided by AEP and their subcontractors. AECOM has assumed this information is accurate, correct, valid, and was developed following current engineering practice.

The conclusions in this report are based on AECOM's understand of current plant operations, ash handling procedures, stormwater management, and conditions at the Flint Creek Power Plant, as of the date of this report, as provided by AEP. Changes in plant operations, stormwater management, or ash handling procedures may invalidate the findings in this report, until AECOM has had the opportunity to review the changes and, if necessary, modify our findings accordingly.

8.0 References

AECOM, 2015. *Scope and Fee Estimate for CCR Rule Structural Stability Certification, AEP Flint Creek Power Plant, near Gentry, Arkansas,* prepared for American Electric Power, May 15.

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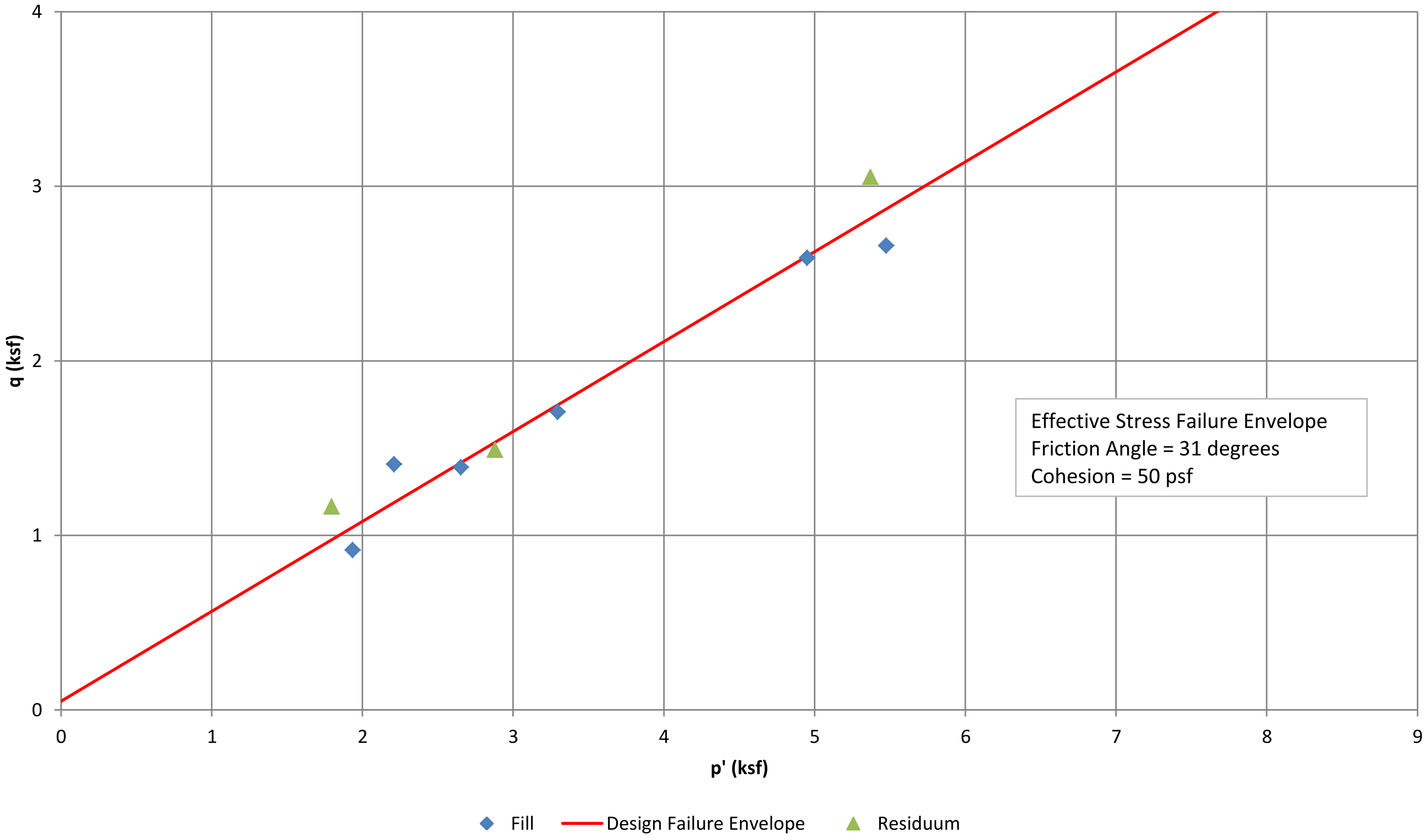
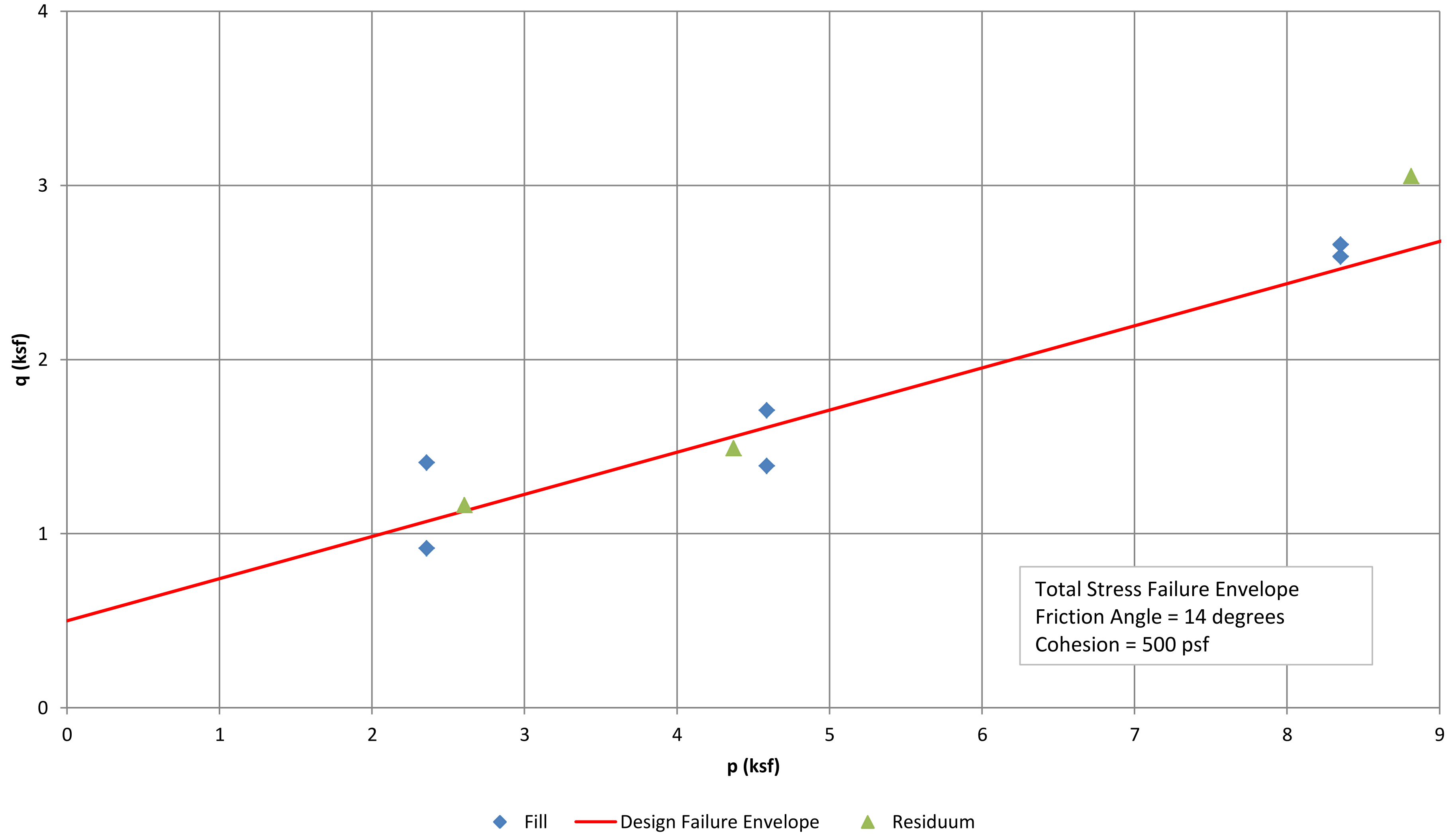
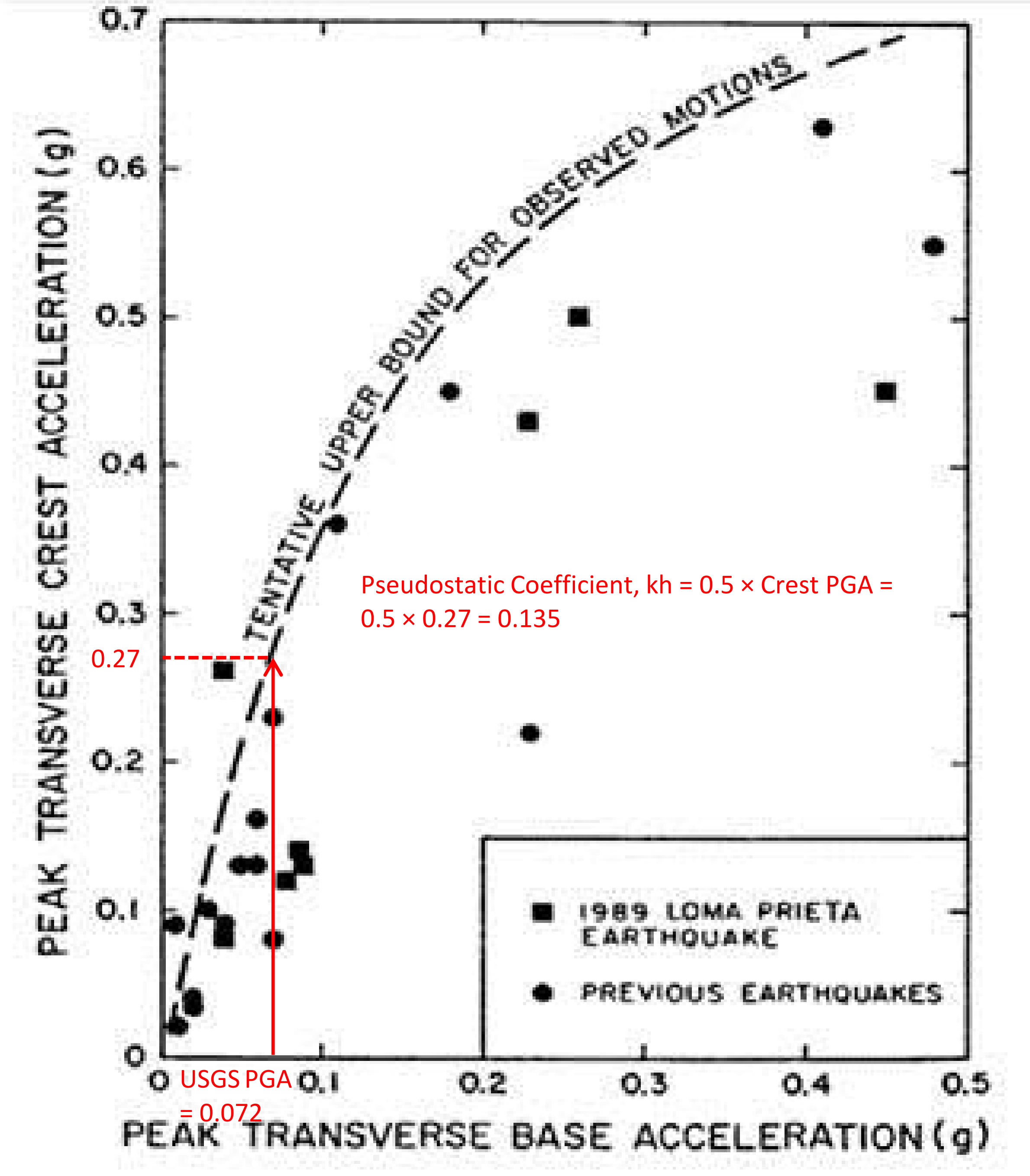
Figures



AECOM	CCR Rule Structural Stability Certification AEP Flint Creek Power Plant, Gentry, AR	**p'-q Plot** **Drained Shear Strengths**	Figure 1
	Project No. 60437225 / Date: December 2015		



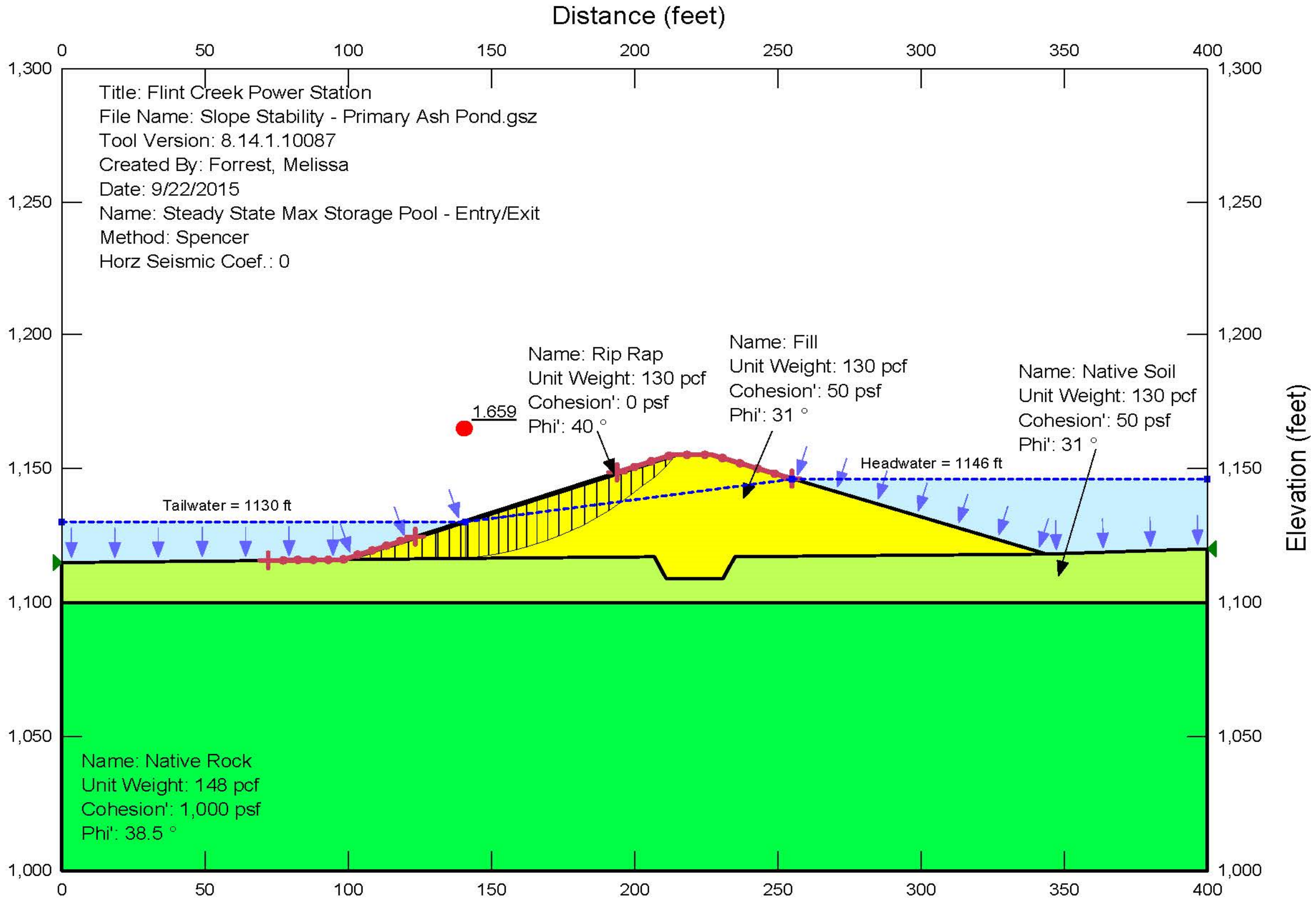
AECOM	CCR Rule Structural Stability Certification AEP Flint Creek Power Plant, Gentry, AR	**p-q Plot** **Undrained Shear Strengths**	Figure 2
	Project No. 60437225 / Date: December 2015		



