LCRA
ENERGY • WATER • COMMUNITY SERVICES

October 28, 2022

Daniela Ortiz de Montellano, Project Manager
Industrial and Hazardous Waste Permits Section
Waste Permits Division
Texas Commission on Environmental Quality

New Coal Combustion Residuals (CCR) Registration No. CCR1
Lower Colorado River Authority – La Grange, Fayette County
Industrial Solid Waste Registration No. 31575
EPA Identification No. TXD083566547
Tracking No. 27214088; RN100226844**/**CN600253637

Ms. Ortiz,

The Lower Colorado River Authority is in receipt of you letter dated September 28, 2022, outlining deficiencies in the Coal Combustion Residuals registration application for the above referenced facility dated January 24, 2022. Our responses are outlined below, corresponding to deficiency number and application section and location. Furthermore, we have included a redline/strike out version of the changes as well as replacement pages.

1. Application Section I.6

   Replace the CCR Unit No. "CCR-101" with "CCR-1" for consistency with the rest of the tables.

   Table I.6 has been updated with CCR-1. The replacement and redlined pages have been included in the Registration Application for Coal Combustion Residuals (CCR) Waste Management in Attachment 1.

2. Application Section IV.25.A

   The application includes a statement indicating that CCR is managed for beneficial use. Provide information to explain how the management of CCR meets the requirements for beneficial use. Add a statement to indicate that beneficial use determination records will be kept on-site.

   CCR's are managed in the landfill as class 2 solid waste and are segregated to provide for potential future recycling/beneficial use. TCEQ has a long history of supporting the beneficial use of CCR's and has designated CCR's as recycled "co-products" which are exempt from the definition of solid waste. This position was memorialized in the adoption preamble for 30 TAC 335,1 (128) (i-viii) known as the 8 non-waste criteria (26 TexReg 3833, May 25, 2001). In the adoption

preamble, TCEQ specifically stated that recycled CCR "co-product" status remained valid and there was no need to revisit the prior determinations. Furthermore, TCEQ clarified that recycled material exempt from the definition of solid waste is not subject to additional tracking records. Therefore, TCEQ has already determined that recycled CCR "co-products" are being legitimately recycled and are exempt from the definition of solid waste. As such they are not subject to 40 CFR 257 or 30 TAC 352.

3. Application Section IV.25.B

   Revise the coefficient sign on the soil permeability number.

   The coefficient sign has been updated in Table IV.B. The replacement and redlined pages have been included in the Registration Application for Coal Combustion Residuals (CCR) Waste Management in Attachment 1.

4. Application Section IV.25.D

   Explain why the Austin evapotranspiration, precipitation, and temperature data was used and not the La Grande/Fayette data to calculate the leachate collection rate and maximum leachate head on the floor of the liner system

   Geosyntec has prepared a Response to NOD Letter that is dated October 26, 2022 and is included in Attachment 2.

5. Application Section IV.25.E

   Explain or revise if the error message, "Manning's n = 0.027 (Error! Reference source not found.2)" for the Manning's number affected the results of the hydraulic calculations for the run-off channel.

   Geosyntec has prepared a Response to NOD Letter that is dated October 26, 2022 and is included in Attachment 2.

6. Application Section IV.25.F

   a. Att. 7: Include a statement to address the referenced rules requirements.

   A statement to address the referenced rules requirements has been added to Section IV.F of the Registration Application. The replacement and redlined pages have been included in the Registration Application for Coal Combustion Residuals (CCR) Waste Management in Attachment 1.

b. Table IV.D, Att.7 and Att. 9: Revise to indicate that weekly inspection items will be conducted at intervals not exceeding 7 days.

Table IV.D and Section IV.F have been revised to indicate that weekly inspection items will be conducted at intervals not exceeding 7 days. The replacement and redlined pages have been included in the Registration Application for Coal Combustion Residuals (CCR) Waste Management in Attachment 1. The weekly landfill inspection checklist has been updated and included as Attachment 3.

7. Application Section IV.25.F

Add the notification types and frequencies to the inspection checklist.

The inspection checklist has been updated to include the notification types and frequencies. The weekly landfill inspection checklist has been updated and included as Attachment 3.

8. Application Section VI.28, 2021 Groundwater and Corrective Action Report

Include a narrative to explain how the values in the combined Shewhart-CUSUM Control Charts prediction "limits" column and base line were determined for each constituent for the intrawell control charts statistical method. Provide justification for data removal, assumptions, data use, and any other information used to perform the calculations.

A narrative to explain how the values in the combined Shewhart-CUSUM Control Charts prediction "limits" column and base line were determined for each constituent for the intrawell control charts statistical method has been included in the Results of Ground Water Statistics First Semi-Annual Monitoring Event 2021 dated May 2021 and Results of Ground Water Statistics Second Semi-Annual Monitoring Event 2021 dated November 2021. LCRA notified TCEQ on March 2, 2021 of the posting to the public website of the 2021 Annual CBL Groundwater Monitoring Report which contains the memos, which contain the requested explanations and justifications. The memos have also been included in Attachment 4.

10. Application Section VI.28, 2021 Groundwater and Corrective Action Report

a. Provide a narrative to explain the statistical method selected and how the control limit, base line mean, and CUSUMs data were determined and will be updated for each constituent. Whether any data was removed and justification for removal, copies of charts or graphs that were used, and any other information used to perform the calculations for the intrawell control charts statistical method.

A narrative to explain the statistical method selected and how the control limit, base line mean, and CUSUMs data were determined and will be updated for each constituent is included in the Results of Ground Water Statistics First Semi-Annual Monitoring Event 2021 dated May 2021 and Results of Ground Water Statistics Second Semi-Annual Monitoring Event 2021 dated November 2021. LCRA notified TCEQ on March 2, 2021 of the posting to the public website of the 2021 Annual CBL Groundwater Monitoring Report which contains the memos. The memos have also been included in Attachment 4.

b. Provide procedures for collection of quality control samples.

Procedures for collection of quality control samples have been added to the Groundwater Monitoring Plan. Replacement pages and redlined pages for the Groundwater Monitoring Plan is included in Attachment 5.

c. Provide the required P.E certification for the statistical method selected, or indicate the location where this certification is located in the application.

P.E. certification for the statistical method selected is included in Appendix M of the Geology and Groundwater Monitoring System Summary Report included in Attachment 4 of the Initial Registration Application dated January 24, 2022.

d. Revise Subsection 5.2 to indicate that groundwater elevations must be measured in each well immediately prior to purging, each time groundwater is sampled.

Subsection 5.2 of the Groundwater Monitoring Plan has been updated to state that groundwater elevations must be measured in each well immediately prior to purging, each time groundwater is sampled. Replacement pages and redlined pages for the Groundwater Monitoring Plan is included in Attachment 5.

e. Address 40 CFR 257.93(e) requirements.

40 CFR 257.93(e) requirements have been added to the Groundwater Monitoring Plan. Replacement pages and redlined pages for the Groundwater Monitoring Plan is included in Attachment 5.

11. Application Section VII.31

Clarify what type of the two final cover system configurations described will be used for proposed Cells 1, 2 and 3.

Geosyntec has prepared a Response to NOD Letter that is dated October 26, 2022 and is included in Attachment 2.

12. Application Section VII.32

Include a statement that any changes to inspection frequencies will comply with recordkeeping and notification requirements.

A statement that any changes to inspection frequencies will comply with recordkeeping and notification requirements has been added to Section IV.25.F of the Registration Application. The replacement and redlined pages have been included in the Registration Application for Coal Combustion Residuals (CCR) Waste Management in Attachment 1.

13. Application Section VII.32

a. Revise the post-closure care cost estimate to be in current dollars (2021 dollar).

The post closure cost estimate is in 2021 dollars. No changes were made to the estimate. The amount will be adjusted for 2022 inflation in accordance with 30 TAC 352.111(5) within 180 days of the end of LCRA's fiscal year (June 30) or December 30, 2023. TCEQ posts the inflation factor by March 2023. This is coincidental with the renewal of the Local Government Test.

b. Revise the statement in "Note 6" to indicate that the registration will be amended to include a post-closure care cost estimate for collection and disposal of leachate and financial assurance will be in place prior to construction and operation of the proposed landfill lateral expansion.

Note 6 of Post Closure Care Cost Table has been modified accordingly in the registration application. The replacement and redlined pages have been included in the Registration Application for Coal Combustion Residuals (CCR) Waste Management in Attachment 6.

14. Application Section VIII.34

    Provide a statement that a Financial Assurance mechanism will be provided within 90 days if a registration is issued. For assistance, contact Mr. Mark Stoebner, Financial Analyst at mark.stoebner@tceq.texas.gov.

    A statement that a Financial Assurance mechanism will be provided within 90 days if a registration is issued was included in the Initial Registration Application dated January 24, 2022 in Section VIII.

Furthermore, in the initial CCR Registration Application Section II.23, Attachment 11, LCRA discovered that the attachments to the January 14, 2018 Technical Memorandum prepared by AMEC were missing from the scanned report included in the initial CCR Registration Application dated January 24, 2022. We have included a revised copy of the 2018 Annual Groundwater and Corrective Action Report including the attachments and it is included as Attachment 7. Furthermore, the corrected report has been added to our public internet site.

If you have any questions or would like additional information, please feel free to contact me at 512-578-3393 or 800-776-5272, ext. 3393.

Sincerely,

Rebecca D Jones

Rebecca Jones

Attachment 1

Replacement Pages

Texas Commission on Environmental Quality

Registration Application for Coal Combustion Residuals (CCR) Waste Management

I. General Information

1. Reason for Submittal

Type of Registration Application

☐ New ☐ Major Amendment ☐ Minor Amendment

☒ Notice of Deficiency (NOD) Response ☐ Transfer ☐ Name Change

☐ Other

2. Application Fees

☒ $150 Application Fee

Payment Method

☐ Check ☒ Online through ePay portal <www3.tceq.texas.gov/epay/>

If paid online, enter ePay Trace Number: 582EA000471145

3. Facility Information

Facility information must match regulated entity information on the Core Data Form.

Applicant: ☐ Owner ☐ Operator ☒ Owner/Operator

Facility TCEQ Solid Waste Registration No: 31575

Facility EPA ID: TXD083566547

Regulated Entity Reference No. (if issued): RN 100226844

Facility Name: Lower Colorado River Authority Fayette Power Project

Facility (Area Code) Telephone Number: (979) 249-3111

Facility physical street address (city, state, zip code, county): 6549 Power Plant Rd., La Grange, TX, 78945, Fayette County

Facility mailing address (city, state, zip code, county): PO Box 220, Austin, TX, 78767, Travis County

Latitude (Degrees, Minutes Seconds): 29°54’53.0712”N

Longitude (Degrees, Minutes Seconds): 96°45’12.726”W

4. Publicly Accessible Website

Provide the URL address of a publicly accessible website where the owner or operator of a CCR unit will post information.

http:// www.lcra.org/energy/electric-power/facilities/fayette-power-project/

5. Facility Landowner(s) Information

Facility landowner(s) name: Lower Colorado River Authority and City of Austin

Facility landowner mailing address: P.O. Box 220

City: Austin State: Texas Zip Code: 78767

(Area Code) Telephone Number: (512) 473-3200

Email Address (optional):

6. CCR Waste Management Unit(s)

☒ Landfill Unit(s) ☐ Surface Impoundment(s)

For each existing landfill, new landfill and lateral expansion, existing surface impoundment, and new surface impoundment and lateral expansion(s) provide information on type of waste, the registered unit(s) in which they are managed, and sampling and analytical methods.

Submit the following tables:

Table I.6. – CCR Waste Management Units;

Table I.6.A. – Waste Management Information;

Table I.6.B. – Waste Managed in Registered Units; and

Table I.6.C. – Sampling and Analytical Methods.

7. Description of Proposed Activities or Changes to Existing Facility

Provide a brief description of the proposed activities if application is for a new facility, or the proposed changes to an existing facility or registration conditions, if the application is for an amendment.

The LCRA Fayette Power Project (FPP) is a coal-fired power plant located east of La Grange in Fayette County, Texas. Coal Combustion Residuals (CCRs) generated at FPP are either sold for beneficial use or disposed of in the Combustion Byproducts Landfill (CBL). The existing CBL consists of Cell 1 and Sub-cell 2D. Cell 1 was constructed in 1988 and sub-cell 2 D in 2015; therefore, both active cells are considered existing landfill units under the U.S. Environmental Protection Agency's Coal Combustion Residuals (CCR) Rules as codified in Title 40 of the Code of Federal Regulations (CFR), Chapter 257, Subpart D. Upon completion the CBL will consist of 3 cells, however there are no immediate plans to expand the landfill beyond Cell 1 and Sub-cell 2D.

8. Primary Contact Information

Contact Name: Rebecca Jones, P.G. Title: Environmental Coordinator

Contact mailing address: P.O. Box 220
City: Austin County: Travis State: TX Zip Code: 78767
(Area Code) Telephone Number: 512-578-3393

Email Address (optional): Rebecca.Jones@lcra.org

9. Notice Publishing

Party responsible for publishing notice:
☒ Applicant ☐ Consultant ☐ Agent in Service

Contact Name: Teresa Angel Title: Manager, Plant Environmental Support

Contact mailing address: P.O. Box E
City: Bastrop County: Bastrop State: TX Zip Code: 78602
(Area Code) Telephone Number: 520-241-5035

10. Alternative Language Notice

Is an alternative language notice required for this application? For determination, refer to Alternative Language Checklist on the Public Notice Verification Form (TCEQ-20244-Waste-NORI).

☐ Yes ☒ No

There is no spanish language publication in Fayette County; therefore, an alternative language notice is not required.

11. Public Place Location of Application

Name of the Public Place: **Fayette Public Library**
Physical Address: **855 S Jefferson St**
City: **La Grange** County: **Fayette** State: **TX** Zip Code: **78945**
(Area code) Telephone Number: **(979) 968-3765**

12. Ownership Status of the Facility

☐ Corporation ☐ Limited Partnership

☐ Sole Proprietorship ☐ General Partnership ☒ Other (specify): River Authority

Does the Site Owner (Permittee/Registrant) own all the CCR units and all the facility property?

☒ Yes ☐ No

13. Property / Legal Description Information

Provide a legal description and supporting documents of the property where the management of CCR waste will occur; including a survey plat and a boundary metes and bounds description (30 TAC §352.231(g)).

Submit the following documents:

a. Property Legal Description
b. Property Metes and Bounds Description
c. Metes and Bounds Drawings
d. On-Site Easements Drawings

The legal description and supporting documents are included as Attachment 1.

14. Operator Information

Identify the entity who will conduct facility operations, if the owner and operator are not the same.

Operator Name: N/A

Operator mailing address:

City: State: Zip Code:

(Area Code) Telephone Number:

Email Address (optional):

15. Confidential Documents

Does the application contain confidential documents?

☐ Yes ☒ No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

16. Permits and Construction Approvals

Permit or Approval	Received	Pending	Not Applicable
Hazardous Waste Management Program under the Texas Solid Waste Disposal Act	☐	☐	☒
Underground Injection Control Program under the Texas Injection Well Act	☐	☒	☐
National Pollutant Discharge Elimination System Program under the Clean Water Act and Waste Discharge Program under Texas Water Code, Chapter 26 (WQ0002105000) and TPDES Industrial Stormwater Multi-Sector General Permit (TXR05M603)	☒	☐	☐

Prevention of Significant Deterioration Program under the Federal Clean Air Act (FCAA). Nonattainment Program under the FCAA PSD Permit (TX486M3) New Source Review (NSR) (51770)	☒	☐	☐
National Emission Standards for Hazardous Air Pollutants Preconstruction Approval under the FCAA	☐	☐	☒

17. Legal Authority

The owner and operator of the facility shall submit verification of their legal status with the application. This shall be a one-page certificate of incorporation issued by the secretary of state. The owner or operator shall list all persons having over a 20% ownership in the facility.

The Lower Colorado River Authority is a conservation and reclamation district created under and pursuant to Section 59, Article XVI, Texas Constitution with the authority and powers therein and in Chapter 8503, Special District Local Laws Code and other general laws. The City of Austin has a >20% ownership in the CBL.

18. TCEQ Core Data Form

The TCEQ requires that a Core Data Form (TCEQ-10400) be submitted on all incoming applications, unless a Regulated Entity and Customer Reference Number has been issued by the TCEQ and no core data information has changed. For more information regarding the Core Data Form, call (512) 239-5175 or visit the TCEQ Website.

19. Other Governmental Entities Information

Coastal Management Program

Is the facility within the Coastal Management Program boundary?

☐ Yes ☒ No

Local Government Jurisdiction (If Applicable)
Within City Limits of: N/A
Within Extraterritorial Jurisdiction of: N/A

Is the facility located in an area in which the governing body of the municipality or county has prohibited the storage, processing or disposal of municipal or industrial solid waste?

☐ Yes ☒ No If "Yes", provide a copy of the ordinance or order as an attachment.

20. Attachments

Does the application include the following?

General Maps	☒ Yes	☐ No
General Topographic Map	☒ Yes	☐ No
Facility Layout Map	☒ Yes	☐ No

Surrounding Features Map	☒ Yes	☐ No
Process Flow Diagram	☒ Yes	☐ No
Land Ownership Map	☒ Yes	☐ No
Land Ownership List	☒ Yes	☐ No
Pre-printed Mailing Labels	☒ Yes	☐ No

Maps and drawings shall be legible and easily readable by eye without magnification. Scales and paper size shall be chosen based on the type of map submitted, the land area covered, and the amount of detail to be shown. See instructions for details regarding maps and drawings to be submitted in application.

21. Verification of Compliance

Does the owner and operator verify that the design, construction, and operation of CCR landfill(s) and surface impoundment(s) meets the requirements of 30 TAC §352.231(f) (30 TAC §352.2; 40 CFR §257.52, and 40 CFR §§257.3-1 – 257.3-3).