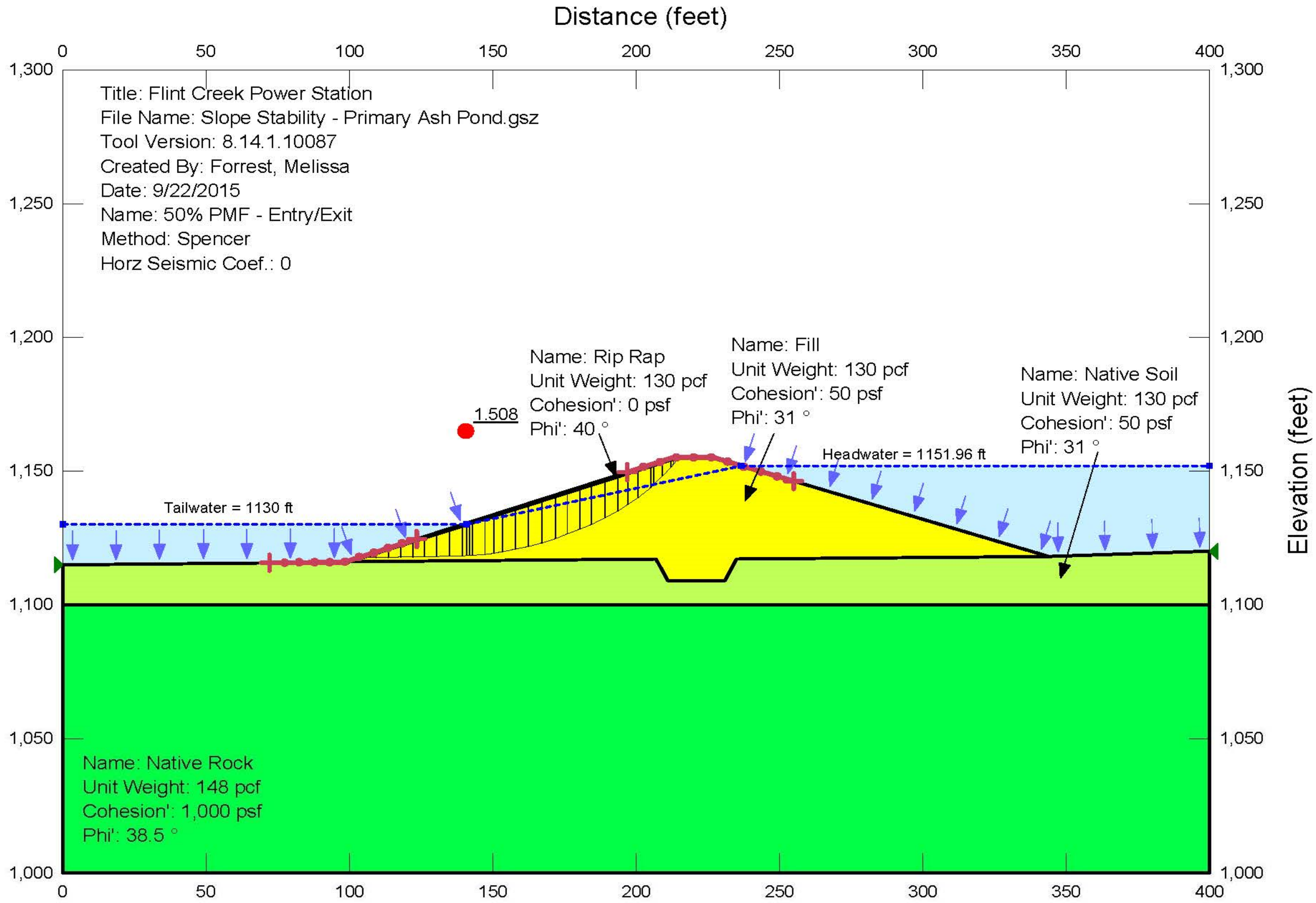
Pseudostatic Coefficient, kh = 0.5 × Crest PGA = 0.5 × 0.27 = 0.135

Reference: Base and Crest Peak Accelerations Recorded at the Earth Dams (Harder, 1991) as referenced in FHWA (2011)

AECOM	CCR Rule Structural Stability Certification AEP Flint Creek Power Plant, Gentry, AR		**Base and Crest Peak Accelerations**	Figure 3
	Project No. 60437225	Date: December 2015		



AECOM	CCR Rule Structural Stability Certification AEP Flint Creek Power Plant, Gentry, AR Project No. 60437225 — Date: December 2015	**Primary Ash Pond** **Steady State** **Max Storage Pool**	Figure 4



AECOM

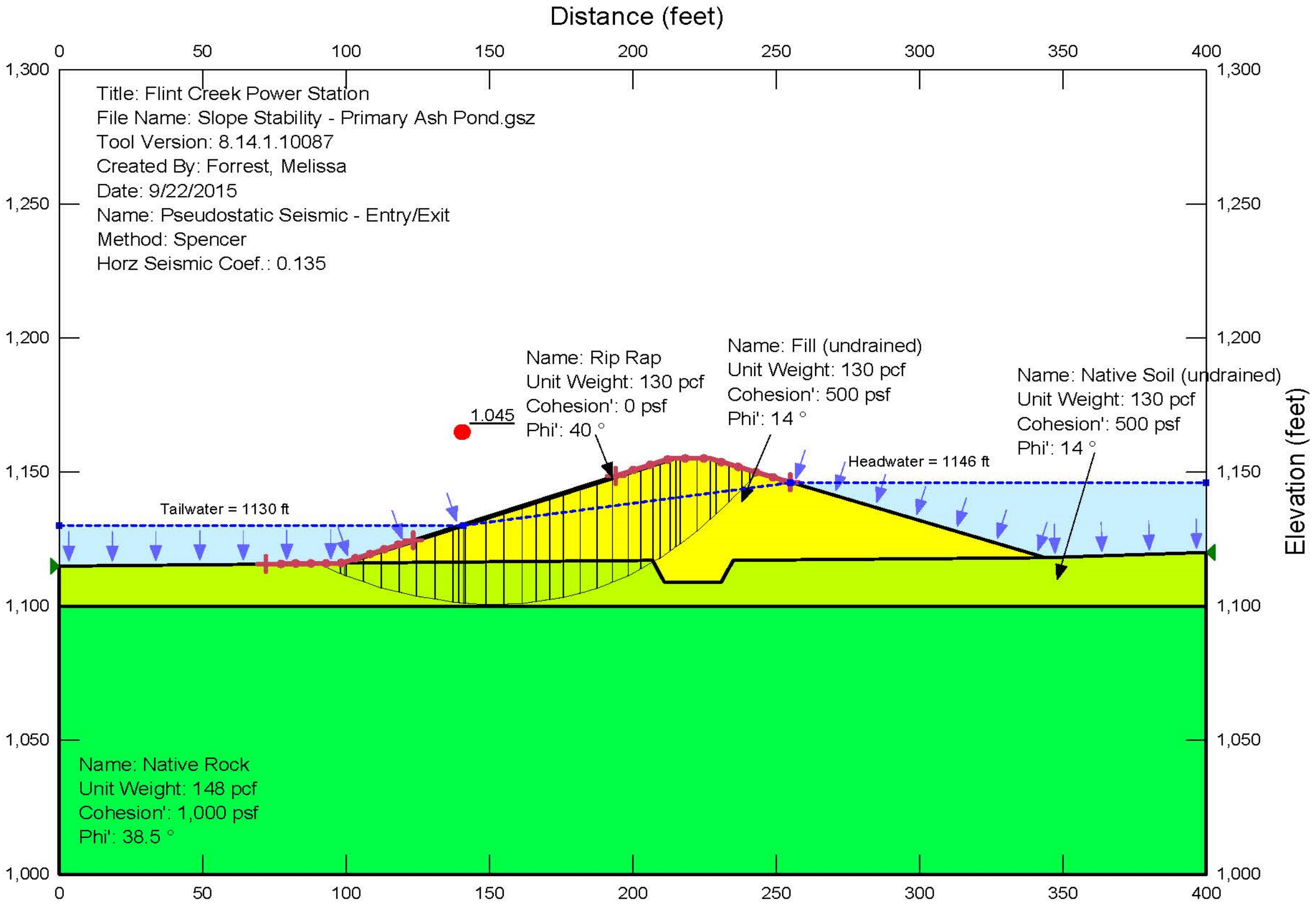
CCR Rule Structural Stability Certification
AEP Flint Creek Power Plant, Gentry, AR

Project No. 60437225

Date: December 2015

Primary Ash Pond
Surcharge Pool (50% PMF)

Figure 5



AECOM

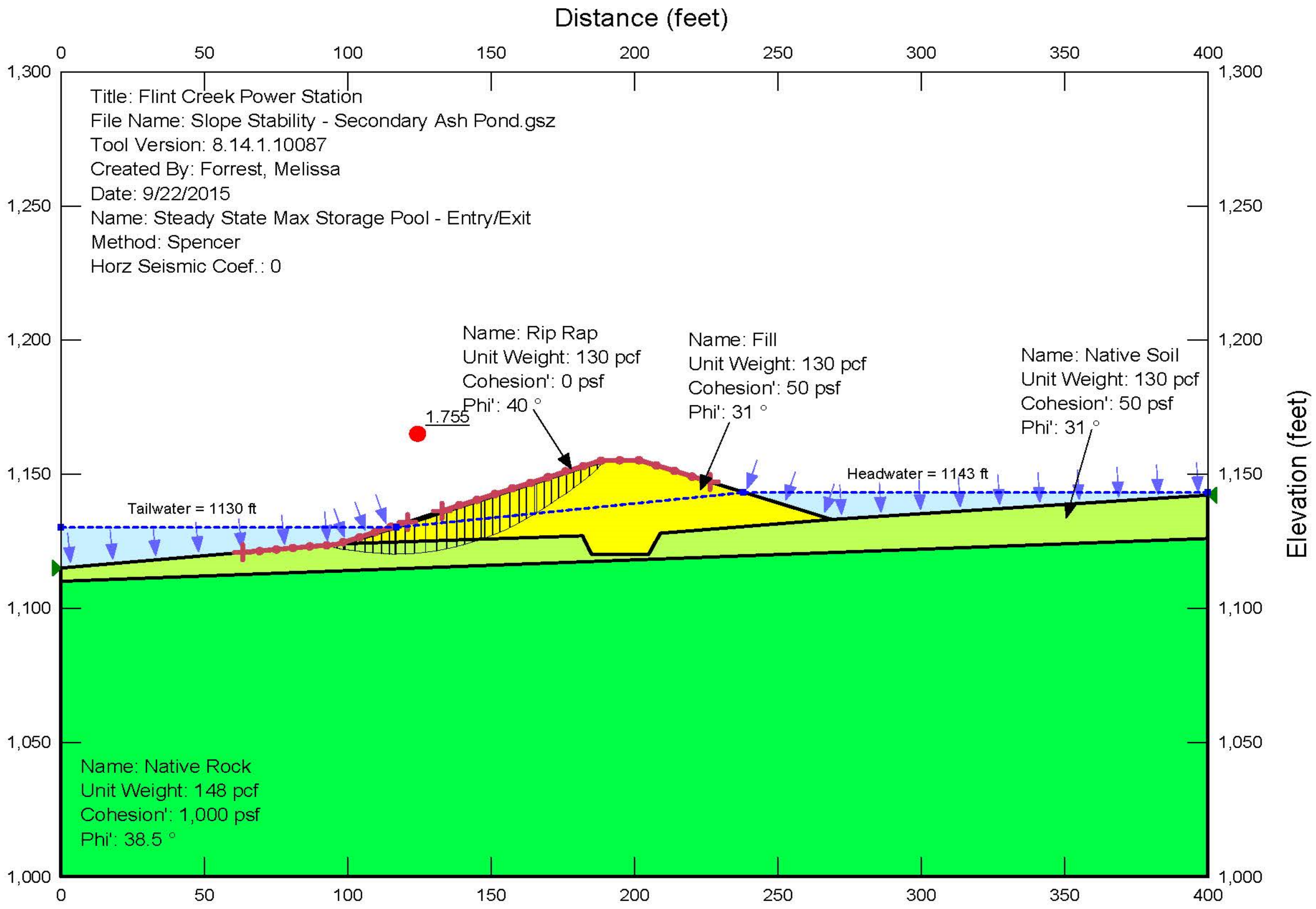
CCR Rule Structural Stability Certification
AEP Flint Creek Power Plant, Gentry, AR

Project No. 60437225

Date: December 2015

Primary Ash Pond
Pseudostatic Seismic

Figure 6



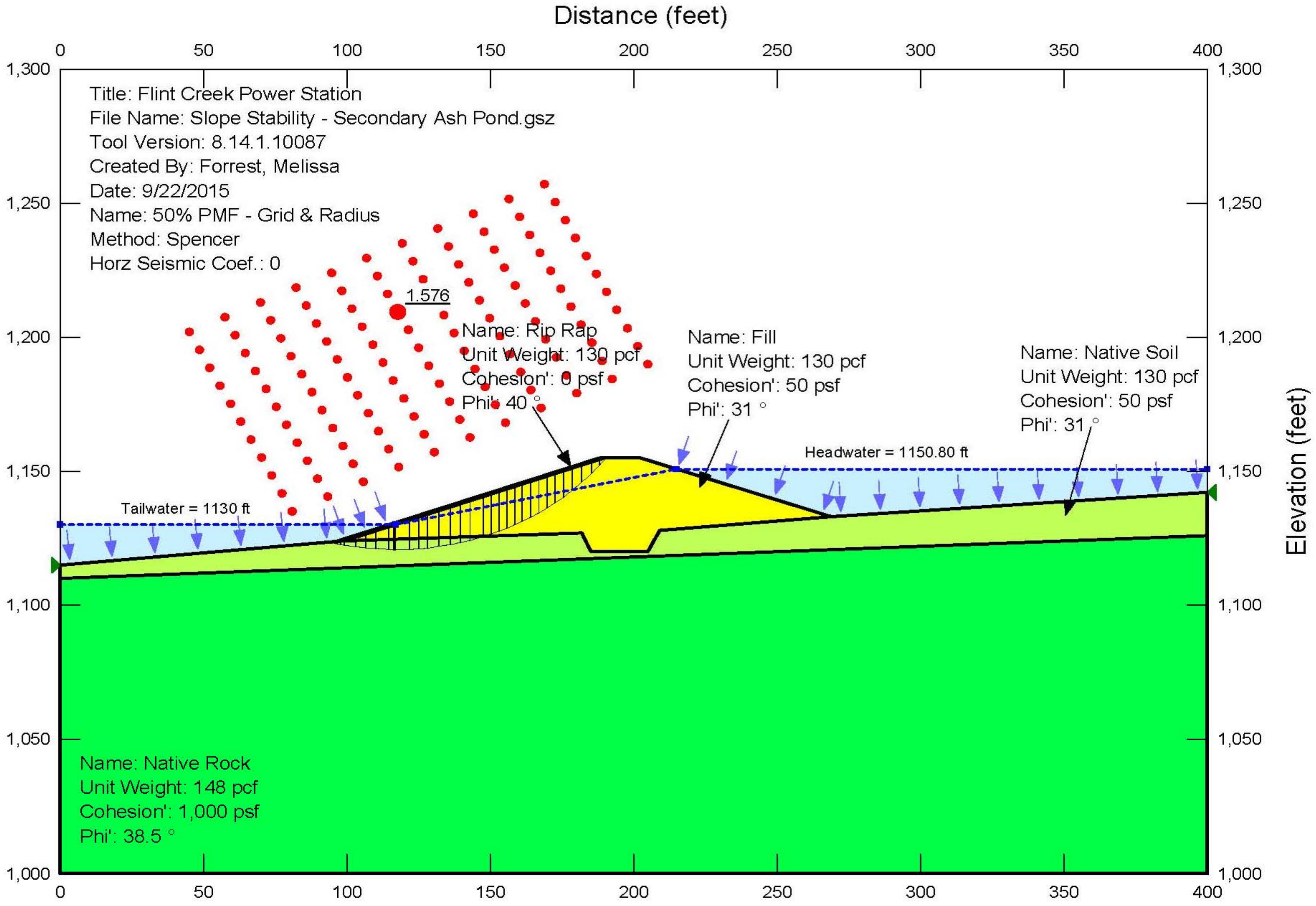
CCR Rule Structural Stability Certification
AEP Flint Creek Power Plant, Gentry, AR

Project No. 60437225

Date: December 2015

Secondary Ash Pond
Steady State
Max Storage Pool

Figure 7



AECOM

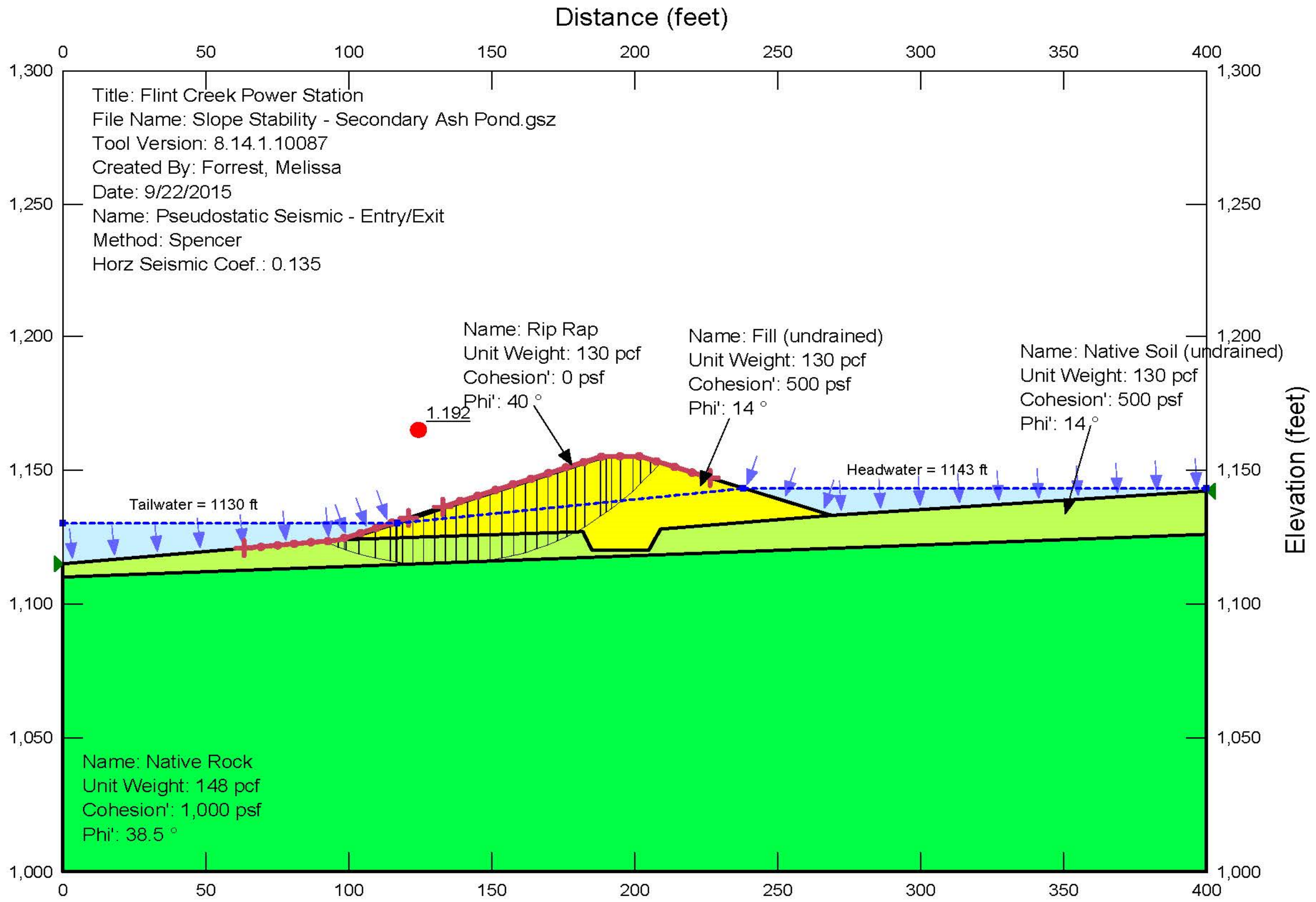
CCR Rule Structural Stability Certification
AEP Flint Creek Power Plant, Gentry, AR

Project No. 60437225

Date: December 2015

Secondary Ash Pond
Surcharge Pool (50% PMF)

Figure 8



AECOM

CCR Rule Structural Stability Certification
AEP Flint Creek Power Plant, Gentry, AR

Project No. 60437225

Date: December 2015

Secondary Ash Pond
Pseudostatic Seismic

Figure 9

Appendix A

Development of Design Shear Strength

A. Objective

Develop Mohr-Coulomb drained and undrained strength properties for the embankment and residual soils at the Primary and Secondary Ash Ponds at the AEP Flint Creek plant in Benton County, Arkansas.

B. Procedure and Results

CIU triaxial tests were performed by ETTL, Incorporated, in 2009. The tests were performed on a total of 9 specimens (from three separate Shelby tubes). Two of the Shelby tubes were collected in the embankment fill, while one of the tubes was collected in the residual soils beneath the embankments. Shelby tubes of embankment soils were obtained in boring B-2 at the secondary pond and boring B-3 at the primary pond, while Shelby tubes of residual soils were only obtained in boring B-2 at the secondary pond. Additional samples were not collected due to the high gravel content in both the embankment and foundation soils, which caused difficulties in advancing and retrieving Shelby tubes.

The results of the CIU triaxial tests have been plotted by AECOM both p'-q and p-q plots. Failure was defined using the maximum stress difference criteria (σ_1-σ_3, or max deviator stress), as the ETTL report does not contain sufficient data to also define failure using the maximum ratio of principal effective stresses during the triaxial test (σ_1/σ_3, or maximum obliquity). Failure at max deviator stress was plotted as a single point, with the two different material types (fill and residuum) shown using different symbols. A review of the resulting plots found that the embankment fill and residuum soils all plotted in a consistent, relatively linear fashion, which indicates that the two materials have similar shear strengths. Therefore, a single set of design strengths were assigned for the combined materials.

For each plot, the design stress ratio at failure line (K_f) was then drawn through the p'-q and p-q plots to develop the Mohr-Coulomb shear strength properties. The K_f line is related to a normal ϕ and c failure envelope using $\sin \phi = \tan \Psi$ (Eqn. 10-24, Holtz & Kovacs, 1981).

Table 1 lists the design Mohr-Coulomb drained and undrained shear strength parameters, for both maximum deviator stress and maximum obliquity failure criteria.

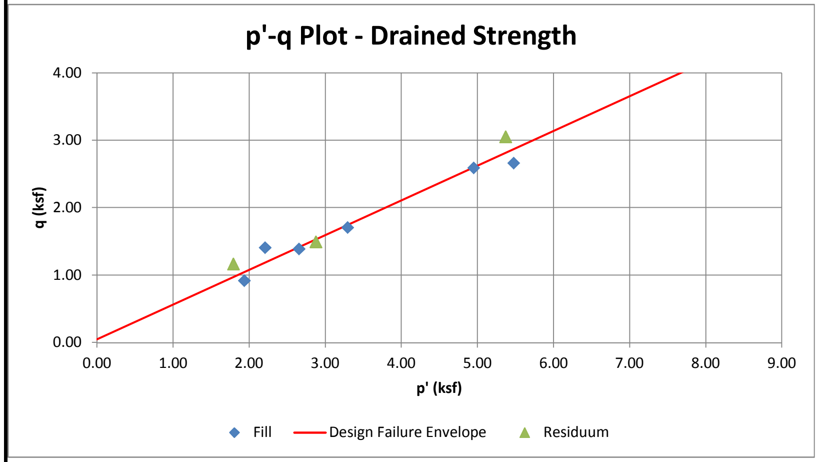
Table 1 – Residuum Strength Properties – Max Obliquity and Max Deviator Stress

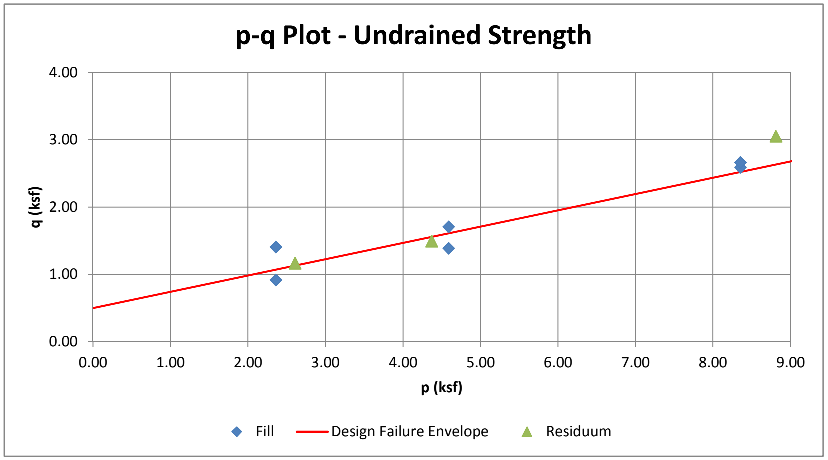
Material	Drained Strength		Undrained Strength	
	ϕ' (degrees)	**c' (psf)**	**ϕ (degrees)**	**c (psf)**
Embankment Fill and Residuum	31	50	14	500

Attachments

1. Test results and p-q plots
2. Laboratory testing forms from ETTL
3. Excerpts from Holtz and Kovacs (1981)

				Data Analysis - Maximum Deviator Stress Criteria							
				Total Stress		Effective		Total Stress		Effective	
Boring #	Test #	Sample #/Depth	Consolidation Stress (σ'_3), psi	σ_1, psi	σ_3, psi	σ'_1, psi	σ'_3, psi	p (ksf)	q (ksf)	p' (ksf)	q (ksf)
B-2	1	3-7	10	22.74	10.00	19.80	7.06	2.36	0.92	1.93	0.92
	2		20	43.73	20.00	34.74	11.01	4.59	1.71	3.29	1.71
	3		40	75.99	40.00	52.37	16.38	8.35	2.59	4.95	2.59
B-2	1	23-35	10	26.18	10.00	20.55	4.37	2.60	1.16	1.79	1.16
	2		20	40.70	20.00	30.34	9.64	4.37	1.49	2.88	1.49
	3		40	82.40	40.00	58.49	16.09	8.81	3.05	5.37	3.05
B-3	1	3-7	10	29.56	10.00	25.12	5.56	2.85	1.41	2.21	1.41
	2		20	39.31	20.00	28.08	8.77	4.27	1.39	2.65	1.39
	3		40	76.95	40.00	56.49	19.54	8.42	2.66	5.47	2.66