☒ Yes ☐ No

II. Location Restrictions and Geology

See Instructions and Technical Guidance

22. Location Restrictions

Submit certifications and technical reports demonstrating compliance of CCR unit(s) with applicable location restrictions (30 TAC 352, Subchapter E) and comply with 30 TAC §352.231(d) and 30 TAC §352.4 for submission of engineering and geoscientific information.

A. **Placement above the uppermost aquifer** (30 TAC §352.601) (40 CFR §257.60). For those CCR units whose base is less than five feet above the upper limit of the uppermost aquifer, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.60(a) – (c).

B. **Wetlands** (30 TAC §352.611) (40 CFR §257.61). For CCR units located in wetlands, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.61(a) – (c).

C. **Fault areas** (30 TAC §352.621) (40 CFR §257.62). For CCR units located within 200 feet of the outermost damage zone of a fault, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.62(a) – (c).

D. **Seismic impact zones** (30 TAC §352.631) (40 CFR §257.63). For CCR units located in a seismic impact zone, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.63(a) – (c).

E. **Unstable areas** (30 TAC §352.641) (40 CFR §257.64). For CCR units located in unstable areas, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.64(a) – (d).

The location restrictions certification and technical report is submitted as Attachment 3.

23. Geology Summary Report

Submit a summary of the geologic conditions at the facility, including the relation of the geologic condition to each CCR unit. The summary must include enough information and data and include sources and references for the information. Include all groundwater monitoring data required by 40 CFR Part 257, Subpart D, (30 TAC §352.241, §352.601, §352.621, §352.631, and §352.641) and submitted in accordance with 30 TAC §352.4.

Note: Previously prepared documents may be submitted but must be supplemented or updated as necessary to provide the requested information (30 TAC §352.241(b)).

The Geology and Groundwater Monitoring System Report can be found as Attachment 4.

Groundwater monitoring data is included in Attachment 11.

III. Fugitive Dust Control Plan

24. Fugitive Dust Control Plan

A. Submit a copy of the CCR Fugitive Dust Control Plan (30 TAC §352.801) (40 CFR §257.80(b)), or the most recently amended plan. The initial plan or subsequent amended plan must be certified by a qualified Texas licensed professional engineer (Texas P.E.) that the plan meets the requirements of 30 TAC Chapter 352.

The CCR Fugitive Dust Control Plan is included as Attachment 5.

B. Submit the most recent Annual CCR Fugitive Dust Control Report (30 TAC §352.801) (40 CFR §257.80(c)) and include the report information.

The 2021 Annual CCR Fugitive Dust Control Report is included as Attachment 6.

IV. Landfill Criteria

See Instructions and Technical Guidance – No. 30 Coal Combustion Residuals Landfill

25. Landfill(s) for CCR Waste

Provide the following information below if there is a landfill; if there is more than one landfill, separate information is required for each landfill.

A. Landfill Characteristics

Describe the design, installation, construction, and operation of the landfill and submit a completed Table IV.A. – Landfill Characteristics.

Design and Installation
The CBL is registered with the Texas Commission on Environmental Quality (TCEQ) as an on-site nonhazardous industrial waste landfill (TCEQ Registration No. 31575) and an on-site waste management unit (Notice of Waste Registration No. MU013) at the FPP. The CBL currently receives Coal Combustion Residuals (CCR) generated during the operation and maintenance of three coal-fired units at FPP as described Tables I.6.A. and I.6.B.

The CBL consists of existing Cell 1 and Subcell 2D, and proposed Cells 2A, 2B, 2C and 3. The design of Cell 1 was reviewed and approved by TCEQ in a letter dated January 18, 1988, and Cell 1 was constructed in 1988. A clay perimeter berm was installed around the north, west, and east sides of Cell 1, and a clay cell separation berm was constructed along the south boundary of the cell. The floor of the cell was constructed at natural grade with minimal excavation. The upper 12 in. of the clay was excavated and recompacted to achieve a hydraulic conductivity of 1x10^{-7} centimeter/second (cm/sec) in accordance with TCEQ Technical Guidance 3 (12/19/83). The hydraulic conductivity of the underlying clay at a depth from approximately 0- 25 ft below grade was documented to be in the range of 1.3 x 10^{-7} to 1.8 x $10^{-9.}$ (Fayette Power Project, Combustion By-product Disposal Area Geotechnical Investigation, May 1992, Jones and Neuse, Inc.). In 1992, the north portion of Cell 1 was closed with a final cover system consisting of a 2-ft thick compacted clay layer (with hydraulic conductivity no greater than 1×10^{-7} cm/s) overlain by 1 ft of general fill and at least 1 ft of topsoil. In 2013 LCRA submitted a request to raise the maximum elevation of the CBL from approximately 430 ft msl to 470 ft msl. The request was approved by TCEQ by letter dated June 12, 2013. With this revision, the maximum elevation of CCRs placed in the landfill for final disposal will be 465.5 or 467 ft msl, depending on the thickness of the selected final cover, with a final elevation of 470 ft. msl.

By letter dated July 14, 2012, TCEQ approved the design and construction of Subcell 2D. Subcell 2D was constructed with a 3-ft compacted clay liner with a hydraulic conductivity less than 1 x 10^{-7} cm/sec, meeting the recommendations of TCEQ Technical Guidance No.3 (2015). Cell 1 and Subcell 2D are existing CCR landfill areas under 40 CFR §257.53. If the remainder of Cell 2 and Cell 3 are constructed, the remainder of Cell 2 and Cell 3 will be constructed with a liner system that meets the requirements of 40 CFR §257.70(b) and (d), which includes a leachate collection system and underlying geomembrane/compacted clay composite liner. See Attachment 7.

Operation

LCRA contracts with a third party for the marketing of CCRs for beneficial use and for a portion of CBL operation. Under the terms of the contract, LCRA oversees the contractor's activities. Currently, CCRs are being harvested from Cell 1 for sale in beneficial use markets and the volume of material in Cell 1 is being reduced. Subcell 2D is being used as a waste storage area for CCRs /product preparation area prior to sale for beneficial use. .

Since the CBL was constructed at grade and will reach a maximum height of 470 ft, waste is not deposited in conventional landfill trenches.

During active marketing of CCRs, the material is sprayed with water from Lake Fayette, and the unit runoff ponds to minimize dust in accordance with the CCR Fugitive Dust Control Plan. When the material is sprayed, it forms a thin crust, making the need for interim cover unnecessary. A minimal amount of water is used to prevent ponding, runoff, and ash saturation.

When waste is being placed for final disposal, the material will be graded to promote drainage (i.e., 2%) and interim waste grades no steeper than 3.5H:1V. Fly ash and synthetic gypsum will be spread in 12 in. lifts and compacted. All compaction will be completed the same day waste is placed and will be to at least 90% of the Standard Proctor maximum dry density. Results of compaction tests will be maintained on-site. For bottom ash, compaction will consist of tracking with a CAT D6 dozer, and no compaction testing will be required.

The third-party marketing contractor is responsible for implementing the procedures contained in the Fugitive Dust Control Plan (see Attachment 5) and the Run-on and Run-off Control Plan (see Attachment 8).

B. Liner Design

1. For existing landfills, provide attachments describing how the facility will comply with 30 TAC 352, Subchapter F (Design Criteria).

   Both Cell 1 and Subcell 2D are existing units and therefore the liner design criteria in 30 TAC 352, Subchapter F are not applicable.
   For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

2. For new landfills or lateral expansions of existing landfills, submit pages describing how the facility will comply with 30 TAC §352.261 and 30 TAC §352.701.

   For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

3. Complete Table IV.B. - Landfill Liner System and specify the type of liner used for the landfill.
4. Provide attachments describing the design, installation, and operation of the liner and leak detection system. The description must demonstrate that the liner and leak detection system will prevent discharge to the land, groundwater, and surface water. Submit a quality assurance project plan (QAPP) to ensure that each analysis is performed appropriately.

   For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

C. Leachate Collection and Removal

Submit design information and description of leachate collection and removal system in accordance with 30 TAC §352.701.

Complete Table IV.C. - Landfill Leachate Collection System

For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

D. Design of Liner and Leachate Collection and Removal System.

For a new landfill or lateral expansion of a CCR landfill, provide a qualified Texas P.E. certification and technical report that the design of the liner and the leachate collection and removal system meets the requirements of 30 TAC §352.711.

For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

E. Run-on and Run-off Controls

At time of application, attach pages describing how the facility will comply with the run-on and run-off system plan for an existing, new, or lateral expansion of a CCR landfill information. Provide a qualified Texas P.E. certification and technical report that the run-on and run-off control system plans meet the requirements of 30 TAC §352.811.

The 2021 Run-on and Run-off Control Plan is included as Attachment 8.

F. Inspection for Landfills

At time of application, attach pages describing how the facility will comply 30 TAC §352.841 and complete Table IV.D. – Inspection Schedule for Landfills. For existing CCR landfills, provide the most recent inspection report. All CCR landfills and any lateral expansions of a CCR landfill must be inspected for any structural weakness, malfunction, deterioration conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit, or any other conditions which may cause harm to human health and environment at a frequency specified in 40 CFR §257.84(a) and (b).

In accordance with 40 CFR 257.84 and 30 TAC 352.841, weekly and annual inspections of the CBL are required. Weekly inspections will be conducted at intervals not exceeding 7 days during the operational life of the unit. Post Closure Care inspections will be conducted quarterly in accordance with the Post Closure Care Plan and 40 CFR 257.104(d(i)

Weekly inspections are conducted to identify any actual or potential structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CBL. Weekly inspections are conducted by a qualified person who has attended the TCEQ Dam Safety Training Course and has been trained by the qualified professional engineer conducting the annual inspections. A copy of the weekly inspection form is retained in the facility's operating record.

The CBL is inspected once per calendar year by a qualified professional engineer in the state of Texas, who has attended the TCEQ Dam Safety Training Course. The annual inspection is conducted to verify that the design, construction, operation, and maintenance of the CBL is consistent with recognized and generally accepted good engineering standards. The inspection includes a review of available information regarding the status and condition of the CBL, including files available in the facility's operating record, and a visual inspection of the CBL to identify signs of distress or malfunction of the CBL. The professional engineer prepares a report following each annual inspection that addresses changes in geometry of the structure since the previous annual inspection, the approximate volume of waste contained in the CBL at the time of the inspection, any appearances of an actual or potential structural weakness of the CBL, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CBL, and any other change(s) which may affect the stability or operation of the CBL since the previous annual inspection. Following completion of the annual inspection, the completed annual report and checklist are placed and maintained in the facility's operating record and the CBL's publicly accessible website.

Consistent with 30 TAC §352.841(b), the LCRA will verbally notify the TCEQ within 24 hours and in writing within five (5) days if a deficiency is observed during a weekly or annual inspection that could result in harm to human health, the environment, or has resulted in a release. Additionally, the TCEQ will be notified in writing within 14 days of all other deficiencies following annual inspections that could have the potential to disrupt operation of the CBL. If a waste release or deficiency is found, the LCRA will prepare a written corrective action plan to remedy the release or deficiency as soon as feasible consistent with 40 CFR §257.84(b)(5). Notifications and correction action plans will be placed in the facility's operating record and on the LCRA's publicly accessible website. Any changes to the inspection frequencies will comply with recordkeeping and notification requirements.

The weekly inspection checklist and the 2021 Annual Inspection Report are provided in Attachment 9.

V. Surface Impoundment Criteria – Not Applicable

See Instructions and Technical Guidance – No. 31 Coal Combustion Residuals Surface Impoundment

26. Surface Impoundment(s) for CCR Waste

Provide the following information below if there is a surface impoundment; if there is more than one surface impoundment, separate information is required for each surface impoundment.

A. General Surface Impoundment(s) Characteristics

Provide information about the characteristics of the surface impoundment(s): incised, surface area (acres), storage volume (acres-feet), and depth (feet).

For all surface impoundment(s), include the following information:

1. Complete Table V.A. - Surface Impoundments Characteristics. List the surface impoundment(s) to be registered as a CCR unit(s), the wastes managed in each unit, and the rated capacity or size of each unit.
2. Describe the surface impoundment(s) and provide a plan view drawing with cross-sections, if available.
3. Specify the minimum freeboard to be maintained and the basis of the design to prevent overtopping resulting from normal or abnormal operation; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms, and other equipment; and human error. Show that adequate freeboard will be available to prevent overtopping from a 100-year, 24-hour storm.
4. Waste Flow
   Describe the means that will be used to immediately shut off the flow of waste to the impoundment in the event of liner failure or to prevent overtopping.
5. Dike Construction ☐ Yes ☐ No

   If Yes, submit the dike certification (located at the end of the application).

   The structural integrity of the dike system must be certified by a qualified Texas P.E. before the registration is issued. If the impoundment is not being used, the dike system must be certified before it can be put into use. The certification must be sealed by a qualified Texas P.E., along with the engineering firm's name and registration number (30 TAC §352.4).

   A report shall accompany the dike certification which summarizes the activities, calculations, and laboratory and field analyses performed in support of the dike certification. Describe the design basis used in construction of the dikes. A QAPP should be included in the report to ensure that each analysis is performed appropriately and include:

   (1) Slope Stability Analysis

   (2) Hydrostatic and Hydrodynamic Analysis

(3) Storm Loading

(4) Rapid Drawdown

Earthen dikes should have a protective cover to minimize wind and water erosion and to preserve the structural integrity of the dike. Describe the protective cover used and describe its installation and maintenance procedures.

B. Liner Design

For surface impoundment(s), provide information about how the facility will comply with 30 TAC §352.711 for existing CCR surface impoundments. For new and lateral expansion of CCR surface impoundments provide information on how the facility will comply with 30 TAC §352.261, and 30 TAC §352.721, see Instructions and Technical Guidance No. 31 Coal Combustion Residuals Surface Impoundment. The qualified Texas P.E. must certify that the design of the liner complies with the requirements of 30 TAC Chapter 352 and 40 CFR Part 257, Subpart D, where required.

Is the CCR surface impoundment unlined? ☐ Yes ☐ No

If “Yes”, the CCR unit is subject to the closure requirements under 30 TAC Chapter 352 and 40 CFR §257.101(a) to retrofit or close. A notification must be prepared stating that an assessment of corrective measures has been initiated.

1. Complete Table V.B. - Surface Impoundment Liner System for each surface impoundment to be registered.
2. Describe the design, installation and operation of liner and leak detection components. The description must demonstrate that the liner and leak detection system will prevent discharge to the land and surface water. Submit a QAPP report to ensure that each analysis is performed appropriately.
3. For new or laterally expansions of existing surface impoundments, provide a subsurface soil investigation report that must include:
    a. A description of all borings drilled, at the unit location, to test soils and characterize groundwater;
    b. A unit map drawn to scale showing the surveyed locations and elevations of the borings, including location of permanent identification markers ((30 TAC §352.731) and (40 CFR §257.73(a)(1));
    c. Cross-sections prepared from the borings depicting the generalized strata at the unit;
    d. Boring logs, including a description of materials encountered, and any discontinuities such as fractures, fissures, slickensides, lenses or seams;
    e. A description of the geotechnical data and the geotechnical properties of the subsurface soil materials, including the suitability of the soils and strata for the intended uses; and
    f. A demonstration that all geotechnical tests were performed in accordance with industry practices and recognized procedures.

C. Hazard Potential Classification

Provide the current hazard potential classification assessment and associated documentation, as required by 30 TAC §352.731 or §352.741 and 40 CFR §257.73(a)(2) or §257.74(a)(2). The qualified Texas P.E. must certify that the initial hazard potential classification and any subsequent periodic classification was conducted in accordance with the requirements of 30 TAC Chapter 352, where required.

Hazard Potential Classification:

D. Emergency Action Plan for High or Significantly High Hazard Potential

Provide the current Emergency Action Plan that has been certified by a qualified Texas P.E. and includes the following requirements from 30 TAC 352, Subchapter F and 40 CFR §257.73(a)(3)(i)(A) - (E) or 40 CFR §257.74 (a)(3)(i)(A) - (E). The qualified Texas P.E. must certify that the written Emergency Action Plan and any subsequent amendment of the plan complies with the requirements of 30 TAC 352, Subchapter F, where required.

Complete Table V.J. - Inspection of Surface Impoundments

E. Inflow Design Flood Control System Plan

Describe how the surface impoundment(s) system will manage stormwater run-on away from the surface impoundment(s) (30 TAC §352.821 and 40 CFR §257.82(a) and (c)). Stormwater run-on must be diverted away from a surface impoundment, based on the hazard potential. Where dikes are used to divert run-on, they must be protected from erosion. Include all analyses used to calculate run-on volumes. Provide the inflow design flood control system plan. Provide qualified Texas P.E. certification that the initial and periodic inflow design flood control system plans meet the requirements of 30 TAC §352.821, where required.

F. History of Construction for Existing CCR Surface Impoundment(s), or the Design and Construction Plans for New and Lateral Expansions

Provide information on the history of construction for each existing CCR surface impoundment (30 TAC §352.731 and 40 CFR §257.73(c)) or the design and construction plans for new and lateral expansions of each CCR surface impoundment (30 TAC §352.741) and (40 CFR §257.74(c)).

G. Structural Stability Assessment

Provide the most recent structural stability assessment of the surface impoundments. Include the combined capacity of all surface impoundment spillways with calculations; the peak discharge the unit must meet for all combined spillways; probable maximum flood-high hazard, 1,000-yr-significant high hazard, 100-yr-low hazard; identify if there were any structural stability deficiencies in last assessment; identify how these deficiencies were managed and corrected; and qualified Texas P.E. certification. The structural stability assessment must include all information required in 30 TAC §352.731 for existing surface impoundments or 30 TAC §352.741 for new or laterally expanding surface impoundments.