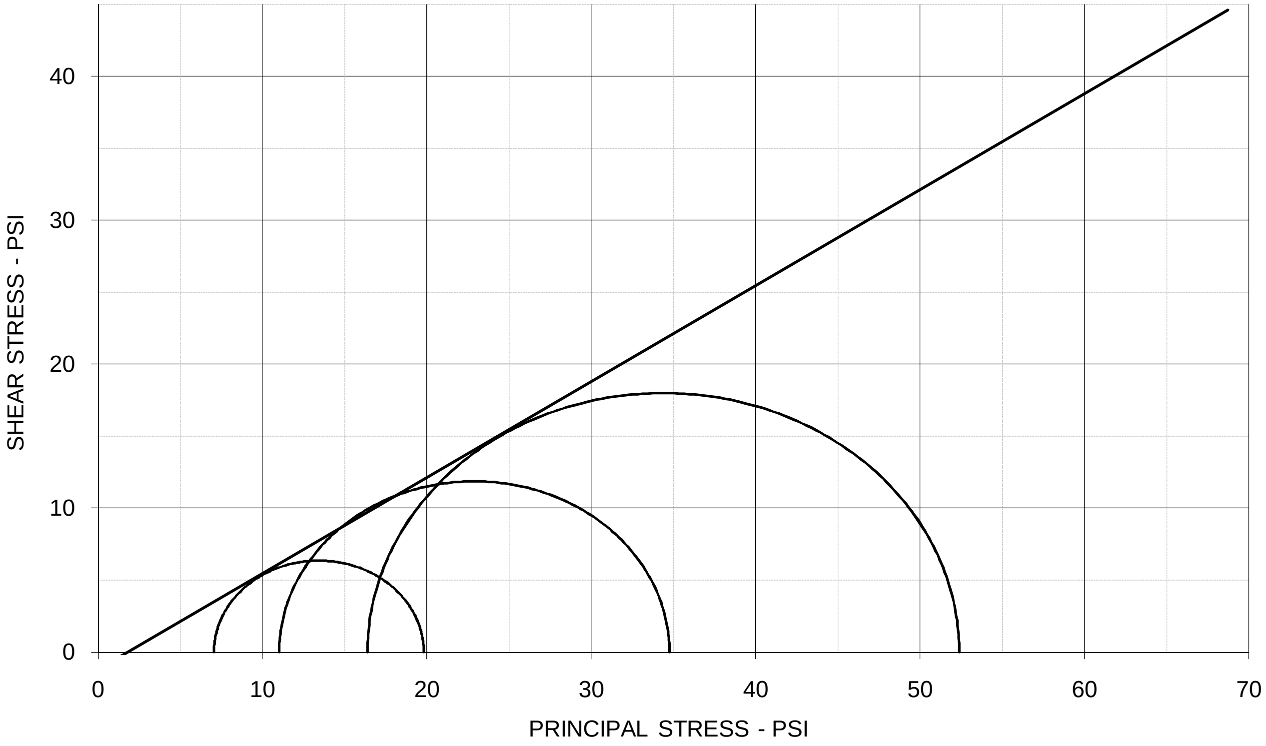


Effective Stress Failure Envelope
c' = 50 psf
phi' = 31 deg

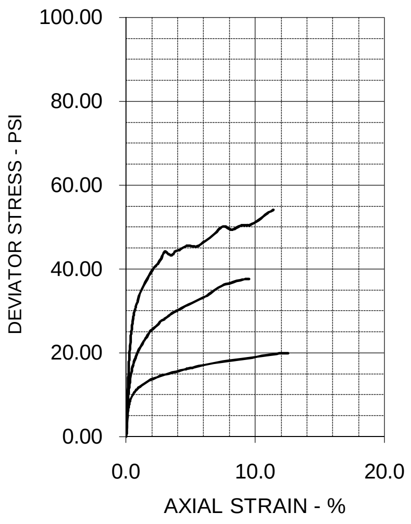
Total Stress Failure Envelope
c = 500 psf
phi = 14 deg

Effective Stress Data - B-2, 3-7' Depth

TRIAXIAL SHEAR TEST REPORT



EFFECTIVE STRESS PARAMETERS	ϕ ' =	33.7 deg	c' =	-1.2 psi
SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	16.9	15.1	21.1	
Dry Density - pcf	108.9	113.4	107.0	
Diameter - inches	2.79	2.75	2.76	
Height - inches	5.68	4.33	5.19	
AT TEST				
Final Moisture - %	21.7	19.9	19.4	
Dry Density - pcf	109.4	114.8	109.2	
Calculated Diameter (in.)	2.79	2.74	2.73	
Height - inches	5.68	4.28	5.12	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.74	23.73	35.99	
Total Pore Pressure - psi	62.9	59.0	73.6	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.6	1.4	
σ_1' Failure - psi	19.80	34.74	52.37	
σ_3' Failure - psi	7.06	11.01	16.38	



TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP

SAMPLE TYPE: Shelby Tube Sample

DESCRIPTION: Redd. Brown & Tan & Gray Fat Clay w/ Gravel

Sampled on Site, B-2 3' to 7' deep

ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve

LL: PL: PI: Percent -200:

REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

G 3243-09, B-2 3'-7' Flint Creek

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant

LOCATION: Centry, AR

PROJECT NO: G 3243 - 09

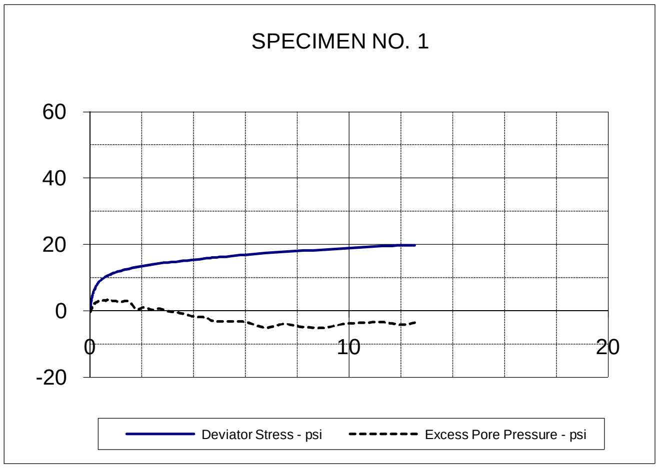
CLIENT: AEP

December 2009

ETTL ENGINEERS & CONSULTANTS

PLATE: B.1

Effective Stress Data - B-2, 3-7' Depth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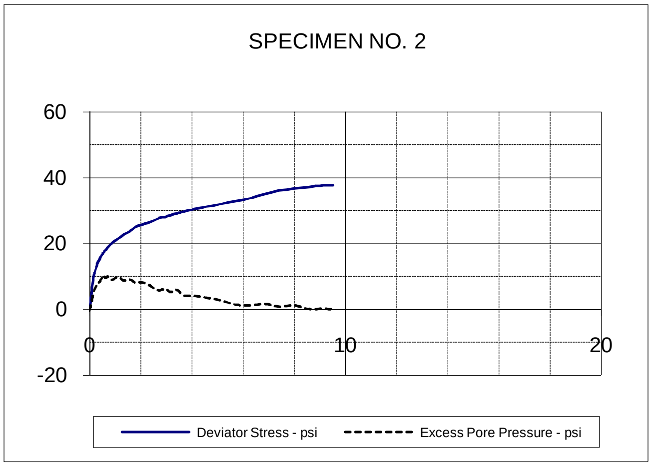
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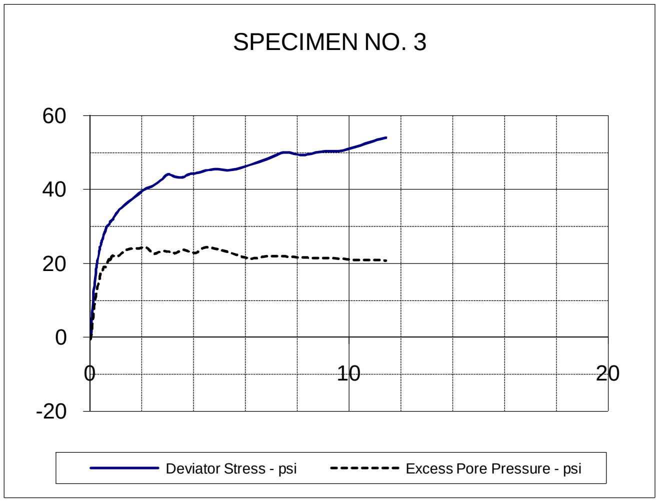
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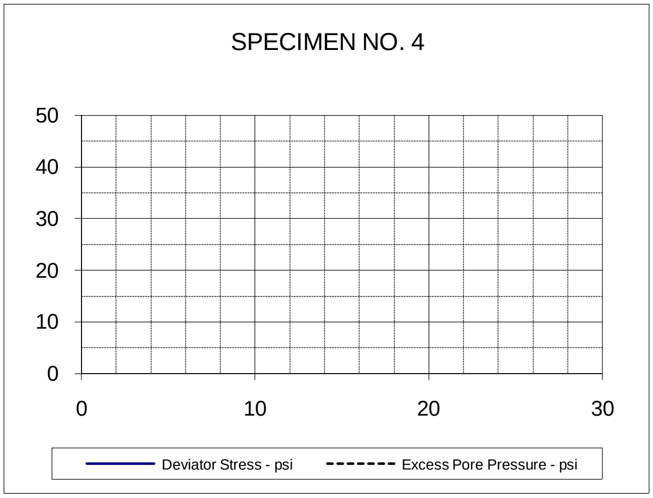
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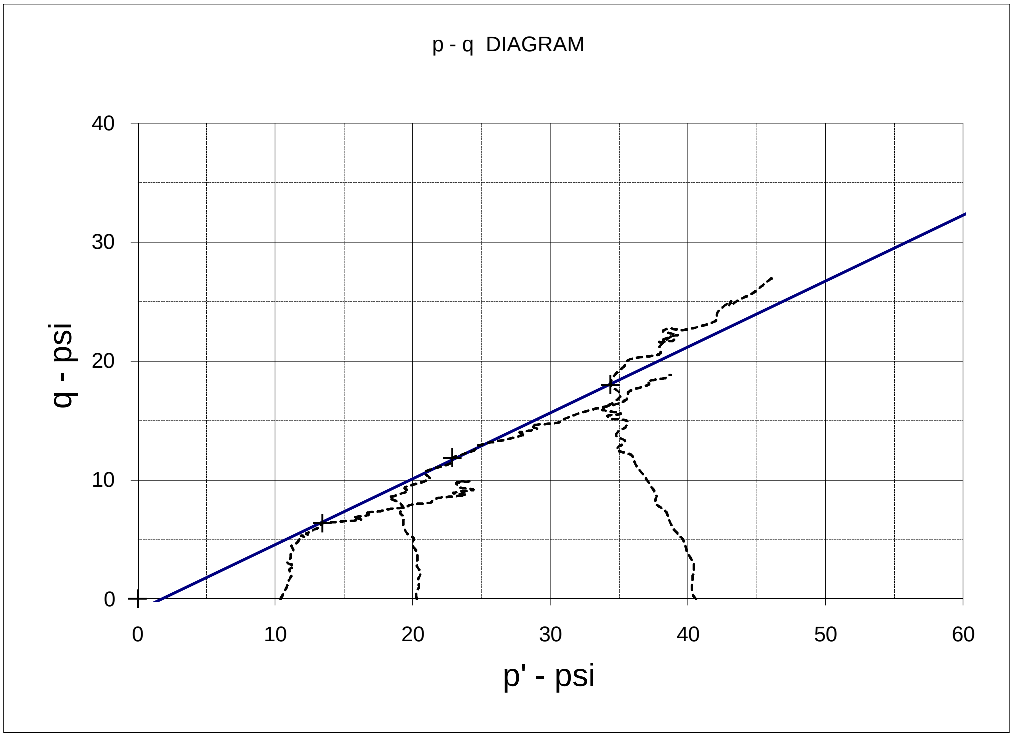

p - q DIAGRAM

EFFECTIVE STRESS PARAMETERS | R^2 = 1.00 | α (deg) = 29.0 | a (psi) = -1.0

PROJECT: Flint Creek Power Plant

TYPE OF TEST & NO: CU with PP

PROJECT NO: G 3243 - 09

DESCRIPTION: Redd. Brown & Tan & Gray Fat Clay w/ Gravel

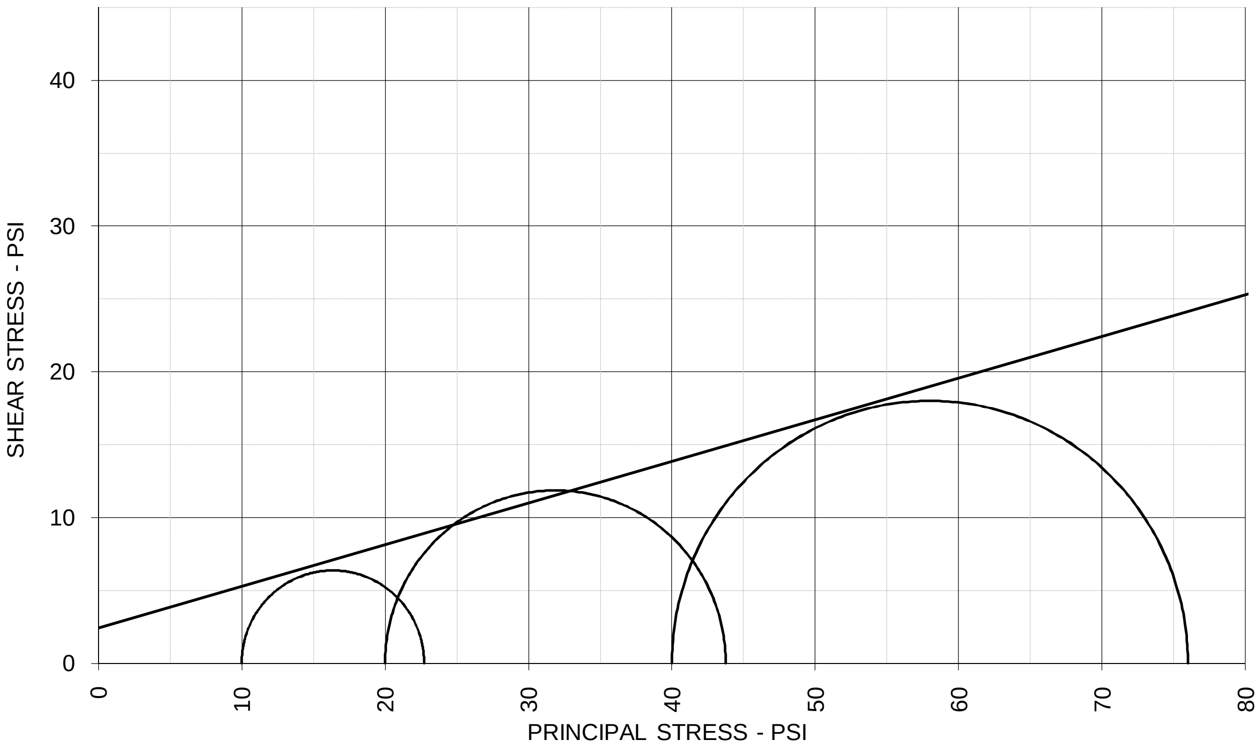
ETTL ENGINEERS & CONSULTANTS

PLATE: B.2

G 3243-09, B-2 3'-7' Flint Creek

Total Stress Data - B-2, 3-7' Depth

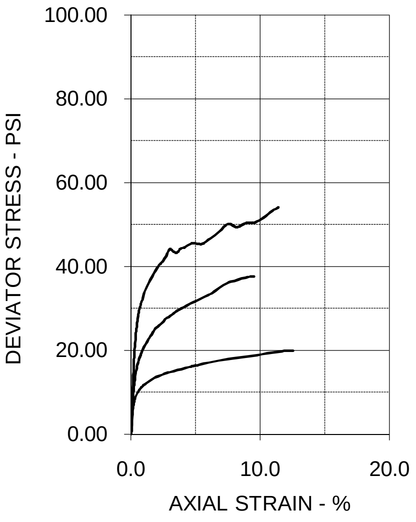
TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS

ϕ = 15.9 deg

c = 2.4 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	16.9	15.1	21.1	
Dry Density - pcf	108.9	113.4	107.0	
Diameter - inches	2.79	2.75	2.76	
Height - inches	5.68	4.33	5.19	
AT TEST				
Final Moisture - %	21.7	19.9	19.4	
Dry Density - pcf	109.4	114.8	109.2	
Calculated Diameter (in.)	2.79	2.74	2.73	
Height - inches	5.68	4.28	5.12	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.74	23.73	35.99	
Total Pore Pressure - psi	62.9	59.0	73.6	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.6	1.4	
σ_1 Failure - psi	22.74	43.73	75.99	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Redd. Brown & Tan & Gray Fat Clay w/ Gravel
Sampled on Site, B-2 3' to 7' deep
ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve
LL: PL: PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Centry, AR
PROJECT NO: G 3243 - 09
CLIENT: AEP
December 2009

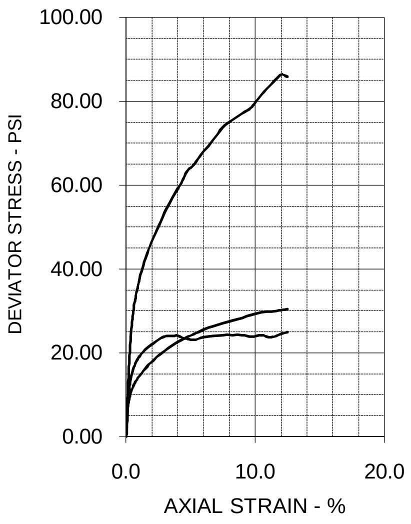
ETTL ENGINEERS & CONSULTANTS

PLATE: B.3

Effective Stress Data - B-2, 23-25' Depth

TRIAXIAL SHEAR TEST REPORT

EFFECTIVE STRESS PARAMETERS	ϕ ' = 33.0 deg	c' = 0.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	21.8	20.0	17.7	
Dry Density - pcf	103.5	109.2	114.4	
Diameter - inches	2.78	2.76	2.80	
Height - inches	5.68	5.67	5.69	
AT TEST				
Final Moisture - %	23.5	21.0	16.6	
Dry Density - pcf	103.8	110.3	117.0	
Calculated Diameter (in.)	2.77	2.74	2.78	
Height - inches	5.65	5.63	5.64	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	16.18	20.70	42.40	
Total Pore Pressure - psi	55.6	60.4	73.9	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.5	1.5	
σ_1' Failure - psi	20.55	30.34	58.49	
σ_3' Failure - psi	4.37	9.64	16.09	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP

SAMPLE TYPE: Shelby Tube Sample

DESCRIPTION: Reddish Brown & Tan Lean Clay

Sampled on Site, B-2 23' to 35' deep

ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve

LL: PL: PI: Percent -200:

REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant

LOCATION: Centry, AR

PROJECT NO: G 3243 - 09

CLIENT: AEP

December 2009

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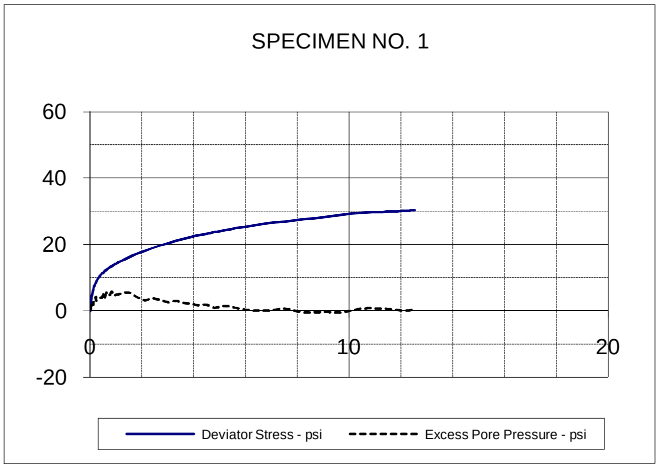
PLATE: B.1

G 3243-09, B-2 23'-35' Flint Creek

Effective Stress Data - B-2, 23-25' Depth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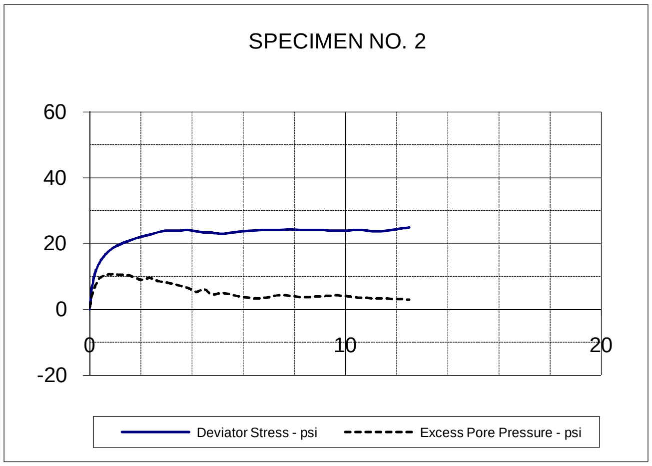
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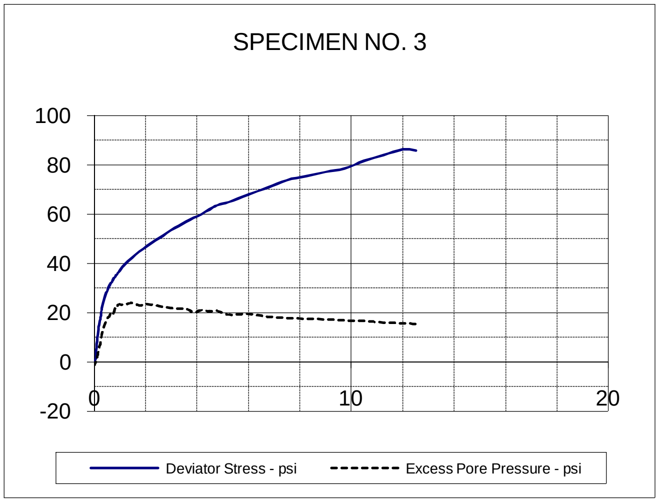
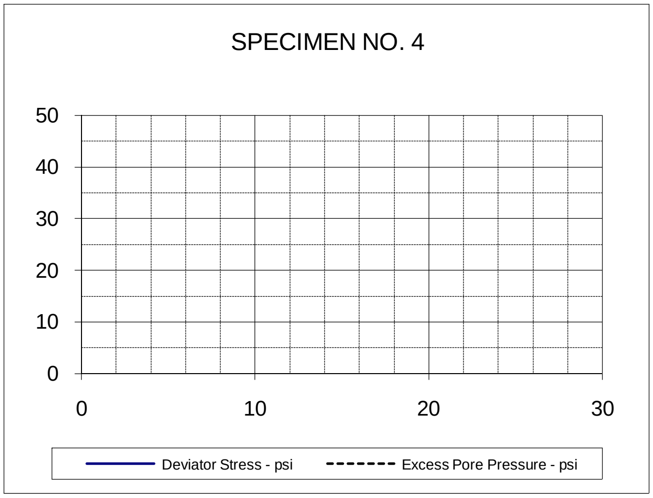

SPECIMEN NO. 3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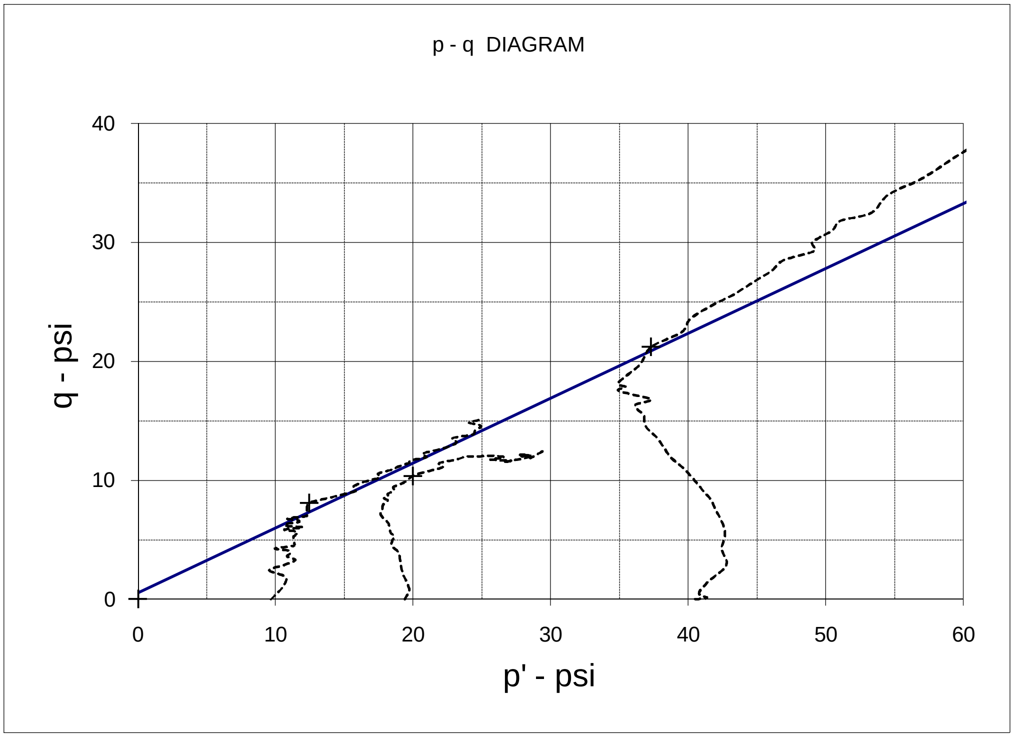
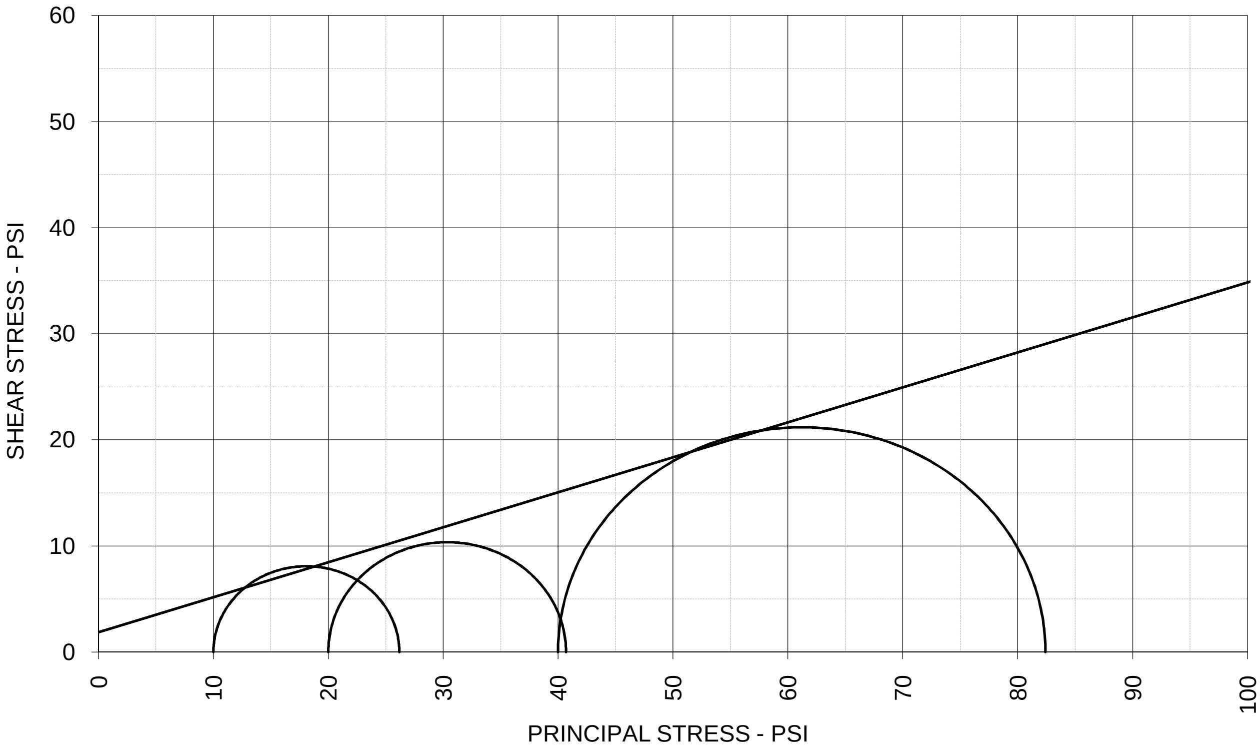

p - q DIAGRAM

EFFECTIVE STRESS PARAMETERS	R^2 = 0.98	α (deg) = 28.6	a (psi) = 0.5
PROJECT: Flint Creek Power Plant		TYPE OF TEST & NO: CU with PP	
PROJECT NO: G 3243 - 09		**ETTL ENGINEERS & CONSULTANTS**	PLATE: B.2
DESCRIPTION: Reddish Brown & Tan Lean Clay			

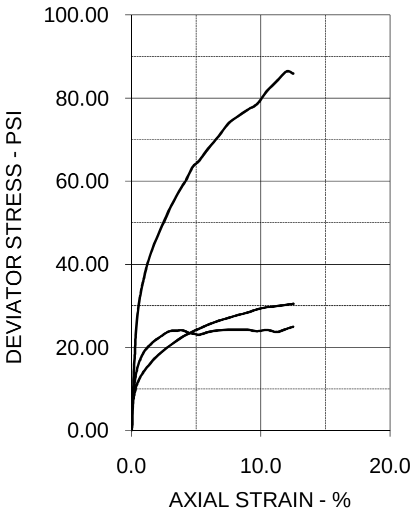
G 3243-09, B-2 23'-35' Flint Creek

Total Stress Data - B-2, 23-25' Depth

TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS	ϕ = 18.3 deg	c = 1.9 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	21.8	20.0	17.7	
Dry Density - pcf	103.5	109.2	114.4	
Diameter - inches	2.78	2.76	2.80	
Height - inches	5.68	5.67	5.69	
AT TEST				
Final Moisture - %	23.5	21.0	16.6	
Dry Density - pcf	103.8	110.3	117.0	
Calculated Diameter (in.)	2.77	2.74	2.78	
Height - inches	5.65	5.63	5.64	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	16.18	20.70	42.40	
Total Pore Pressure - psi	55.6	60.4	73.9	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.5	1.5	
σ_1 Failure - psi	26.18	40.70	82.40	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Reddish Brown & Tan Lean Clay
Sampled on Site, B-2 23' to 35' deep
ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve
LL: PL: PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Centry, AR
PROJECT NO: G 3243 - 09
CLIENT: AEP
December 2009

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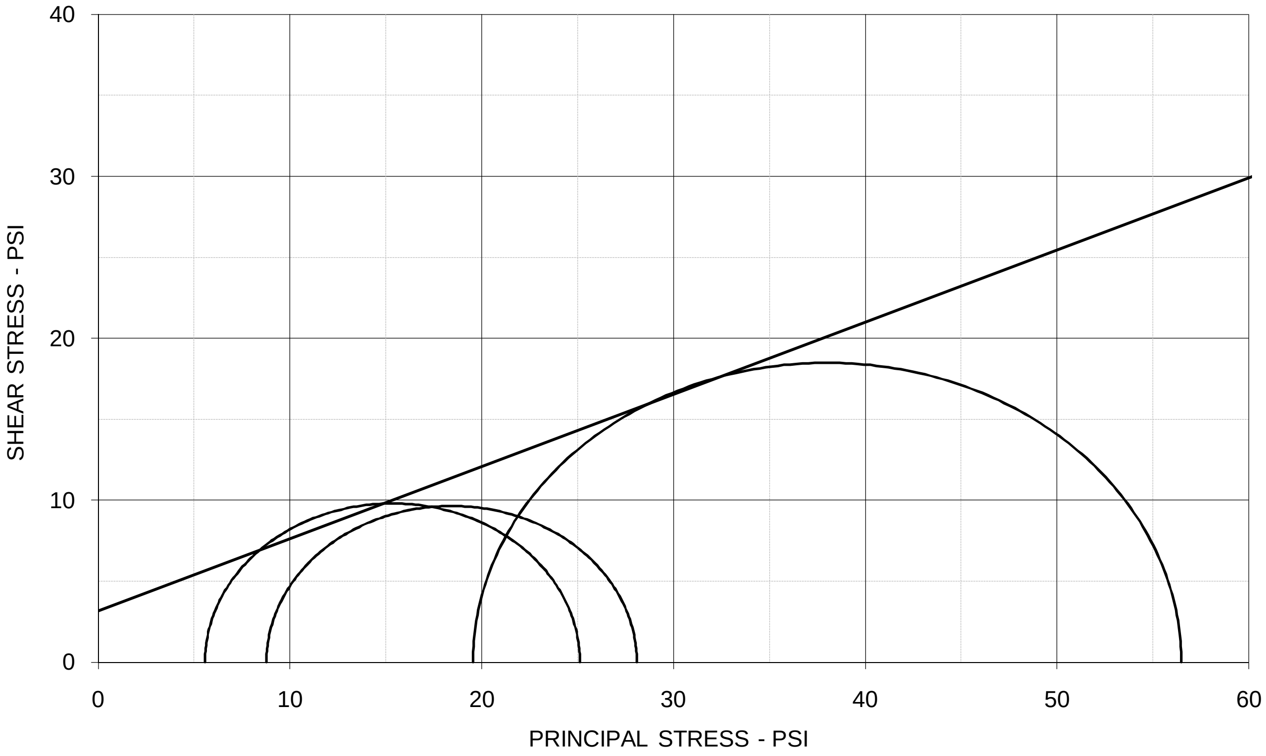
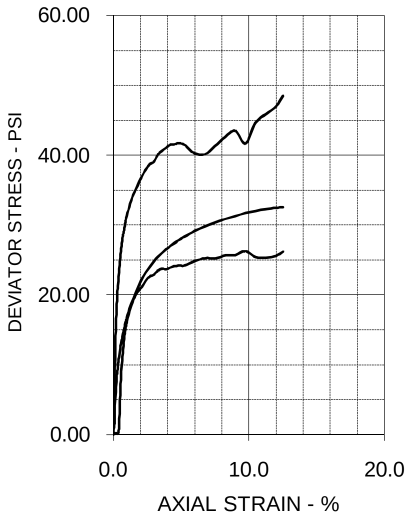
PLATE: B.3

Effective Stress Data - B-2, 23-25' Depth

TRIAXIAL SHEAR TEST REPORT



EFFECTIVE STRESS PARAMETERS	ϕ ' =	24.0 deg	c' =	3.2 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	17.6	20.3	17.6	
Dry Density - pcf	107.9	106.2	107.7	
Diameter - inches	2.76	2.76	2.77	
Height - inches	5.68	5.68	5.68	
AT TEST				
Final Moisture - %	24.0	22.3	22.0	
Dry Density - pcf	108.5	107.0	109.8	
Calculated Diameter (in.)	2.76	2.75	2.75	
Height - inches	5.67	5.64	5.62	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	19.56	19.31	36.95	
Total Pore Pressure - psi	54.4	61.2	70.5	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.5	2.1	
σ_1' Failure - psi	25.12	28.08	56.49	
σ_3' Failure - psi	5.56	8.77	19.54	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP

SAMPLE TYPE: Shelby Tube Sample

DESCRIPTION: Redd. Brown & Tan Sandy Lean Clay w/ Gravel

Sampled on Site, B-3 3' to 7' deep

ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve

LL: PL: PI: Percent -200:

REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

G 3243-09, B-3 5'-7' Flint Creek

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant

LOCATION: Centry, AR

PROJECT NO: G 3243 - 09

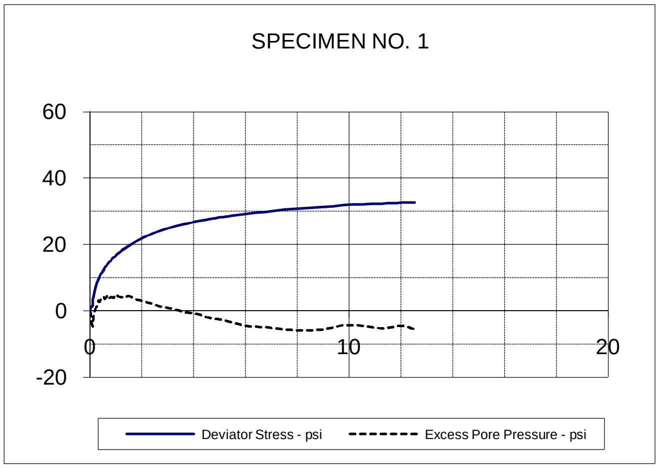
CLIENT: AEP

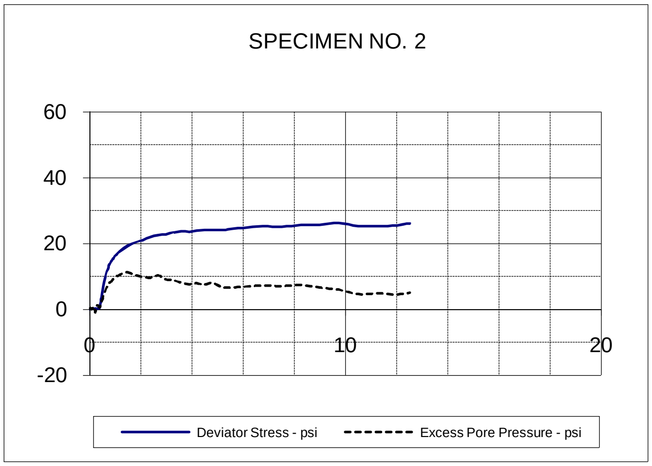
December 2009

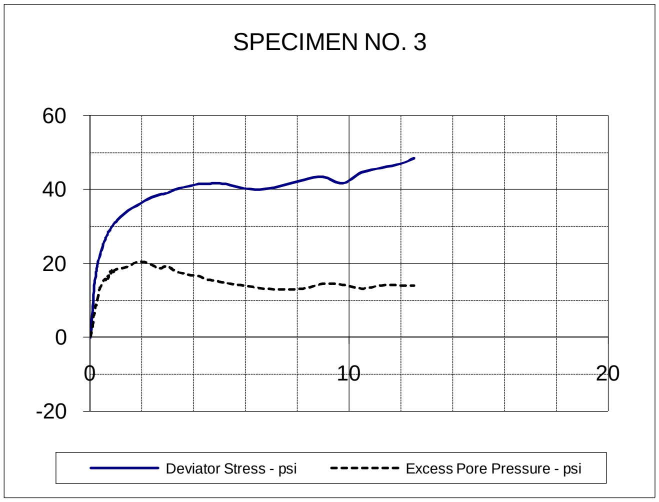
ETTL ENGINEERS & CONSULTANTS

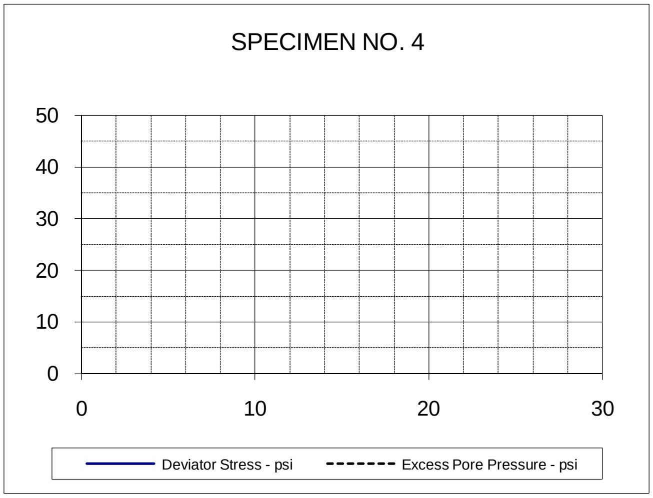
PLATE: B.1

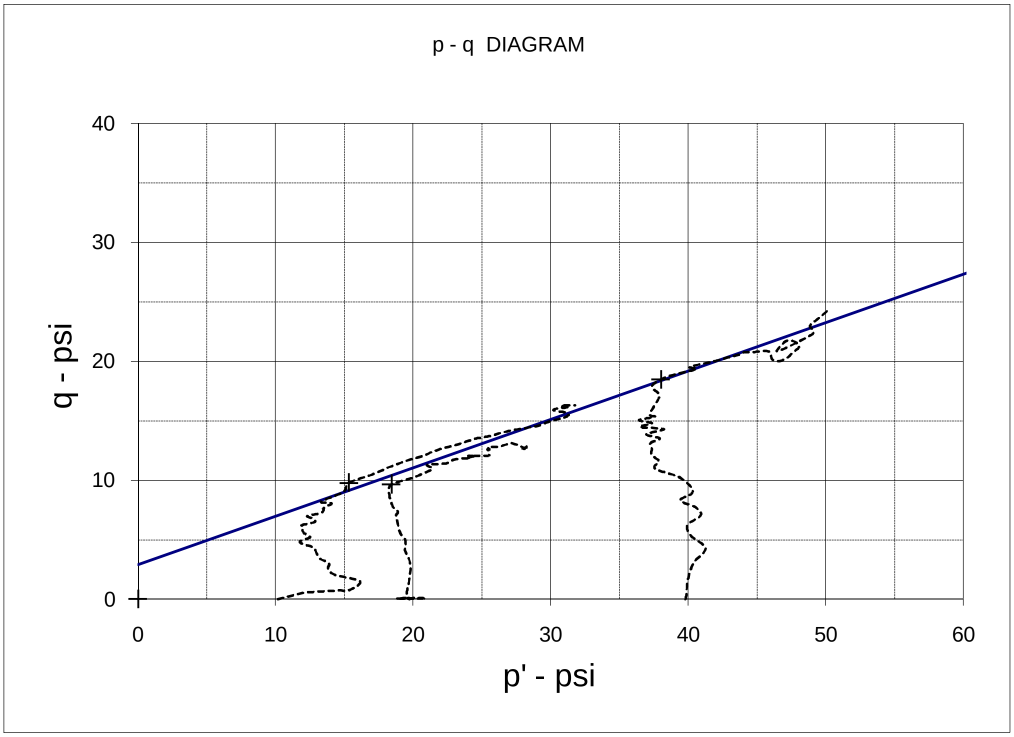
Effective Stress Data - B-2, 23-25' Depth