H. Safety Factor Assessment

The current safety factor assessment must be submitted with the application. It must include documentation that demonstrates whether the calculated factors of safety for each CCR surface impoundment achieve the minimum safety factors specified in 30 TAC 352, Subchapter F and 40 CFR §257.73(e)(1)(i) - (iv) and 40 CFR §257.74(e)(1)(i) - (iv) for the critical cross-section of the embankment. The critical cross-section is the cross-section anticipated to be the most susceptible to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations and certified by a qualified Texas P.E.

VI. Groundwater Monitoring and Corrective Action (30 TAC 352, Subchapter H)

See Instructions and Technical Guidance – No. 32 Coal Combustion Residuals Groundwater Monitoring and Corrective Action

27. Groundwater Monitoring System

A. Complete Table VI.A. - Unit Groundwater Detection Monitoring System.

B. Provide a map showing location of wells, groundwater elevations, and groundwater flow direction.

C. Provide attachments describing how the facility will comply with the requirements in 30 TAC §352.911 and provide a certification by a qualified Texas P.E or qualified Texas P.G. that the groundwater monitoring system design and construction meet the requirements of 30 TAC Chapter 352.

D. Provide a figure showing the geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

E. For a multiunit groundwater monitoring system, demonstrate that the groundwater monitoring system will be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system for each CCR unit by providing at minimum the following information: Not Applicable

1. Number, spacing, and orientation of each CCR unit;
2. Hydrogeologic setting; and
3. Site history.

F. Has there been any sampling concentrations of one or more constituents listed in Appendix IV detected at statistically significant levels above the groundwater protection standard (GWPS)? ☐ Yes ☒ No

G. Provide information on how monitoring wells have been constructed and cased in a manner that maintains the integrity of the monitoring well borehole and to prevent contamination of samples and the groundwater.

The Geology and Groundwater Monitoring System Report can be found as Attachment 4.

28. Groundwater Monitoring Sampling and Analysis Program

Provide a sampling and analysis plan that includes procedures and techniques; sampling and analytical methods that are appropriate for groundwater sampling; and that address the requirements of 30 TAC §352.931 and 40 CFR §257.93. Provide a P.E or P.G. certification that describes the statistical method selected to evaluate the groundwater monitoring data and certifies that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. Refer to TG-32 for information and guidance.

The CCR Groundwater Sampling and Analysis Plan is included as Attachment 10.

29. CCR Unit(s) in a Detection Monitoring Program

Does the facility have CCR unit(s) in a Detection Monitoring Program?

☒ Yes ☐ No

If "Yes", Submit the following information:

A. Submit Table VI.C. – Facility CCR Units Under Detection Monitoring.

B. Provide a Background Evaluation Report.

C. Provide a report with the results of semiannual monitoring events.

1. Has a statistically significant increase (SSI) been detected for one or more of the constituents listed in Appendix III at any monitoring well?

   ☐ Yes ☒ No

2. Has a notification to the executive director been sent within 14 days?

   ☐ Yes ☒ No

3. Date assessment monitoring program will start: **N/A**
4. Do you plan to provide an alternative source demonstration (ASD)?

   ☐ Yes ☒ No

Groundwater monitoring data is included in Attachment 11.

30. CCR Unit(s) in an Assessment Monitoring Program – Not Applicable

Does the facility have CCR unit(s) in an Assessment Monitoring Program?

☐ Yes ☒ No
If "Yes", Submit information related for units.

A. Complete Table VI.D. – CCR Units Under Assessment Monitoring.

B. Provide, for each well in assessment monitoring status, the recorded concentrations lab sheets and results in a tabulated form.

C. Have the concentrations of all constituents listed in Appendices III and IV been at or below background values, using the statistical procedures in 30 TAC §352.931 and 40 CFR §257.93(g), for two consecutive sampling events for the CCR unit(s)? ☐ Yes ☐ No

If answer to above is yes, detection monitoring may resume. The owner or operator must prepare a notification stating that detection monitoring is resuming for the CCR unit and obtain written approval from the executive director.

D. Are there any concentrations of any constituent in Appendices III and IV above background values? ☐ Yes ☐ No

1. Has a notification to the executive director been sent within 14 days?

   ☐ Yes ☐ No

E. Date assessment of corrective measures will be initiated (must be within **90 days** of finding a statistically significant level above the GWPS) for the CCR unit(s):

F. Will you provide an ASD (see TG-32 for an acceptable submittal)? ☐ Yes ☐ No

G. Date assessment of corrective measures will be initiated if ASD is not accepted?

H. Complete Table VI.D-2. - Groundwater Detection Monitoring Parameters

Note: Refer to TG-32 regarding establishing a GWPS for each constituent in Appendix IV detected in the groundwater and attach as table.

I. Have you completed the assessment of corrective measures? ☐ Yes ☐ No
If "Yes", date assessment of corrective measures was completed:
If "No", date assessment of corrective measures will be completed:
Expected date of submittal of amendment (see note below):
Provide completed assessment of corrected measures materials.

Note: Within **30 days** of completing the assessment of corrective measures, and before remedy implementation, the owner or operator shall submit an application for amendment to the registration. In some circumstances, the assessment of corrective measures and selected remedy may be approved as part of the initial application for the CCR unit registration.

J. Have you selected a remedy? ☐ Yes ☐ No

Provide public meeting documentation under 30 TAC §352.961 and a report under 30 TAC §352.971 and 40 CFR §257.97.

VII. Closure and Post-Closure Care

See Instructions and Technical Guidance

Submit a full closure plan and post-closure plan and all information describing how the owner or operator will comply with 30 TAC 352, Subchapter J and 40 CFR §§257.100 - 257.104. The owner of property on which an existing disposal facility is located, following the closure of a unit, must also submit documentation that a notation has been placed in the deed to the facility that will in perpetuity notify any potential purchasers of the property that the land has been used to manage CCR wastes and its use is restricted (30 TAC §352.1221 and 40 CFR §257.102(i)). For CCR units, closed after October 19, 2015, that were closed before submission of the application, the applicant should submit documentation to show that notices required under 30 TAC 352, Subchapter K and 40 CFR §257.105 or §257.106 have been filed.

31. Closure Plan

This section applies to the owners and operators of all CCR units required to be registered. The applicant must close the facility in a manner that minimizes need for further maintenance and controls, or eliminates, to the extent necessary to protect human health and the environment, the post-closure release of CCR waste, chemical constituents of concern, leachate, contaminated rainfall, or waste decomposition products to the groundwater, surface waters, or to the atmosphere.

The type of unit to be closed can determine the level of detail sufficient for a closure plan. CCR units which have been certified closed after October 19, 2015, must provide documentation to demonstrate compliance with state and federal regulations.

For each unit to be registered, complete Table VII.A.1. - Unit Closure and list the CCR Unit components to be decontaminated, possible methods of decontamination, and possible methods of disposal of wastes and waste residues generated during unit closure. All ancillary components must be decontaminated, and the generated waste disposed of appropriately.

Information about CCR units closed or to be closed under alternative closure requirements must be provided in Table VII.A.2. - CCR Units Under Alternative Closure Notification.

Guidance on design of a closure cap and final cover for non-hazardous industrial solid wastes landfills is provided in EPA publication 530-SW-85-014, TCEQ Technical Guidance No. 3 and TCEQ publication, RG-534, "Guidance for Liner Construction and Testing for a Municipal Solid Waste Landfill".

The Closure and Post Closure Care plan are included as Attachment 12.

32. Post-Closure Care Plan

Provide a post-closure care plan that complies with the requirements of 30 TAC §352.1241. Post-closure care of each CCR unit must continue for at least 30 years after the date of completing closure of the unit and must consist of monitoring and reporting of the groundwater monitoring systems, in addition to the maintenance and monitoring of CCR unit. Continuation of certain security requirements may be necessary after the date of closure. Post-closure use of property on or in which waste remains after closure must never be allowed to disrupt the integrity of the containment system. In addition, submit the following information:

- The name, address, and phone number of the person or office to contact about the CCR unit during the post-closure period; and
- A discussion of the future use of the land associated with each unit.

Landfills and surface impoundments which have been certified closed after October 19, 2015, must be included in post-closure care plans, unless they have been determined to have been closed by waste removal equivalent to the closure standards in 30 TAC §352.1221 and 40 CFR §257.102 or 30 TAC §352.1231 and 40 CFR §257.103. If such a demonstration has been made pursuant to 40 CFR §257.102 or §257.103, but an equivalency determination has not been made, please submit a copy of the demonstration documentation. If an equivalency determination has been made, applicant should submit a copy of this determination.

The Closure and Port Closure Care plan are included as Attachment 12.

VIII. Financial Assurance

33. Post-Closure Care Cost Estimate

Financial assurance for post-closure care (30 TAC §352.1101) applies to owners or operators of all CCR units, except CCR units from which the owner or operator intends to remove wastes and perform clean closure. Provide a written cost estimate in current dollars of the total cost of the 30-year (or longer, if applicable under 30 TAC §352.1101(d)) post-closure care period to perform post-closure care requirements as prescribed in 30 TAC §352.1241. The cost estimate must be based on the costs of hiring a third party to conduct post-closure care maintenance.

Complete Table VIII.A.1 – Post-Closure Cost Summary for Existing Registered Units

Complete Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units

The Post Closure Care Cost Estimates are included as Attachment 12. The estimate is in 2021 dollars. In accordance with 30 TAC 37.131, the estimate will be adjusted for inflation each year as long as the landfill is operating. Once the Landfill moves to post closure care, the annual adjustment is not required by TCEQ. LCRA intends to utilize the Local Government Financial Test in accordance with 30 TAC 352.111(5). Therefore, the 2021 cost estimate will be adjusted in accordance with TCEQ's published inflation factors within 180 days of the close of LCRA's fiscal year (June) using TCEQ's published inflation factors. This adjustment coincides with the renewal of the Local Government Financial Test.

34. Financial Assurance Mechanism

The financial assurance for post-closure care is required in accordance with 30 TAC §352.1101. The applicant shall demonstrate the financial assurance within 90 days after approval of the registration with a financial mechanism acceptable to TCEQ in compliance with 30 TAC §352.1101(c) and 30 TAC §37, Subchapters A through D, except as indicated in 30 TAC §352.1111, in an amount no less than the amount specified in the approved Post-Closure Care Cost Summary. Provide a description of the proposed financial assurance mechanism.

LCRA intends to use the Local Government Financial Test in accordance with 30 TAC 352.111(5) and 30 TAC 37.271 to satisfy the provisions of 30 TAC 352.1101(c). The signed documents will be submitted to the Texas Commission on Environmental Quality (TCEQ) within 90 days after approval of the registration.

Complete Table VIII.B. - Post-Closure Period, for the authorized post-closure period, to meet the requirements of 30 TAC §352.1241(a) through (c).

Signature Page

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Applicant Signature: ______________________________ Date: _____________

Name and Official Title (type or print): _____________________________________

Owner or Operator Signature: _______________________ Date: _____________

Name and Official Title (type or print): _____________________________________

To be completed by the owner or operator if the application is signed by an authorized representative for the operator

I, ________________________ hereby designate ____________________________
(operator) (authorized representative)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a CCR waste management registration. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any registration which might be issued based upon this application.

____
Printed or Typed Name of Applicant or Principal Executive Officer

____
Signature

(Note: Application Must Bear Signature & Seal of Notary Public)

Subscribed and sworn to before me by the said _______________________ on this

___________________ day of ________________, _______.

My commission expires on the ___________ day of ______________, _______

(Seal) Notary Public in and for ____________________ County, Texas

Registration Application for Coal Combustion Residuals Waste Management

(See instructions for P.E/P.G. seal requirements.)

Attachments and Tables	**Attachment No.**
General Information	1
Attachments	2
Technical Report and Certification	N/A
Location Restrictions Certifications	3
Placement above the uppermost aquifer	3
Wetlands	3
Fault Areas	3
Seismic impact zones	3
Unstable areas	3
Geology Summary	4
CCR Fugitive Dust Control Plan	5
Annual CCR Fugitive Dust Control Report	6
Landfill Design and Operating Criteria	7
Landfill Characteristics	7
Liner Design	7
Leachate Collection and Removal	7
Run-on and Run-off Controls	8
Inspection for Landfills	9
Surface Impoundment Design and Operating Criteria	N/A
General Surface Impoundment Characteristics	N/A
Liner Design	N/A
Hazard Potential Classification	N/A
Emergency Action Plan	N/A
Inflow Design Flood Control System Plan	N/A
Construction History/Design Plans	N/A
Structural Stability Assessment	N/A
Safety Factor Assessment	N/A
Groundwater Monitoring and Corrective Action	4
Groundwater Monitoring System	4
Groundwater Monitoring Sampling and Analysis Program	10
Detection Monitoring Program	11
Assessment Monitoring Program	N/A
Assessment of Corrective Measures	N/A
Remedy Report	N/A
Closure and Post-Closure Care	12
Closure Plan	12
Post-Closure Care	12
Financial Assurance	N/A

Tables

Tables	Submitted	Not Applicable
Table I.6. - CCR Waste Management Units	☒	☐
Table I.6.A. - Waste Management Information	☒	☐
Table I.6.B. - Wastes Managed in Registered Units	☒	☐
Table I.6.C. - Sampling and Analytical Methods	☒	☐
Table IV.A. - Landfill Characteristics	☒	☐
Table IV.B. - Landfill Liner System	☒	☐
Table IV.C. - Landfill Leachate Collection System	☒	☐
Table IV.D. - Inspection Schedule of Landfills	☒	☐
Table V.A. - Surface Impoundments Characteristics	☐	☒
Table V.B. - Surface Impoundment Liner System	☐	☒
Table V.J. - Inspection of Surface Impoundments	☐	☒
Table VI.A. - Unit Groundwater Detection Monitoring System	☒	☐
Table VI.C. - CCR Units Under Detection Monitoring	☒	☐
Table VI.D. - CCR Units Under Assessment Monitoring	☐	☒
Table VI.D-2. - Groundwater Detection Monitoring Parameters	☒	☐
Table VII.A.1. - Unit Closure	☒	☐
Table VII.A.2. - CCR Units Under Alternative Closure Notification	☐	☒
Table VIII.A.1. - Post-Closure Cost Summary for Existing Registered Units	☒	☐
Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units	☒	☐
Table VIII.B. - Post-Closure Period	☒	☐
Engineering Certification(s) - Dike Construction	☐	☒

Additional Attachments as Applicable - Select all those apply and add as necessary

☒ TCEQ Core Data Form(s)
☐ Signatory Authority Delegation
☒ Fee Payment Receipt
☐ Confidential Documents
☐ Certificate of Fact (Certificate of Incorporation)
☐ Assumed Name Certificate

Table I.6. – CCR Waste Management Units

CCR Unit No.[1]	Unit Name	N.O.R. No.[1]	Unit Description[3]	Capacity	Unit Status[2]
CCR-1	Combustion Byproduct Landfill (CBL)	013	Cells 1 and 2D	12,4000,000 Cu yds	Active
CCR-1	Combustion Byproduct Landfill (CBL)	013	Cells 2A, 2B, 2C and 3		Proposed[4]

1 Registered Unit No. and N.O.R. No. cannot be reassigned to new units or used more than once.
2 Unit Status options: Active, Closed, Inactive (built but not managing waste), Proposed (not yet built), Never Built, Transferred, Post-Closure.
3 If a unit has been transferred, the applicant should indicate which facility/permit it has been transferred to in the Unit Description column.
4 No schedule for development at the time of application submittal but all future cells are developed within the deed recorded footprint of unit CCR-101/NOR 013.

Table I.6.A. – Waste Management Information

Waste No.[1]	Waste Type(s)	Source	Volume (tons/year)[2]
1	Fly Ash Unit 1 and 2	Generated from coal combustion process at FPP	6,728
2	Fly Ash Unit 3	Generated from coal combustion process at FPP	2,849
3	Bottom Ash Unit 1 and 2	Generated from coal combustion process at FPP	36,993
4	Bottom Ash Unit 3	Generated from coal combustion process at FPP	15,751
5	Synthetic Gypsum	Generated from coal combustion process at FPP	28,449
6	Refractory, bowl mill rejects, waste sand filter media, waste charcoal filter media, waste resin beads, ash bag house filters, pyrite and coal reject generated from maintenance operations	Generated from coal combustion process at FPP	737
7	Activated carbon waste	Generated from coal combustion process at FPP	0
8	ACI Pipe cleaning waste	Generated from coal combustion process at FPP	0

1 Assign waste number sequentially. Do not remove waste number wastes which are no longer generated.

2 Disposal Rates based on 4-year average of actual deposition rates independent of facility generation rates.

Table I.6.B. – Wastes Managed in Registered Units

Waste No.[1]	Waste	TCEQ Sequence Number	TCEQ Form Code	TCEQ Classification Code
1	Fly Ash Unit 1 & 2	5014	304	2
2	Fly Ash Unit 3	5015	304	2
3	Bottom Ash Unit 1 & 2	5016	304	2
4	Bottom Ash Unit 3	5017	304	2
5	Synthetic Gypsum	5018	392	2
6	Refractory, bowl mill rejects, waste sand filter media, waste charcoal filter media, waste resin beads, ash bag house filters, pyrite and coal reject generated from maintenance operations	5118	319	2
7	Activated carbon waste	5216	319	2
8	ACI Pipe cleaning waste	5224	319	2

1 from Table I.6.A., first column

Table I.6.C – Sampling and Analytical Methods

Waste No.[1]	Sampling Location	Sampling Method	Frequency	Parameter	Test Method	Desired Accuracy Level
1	Fly Ash Silo [2 and 3]	SW846, representative grab samples	Waste will be sampled when there is a change in the process	If necessary due to a change in process: process knowledge and TCLP HG, TCLP metals	If necessary due to a change in process: SW7470A and SW6010B	LOD/LOQ[4]
2	Fly Ash Silo [2 and 3]					HG 0.00007/ 0.0002 mg/L
3	Bottom Ash Bunker[2 and 3]					AS 0.2/0.5 mg/L
4	Bottom Ash Bunker[2 and 3]					BA 0.04/0.1 mg/L
5	Synthetic Gypsum Dome[2 and 3]					CD 0.03/0.08 mg/L
6	Boiler and associated equipment for coal processing [2 and 3]					CR 0.04/0.1 mg/L
7	Activated Carbon Injection System [2]					PB 0.2/0.5 mg/L
8	Activated Carbon Injection System [2]					SE 0.4/1.0 mg/L
						AG 0.04/0.1 mg/L

1 from Table I.6.A., first column

2 All waste has been classified in accordance with 30 TAC 335, Subchapter R, and TCEQ RG-22 Guidelines for the Classification and Coding of Industrial and Hazardous Waste. Prior testing and/or process knowledge of the waste streams eliminates the need for further testing. In accordance with TCEQ waste classification regulations, waste classifications will only be revisited when there is a change in the process which necessitates the need to revisit the classification. Waste is only sampled and reclassified when there is a process change.