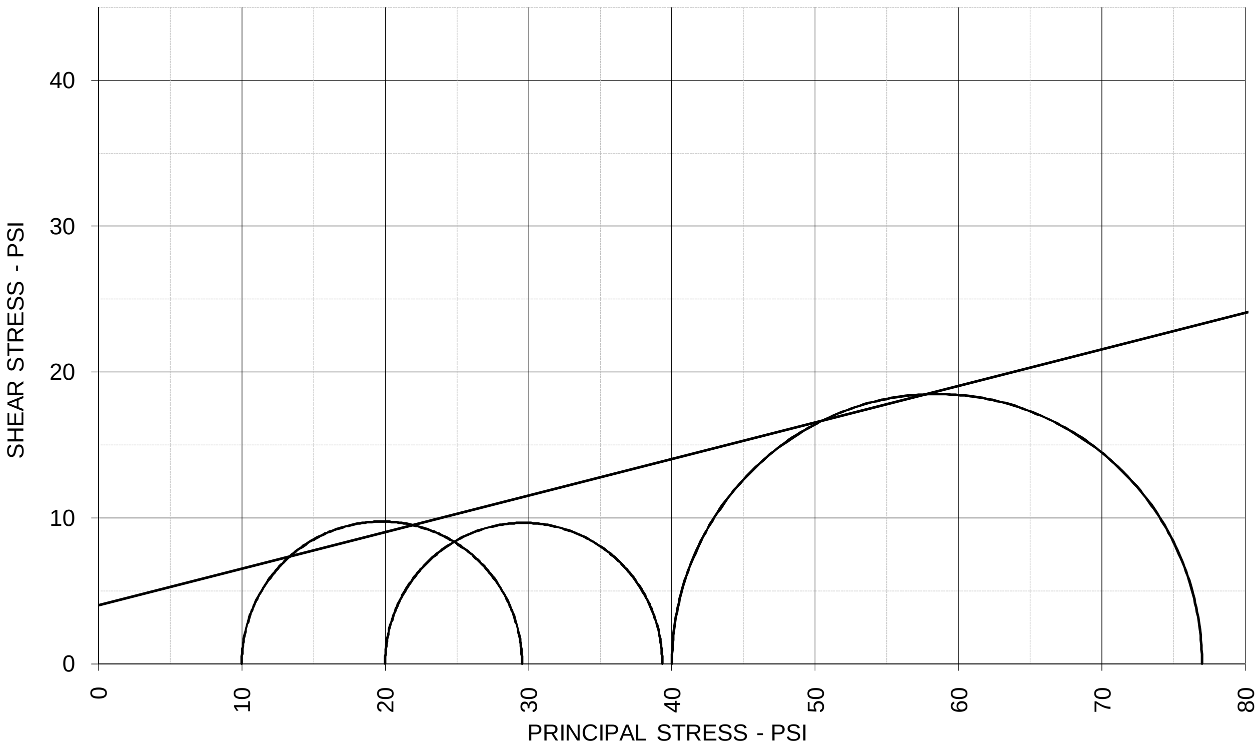




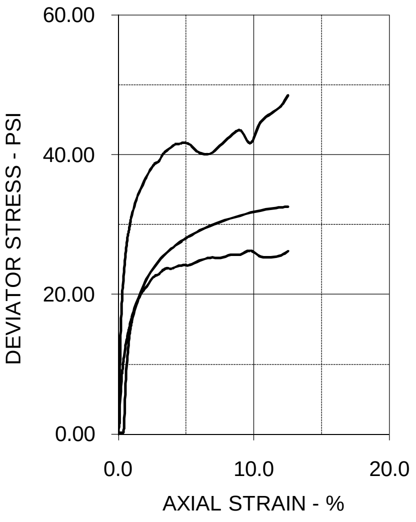
EFFECTIVE STRESS PARAMETERS	R^2 = 0.98	α (deg) = 22.2	a (psi) = 2.9
PROJECT: Flint Creek Power Plant		TYPE OF TEST & NO: CU with PP	
PROJECT NO: G 3243 - 09		**ETTL ENGINEERS & CONSULTANTS**	PLATE: B.2
DESCRIPTION: Redd. Brown & Tan Sandy Lean Clay w/ Gravel			

Total Stress Data - B-2, 23-25' Depth

TRIAXIAL SHEAR TEST REPORT



TOTAL STRESS PARAMETERS	ϕ = 14.1 deg	c = 4.0 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	17.6	20.3	17.6	
Dry Density - pcf	107.9	106.2	107.7	
Diameter - inches	2.76	2.76	2.77	
Height - inches	5.68	5.68	5.68	
AT TEST				
Final Moisture - %	24.0	22.3	22.0	
Dry Density - pcf	108.5	107.0	109.8	
Calculated Diameter (in.)	2.76	2.75	2.75	
Height - inches	5.67	5.64	5.62	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	19.56	19.31	36.95	
Total Pore Pressure - psi	54.4	61.2	70.5	
Strain Rate - inches/min.	0.00050	0.00050	0.00050	
Failure Strain - %	1.5	1.5	2.1	
σ_1 Failure - psi	29.56	39.31	76.95	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with PP
SAMPLE TYPE: Shelby Tube Sample
DESCRIPTION: Redd. Brown & Tan Sandy Lean Clay w/ Gravel
Sampled on Site, B-3 3' to 7' deep
ASSUMED SPECIFIC GRAVITY: 2.7 + 40 Sieve
LL: PL: PI: Percent -200:
REMARKS: Diameter and Both Ends Trimmed + # 4 Sieve

PROJECT INFORMATION

PROJECT: Flint Creek Power Plant
LOCATION: Centry, AR
PROJECT NO: G 3243 - 09
CLIENT: AEP
December 2009

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PLATE: B.3

T

Holtz & Kovacs Reference

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N. M. Newmark and W. J. Hall, Editors

An Introduction to Geotechnical Engineering

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Holtz & Kovacs Reference

failure depends on the field loading conditions one wishes to model. Four common field conditions and the laboratory stress paths which model them are shown in Fig. 10.22. Note that these stress paths are for *drained* loading (discussed in the next chapter) in which there is *no* excess pore water pressure; therefore total stresses equal effective stresses and the total stress path (TSP) for a given loading is identical to the effective stress path (ESP).

As suggested by Eq. 10-20, we are often interested in conditions at failure, and it is useful to know the relationship between the K_f line and the Mohr-Coulomb failure envelope. Consider the two Mohr circles shown in Fig. 10.23. The circle on the left, drawn for illustrative purposes only, represents failure in terms of the *p-q* diagram. The identical circle on the right is the same failure circle on the Mohr τ-σ diagram. To establish the slopes of the two lines and their intercepts, several Mohr circles and stress paths, determined over a range of stresses, were used. The equation of the K_f line is

$$q_f = a + p_f \tan\psi \tag{10-23}$$

where a = the intercept on the q-axis, in stress units, and

ψ = the angle of the K_f line with respect to the horizontal, in degrees.

The equation of the Mohr-Coulomb failure envelope is

$$\tau_{ff} = c + \sigma_{ff} \tan\phi \tag{10-9}$$

From the geometries of the two circles, it can be shown that

$$\sin\phi = \tan\psi \tag{10-24}$$

and

$$c = \frac{a}{\cos\phi} \tag{10-25}$$

So, from a *p-q* diagram the shear strength parameters ϕ and c may readily be computed.

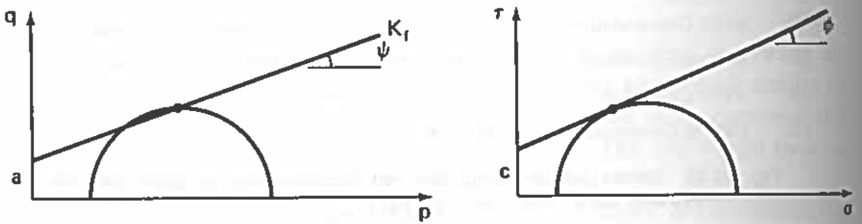


Fig. 10.23 Relationship between the K_f line and the Mohr-Coulomb failure envelope.

Another useful aspect of the *p-q* diagram is that it may be used to show both total and effective stress paths on the same diagram. We said before that for drained loading, the total stress path (TSP) and the effective stress path (ESP) were identical. This is because the pore water pressure induced by loading was approximately equal to zero at all times during shear. However, in general, during *undrained* loading the TSP is not equal to the ESP because excess pore water pressure develops. For axial compression (AC) loading of a normally consolidated clay ($K_o < 1$), a *positive* excess pore water pressure Δu develops. Therefore the ESP lies to the *left* of the TSP because $\sigma' = \sigma - \Delta u$. At any point during the loading, the pore water pressure Δu may be scaled off any horizontal line between the TSP and ESP, as shown in Fig. 10.24.

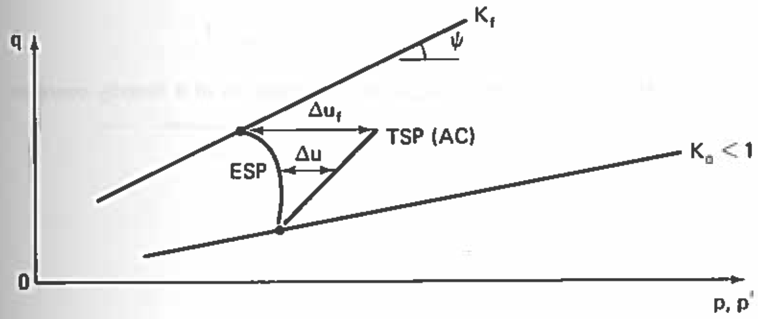


Fig. 10.24 Stress paths during undrained axial compression loading of a normally consolidated clay.

If a clay is overconsolidated ($K_o > 1$), then *negative* pore water pressure ($-\Delta u$) develops because the clay *tends* to expand during shear, but it can't. (Remember: we are talking about undrained loading in which no volume change is allowed.) For AC loading on an overconsolidated clay, stress paths like those shown in Fig. 10.25 will develop. Similarly, we can plot total and effective stress paths for other types of loadings and unloadings, for both normally and overconsolidated soils, and we shall show some of these in Chapter 11.

In most practical situations in geotechnical engineering, there exists a static ground water table; thus an initial pore water pressure u_o, is acting on the element in question. So there are really three stress paths we should consider, the ESP, the TSP, and the (T $- u_o$)SP. These three paths are shown in Fig. 10.26 for a normally consolidated clay with an initial pore water pressure u_o undergoing AC loading. Note that as long as the ground water table remains at the same elevation, u_o does not affect either the ESP or the conditions at failure.

Appendix B

Pseudostatic Coefficient Reference Material

Project Name:	Flint Creek Power Station, Existing Ash Storage Ponds Embankment		
Project Number:	60437225		
Client:			
Description:	Site Classifications		
By:	MF	**Checked By:**	JD
Date:	1-Sep-15	**Date:**	1-Sep-15

Task:

Evaluate the site classification based on the average blow count, Ñ, in the upper 100 feet of the soil profile.

Reference:

ASCE (2013). Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10)

Site Class Definitions:

Chapter 20 Site Classficationm Procedure for Seismic Design; Table 20.3-1

Average Blow Count, Ñ	Average Soil Shear Wave Velocity, V_s (feet/sec)	Site Class	Soil Profile Name
N/A	$V_s > 5000$	A	Hard rock
N/A	2500 < Vs ≤ 5000	B	Rock
Ñ > 50	1200 < Vs ≤ 2500	C	Very dense soil and soft rock
15 ≤ Ñ ≤ 50	600 < Vs ≤ 1200	D	Stiff soil profile
Ñ < 15	Vs < 600	E	Soft soil profile

General Site Data from Boring Logs:

Reference: SPT data from B-1 through B-7

Selected most critical soil profile where fill layer is the thickest

Soil Type		Average Layer Thickness (ft)	Average Blow Count
Fill		20	19
Native Soil		20	28
Weathered Limestone		60	50
	=	100	

Evaluation of Average Blow Count, Ñ:

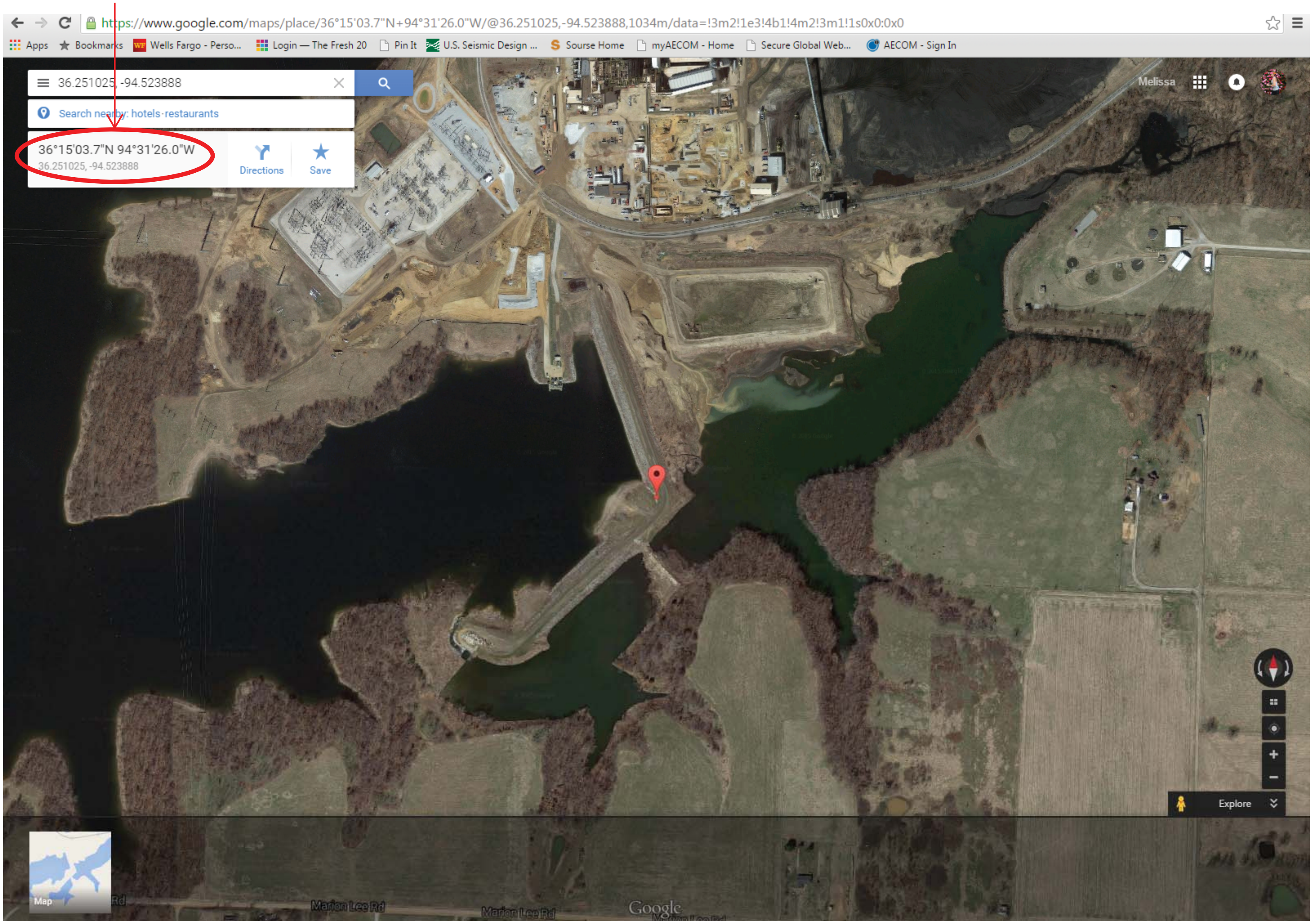
$$\tilde{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

Ñ = 39

Soil Classification Recommendation:

D	Stiff Soil Profile

Approximate site coordinates



https://www.google.com/maps/place/36°15'03.7"N+94°31'26.0"W/@36.251025,-94.523888,1034m/data=!3m2!1e3!4b1!4m2!3m1!1s0x0:0x0

36.251025 -94.523888

36°15'03.7"N 94°31'26.0"W
36.251025, -94.523888

USGS Design Maps Detailed Report

ASCE 7-10 Standard (36.25103°N, 94.52389°W)

Site Class D – “Stiff Soil”, Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	$S_S = 0.150$ g
From Figure 22-2 [2]	$S_1 = 0.085$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content *w* ≥ 40%, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 0.150 g, F_a = 1.600