3 Waste classification has been audited and approved by TCEQ.

4 LOD Limit of Detection; LOQ Limit of Quantification

Table IV.A. – Landfills Characteristics

Registered Unit No.	Landfill	N.O.R. No.	Waste Nos.[1]	Rated Capacity	Dimensions[2]	Distance from lowest liner to groundwater	Action Leakage Rate (if required)	Unit will manage CCR Waste and non-CCR Waste (state all that apply)
CCR-1	Combustion Byproducts Landfill	013	1-8	12,400,000 cu/yds	123 acres Length 2,829 ft Width 1,932 ft Depth 360 ft MSL Max elevation 470 ft MSL[3]	Greater than 5 ft[4]	NA	Waste 1-8 listed in Table I.6.A and I.6.B

1 From Table I.6.A., first column
2 Dimensions should be provided as average length, width, and depth, also include the surface acreage for the unit.
3 Elevation approved by TCEQ by Letter dated June 12, 2013
4 Cell 1 and Subcell 2D are existing cells 40 CFR 257.60 is not applicable. Cell 2 (A-C) and Cell 3 will be sited in accordance with 40 CFR 257.60.

Table IV.B. – Landfill Liner System

Registered Unit No.*	Landfill	Geomembrane Liner Material	Geomembrane Liner Permeability (cm/sec)	Geomembrane Liner Thickness	Soil Liner Material	Soil Liner Permeability (cm/sec)	Soil Liner Thickness
CCR-1	Cell 1[1]	NA	NA	NA	Compacted Clay	$<1 \times 10^{-7}$ cm/sec	12 inches of recompacted clay over >3 ft of in situ clay
	Cell 2D[2]	NA	NA	NA	Compacted Clay	$<1 \times 10^{-7}$ cm/sec	3 ft of recompacted clay plus 2 ft of a protective soil cover
	Cell 2(A-C)[3]	Textured high density polyethylene (HDPE)	1×10^{-13} cm/s	60 mil	Compacted Soil Liner	$<1 \times 10^{-7}$ cm/sec	2 ft
	Cell 3[3]	Textured HDPE	1×10^{-13} cm/s	60 mil	Compacted Soil Liner	$<1 \times 10^{-7}$ cm/sec	2 ft

* This number should match the Registration Unit No. given on Table IV.A.

[1] Existing landfill cell constructed in 1988. Design approved by TCEQ in a letter dated January 18, 1988 in accordance with TCEQ Technical Guidance Document #3- Landfills.

[2] Existing landfill cell constructed in 2014. Design approved by TCEQ in a letter dated June 14, 2012 in accordance with TCEQ Technical Guidance Document #3- Landfills.

[3] Construction of Cells 2 A-C and Cell 3 will be in accordance with 30 TAC 352 and 40 CFR 257 as described in the Composite Liner Design and Operating Criteria Report (Attachment 7). No schedule for development of these cells at the time of application submittal.

Table IV.C. – Landfill Leachate Collection System

Registered Unit No.	Landfill Name	Drainage Media	Collection Pipes (including risers)	Filter Fabric	Geofabric	Sump Material
CCR-1	Cell 1[1]	NA	NA	NA	NA	NA
CCR-1	Cell 2D[2]	NA	NA	NA	NA	NA
CCR-1	Cell 2(A-C)[3]	NA (no granular drainage layer)	6-inch diameter standard dimension ratio (SDR) high density polyethylene (HDPE) pipe	8-oz/yd2 nonwoven geotextiles around chimney drain gravel and associated HDPE pipe	Double-sided (geotextile-geonet-geotextile) geocomposite drainage layer	NA (leachate gravity drains to a pond)
CCR-1	Cell 3[3]	NA (no granular drainage layer)	6-inch diameter standard dimension ratio (SDR) high density polyethylene (HDPE) pipe	8-oz/yd2 nonwoven geotextiles around chimney drain gravel and associated HDPE pipe	Double-sided (geotextile-geonet-geotextile) geocomposite drainage layer	NA (leachate gravity drains to a pond)

1 Existing landfill cell constructed in 1988. Design approved by TCEQ in a letter dated January 18, 1988 in accordance with TCEQ Technical Guidance Document #3- Landfills.

2 Existing landfill cell constructed in 2014. Design approved by TCEQ in a letter dated June 14, 2012 in accordance with TCEQ Technical Guidance Document #3- Landfills.

3 Construction of Cells 2 A-C and Cell 3 will be in accordance with 30 TAC 352 and 40 CFR 257 as described in the Composite Liner Design and Operating Criteria Report included (Attachment 7). No schedule for development of these cells at the time of application submittal.

Table IV.D. – Inspection Schedule of Landfills

Facility Unit(s)	Basic Elements	Possible Error, Malfunction, or Deterioration	Frequency of Inspection
CCR-1	General	Inspect for signage in need of repair; groundwater monitoring well damage; haul roads in need of repair; evidence of spillage of CCR on haul road	Weekly(at interval not exceeding 7 days)/annual
CCR-1	Landfill Top Cap	Inspect for poor grass cover; trees or bushes; animal burrows or damage; standing water/ponding; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Landfill Northern Slope	Inspect for poor grass cover; trees or bushes; animal burrows or damage; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sloughing; slides; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Landfill Eastern Slope	Inspect for poor grass cover; trees or bushes; animal burrows or damage; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sloughing; slides; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Landfill Western Slope	Inspect for poor grass cover; trees or bushes; animal burrows or damage; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sloughing; slides; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Annual Volume Approximation	Inspect for changes to geometry, structure, and volume	Annual
CCR-1	Document Review	Review weekly inspection reports	Annual

Table V.A. – Surface Impoundment Characteristics

Registered Unit No.	Surface Impoundment Name	N.O.R. No.	Waste Nos.[1]	Rated Capacity	Dimensions[2]	Distance from lowest liner to groundwater	Action Leakage Rate (if required)	Unit will manage CCR Waste and non-CCR Waste (state all that apply)
N/A								

1 From Table I.6.A., first column
2 Dimensions should be provided as average length, width and depth, also include the surface acreage for the unit.

Table V.B. – Surface Impoundment Liner System

Registered Unit No.*	Surface Impoundment Name	Geomembrane Liner Material	Geomembrane Liner Permeability (cm/sec)	Geomembrane Liner Thickness	Soil Liner Material	Soil Liner Permeability (cm/sec)	Soil Liner Thickness
N/A							

* This number should match the Registration Unit No. given on Table V.A.

Table V.J. – Inspection Schedule of Surface Impoundments

Facility Unit(s) and Basic Elements	Possible Error, Malfunction, or Deterioration	Frequency of Inspection
N/A		

Table VI.A. – Unit Groundwater Detection Monitoring Systems

Waste Management Unit/Area Name[1]	**Coal Combustion Byproduct Landfill (CBL)**					
Well Number(s):	340I	301I	302I	306I	308I	341I
Hydrogeologic Unit Monitored	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand
Type (e.g., point of compliance, background, observation, etc.)[2]	NA	NA	NA	NA	NA	NA
Up or Down Gradient	Up	Down	Down	Down	Down	Down
Casing Diameter and Material	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC
Screen Diameter and Material	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC
Screen Slot Size (in.)	0.010-inch	0.010-inch	0.010-inch	0.010-inch	0.010-inch	0.010-inch
Top of Casing Elevation (Ft, Mean Sea Level *[MSL]*)	376.98	372.11	358.99	339.96	368.67	366.65
Grade or Surface Elevation (Ft, MSL)	374.69	369.75	355.99	337.93	364.93	364.03
Well Depth (Ft, Below Grade Surface *[BGS]*)	37	51	24	12.5	32	43
Well Depth (Ft, Below Top of Casing *[BTOC]*)	39.3	53.4	27	14.5	35.7	45.6
Screen Interval: From (Ft,BGS) to (Ft,BGS)	22-37	41-51	14-24	7.5-12.5	22-32	33-43
Screen Interval: From (Ft, BTOC) to (Ft, BTOC)	24.3-39.3	43.4-53.4	17-27	9.53-14.53	25.7-35.7	35.6-45.6

1 From Tables in Section I.; *MSL*: Mean Sea Level; *BGS*: Below Grade Surface; *BTOC*: Below Top of Casing
2 Terms are not defined or used in 40 CFR 257, 30 TAC 352, or TCEQ Technical Guidance Document #32

Table VI.C. – CCR Units Under Detection Monitoring

N.O.R. Unit No.	Unit Description~~[1,2]~~	Well(s)	Constituent(s)	Date of SSI Determination	Date of Assessment Monitoring Notification[3]
013	Combustion Byproducts Landfill [4]	340I, 301I, 302I, 306I, 308I, 341I	Boron, Calcium, Chloride, Fluoride, pH, Sulfate, Total Dissolved Solids (TDS)	NA	NA

~~[1] Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.~~

~~[2] Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.~~

[3] Enter month, day, and year.

[4] CBL is under detection monitoring and has not requested an alternate closure determination in accordance with 40 CFR 257.103.

Table VI.D. – CCR Units Under Assessment Monitoring

N.O.R. Unit No.	Unit Description[1,2]	Well(s)	Constituent(s)	Date of SSI Determination	Date of Assessment Monitoring Notification[3]
N/A					

1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.

2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.

3 Enter month, day, and year

Table VI.D-2. – Groundwater Detection Monitoring Parameters

Parameter	Sampling Frequency	Analytical Method	Practical Quantification Limit (units)[3]	Concentration Limit[1]
Boron	Semi-annual	SW3010A, Metals Prep SW 6010B ICP-AES	0.0500 mg/l	See Note 2
Calcium	Semi-annual	SW3010A, Metals Prep SW 6010B ICP-AES	0.200 mg/l	See Note 2
Chloride	Semi-annual	E300.0 Anions	1 mg/l	See Note 2
Fluoride	Semi-annual	E300.0 Anions	0.0100 mg/l	See Note 2
pH	Semi-annual	Field pH SM 4500H +B TCEQ Vol.1	NA	See Note 2
Sulfate	Semi-annual	E300.0 Anions	1 mg/l	See Note 2
Total Dissolved Solids	Semi-annual	SM 2540C	25.0 mg/l	See Note 2

~~1 The concentration limit is the basis for determining whether a release has occurred from the CCR unit/area.~~

2 In accordance with 30 TAC 352.914 which adopts 40 CFR 257.94, groundwater concentrations of the listed constituents are analyzed using statistical analyses, specifically, 30 TAC 352.914(b) discusses actions triggered by a statistically significant increase for Appendix III constituents.

3 LCRA Environmental Laboratory Services report the Minimum Reporting Limit instead of PQL.

Table VII.A.1. – Unit Closure

For each unit to be registered, list the unit components to be decontaminated, the possible methods of decontamination, and the possible methods of disposal of wastes and waste residues generated during unit closure.

Equipment or CCR Unit	Possible Methods of Decontamination[1]	Possible Methods of Disposal[1]
CCR-1	NA	Closure in place

1 Applicants may list more than one appropriate method.

Table VII.A.2. – CCR Units Under Alternative Closure Notification

Registered Unit No.	N.O.R. Unit No.	Unit Description[1,2]	Date of Receipt of Last Waste[3]	Date of Closure Notification[3]
N/A				

1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.

2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.

3 Enter month, day, and year.

Table VIII.A.1. – Post-Closure Cost Summary for Existing Registered Units

Unit	Cost
CCR-1; Cell 1 and 2D	$2,013,815
Total Existing Unit Post-Closure Cost Estimate	$2,013,815 (in 2021 Dollar)[1]

Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units

Unit	Cost
CCR-1; Cell 2A, 2B, 2C, and 3	$610,080
Total Proposed Unit Post-Closure Cost Estimate	$610,080 (in 2021 Dollar)[1]

1 As units are added or deleted from these tables through future registration amendments, the remaining itemized unit costs should be updated for inflation when re-calculating the revised total cost in current dollars.

Table VIII.B. – Post-Closure Period

Unit Name	Date Certified Closed	Authorized Post-Closure Period (Yrs.)	Earliest Date Post-Closure Ends (See Note 1)
CCR-1	TBD	30 years	TBD

Note 1 – Post-Closure Care shall continue beyond the specified date until the Executive Director has approved the applicant's request to reduce or terminate the post-closure period, consistent with 30 TAC §352.1241 – Post-Closure Care Requirements.

Surface Impoundments: Dike Construction – Not Applicable

For each surface impoundment dike complete submit the following information:

"I, ________(licensed Professional Engineer), Texas P.E. License Number _________, of Registered Firm ________(Name), Registered Firm No.________ (Registration Number), certify under penalty of law that I have personally examined and am familiar with the design and construction of the dikes that are a portion of (surface impoundment unit name).

I further certify that I have evaluated the dike design and materials of construction using accepted engineering procedures, and have determined that the dike, including the portion of the dike providing freeboard, has structural integrity, and

(1) will withstand the stress of the pressure exerted by the types and amounts of wastes to be placed in the impoundment; and

(2) will not fail due to scouring or piping, without dependence on any liner system included in the impoundment construction.

Date: ___________________"

"(Signature)"

"(Seal)"

Redlined Pages

Texas Commission on Environmental Quality

Registration Application for Coal Combustion Residuals (CCR) Waste Management

I. General Information

1. Reason for Submittal

Type of Registration Application

☐☒ New ☐ Major Amendment ☐ Minor Amendment

☒ Notice of Deficiency (NOD) Response ☐ Transfer ☐ Name Change

☐ Other

2. Application Fees

☒ $150 Application Fee

Payment Method

☐ Check ☒ Online through ePay portal <www3.tceq.texas.gov/epay/>

If paid online, enter ePay Trace Number: 582EA000471145

3. Facility Information

Facility information must match regulated entity information on the Core Data Form.

Applicant: ☐ Owner ☐ Operator ☒ Owner/Operator

Facility TCEQ Solid Waste Registration No: 31575

Facility EPA ID: TXD083566547

Regulated Entity Reference No. (if issued): RN 100226844

Facility Name: Lower Colorado River Authority Fayette Power Project

Facility (Area Code) Telephone Number: (979) 249-3111

Facility physical street address (city, state, zip code, county): 6549 Power Plant Rd., La Grange, TX, 78945, Fayette County

Facility mailing address (city, state, zip code, county): PO Box 220, Austin, TX, 78767, Travis County

Latitude (Degrees, Minutes Seconds): 29°54’53.0712”N

Longitude (Degrees, Minutes Seconds): 96°45’12.726”W

4. Publicly Accessible Website

Provide the URL address of a publicly accessible website where the owner or operator of a CCR unit will post information.

http:// www.lcra.org/energy/electric-power/facilities/fayette-power-project/

5. Facility Landowner(s) Information

Facility landowner(s) name: Lower Colorado River Authority and City of Austin

Facility landowner mailing address: P.O. Box 220

City: Austin State: Texas Zip Code: 78767

(Area Code) Telephone Number: (512) 473-3200

Email Address (optional):

6. CCR Waste Management Unit(s)

☒ Landfill Unit(s) ☐ Surface Impoundment(s)

For each existing landfill, new landfill and lateral expansion, existing surface impoundment, and new surface impoundment and lateral expansion(s) provide information on type of waste, the registered unit(s) in which they are managed, and sampling and analytical methods.

Submit the following tables:

Table I.6. – CCR Waste Management Units;

Table I.6.A. – Waste Management Information;

Table I.6.B. – Waste Managed in Registered Units; and

Table I.6.C. – Sampling and Analytical Methods.

7. Description of Proposed Activities or Changes to Existing Facility

Provide a brief description of the proposed activities if application is for a new facility, or the proposed changes to an existing facility or registration conditions, if the application is for an amendment.

The LCRA Fayette Power Project (FPP) is a coal-fired power plant located east of La Grange in Fayette County, Texas. Coal Combustion Residuals (CCRs) generated at FPP are either sold for beneficial use or disposed of in the Combustion Byproducts Landfill (CBL). The existing CBL consists of Cell 1 and Sub-cell 2D. Cell 1 was constructed in 1988 and sub-cell 2 D in 2015; therefore, both active cells are considered existing landfill units under the U.S. Environmental Protection Agency's Coal Combustion Residuals (CCR) Rules as codified in Title 40 of the Code of Federal Regulations (CFR), Chapter 257, Subpart D. Upon completion the CBL will consist of 3 cells, however there are no immediate plans to expand the landfill beyond Cell 1 and Sub-cell 2D.

8. Primary Contact Information

Contact Name: Rebecca Jones, P.G. Title: Environmental Coordinator

Contact mailing address: P.O. Box 220
City: Austin County: Travis State: TX Zip Code: 78767
(Area Code) Telephone Number: 512-578-3393

Email Address (optional): Rebecca.Jones@lcra.org

9. Notice Publishing

Party responsible for publishing notice:
☒ Applicant ☐ Consultant ☐ Agent in Service

Contact Name: Teresa Angel Title: Manager, Plant Environmental Support

Contact mailing address: P.O. Box E
City: Bastrop County: Bastrop State: TX Zip Code: 78602
(Area Code) Telephone Number: 520-241-5035

10. Alternative Language Notice

Is an alternative language notice required for this application? For determination, refer to Alternative Language Checklist on the Public Notice Verification Form (TCEQ-20244-Waste-NORI).