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.085 g, F_v = 2.400

Equation (11.4–1): $S_{MS} = F_a S_S = 1.600 \text{ x } 0.150 = 0.240$ g

Equation (11.4–2): $S_{M1} = F_v S_1 = 2.400 \text{ x } 0.085 = 0.205$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

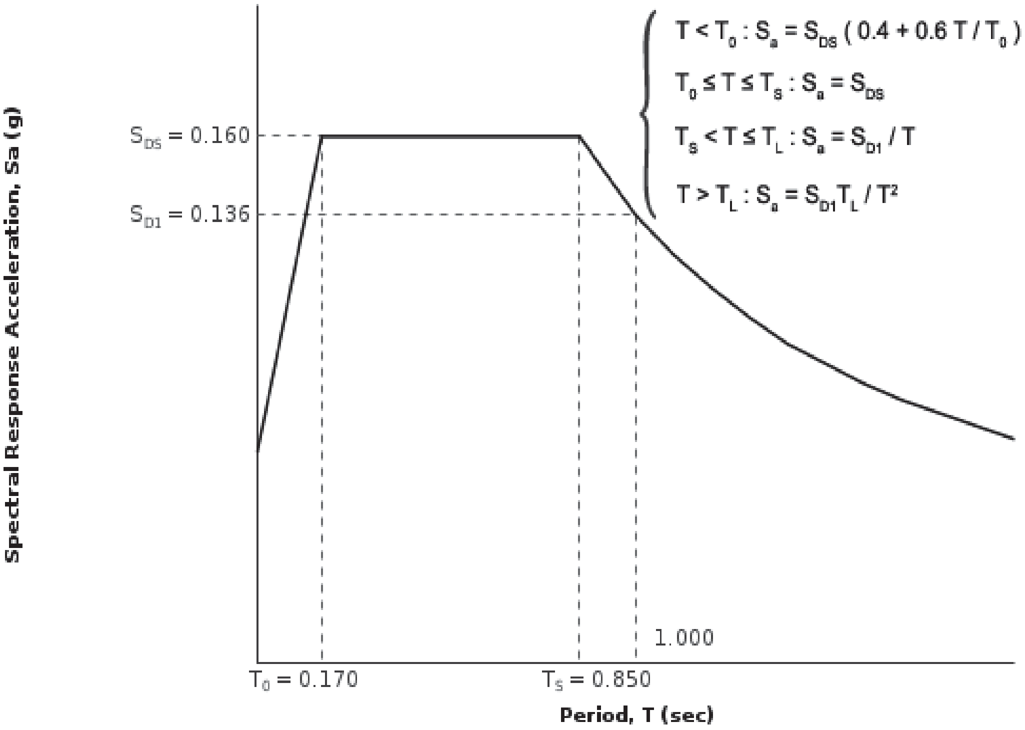
Equation (11.4–3): $S_{DS} = ⅔ S_{MS} = ⅔ \text{ x } 0.240 = 0.160$ g

Equation (11.4–4): $S_{D1} = ⅔ S_{M1} = ⅔ \text{ x } 0.205 = 0.136$ g

Section 11.4.5 — Design Response Spectrum

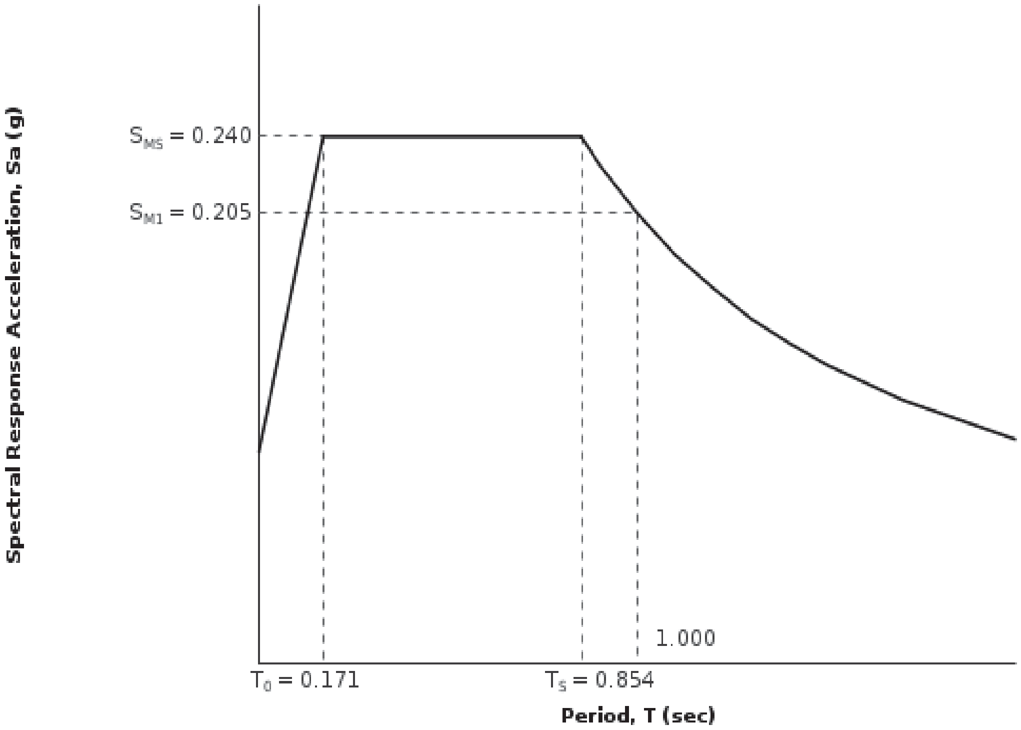
From Figure 22-12 [3] T_L = 12 seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE$_R$) Response Spectrum

The MCE$_R$ Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.072

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.600 \times 0.072 = 0.115$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.072 g, F_{PGA} = 1.600

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 0.872

From Figure 22-18 [6] C_{R1} = 0.841

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 0.160 g, Seismic Design Category = A

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.136 g, Seismic Design Category = C

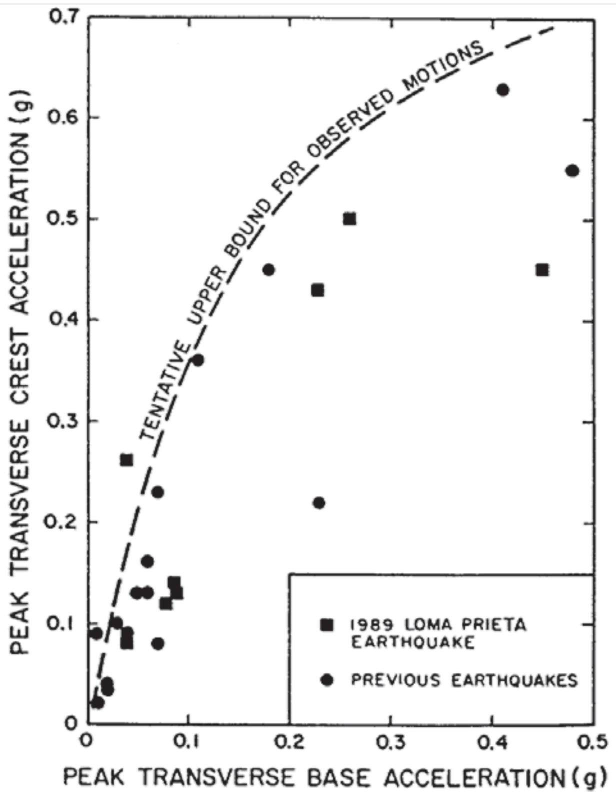
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = C

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf



FHWA, (2011). *LRFD Seismic Analysis and Design Transportation Geotechnical Features and Structural Foundations - Reference Manual,* NHI Course No. 130094, FHWA-NHI-11-032, GEC No. 3, August (Rev. 1).

Figure 5-5 Base and Crest Peak Accelerations Recorded at the Earth Dams (Harder, 1991)

The free field amplification curves presented in Figure 5-3 and Figure 5-4 may be used in a simplified three-step site response analysis procedure to account for the influence of local soil conditions on the peak ground acceleration from a conventional seismic hazard analysis (i.e. a seismic hazard analysis for Site Class B ground conditions) for PGA values less than or equal to 0.5. The observational data presented in Figure 5-5 may be used in a fourth step to account for the influence of an embankment on the transverse peak acceleration at the crest of the embankment. The procedure is as follows:

Step 1: *Evaluate the free field bedrock acceleration at the site for NEHRP/AASHTO Site Class B.* Determine the PGA from a conventional seismic hazard analysis for NEHRP/ASHTO Site Class B.

Step 2: *Classify the site according to the NEHRP/AASHTO site classification system.* Using Table 3-5, classify the site on the basis of the average shear wave velocity for the top 100 ft (30 meters) of soil, Vs_{30}.

Kramer, S.L. (1996). Geotechnical Earthquake Engineering, Prentice Hall Upper Saddle River, NJ

Resisting moment:

Section	Length (ft)	c (lb/ft^2)	Force (kips)	Moment Arm (ft)	Moment (kip-ft/ft)
A	11.5	600	6.9	78	538.2
B	129.3	1000	129.3	78	10,085.4
					10,623.6

Factor of safety:

$$\text{Static FS} = \frac{\text{resisting moment}}{\text{static overturning moment}} = \frac{10{,}623.6}{5925.5} = 1.79$$

$$\text{Pseudostatic FS} = \frac{\text{resisting moment}}{\text{static + pseudostatic overturning moments}}$$

$$= \frac{10{,}623.6}{8281.1} = 1.28$$

Selection of Pseudostatic Coefficient. The results of pseudostatic analyses are critically dependent on the value of the seismic coefficient, k_h. Selection of an appropriate pseudostatic coefficient is the most important, and most difficult, aspect of a pseudostatic stability analysis. The seismic coefficient controls the pseudostatic force on the failure mass, so its value should be related to some measure of the amplitude of the inertial force induced in the potentially unstable material. If the slope material was rigid, the inertial force induced on a potential slide would be equal to the product of the actual horizontal acceleration and the mass of the unstable material. This inertial force would reach its maximum value when the horizontal acceleration reached its maximum value. In recognition of the fact that actual slopes are not rigid and that the peak acceleration exists for only a very short time, the pseudostatic coefficients used in practice generally correspond to acceleration values well below $a_{\max}$. Terzaghi (1950) originally suggested the use of $k_h = 0.1$ for "severe" earthquakes (Rossi-Forel IX), $k_h = 0.2$ for "violent, destructive" earthquakes (Rossi-Forel X), and $k_h = 0.5$ for "catastrophic" earthquakes. Seed (1979) listed pseudostatic design criteria for 14 dams in 10 seismically active countries; 12 required minimum factors of safety of 1.0 to 1.5 with pseudostatic coefficients of 0.10 to 0.12. Marcuson (1981) suggested that appropriate pseudostatic coefficients for dams should correspond to one-third to one-half of the maximum acceleration, including amplification or deamplification effects, to which the dam is subjected. Using shear beam models, Seed and Martin (1966) and Dakoulas and Gazetas (1986) showed that the inertial force on a potentially unstable slope in an earth dam depends on the response of the dam and that the average seismic coefficient for a deep failure surface is substantially smaller than that of a failure surface that does not extend far below the crest. Seed (1979) also indicated that deformations of earth dams constructed of ductile soils (defined as those that do not generate high pore pressures or show more than 15% strength loss upon cyclic loading) with crest accelerations less than $0.75g$ would be acceptably small for pseudostatic factors of safety of at least 1.15 with $k_h = 0.10$ ($M = 6.5$) to $k_h = 0.15$ ($M = 8.25$). This criteria would allow the use of pseudostatic accelerations as small as 13 to 20% of the peak crest acceleration. Hynes-Griffin and Franklin (1984) applied the Newmark sliding block analysis described in the following section to over 350 accelerograms and concluded that earth dams with pseudostatic factors of safety greater than 1.0 using $k_h = 0.5a_{\max}/g$ would not develop "dangerously large" deformations.

As the preceding discussion indicates, there are no hard and fast rules for selection of a pseudostatic coefficient for design. It seems clear, however, that the pseudostatic coefficient should be based on the actual anticipated level of acceleration in the failure mass (including any amplification or deamplification effects) and that it should correspond to some fraction of the anticipated peak acceleration. Although engineering judgment is required for all cases, the criteria of Hynes-Griffin and Franklin (1984) should be appropriate for most slopes.

Limitations of the Pseudostatic Approach. Representation of the complex, transient, dynamic effects of earthquake shaking by a single constant unidirectional pseudostatic acceleration is obviously quite crude. Even in its infancy, the limitations of the pseudostatic approach were clearly recognized. Terzaghi (1950) stated that "the concept it conveys of earthquake effects on slopes is very inaccurate, to say the least," and that a slope could be unstable even if the computed pseudostatic factor of safety was greater than 1. Detailed analyses of historical and recent earthquake-induced landslides (e.g., Seed et al., 1969, 1975; Marcuson et al., 1979) have illustrated significant shortcomings of the pseudostatic approach. Experience has clearly shown, for example, that pseudostatic analyses can be unreliable for soils that build up large pore pressures or show more than about 15% degradation of strength due to earthquake shaking. As illustrated in Table 10-4, pseudostatic analyses produced factors of safety well above 1 for a number of dams that later failed during earthquakes. These cases illustrate the inability of the pseudostatic method to reliably evaluate the stability of slopes susceptible to weakening instability. Nevertheless, the pseudostatic approach can provide at least a crude index of relative, if not absolute, stability.

Discussion. The pseudostatic approach has a number of attractive features. The analysis is relatively simple and straightforward; indeed, its similarity to the static limit equilibrium analyses routinely conducted by geotechnical engineers makes its computations easy to understand and perform. It produces a scalar index of stability (the factor of safety) that is analogous to that produced by static stability analyses. It must always be recognized, however, that the accuracy of the pseudostatic approach is governed by the accuracy with which the simple pseudostatic inertial forces represent the complex dynamic inertial forces that actually exist in an earthquake. Difficulty in the assignment of appropriate pseudostatic coefficients and in interpretation of pseudostatic factors of safety, coupled with the development of more realistic methods of analysis, have reduced the use of the pseudostatic approach for seismic slope stability analyses. Methods based on evaluation of permanent slope deformation, such as those described in the following sections, are being used increasingly for seismic slope stability analysis.

Table 10-4 Results of Pseudostatic Analyses of Earth Dams That Failed during Earthquakes

Dam	k_h	FS	Effect of Earthquake
Sheffield Dam	0.10	1.2	Complete failure
Lower San Fernando Dam	0.15	1.3	Upstream slope failure
Upper San Fernando Dam	0.15	~2–2.5	Downstream shell, including crest slipped about 6 ft downstream
Tailings dam (Japan)	0.20	~1.3	Failure of dam with release of tailings

Source: After Seed (1979).