☐ Yes ☒ No

There is no spanish language publication in Fayette County; therefore, an alternative language notice is not required.

11. Public Place Location of Application

Name of the Public Place: **Fayette Public Library**
Physical Address: **855 S Jefferson St**
City: **La Grange** County: **Fayette** State: **TX** Zip Code: **78945**
(Area code) Telephone Number: **(979) 968-3765**

12. Ownership Status of the Facility

☐ Corporation ☐ Limited Partnership

☐ Sole Proprietorship ☐ General Partnership ☒ Other (specify): River Authority

Does the Site Owner (Permittee/Registrant) own all the CCR units and all the facility property?

☒ Yes ☐ No

13. Property / Legal Description Information

Provide a legal description and supporting documents of the property where the management of CCR waste will occur; including a survey plat and a boundary metes and bounds description (30 TAC §352.231(g)).

Submit the following documents:

a. Property Legal Description
b. Property Metes and Bounds Description
c. Metes and Bounds Drawings
d. On-Site Easements Drawings

The legal description and supporting documents are included as Attachment 1.

14. Operator Information

Identify the entity who will conduct facility operations, if the owner and operator are not the same.

Operator Name: N/A

Operator mailing address:

City: State: Zip Code:

(Area Code) Telephone Number:

Email Address (optional):

15. Confidential Documents

Does the application contain confidential documents?

☐ Yes ☒ No

If “Yes”, cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked “CONFIDENTIAL.”

16. Permits and Construction Approvals

Permit or Approval	Received	Pending	Not Applicable
Hazardous Waste Management Program under the Texas Solid Waste Disposal Act	☐	☐	☒
Underground Injection Control Program under the Texas Injection Well Act	☐	☒	☐
National Pollutant Discharge Elimination System Program under the Clean Water Act and Waste Discharge Program under Texas Water Code, Chapter 26 (WQ0002105000) and TPDES Industrial Stormwater Multi-Sector General Permit (TXR05M603)	☒	☐	☐

Prevention of Significant Deterioration Program under the Federal Clean Air Act (FCAA). Nonattainment Program under the FCAA PSD Permit (TX486M3) New Source Review (NSR) (51770)	☒	☐	☐
National Emission Standards for Hazardous Air Pollutants Preconstruction Approval under the FCAA	☐	☐	☒

17. Legal Authority

The owner and operator of the facility shall submit verification of their legal status with the application. This shall be a one-page certificate of incorporation issued by the secretary of state. The owner or operator shall list all persons having over a 20% ownership in the facility.

The Lower Colorado River Authority is a conservation and reclamation district created under and pursuant to Section 59, Article XVI, Texas Constitution with the authority and powers therein and in Chapter 8503, Special District Local Laws Code and other general laws. The City of Austin has a >20% ownership in the CBL.

18. TCEQ Core Data Form

The TCEQ requires that a Core Data Form (TCEQ-10400) be submitted on all incoming applications, unless a Regulated Entity and Customer Reference Number has been issued by the TCEQ and no core data information has changed. For more information regarding the Core Data Form, call (512) 239-5175 or visit the TCEQ Website.

19. Other Governmental Entities Information

Coastal Management Program

Is the facility within the Coastal Management Program boundary?

☐ Yes ☒ No

Local Government Jurisdiction (If Applicable)
Within City Limits of: N/A
Within Extraterritorial Jurisdiction of: N/A

Is the facility located in an area in which the governing body of the municipality or county has prohibited the storage, processing or disposal of municipal or industrial solid waste?

☐ Yes ☒ No If "Yes", provide a copy of the ordinance or order as an attachment.

20. Attachments

Does the application include the following?

General Maps	☒ Yes	☐ No
General Topographic Map	☒ Yes	☐ No
Facility Layout Map	☒ Yes	☐ No

Surrounding Features Map ☒ Yes ☐ No
Process Flow Diagram ☒ Yes ☐ No
Land Ownership Map ☒ Yes ☐ No
  Land Ownership List ☒ Yes ☐ No
  Pre-printed Mailing Labels ☒ Yes ☐ No

Maps and drawings shall be legible and easily readable by eye without magnification. Scales and paper size shall be chosen based on the type of map submitted, the land area covered, and the amount of detail to be shown. See instructions for details regarding maps and drawings to be submitted in application.

21. Verification of Compliance

Does the owner and operator verify that the design, construction, and operation of CCR landfill(s) and surface impoundment(s) meets the requirements of 30 TAC §352.231(f) (30 TAC §352.2; 40 CFR §257.52, and 40 CFR §§257.3-1 – 257.3-3).

☒ Yes ☐ No

II. Location Restrictions and Geology

See Instructions and Technical Guidance

22. Location Restrictions

Submit certifications and technical reports demonstrating compliance of CCR unit(s) with applicable location restrictions (30 TAC 352, Subchapter E) and comply with 30 TAC §352.231(d) and 30 TAC §352.4 for submission of engineering and geoscientific information.

A. **Placement above the uppermost aquifer** (30 TAC §352.601) (40 CFR §257.60). For those CCR units whose base is less than five feet above the upper limit of the uppermost aquifer, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.60(a) – (c).

B. **Wetlands** (30 TAC §352.611) (40 CFR §257.61). For CCR units located in wetlands, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.61(a) – (c).

C. **Fault areas** (30 TAC §352.621) (40 CFR §257.62). For CCR units located within 200 feet of the outermost damage zone of a fault, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.62(a) – (c).

D. **Seismic impact zones** (30 TAC §352.631) (40 CFR §257.63). For CCR units located in a seismic impact zone, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.63(a) – (c).

E. **Unstable areas** (30 TAC §352.641) (40 CFR §257.64). For CCR units located in unstable areas, please submit a copy of the demonstration showing evidence of compliance with 40 CFR §257.64(a) – (d).

The location restrictions certification and technical report is submitted as Attachment 3.

23. Geology Summary Report

Submit a summary of the geologic conditions at the facility, including the relation of the geologic condition to each CCR unit. The summary must include enough information and data and include sources and references for the information. Include all groundwater monitoring data required by 40 CFR Part 257, Subpart D, (30 TAC §352.241, §352.601, §352.621, §352.631, and §352.641) and submitted in accordance with 30 TAC §352.4.

Note: Previously prepared documents may be submitted but must be supplemented or updated as necessary to provide the requested information (30 TAC §352.241(b)).

The Geology and Groundwater Monitoring System Report can be found as Attachment 4.

Groundwater monitoring data is included in Attachment 11.

III. Fugitive Dust Control Plan

24. Fugitive Dust Control Plan

A. **Submit a copy of the CCR Fugitive Dust Control Plan** (30 TAC §352.801) (40 CFR §257.80(b)), or the most recently amended plan. The initial plan or subsequent amended plan must be certified by a qualified Texas licensed professional engineer (Texas P.E.) that the plan meets the requirements of 30 TAC Chapter 352.

The CCR Fugitive Dust Control Plan is included as Attachment 5.

B. **Submit the most recent Annual CCR Fugitive Dust Control Report** (30 TAC §352.801) (40 CFR §257.80(c)) and include the report information.

The 2021 Annual CCR Fugitive Dust Control Report is included as Attachment 6.

IV. Landfill Criteria

See Instructions and Technical Guidance – No. 30 Coal Combustion Residuals Landfill

25. Landfill(s) for CCR Waste

Provide the following information below if there is a landfill; if there is more than one landfill, separate information is required for each landfill.

A. **Landfill Characteristics**

Describe the design, installation, construction, and operation of the landfill and submit a completed Table IV.A. – Landfill Characteristics.

Design and Installation
The CBL is registered with the Texas Commission on Environmental Quality (TCEQ) as an on-site nonhazardous industrial waste landfill (TCEQ Registration No. 31575) and an on-site waste management unit (Notice of Waste Registration No. MU013) at the FPP. The CBL currently receives Coal Combustion Residuals (CCR) generated during the operation and maintenance of three coal-fired units at FPP as described Tables I.6.A. and I.6.B.

The CBL consists of existing Cell 1 and Subcell 2D, and proposed Cells 2A, 2B, 2C and 3. The design of Cell 1 was reviewed and approved by TCEQ in a letter dated January 18, 1988, and Cell 1 was constructed in 1988. A clay perimeter berm was installed around the north, west, and east sides of Cell 1, and a clay cell separation berm was constructed along the south boundary of the cell. The floor of the cell was constructed at natural grade with minimal excavation. The upper 12 in. of the clay was excavated and recompacted to achieve a hydraulic conductivity of $1x10^{-7}$ centimeter/second (cm/sec) in accordance with TCEQ Technical Guidance 3 (12/19/83). The hydraulic conductivity of the underlying clay at a depth from approximately 0- 25 ft below grade was documented to be in the range of 1.3 x 10^{-7} to 1.8 x $10^{-9.}$ (Fayette Power Project, Combustion By-product Disposal Area Geotechnical Investigation, May 1992, Jones and Neuse, Inc.). In 1992, the north portion of Cell 1 was closed with a final cover system consisting of a 2-ft thick compacted clay layer (with hydraulic conductivity no greater than 1×10^{-7} cm/s) overlain by 1 ft of general fill and at least 1 ft of topsoil. In 2013 LCRA submitted a request to raise the maximum elevation of the CBL from approximately 430 ft msl to 470 ft msl. The request was approved by TCEQ by letter dated June 12, 2013. With this revision, the maximum elevation of CCRs placed in the landfill for final disposal will be 465.5 or 467 ft msl, depending on the thickness of the selected final cover, with a final elevation of 470 ft. msl.

By letter dated July 14, 2012, TCEQ approved the design and construction of Subcell 2D. Subcell 2D was constructed with a 3-ft compacted clay liner with a hydraulic conductivity less than 1 x 10^{-7} cm/sec, meeting the recommendations of TCEQ Technical Guidance No.3 (2015). Cell 1 and Subcell 2D are existing CCR landfill areas under 40 CFR §257.53. If the remainder of Cell 2 and Cell 3 are constructed, the remainder of Cell 2 and Cell 3 will be constructed with a liner system that meets the requirements of 40 CFR §257.70(b) and (d), which includes a leachate collection system and underlying geomembrane/compacted clay composite liner. See Attachment 7.

Operation

LCRA contracts with a third party for the marketing of CCRs for beneficial use and for a portion of CBL operation. Under the terms of the contract, LCRA oversees the contractor's activities. Currently, CCRs are being harvested from Cell 1 for sale in beneficial use markets and the volume of material in Cell 1 is being reduced. Subcell 2D is being used as a waste storage area for CCRs /product preparation area prior to sale for beneficial use. .

Since the CBL was constructed at grade and will reach a maximum height of 470 ft, waste is not deposited in conventional landfill trenches.
During active marketing of CCRs, the material is sprayed with water from Lake Fayette, and the unit runoff ponds to minimize dust in accordance with the CCR Fugitive Dust Control Plan. When the material is sprayed, it forms a thin crust, making the need for interim cover unnecessary. A minimal amount of water is used to prevent ponding, runoff, and ash saturation.

When waste is being placed for final disposal, the material will be graded to promote drainage (i.e., 2%) and interim waste grades no steeper than 3.5H:1V. Fly ash and synthetic gypsum will be spread in 12 in. lifts and compacted. All compaction will be completed the same day waste is placed and will be to at least 90% of the Standard Proctor maximum dry density. Results of compaction tests will be maintained on-site. For bottom ash, compaction will consist of tracking with a CAT D6 dozer, and no compaction testing will be required.

The third-party marketing contractor is responsible for implementing the procedures contained in the Fugitive Dust Control Plan (see Attachment 5) and the Run-on and Run-off Control Plan (see Attachment 8).

B. Liner Design

1. For existing landfills, provide attachments describing how the facility will comply with 30 TAC 352, Subchapter F (Design Criteria).

   Both Cell 1 and Subcell 2D are existing units and therefore the liner design criteria in 30 TAC 352, Subchapter F are not applicable.
   For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

2. For new landfills or lateral expansions of existing landfills, submit pages describing how the facility will comply with 30 TAC §352.261 and 30 TAC §352.701.

   For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

3. Complete Table IV.B. - Landfill Liner System and specify the type of liner used for the landfill.
4. Provide attachments describing the design, installation, and operation of the liner and leak detection system. The description must demonstrate that the liner and leak detection system will prevent discharge to the land, groundwater, and surface water. Submit a quality assurance project plan (QAPP) to ensure that each analysis is performed appropriately.

   For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

C. Leachate Collection and Removal

Submit design information and description of leachate collection and removal system in accordance with 30 TAC §352.701.

Complete Table IV.C. - Landfill Leachate Collection System

For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

D. Design of Liner and Leachate Collection and Removal System.

For a new landfill or lateral expansion of a CCR landfill, provide a qualified Texas P.E. certification and technical report that the design of the liner and the leachate collection and removal system meets the requirements of 30 TAC §352.711.

For Cells 2A, 2B, 2C and 3, see the Geosyntec Composite Liner Design and Operating Criteria Report included as Attachment 7.

E. Run-on and Run-off Controls

At time of application, attach pages describing how the facility will comply with the run-on and run-off system plan for an existing, new, or lateral expansion of a CCR landfill information. Provide a qualified Texas P.E. certification and technical report that the run-on and run-off control system plans meet the requirements of 30 TAC §352.811.

The 2021 Run-on and Run-off Control Plan is included as Attachment 8.

F. Inspection for Landfills

At time of application, attach pages describing how the facility will comply 30 TAC §352.841 and complete Table IV.D. – Inspection Schedule for Landfills. For existing CCR landfills, provide the most recent inspection report. All CCR landfills and any lateral expansions of a CCR landfill must be inspected for any structural weakness, malfunction, deterioration conditions which are disrupting or have the potential to disrupt the operation or safety of the CCR unit, or any other conditions which may cause harm to human health and environment at a frequency specified in 40 CFR §257.84(a) and (b).

In accordance with 40 CFR 257.84 and 30 TAC 352.841, weekly and annual inspections of the CBL are required. Weekly inspections will be conducted at intervals not exceeding 7 days during the operational life of the unit. Post Closure Care inspections will be conducted quarterly in accordance with the Post Closure Care Plan and 40 CFR 257.104(d(i)

Weekly inspections are conducted to identify any actual or potential structural weakness and other conditions which are disrupting or have the potential to disrupt the operation or safety of the CBL. Weekly inspections are conducted by a qualified person who has attended the TCEQ Dam Safety Training Course and has been trained by the qualified professional engineer conducting the annual inspections. A copy of the weekly inspection form is retained in the facility's operating record.

The CBL is inspected once per calendar year by a qualified professional engineer in the state of Texas, who has attended the TCEQ Dam Safety Training Course. The annual inspection is conducted to verify that the design, construction, operation, and maintenance of the CBL is consistent with recognized and generally accepted good engineering standards. The inspection includes a review of available information regarding the status and condition of the CBL, including files available in the facility's operating record, and a visual inspection of the CBL to identify signs of distress or malfunction of the CBL. The professional engineer prepares a report following each annual inspection that addresses changes in geometry of the structure since the previous annual inspection, the approximate volume of waste contained in the CBL at the time of the inspection, any appearances of an actual or potential structural weakness of the CBL, in addition to any existing conditions that are disrupting or have the potential to disrupt the operation and safety of the CBL, and any other change(s) which may affect the stability or operation of the CBL since the previous annual inspection. Following completion of the annual inspection, the completed annual report and checklist are placed and maintained in the facility's operating record and the CBL's publicly accessible website.

Consistent with 30 TAC §352.841(b), the LCRA will verbally notify the TCEQ within 24 hours and in writing within five (5) days if a deficiency is observed during a weekly or annual inspection that could result in harm to human health, the environment, or has resulted in a release. Additionally, the TCEQ will be notified in writing within 14 days of all other deficiencies following annual inspections that could have the potential to disrupt operation of the CBL. If a waste release or deficiency is found, the LCRA will prepare a written corrective action plan to remedy the release or deficiency as soon as feasible consistent with 40 CFR §257.84(b)(5). Notifications and correction action plans will be placed in the facility's operating record and on the LCRA's publicly accessible website. Any changes to the inspection frequencies will comply with recordkeeping and notification requirements.

The weekly inspection checklist and the 2021 Annual Inspection Report are provided in Attachment 9.

V. Surface Impoundment Criteria – Not Applicable

See Instructions and Technical Guidance – No. 31 Coal Combustion Residuals Surface Impoundment

26. Surface Impoundment(s) for CCR Waste

Provide the following information below if there is a surface impoundment; if there is more than one surface impoundment, separate information is required for each surface impoundment.

A. General Surface Impoundment(s) Characteristics

Provide information about the characteristics of the surface impoundment(s): incised, surface area (acres), storage volume (acres-feet), and depth (feet).

For all surface impoundment(s), include the following information:

1. Complete Table V.A. - Surface Impoundments Characteristics. List the surface impoundment(s) to be registered as a CCR unit(s), the wastes managed in each unit, and the rated capacity or size of each unit.
2. Describe the surface impoundment(s) and provide a plan view drawing with cross-sections, if available.
3. Specify the minimum freeboard to be maintained and the basis of the design to prevent overtopping resulting from normal or abnormal operation; overfilling; wind and wave action; rainfall; run-on; malfunctions of level controllers, alarms, and other equipment; and human error. Show that adequate freeboard will be available to prevent overtopping from a 100-year, 24-hour storm.
4. Waste Flow
   Describe the means that will be used to immediately shut off the flow of waste to the impoundment in the event of liner failure or to prevent overtopping.
5. Dike Construction ☐ Yes ☐ No

   If Yes, submit the dike certification (located at the end of the application).

   The structural integrity of the dike system must be certified by a qualified Texas P.E. before the registration is issued. If the impoundment is not being used, the dike system must be certified before it can be put into use. The certification must be sealed by a qualified Texas P.E., along with the engineering firm's name and registration number (30 TAC §352.4).

   A report shall accompany the dike certification which summarizes the activities, calculations, and laboratory and field analyses performed in support of the dike certification. Describe the design basis used in construction of the dikes. A QAPP should be included in the report to ensure that each analysis is performed appropriately and include:

   (1) Slope Stability Analysis

   (2) Hydrostatic and Hydrodynamic Analysis

(3) Storm Loading

(4) Rapid Drawdown

Earthen dikes should have a protective cover to minimize wind and water erosion and to preserve the structural integrity of the dike. Describe the protective cover used and describe its installation and maintenance procedures.

B. Liner Design

For surface impoundment(s), provide information about how the facility will comply with 30 TAC §352.711 for existing CCR surface impoundments. For new and lateral expansion of CCR surface impoundments provide information on how the facility will comply with 30 TAC §352.261, and 30 TAC §352.721, see Instructions and Technical Guidance No. 31 Coal Combustion Residuals Surface Impoundment. The qualified Texas P.E. must certify that the design of the liner complies with the requirements of 30 TAC Chapter 352 and 40 CFR Part 257, Subpart D, where required.

Is the CCR surface impoundment unlined? ☐ Yes ☐ No

If “Yes”, the CCR unit is subject to the closure requirements under 30 TAC Chapter 352 and 40 CFR §257.101(a) to retrofit or close. A notification must be prepared stating that an assessment of corrective measures has been initiated.

1. Complete Table V.B. - Surface Impoundment Liner System for each surface impoundment to be registered.
2. Describe the design, installation and operation of liner and leak detection components. The description must demonstrate that the liner and leak detection system will prevent discharge to the land and surface water. Submit a QAPP report to ensure that each analysis is performed appropriately.
3. For new or laterally expansions of existing surface impoundments, provide a subsurface soil investigation report that must include:
    a. A description of all borings drilled, at the unit location, to test soils and characterize groundwater;
    b. A unit map drawn to scale showing the surveyed locations and elevations of the borings, including location of permanent identification markers ((30 TAC §352.731) and (40 CFR §257.73(a)(1));
    c. Cross-sections prepared from the borings depicting the generalized strata at the unit;
    d. Boring logs, including a description of materials encountered, and any discontinuities such as fractures, fissures, slickensides, lenses or seams;
    e. A description of the geotechnical data and the geotechnical properties of the subsurface soil materials, including the suitability of the soils and strata for the intended uses; and
    f. A demonstration that all geotechnical tests were performed in accordance with industry practices and recognized procedures.

C. Hazard Potential Classification

Provide the current hazard potential classification assessment and associated documentation, as required by 30 TAC §352.731 or §352.741 and 40 CFR §257.73(a)(2) or §257.74(a)(2). The qualified Texas P.E. must certify that the initial hazard potential classification and any subsequent periodic classification was conducted in accordance with the requirements of 30 TAC Chapter 352, where required.

Hazard Potential Classification:

D. Emergency Action Plan for High or Significantly High Hazard Potential

Provide the current Emergency Action Plan that has been certified by a qualified Texas P.E. and includes the following requirements from 30 TAC 352, Subchapter F and 40 CFR §257.73(a)(3)(i)(A) - (E) or 40 CFR §257.74 (a)(3)(i)(A) - (E). The qualified Texas P.E. must certify that the written Emergency Action Plan and any subsequent amendment of the plan complies with the requirements of 30 TAC 352, Subchapter F, where required.

Complete Table V.J. - Inspection of Surface Impoundments

E. Inflow Design Flood Control System Plan

Describe how the surface impoundment(s) system will manage stormwater run-on away from the surface impoundment(s) (30 TAC §352.821 and 40 CFR §257.82(a) and (c)). Stormwater run-on must be diverted away from a surface impoundment, based on the hazard potential. Where dikes are used to divert run-on, they must be protected from erosion. Include all analyses used to calculate run-on volumes. Provide the inflow design flood control system plan. Provide qualified Texas P.E. certification that the initial and periodic inflow design flood control system plans meet the requirements of 30 TAC §352.821, where required.

F. History of Construction for Existing CCR Surface Impoundment(s), or the Design and Construction Plans for New and Lateral Expansions

Provide information on the history of construction for each existing CCR surface impoundment (30 TAC §352.731 and 40 CFR §257.73(c)) or the design and construction plans for new and lateral expansions of each CCR surface impoundment (30 TAC §352.741) and (40 CFR §257.74(c)).

G. Structural Stability Assessment

Provide the most recent structural stability assessment of the surface impoundments. Include the combined capacity of all surface impoundment spillways with calculations; the peak discharge the unit must meet for all combined spillways; probable maximum flood-high hazard, 1,000-yr-significant high hazard, 100-yr-low hazard; identify if there were any structural stability deficiencies in last assessment; identify how these deficiencies were managed and corrected; and qualified Texas P.E. certification. The structural stability assessment must include all information required in 30 TAC §352.731 for existing surface impoundments or 30 TAC §352.741 for new or laterally expanding surface impoundments.

H. Safety Factor Assessment

The current safety factor assessment must be submitted with the application. It must include documentation that demonstrates whether the calculated factors of safety for each CCR surface impoundment achieve the minimum safety factors specified in 30 TAC 352, Subchapter F and 40 CFR §257.73(e)(1)(i) - (iv) and 40 CFR §257.74(e)(1)(i) - (iv) for the critical cross-section of the embankment. The critical cross-section is the cross-section anticipated to be the most susceptible to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations and certified by a qualified Texas P.E.

VI. Groundwater Monitoring and Corrective Action (30 TAC 352, Subchapter H)

See Instructions and Technical Guidance – No. 32 Coal Combustion Residuals Groundwater Monitoring and Corrective Action

27. Groundwater Monitoring System

A. Complete Table VI.A. - Unit Groundwater Detection Monitoring System.

B. Provide a map showing location of wells, groundwater elevations, and groundwater flow direction.

C. Provide attachments describing how the facility will comply with the requirements in 30 TAC §352.911 and provide a certification by a qualified Texas P.E or qualified Texas P.G. that the groundwater monitoring system design and construction meet the requirements of 30 TAC Chapter 352.

D. Provide a figure showing the geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

E. For a multiunit groundwater monitoring system, demonstrate that the groundwater monitoring system will be equally as capable of detecting monitored constituents at the waste boundary of the CCR unit as the individual groundwater monitoring system for each CCR unit by providing at minimum the following information: Not Applicable

1. Number, spacing, and orientation of each CCR unit;
2. Hydrogeologic setting; and
3. Site history.

F. Has there been any sampling concentrations of one or more constituents listed in Appendix IV detected at statistically significant levels above the groundwater protection standard (GWPS)? ☐ Yes ☒ No

G. Provide information on how monitoring wells have been constructed and cased in a manner that maintains the integrity of the monitoring well borehole and to prevent contamination of samples and the groundwater.

The Geology and Groundwater Monitoring System Report can be found as Attachment 4.

28. Groundwater Monitoring Sampling and Analysis Program

Provide a sampling and analysis plan that includes procedures and techniques; sampling and analytical methods that are appropriate for groundwater sampling; and that address the requirements of 30 TAC §352.931 and 40 CFR §257.93. Provide a P.E or P.G. certification that describes the statistical method selected to evaluate the groundwater monitoring data and certifies that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. Refer to TG-32 for information and guidance.

The CCR Groundwater Sampling and Analysis Plan is included as Attachment 10.

29. CCR Unit(s) in a Detection Monitoring Program

Does the facility have CCR unit(s) in a Detection Monitoring Program?

☒ Yes ☐ No

If “Yes”, Submit the following information:

A. Submit Table VI.C. – Facility CCR Units Under Detection Monitoring.

B. Provide a Background Evaluation Report.

C. Provide a report with the results of semiannual monitoring events.

1. Has a statistically significant increase (SSI) been detected for one or more of the constituents listed in Appendix III at any monitoring well?

   ☐ Yes ☒ No

2. Has a notification to the executive director been sent within 14 days?

   ☐ Yes ☒ No

3. Date assessment monitoring program will start: **N/A**

4. Do you plan to provide an alternative source demonstration (ASD)?

   ☐ Yes ☒ No

Groundwater monitoring data is included in Attachment 11.

30. CCR Unit(s) in an Assessment Monitoring Program – Not Applicable

Does the facility have CCR unit(s) in an Assessment Monitoring Program?

☐ Yes ☒ No
If “Yes”, Submit information related for units.

A. Complete Table VI.D. – CCR Units Under Assessment Monitoring.

B. Provide, for each well in assessment monitoring status, the recorded concentrations lab sheets and results in a tabulated form.

C. Have the concentrations of all constituents listed in Appendices III and IV been at or below background values, using the statistical procedures in 30 TAC §352.931 and 40 CFR §257.93(g), for two consecutive sampling events for the CCR unit(s)? ☐ Yes ☐ No

If answer to above is yes, detection monitoring may resume. The owner or operator must prepare a notification stating that detection monitoring is resuming for the CCR unit and obtain written approval from the executive director.

D. Are there any concentrations of any constituent in Appendices III and IV above background values? ☐ Yes ☐ No

1. Has a notification to the executive director been sent within 14 days?

   ☐ Yes ☐ No

E. Date assessment of corrective measures will be initiated (must be within **90 days** of finding a statistically significant level above the GWPS) for the CCR unit(s):

F. Will you provide an ASD (see TG-32 for an acceptable submittal)? ☐ Yes ☐ No

G. Date assessment of corrective measures will be initiated if ASD is not accepted?

H. Complete Table VI.D-2. - Groundwater Detection Monitoring Parameters

Note: Refer to TG-32 regarding establishing a GWPS for each constituent in Appendix IV detected in the groundwater and attach as table.

I. Have you completed the assessment of corrective measures? ☐ Yes ☐ No
If "Yes", date assessment of corrective measures was completed:
If "No", date assessment of corrective measures will be completed:
Expected date of submittal of amendment (see note below):
Provide completed assessment of corrected measures materials.

Note: Within **30 days** of completing the assessment of corrective measures, and before remedy implementation, the owner or operator shall submit an application for amendment to the registration. In some circumstances, the assessment of corrective measures and selected remedy may be approved as part of the initial application for the CCR unit registration.

J. Have you selected a remedy? ☐ Yes ☐ No

Provide public meeting documentation under 30 TAC §352.961 and a report under 30 TAC §352.971 and 40 CFR §257.97.

VII. Closure and Post-Closure Care

See Instructions and Technical Guidance

Submit a full closure plan and post-closure plan and all information describing how the owner or operator will comply with 30 TAC 352, Subchapter J and 40 CFR §§257.100 - 257.104. The owner of property on which an existing disposal facility is located, following the closure of a unit, must also submit documentation that a notation has been placed in the deed to the facility that will in perpetuity notify any potential purchasers of the property that the land has been used to manage CCR wastes and its use is restricted (30 TAC §352.1221 and 40 CFR §257.102(i)). For CCR units, closed after October 19, 2015, that were closed before submission of the application, the applicant should submit documentation to show that notices required under 30 TAC 352, Subchapter K and 40 CFR §257.105 or §257.106 have been filed.

31. Closure Plan

This section applies to the owners and operators of all CCR units required to be registered. The applicant must close the facility in a manner that minimizes need for further maintenance and controls, or eliminates, to the extent necessary to protect human health and the environment, the post-closure release of CCR waste, chemical constituents of concern, leachate, contaminated rainfall, or waste decomposition products to the groundwater, surface waters, or to the atmosphere.

The type of unit to be closed can determine the level of detail sufficient for a closure plan. CCR units which have been certified closed after October 19, 2015, must provide documentation to demonstrate compliance with state and federal regulations.

For each unit to be registered, complete Table VII.A.1. - Unit Closure and list the CCR Unit components to be decontaminated, possible methods of decontamination, and possible methods of disposal of wastes and waste residues generated during unit closure. All ancillary components must be decontaminated, and the generated waste disposed of appropriately.

Information about CCR units closed or to be closed under alternative closure requirements must be provided in Table VII.A.2. - CCR Units Under Alternative Closure Notification.

Guidance on design of a closure cap and final cover for non-hazardous industrial solid wastes landfills is provided in EPA publication 530-SW-85-014, TCEQ Technical Guidance No. 3 and TCEQ publication, RG-534, "Guidance for Liner Construction and Testing for a Municipal Solid Waste Landfill".

The Closure and Post Closure Care plan are included as Attachment 12.

32. Post-Closure Care Plan

Provide a post-closure care plan that complies with the requirements of 30 TAC §352.1241. Post-closure care of each CCR unit must continue for at least 30 years after the date of completing closure of the unit and must consist of monitoring and reporting of the groundwater monitoring systems, in addition to the maintenance and monitoring of CCR unit. Continuation of certain security requirements may be necessary after the date of closure. Post-closure use of property on or in which waste remains after closure must never be allowed to disrupt the integrity of the containment system. In addition, submit the following information:

- The name, address, and phone number of the person or office to contact about the CCR unit during the post-closure period; and
- A discussion of the future use of the land associated with each unit.

Landfills and surface impoundments which have been certified closed after October 19, 2015, must be included in post-closure care plans, unless they have been determined to have been closed by waste removal equivalent to the closure standards in 30 TAC §352.1221 and 40 CFR §257.102 or 30 TAC §352.1231 and 40 CFR §257.103. If such a demonstration has been made pursuant to 40 CFR §257.102 or §257.103, but an equivalency determination has not been made, please submit a copy of the demonstration documentation. If an equivalency determination has been made, applicant should submit a copy of this determination.

The Closure and Port Closure Care plan are included as Attachment 12.

VIII. Financial Assurance

33. Post-Closure Care Cost Estimate

Financial assurance for post-closure care (30 TAC §352.1101) applies to owners or operators of all CCR units, except CCR units from which the owner or operator intends to remove wastes and perform clean closure. Provide a written cost estimate in current dollars of the total cost of the 30-year (or longer, if applicable under 30 TAC §352.1101(d)) post-closure care period to perform post-closure care requirements as prescribed in 30 TAC §352.1241. The cost estimate must be based on the costs of hiring a third party to conduct post-closure care maintenance.

Complete Table VIII.A.1 – Post-Closure Cost Summary for Existing Registered Units

Complete Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units

The Post Closure Care Cost Estimates are included as Attachment 12. The estimate is in 2021 dollars. In accordance with 30 TAC 37.131, the estimate will be adjusted for inflation each year as long as the landfill is operating. Once the Landfill moves to post closure care, the annual adjustment is not required by TCEQ. LCRA intends to utilize the Local Government Financial Test in accordance with 30 TAC 352.111(5). Therefore, the 2021 cost estimate will be adjusted in accordance with TCEQ's published inflation factors within 180 days of the close of LCRA's fiscal year (June) using TCEQ's published inflation factors. This adjustment coincides with the renewal of the Local Government Financial Test.

34. Financial Assurance Mechanism

The financial assurance for post-closure care is required in accordance with 30 TAC §352.1101. The applicant shall demonstrate the financial assurance within 90 days after approval of the registration with a financial mechanism acceptable to TCEQ in compliance with 30 TAC §352.1101(c) and 30 TAC §37, Subchapters A through D, except as indicated in 30 TAC §352.1111, in an amount no less than the amount specified in the approved Post-Closure Care Cost Summary. Provide a description of the proposed financial assurance mechanism.

LCRA intends to use the Local Government Financial Test in accordance with 30 TAC 352.111(5) and 30 TAC 37.271 to satisfy the provisions of 30 TAC 352.1101(c). The signed documents will be submitted to the Texas Commission on Environmental Quality (TCEQ) within 90 days after approval of the registration.

Complete Table VIII.B. - Post-Closure Period, for the authorized post-closure period, to meet the requirements of 30 TAC §352.1241(a) through (c).

Signature Page

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Applicant Signature: ______________________________ Date: _____________

Name and Official Title (type or print): _____________________________________

Owner or Operator Signature: _______________________ Date: _____________

Name and Official Title (type or print): _____________________________________

To be completed by the owner or operator if the application is signed by an authorized representative for the operator

I, ________________________ hereby designate ____________________________
(operator) (authorized representative)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a CCR waste management registration. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any registration which might be issued based upon this application.

____
Printed or Typed Name of Applicant or Principal Executive Officer

____
Signature

(Note: Application Must Bear Signature & Seal of Notary Public)

Subscribed and sworn to before me by the said _______________________ on this

___________________ day of _________________, _______.

My commission expires on the ___________ day of ______________, _______

(Seal) Notary Public in and for ____________________ County, Texas

Registration Application for Coal Combustion Residuals Waste Management

(See instructions for P.E/P.G. seal requirements.)

Attachments and Tables	**Attachment No.**
General Information	1
Attachments	2
Technical Report and Certification	N/A
Location Restrictions Certifications	3
Placement above the uppermost aquifer	3
Wetlands	3
Fault Areas	3
Seismic impact zones	3
Unstable areas	3
Geology Summary	4
CCR Fugitive Dust Control Plan	5
Annual CCR Fugitive Dust Control Report	6
Landfill Design and Operating Criteria	7
Landfill Characteristics	7
Liner Design	7
Leachate Collection and Removal	7
Run-on and Run-off Controls	8
Inspection for Landfills	9
Surface Impoundment Design and Operating Criteria	N/A
General Surface Impoundment Characteristics	N/A
Liner Design	N/A
Hazard Potential Classification	N/A
Emergency Action Plan	N/A
Inflow Design Flood Control System Plan	N/A
Construction History/Design Plans	N/A
Structural Stability Assessment	N/A
Safety Factor Assessment	N/A
Groundwater Monitoring and Corrective Action	4
Groundwater Monitoring System	4
Groundwater Monitoring Sampling and Analysis Program	10
Detection Monitoring Program	11
Assessment Monitoring Program	N/A
Assessment of Corrective Measures	N/A
Remedy Report	N/A
Closure and Post-Closure Care	12
Closure Plan	12
Post-Closure Care	12
Financial Assurance	N/A

Tables

Tables	Submitted	Not Applicable
Table I.6. - CCR Waste Management Units	☒	☐
Table I.6.A. - Waste Management Information	☒	☐
Table I.6.B. - Wastes Managed in Registered Units	☒	☐
Table I.6.C. - Sampling and Analytical Methods	☒	☐
Table IV.A. - Landfill Characteristics	☒	☐
Table IV.B. - Landfill Liner System	☒	☐
Table IV.C. - Landfill Leachate Collection System	☒	☐
Table IV.D. - Inspection Schedule of Landfills	☒	☐
Table V.A. - Surface Impoundments Characteristics	☐	☒
Table V.B. - Surface Impoundment Liner System	☐	☒
Table V.J. - Inspection of Surface Impoundments	☐	☒
Table VI.A. - Unit Groundwater Detection Monitoring System	☒	☐
Table VI.C. - CCR Units Under Detection Monitoring	☒	☐
Table VI.D. - CCR Units Under Assessment Monitoring	☐	☒
Table VI.D-2. - Groundwater Detection Monitoring Parameters	☒	☐
Table VII.A.1. - Unit Closure	☒	☐
Table VII.A.2. - CCR Units Under Alternative Closure Notification	☐	☒
Table VIII.A.1. - Post-Closure Cost Summary for Existing Registered Units	☒	☐
Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units	☒	☐
Table VIII.B. - Post-Closure Period	☒	☐
Engineering Certification(s) - Dike Construction	☐	☒

Additional Attachments as Applicable - Select all those apply and add as necessary

☒ TCEQ Core Data Form(s)
☐ Signatory Authority Delegation
☒ Fee Payment Receipt
☐ Confidential Documents
☐ Certificate of Fact (Certificate of Incorporation)
☐ Assumed Name Certificate

Table I.6. – CCR Waste Management Units

CCR Unit No.[1]	Unit Name	N.O.R. No.[1]	Unit Description[3]	Capacity	Unit Status[2]
CCR-~~101~~1	Combustion Byproduct Landfill (CBL)	013	Cells 1 and 2D	12,4000,000 Cu yds	Active
CCR-~~101~~1	Combustion Byproduct Landfill (CBL)	013	Cells 2A, 2B, 2C and 3		Proposed[4]

1 Registered Unit No. and N.O.R. No. cannot be reassigned to new units or used more than once.
2 Unit Status options: Active, Closed, Inactive (built but not managing waste), Proposed (not yet built), Never Built, Transferred, Post-Closure.
3 If a unit has been transferred, the applicant should indicate which facility/permit it has been transferred to in the Unit Description column.
4 No schedule for development at the time of application submittal but all future cells are developed within the deed recorded footprint of unit CCR-101/NOR 013.

Table I.6.A. – Waste Management Information

Waste No.[1]	Waste Type(s)	Source	Volume (tons/year)[2]
1	Fly Ash Unit 1 and 2	Generated from coal combustion process at FPP	6,728
2	Fly Ash Unit 3	Generated from coal combustion process at FPP	2,849
3	Bottom Ash Unit 1 and 2	Generated from coal combustion process at FPP	36,993
4	Bottom Ash Unit 3	Generated from coal combustion process at FPP	15,751
5	Synthetic Gypsum	Generated from coal combustion process at FPP	28,449
6	Refractory, bowl mill rejects, waste sand filter media, waste charcoal filter media, waste resin beads, ash bag house filters, pyrite and coal reject generated from maintenance operations	Generated from coal combustion process at FPP	737
7	Activated carbon waste	Generated from coal combustion process at FPP	0
8	ACI Pipe cleaning waste	Generated from coal combustion process at FPP	0

1 Assign waste number sequentially. Do not remove waste number wastes which are no longer generated.

2 Disposal Rates based on 4-year average of actual deposition rates independent of facility generation rates.

Table I.6.B. – Wastes Managed in Registered Units

Waste No.[1]	Waste	TCEQ Sequence Number	TCEQ Form Code	TCEQ Classification Code
1	Fly Ash Unit 1 & 2	5014	304	2
2	Fly Ash Unit 3	5015	304	2
3	Bottom Ash Unit 1 & 2	5016	304	2
4	Bottom Ash Unit 3	5017	304	2
5	Synthetic Gypsum	5018	392	2
6	Refractory, bowl mill rejects, waste sand filter media, waste charcoal filter media, waste resin beads, ash bag house filters, pyrite and coal reject generated from maintenance operations	5118	319	2
7	Activated carbon waste	5216	319	2
8	ACI Pipe cleaning waste	5224	319	2

1 from Table I.6.A., first column

Table I.6.C – Sampling and Analytical Methods

Waste No.[1]	Sampling Location	Sampling Method	Frequency	Parameter	Test Method	Desired Accuracy Level
1	Fly Ash Silo [2 and 3]	SW846, representative grab samples	Waste will be sampled when there is a change in the process	If necessary due to a change in process: process knowledge and TCLP HG, TCLP metals	If necessary due to a change in process: SW7470A and SW6010B	LOD/LOQ[4]
2	Fly Ash Silo [2 and 3]					HG 0.00007/ 0.0002 mg/L
3	Bottom Ash Bunker[2 and 3]					AS 0.2/0.5 mg/L
4	Bottom Ash Bunker[2 and 3]					BA 0.04/0.1 mg/L
5	Synthetic Gypsum Dome[2 and 3]					CD 0.03/0.08 mg/L
6	Boiler and associated equipment for coal processing [2 and 3]					CR 0.04/0.1 mg/L
7	Activated Carbon Injection System [2]					PB 0.2/0.5 mg/L
8	Activated Carbon Injection System [2]					SE 0.4/1.0 mg/L
						AG 0.04/0.1 mg/L

1 from Table I.6.A., first column

2 All waste has been classified in accordance with 30 TAC 335, Subchapter R, and TCEQ RG-22 Guidelines for the Classification and Coding of Industrial and Hazardous Waste. Prior testing and/or process knowledge of the waste streams eliminates the need for further testing. In accordance with TCEQ waste classification regulations, waste classifications will only be revisited when there is a change in the process which necessitates the need to revisit the classification. Waste is only sampled and reclassified when there is a process change.

3 Waste classification has been audited and approved by TCEQ.

4 LOD Limit of Detection; LOQ Limit of Quantification

Table IV.A. – Landfills Characteristics

Registered Unit No.	Landfill	N.O.R. No.	Waste Nos.[1]	Rated Capacity	Dimensions[2]	Distance from lowest liner to groundwater	Action Leakage Rate (if required)	Unit will manage CCR Waste and non-CCR Waste (state all that apply)
CCR-1	Combustion Byproducts Landfill	013	1-8	12,400,000 cu/yds	123 acres Length 2,829 ft Width 1,932 ft Depth 360 ft MSL Max elevation 470 ft MSL[3]	Greater than 5 ft[4]	NA	Waste 1-8 listed in Table I.6.A and I.6.B

1 From Table I.6.A., first column
2 Dimensions should be provided as average length, width, and depth, also include the surface acreage for the unit.
3 Elevation approved by TCEQ by Letter dated June 12, 2013
4 Cell 1 and Subcell 2D are existing cells 40 CFR 257.60 is not applicable. Cell 2 (A-C) and Cell 3 will be sited in accordance with 40 CFR 257.60.

Table IV.B. – Landfill Liner System

Registered Unit No.*	Landfill	Geomembrane Liner Material	Geomembrane Liner Permeability (cm/sec)	Geomembrane Liner Thickness	Soil Liner Material	Soil Liner Permeability (cm/sec)	Soil Liner Thickness
CCR-1	Cell 1[1]	NA	NA	NA	Compacted Clay	<1 x 10 ~~^{7}~~$^{-7}$ cm/sec	12 inches of recompacted clay over >3 ft of in situ clay
	Cell 2D[2]	NA	NA	NA	Compacted Clay	<1 x 10 ~~^{7}~~$^{-7}$ cm/sec	3 ft of recompacted clay plus 2 ft of a protective soil cover
	Cell 2(A-C)[3]	Textured high density polyethylene (HDPE)	1 x 10^{-13} cm/s	60 mil	Compacted Soil Liner	<1 x 10 ~~^{7}~~$^{-7}$ cm/sec	2 ft
	Cell 3[3]	Textured HDPE	1 x 10^{-13} cm/s	60 mil	Compacted Soil Liner	<1 x 10 ~~^{7}~~$^{-7}$ cm/sec	2 ft

* This number should match the Registration Unit No. given on Table IV.A.

1 Existing landfill cell constructed in 1988. Design approved by TCEQ in a letter dated January 18, 1988 in accordance with TCEQ Technical Guidance Document #3- Landfills.

2 Existing landfill cell constructed in 2014. Design approved by TCEQ in a letter dated June 14, 2012 in accordance with TCEQ Technical Guidance Document #3- Landfills.

3 Construction of Cells 2 A-C and Cell 3 will be in accordance with 30 TAC 352 and 40 CFR 257 as described in the Composite Liner Design and Operating Criteria Report (Attachment 7). No schedule for development of these cells at the time of application submittal.

Table IV.C. – Landfill Leachate Collection System

Registered Unit No.	Landfill Name	Drainage Media	Collection Pipes (including risers)	Filter Fabric	Geofabric	Sump Material
CCR-1	Cell 1[1]	NA	NA	NA	NA	NA
CCR-1	Cell 2D[2]	NA	NA	NA	NA	NA
CCR-1	Cell 2(A-C)[3]	NA (no granular drainage layer)	6-inch diameter standard dimension ratio (SDR) high density polyethylene (HDPE) pipe	8-oz/yd2 nonwoven geotextiles around chimney drain gravel and associated HDPE pipe	Double-sided (geotextile-geonet-geotextile) geocomposite drainage layer	NA (leachate gravity drains to a pond)
CCR-1	Cell 3[3]	NA (no granular drainage layer)	6-inch diameter standard dimension ratio (SDR) high density polyethylene (HDPE) pipe	8-oz/yd2 nonwoven geotextiles around chimney drain gravel and associated HDPE pipe	Double-sided (geotextile-geonet-geotextile) geocomposite drainage layer	NA (leachate gravity drains to a pond)

1 Existing landfill cell constructed in 1988. Design approved by TCEQ in a letter dated January 18, 1988 in accordance with TCEQ Technical Guidance Document #3- Landfills.

2 Existing landfill cell constructed in 2014. Design approved by TCEQ in a letter dated June 14, 2012 in accordance with TCEQ Technical Guidance Document #3- Landfills.

3 Construction of Cells 2 A-C and Cell 3 will be in accordance with 30 TAC 352 and 40 CFR 257 as described in the Composite Liner Design and Operating Criteria Report included (Attachment 7). No schedule for development of these cells at the time of application submittal.

Table IV.D. – Inspection Schedule of Landfills

Facility Unit(s)	Basic Elements	Possible Error, Malfunction, or Deterioration	Frequency of Inspection
CCR-1	General	Inspect for signage in need of repair; groundwater monitoring well damage; haul roads in need of repair; evidence of spillage of CCR on haul road	Weekly(at interval not exceeding 7 days)/annual
CCR-1	Landfill Top Cap	Inspect for poor grass cover; trees or bushes; animal burrows or damage; standing water/ponding; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Landfill Northern Slope	Inspect for poor grass cover; trees or bushes; animal burrows or damage; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sloughing; slides; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Landfill Eastern Slope	Inspect for poor grass cover; trees or bushes; animal burrows or damage; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sloughing; slides; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Landfill Western Slope	Inspect for poor grass cover; trees or bushes; animal burrows or damage; wet areas; erosion; depressions; rutting; cracks; bulges; misalignments; sloughing; slides; sinkholes	Weekly (at interval not exceeding 7 days)/annual
CCR-1	Annual Volume Approximation	Inspect for changes to geometry, structure, and volume	Annual
CCR-1	Document Review	Review weekly inspection reports	Annual

Table V.A. – Surface Impoundment Characteristics

Registered Unit No.	Surface Impoundment Name	N.O.R. No.	Waste Nos.[1]	Rated Capacity	Dimensions[2]	Distance from lowest liner to groundwater	Action Leakage Rate (if required)	Unit will manage CCR Waste and non-CCR Waste (state all that apply)
N/A								

1 From Table I.6.A., first column
2 Dimensions should be provided as average length, width and depth, also include the surface acreage for the unit.

Table V.B. – Surface Impoundment Liner System

Registered Unit No.*	Surface Impoundment Name	Geomembrane Liner Material	Geomembrane Liner Permeability (cm/sec)	Geomembrane Liner Thickness	Soil Liner Material	Soil Liner Permeability (cm/sec)	Soil Liner Thickness
N/A							

* This number should match the Registration Unit No. given on Table V.A.

Table V.J. – Inspection Schedule of Surface Impoundments

Facility Unit(s) and Basic Elements	Possible Error, Malfunction, or Deterioration	Frequency of Inspection
N/A		

Table VI.A. – Unit Groundwater Detection Monitoring Systems

Waste Management Unit/Area Name[1]	**Coal Combustion Byproduct Landfill (CBL)**					
Well Number(s):	340I	301I	302I	306I	308I	341I
Hydrogeologic Unit Monitored	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand
Type (e.g., point of compliance, background, observation, etc.)[2]	NA	NA	NA	NA	NA	NA
Up or Down Gradient	Up	Down	Down	Down	Down	Down
Casing Diameter and Material	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC
Screen Diameter and Material	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC	2” PVC
Screen Slot Size (in.)	0.010-inch	0.010-inch	0.010-inch	0.010-inch	0.010-inch	0.010-inch
Top of Casing Elevation (Ft, Mean Sea Level *[MSL]*)	376.98	372.11	358.99	339.96	368.67	366.65
Grade or Surface Elevation (Ft, MSL)	374.69	369.75	355.99	337.93	364.93	364.03
Well Depth (Ft, Below Grade Surface *[BGS]*)	37	51	24	12.5	32	43
Well Depth (Ft, Below Top of Casing *[BTOC]*)	39.3	53.4	27	14.5	35.7	45.6
Screen Interval: From (Ft,BGS) to (Ft,BGS)	22-37	41-51	14-24	7.5-12.5	22-32	33-43
Screen Interval: From (Ft, BTOC) to (Ft, BTOC)	24.3-39.3	43.4-53.4	17-27	9.53-14.53	25.7-35.7	35.6-45.6

1 From Tables in Section I.; *MSL*: Mean Sea Level; *BGS*: Below Grade Surface; *BTOC*: Below Top of Casing
2 Terms are not defined or used in 40 CFR 257, 30 TAC 352, or TCEQ Technical Guidance Document #32

Table VI.C. – CCR Units Under Detection Monitoring

N.O.R. Unit No.	Unit Description~~[1,2]~~	Well(s)	Constituent(s)	Date of SSI Determination	Date of Assessment Monitoring Notification[3]
013	Combustion Byproducts Landfill [4]	340I, 301I, 302I, 306I, 308I, 341I	Boron, Calcium, Chloride, Fluoride, pH, Sulfate, Total Dissolved Solids (TDS)	NA	NA

~~1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.~~

~~2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.~~

3 Enter month, day, and year.

4 CBL is under detection monitoring and has not requested an alternate closure determination in accordance with 40 CFR 257.103.

Table VI.D. – CCR Units Under Assessment Monitoring

N.O.R. Unit No.	Unit Description[1,2]	Well(s)	Constituent(s)	Date of SSI Determination	Date of Assessment Monitoring Notification[3]
N/A					

1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.

2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.

3 Enter month, day, and year

Table VI.D-2. – Groundwater Detection Monitoring Parameters

Parameter	Sampling Frequency	Analytical Method	Practical Quantification Limit (units)[3]	Concentration Limit~~[1]~~
Boron	Semi-annual	SW3010A, Metals Prep SW 6010B ICP-AES	0.0500 mg/l	See Note 2
Calcium	Semi-annual	SW3010A, Metals Prep SW 6010B ICP-AES	0.200 mg/l	See Note 2
Chloride	Semi-annual	E300.0 Anions	1 mg/l	See Note 2
Fluoride	Semi-annual	E300.0 Anions	0.0100 mg/l	See Note 2
pH	Semi-annual	Field pH SM 4500H +B TCEQ Vol.1	NA	See Note 2
Sulfate	Semi-annual	E300.0 Anions	1 mg/l	See Note 2
Total Dissolved Solids	Semi-annual	SM 2540C	25.0 mg/l	See Note 2

~~1 The concentration limit is the basis for determining whether a release has occurred from the CCR unit/area.~~

2 In accordance with 30 TAC 352.914 which adopts 40 CFR 257.94, groundwater concentrations of the listed constituents are analyzed using statistical analyses, specifically, 30 TAC 352.914(b) discusses actions triggered by a statistically significant increase for Appendix III constituents.

3 LCRA Environmental Laboratory Services report the Minimum Reporting Limit instead of PQL.

Table VII.A.1. – Unit Closure

For each unit to be registered, list the unit components to be decontaminated, the possible methods of decontamination, and the possible methods of disposal of wastes and waste residues generated during unit closure.

Equipment or CCR Unit	Possible Methods of Decontamination[1]	Possible Methods of Disposal[1]
CCR-1	NA	Closure in place

1 Applicants may list more than one appropriate method.

Table VII.A.2. – CCR Units Under Alternative Closure Notification

Registered Unit No.	N.O.R. Unit No.	Unit Description[1,2]	Date of Receipt of Last Waste[3]	Date of Closure Notification[3]
N/A				

1 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been requested pursuant to 40 CFR §257.103.
2 Indicates a unit for which a 30 TAC Chapter 352/40 CFR Part 257, Subpart D alternative closure determination has been made pursuant to 40 CFR §257.103.
3 Enter month, day, and year.

Table VIII.A.1. – Post-Closure Cost Summary for Existing Registered Units

Unit	Cost
CCR-1; Cell 1 and 2D	$2,013,815
Total Existing Unit Post-Closure Cost Estimate	$2,013,815 (in 2021 Dollar)[1]

Table VIII.A.2. - Post-Closure Cost Summary for Proposed Registered Units

Unit	Cost
CCR-1; Cell 2A, 2B, 2C, and 3	$610,080
Total Proposed Unit Post-Closure Cost Estimate	$610,080 (in 2021 Dollar)[1]

1 As units are added or deleted from these tables through future registration amendments, the remaining itemized unit costs should be updated for inflation when re-calculating the revised total cost in current dollars.

Table VIII.B. – Post-Closure Period

Unit Name	Date Certified Closed	Authorized Post-Closure Period (Yrs.)	Earliest Date Post-Closure Ends (See Note 1)
CCR-1	TBD	30 years	TBD

Note 1 – Post-Closure Care shall continue beyond the specified date until the Executive Director has approved the applicant's request to reduce or terminate the post-closure period, consistent with 30 TAC §352.1241 – Post-Closure Care Requirements.

Surface Impoundments: Dike Construction – Not Applicable

For each surface impoundment dike complete submit the following information:

"I, ________(licensed Professional Engineer), Texas P.E. License Number _________, of Registered Firm ________(Name), Registered Firm No.________ (Registration Number), certify under penalty of law that I have personally examined and am familiar with the design and construction of the dikes that are a portion of (surface impoundment unit name).

I further certify that I have evaluated the dike design and materials of construction using accepted engineering procedures, and have determined that the dike, including the portion of the dike providing freeboard, has structural integrity, and

(1) will withstand the stress of the pressure exerted by the types and amounts of wastes to be placed in the impoundment; and

(2) will not fail due to scouring or piping, without dependence on any liner system included in the impoundment construction.

Date: ___________________"

"(Signature)"

"(Seal)"

Attachment 2

Geosyntec consultants

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Austin, Texas 78757
PH 512.451.4003
www.Geosyntec.com

25 October 2022

Ms. Daniela Ortiz de Montellano
Texas Commission on Environmental Quality (TCEQ)
Industrial and Hazardous Waste Permits Section
Waste Permits Division

Subject: Response to Notice of Deficiency (NOD)
Lower Colorado River Authority – La Grande, Fayette County
Coal Combustion Residuals Registration No. CCR1
Industrial Solid Waste Registration No. 31575
EPA Identification No. TXD083566547
Tracking No. 27214088; RN100226844/CN600253637

Dear Ms. Ortiz de Montellano:

On behalf of the Lower Colorado River Authority (LCRA), Geosyntec Consultants (Geosyntec) has prepared this letter in response to the notice of deficiency (NOD) comments 4, 5 and 11 on the above-referenced Coal Combustion Residuals (CCR) Registration submittal transmitted in an email dated 28 September 2022 from the Texas Commission on Environmental Quality (TCEQ) to LCRA. The comment number is the same as the unique deficiency identifier in the NOD. No changes to the existing registration application are proposed to respond to these comments.

TCEQ comments 4, 5, and 11 are presented below in italicized type, with responses immediately following the comments in regular type.

Comment 4: Explain why the Austin evapotranspiration, precipitation, and temperature data was used and not the La Grande/Fayette data to calculate the leachate collection rate and maximum leachate head on the floor of the liner system.

Response to Comment 4: As shown in the Hydrologic Evaluation of Landfill Performance (HELP) model output included in Appendix C of Attachment 7, the weather data used in HELP were synthetically generated using statistical coefficients. These statistical coefficients are only available for 139 major cities across the U.S., and Austin is the city in the database that is closest to La Grange. However, the peak daily rainfall from the synthetically generated precipitation record (5.09 in.) was manually increased to model the impact of the 25-year, 24-hour storm event on peak hydraulic head. The 25-year, 24-hour storm intensity for the site was assumed to be 8.49 in. based on the average of values reported for Fayette County in the Texas Department of Transportation Hydraulic Design Manual (2011).

Comment 5: *Explain or revise if the error message, "Manning's n = 0.027 (Error! Reference source not found.2)" for the Manning's number affected the results of the hydraulic calculations for the run-off channel.*

Response to Comment 5: The error message on page 8 of Attachment 8, Appendix C occurs when an embedded Microsoft Word caption or other content that is referenced elsewhere in the document is removed. The removal of this reference does not affect the results of the hydraulic calculations for the run-off channel presented in Attachment 8, Appendix C.

Comment 11: *Clarify what type of the two final cover system configurations described will be used for proposed Cells 1, 2 and 3.*

Response to Comment 11: Either of the final cover system configurations (Option 1 or Option 2) described in Attachment 12, Section 3.4, and shown on Drawing 7 of Attachment 12 may be selected for Cells 1, 2, or 3 closure construction. Having two options gives LCRA flexibility to construct the most feasible cover at the time of construction. For example, the Option 1 final cover system requires a 3-ft thick layer of compacted clay, while the Option 2 requires 50% less compacted clay but also requires a geomembrane and geocomposite drainage layer. Depending on how far landfill development has progressed at the time of closure construction (and the amount of clay soil that has been excavated for cell construction) as well as on the availability of the required geosynthetic materials, LCRA will select either the Option 1 or Option 2 final cover system.

Geosyntec trusts that the above responses to TCEQ's comments provide the necessary information requested by TCEQ to complete their technical review.

Sincerely,

Beth Ann Gross

Olivia Bramlet, P.E.
Senior Staff Engineer

Beth Gross, Ph.D., P.E.
Senior Consultant / Principal

BETH ANN GROSS
79864

OCTOBER 25, 2022

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM
REGISTRATION #1182

Copy to: Rebecca Jones, LCRA
Nancy Overesch, LCRA
Bill Steinhauser, LCRA

Attachment 3

FAYETTE POWER PROJECT
COMBUSTION BI-PRODUCTS LANDFILL
EPA/TCEQ COAL COMBUSTION RESIDUALS RULE
WEEKLY INSPECTION REPORT (Every 7 days)

Date:
Start & End Times:
Inspectors Name/Title:
Weather & Temperature:
Ground Moisture: ☐ Dry ☐ Damp ☐ Wet
Rainfall Since Last Inspection:

Per 40 CFR 257.84 Inspections must be performed at intervals not exceeding seven days.

NOTIFY ENGINEER IMMEDIATELY UPON DETECTION OF SLOUGHING, SLIDES AND SINKHOLES.

NOTIFY ENGINEER OF OTHER ITEMS REQUIRING ATTENTION BEYOND NORMAL GRASS, VEGETATION, MINOR GRADING AND ANIMAL MAINTENANCE ISSUES.

General

Problems Noted: ☐ None ☐ Signage in need of repair or update ☐Groundwater monitor well damage
☐ On-site Haul roads in need of repair ☐Evidene of spillage of CCR on on-site haul roads
Comments/Actions:

Landfill Top Cap

Problems Noted: ☐ None ☐ Poor Grass Cover ☐Trees or Brush ☐ Animal Burrows or Damage ☐Standing Water/Ponding
☐ Wet Areas ☐ Erosion ☐ Depressions ☐ Rutting ☐ Cracks ☐ Bulges ☐Misalignment ☐ Sinkhole ☐ Other:
Comments/Actions:

Landfill Northern Slope

Problems Noted: ☐ None ☐ Poor Grass Cover ☐Trees or Brush ☐ Animal Burrows or Damage ☐ Wet Areas ☐ Erosion
☐ Depressions ☐ Rutting ☐ Cracks ☐ Bulges ☐Misalignment ☐ Sloughing ☐ Slides ☐ Sinkhole ☐ Other:
Comments/Actions:

Landfill Eastern Slope

Problems Noted: ☐ None ☐ Poor Grass Cover ☐Trees or Brush ☐ Animal Burrows or Damage ☐ Wet Areas ☐ Erosion
☐ Depressions ☐ Rutting ☐ Cracks ☐ Bulges ☐Misalignment ☐ Sloughing ☐ Slides ☐ Sinkhole ☐ Other:
Comments/Actions:

Landfill Western Slope

Problems Noted: ☐ None ☐ Poor Grass Cover ☐Trees or Brush ☐ Animal Burrows or Damage ☐ Wet Areas ☐ Erosion
☐ Depressions ☐ Rutting ☐ Cracks ☐ Bulges ☐Misalignment ☐ Sloughing ☐ Slides ☐ Sinkhole ☐ Other:
Comments/Actions:

Deficiencies requiring TCEQ notification (30 TAC 352.841): Notify TCEQ Executive Director verbally within 24 hours and in writing within 5 days if a deficiency could result in harm to human health, the environment, or has resulted in a release. Notify the TCEQ Executive Director in writing within 14 days of all other deficiencies under 40 CFR 257.84(b)(5).

Vegetation cover and topsoil conditions or changes resulting in a possible release. (Not including routine vegetation removal and reseeding, minor erosion)
Cross-contamination of stormwater and leachate. (Stormwater to leachate and leachate to stormwater)
CCR releases to adjacent surface water bodies. (Fly ash, bottom ash, gypsum)
Damage, debris, or sediment buildup in drainage works or discharge outlets result-ing in a possible release. (Does not include routine or normal maintenance)
Groundwater monitoring system well damage. (Requiring well replacement because the well is not functional)
Pump/piping conditions causing a failure in normal operations. (Does not include the use of back up/pump rental during non routine/hurricane weather conditions)
Dike condition changes requiring repairs. (Includes Engineered repairs and not routine maintenance)
And any other condition that has a very high potential for a release of CCRs from the CBL

Rev. 1 09/29/22

Attachment 4

Results of the Ground Water Statistics

for Lower Colorado River Authority Fayette Power Project

First Semi-Annual Monitoring Event in 2021

Prepared for:
Lower Colorado River Authority (LCRA)
Fayette Power Project
LaGrange, TX

Prepared by:
Jeffrey A. Holmgren
Otter Creek Environmental Services, L.L.C.
40W565 Foxwick Court
Elgin, IL 60124
(847) 464-1355

May 2021

Introduction

This report contains the results of the statistical analyses used to evaluate the ground water data obtained during the first semi-annual monitoring event in 2021 at the Lower Colorado River Authority (LCRA) Fayette Power Project. The ground water at the LCRA Fayette Power Project is monitored by wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I. Statistical comparisons and evaluation for statistically significant increases were completed within 90 days of receipt of laboratory data.

The statistical plan is designed to detect a release from the facility at the earliest indication. An intrawell methodology is described and then applied to the LCRA Fayette Power Project data. The statistics conform to the Coal Combustion Residual (CCR) rule (40 CFR Part 257), USEPA Guidance document (*"Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance,"* March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, *Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs*.

Ground Water Monitoring Program

The groundwater monitoring network for LCRA Fayette Power Project includes background well CBL 340I and down-gradient wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I. Each of the groundwater monitoring wells is sampled semiannually and analyzed for the detection monitoring parameters listed in Appendix III of 40 CFR Part 257.

.

Appendix III to Part 257 – Constituents for Detection Monitoring

Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids

Appendix IV to Part 257 – Constituents for Assessment Monitoring

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Fluoride
Lead
Lithium
Mercury
Molybdenum
Selenium
Thallium
Radium 226
Radium 228

The down-gradient groundwater data obtained during the first semi-annual monitoring event in 2021 are summarized in Attachment A. Historical Appendix III data are summarized in Attachment B.

INTRAWELL STATISTICAL METHODOLOGY FOR DETECTION MONITORING

The CCR rule provides several options for evaluating the groundwater data (40 CFR 257.93(f)). As referenced in *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (EPA 530/R-09-007), the preferred methods for comparing groundwater data are using either prediction limits or using control charts. With the accumulation of a larger set of groundwater data over time, control charts methodology becomes an advantageous method, allowing for better identification of long-term trends.

An intrawell control chart method was applied to the LCRA Fayette Power Project 2021 Q1 data using the DUMPStat® statistical program. DUMPStat® is a program for the statistical analysis of groundwater monitoring data using methods described in "Statistical Methods for Groundwater Monitoring" by Dr. Robert D. Gibbons. Groundwater statistics are conducted on the Appendix III constituents listed above. Previous statistical analyses were performed using the prediction limits method with the ProUCL program.

As of this First Quarter 2021 statistical evaluation and moving forward, intrawell analysis will continue, using the control chart methodology referenced in 40 CFR 257.93(f)(4), instead of the prediction limits method previously used. In accordance with 40 CFR 257.93(f)(6), a new certification of the statistical method was issued by a professional engineer.

Intrawell statistics

Intrawell statistics compare new measurements to the historical data at each ground water monitoring well independently. The Unified Guidance-recommended technique for intrawell comparisons is the combined Shewhart-CUSUM control chart. This control chart procedure is useful because it will detect changes in analyte concentrations both in terms of the constituent concentration and cumulative concentration increases. This method is also sensitive to sudden and gradual releases. A requirement for constructing these control charts is that the parameter is detected at a frequency greater than or equal to 25%, otherwise the data variance is not properly defined.

The combined Shewhart-CUSUM control chart assumes that the data are independent and normally distributed with a fixed mean and a constant variance. Independent data is much more critical than the normality assumption. To achieve independence, it is recommended that data are collected no more frequently than quarterly to account for seasonal variation. The combined Shewhart-CUSUM control chart is robust to deviations from normality. Because the control charts do not use a specific multiplier based on a normal distribution, it is more conservative to assume normality.

Groundwater monitoring parameters that are not detected at a frequency great enough to generate the combined Shewhart-CUSUM control charts. For constituents that are detected less than 25% of the time at a particular well, the data should be plotted as a time series until enough data points are available to provide a 99% confidence nonparametric prediction limit. Thirteen independent measurements (with 1 resample) are necessary to achieve a 99% confidence (1% false positive rate) nonparametric prediction limit. Eight independent measurements (for pass 1 of 2 resamples) are necessary to achieve a 99% confidence nonparametric prediction limit. The nonparametric prediction limit is the largest determination out of the data set collected for that well and parameter. If the detection frequency is 0% after thirteen samples have been collected, the practical quantitation limit (PQL) becomes the nonparametric prediction limit.

In developing the statistical background, the historical data must be thoroughly screened for anomalous data due to sampling error, analytical error, or simply by chance alone. An erroneous data point, if not removed prior to the mean and variance computations, would yield a larger control limit thus increasing the false negative rate. The DUMPStat® program screens for outliers using the Dixon test. If the Dixon test indicates an outlier, the value is compared to three times the median value for intrawell analyses. If the value fails both criteria of the two-stage screening, the value is considered a statistical outlier and will not be used in the mean and variance determinations. Anomalous data will still be plotted on the graphs (with a unique symbol) but will not be included in the calculations.

The verification resample plan is an integral function of the statistical method to reduce the probability that anomalous data obtained after the background has been established, is indicative of a landfill release. Should an indication of a statistically significant increase be identified, the resampling plan is implemented by the operator to collect a verification sample within 60 days of identification.

Results of the Intrawell Statistics

The Appendix III parameter data from wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I were evaluated using the combined Shewhart-CUSUM control chart method.

The initial background was established using the ProUCL software package discussed above, using data obtained in 2016 and 2017. Initial exceedances for boron at CBL-301I and boron at CBL-341I were reported following the second semi-annual monitoring in 2020. Since the boron concentrations determined subsequently in January 2021 at CBL-301I (<50 μg/L) and CBL-341I (<50 μg/L) do not exceed the baseline threshold values (BTV), the previous exceedances are not statistically significant. BTV will be analogous to control limits in this report and future reports.

As groundwater monitoring at a CCR facility proceeds, it is recommended to update background data sets periodically with valid detection monitoring results that are representative of background groundwater quality. Failure to update background will exclude factors such as natural temporal variation, changes in field or laboratory methodologies, and changes in the water table due to meteorological conditions or other influences. Since there were no exceedances attributed to the unit the background data in this evaluation includes historical data obtained from 2016 through 2020 for wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I.

A summary of the intrawell statistics is included in Attachment C, Table 1 "Summary Statistics and Intermediate Computations for Combined Shewhart-CUSUM Control Charts." The control charts or time series graphs follow the summary table. For the parameters evaluated, there were no control limit exceedances detected.

A slight increasing trend was detected in the background data for sulfate at CBL-302I.

A control chart factor was selected to provide a balance of the site-wide false positive and false negative rates. A statistical power curve indicates the expected false assessments for the site as a whole. The site-wide false positive rate is 4% and the test becomes sensitive to 3 standard deviation units over background.

CONCLUSIONS

This document describes a comprehensive statistical method designated for the LCRA Fayette Power Project. The groundwater monitoring network for LCRA Fayette Power Project includes wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I. Each of the groundwater monitoring wells is to be sampled and analyzed for the detection monitoring parameters listed in Appendix III of 40 CFR Part 257. The current groundwater data was compared to background using intrawell control charts. Using intrawell comparisons, there were no control limit exceedances detected.

Attachment A

Ground Water Data obtained during the First Semi-Annual Monitoring Event in 2021

Table 1

Analytical Data Summary for 1/26/2021 to 1/28/2021

Constituents	Units	CBL-301I	CBL-302I	CBL-306I	CBL-308I	CBL-341I
Boron, Total	mg/L	<.05	<.05	<.05	<.05	<.05
Calcium, Total	mg/L	1130	1020	257	830	874
Chloride	mg/L	2420	1370	292	2200	1800
Fluoride	mg/L	<.50	<.50	2.90	1.44	<.50
pH	S.U.	6.06	6.21	6.84	6.26	6.06
Sulfate	mg/L	374	1290	388	1340	324
Total Dissolved Solids	mg/L	6060	4800	1420	6190	3940

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment B

Historical Appendix III Ground Water Data

Table 1

Analytical Data Summary for CBL-301I

Constituents	Units	1/21/2016	5/4/2016	7/27/2016	10/24/2016	1/23/2017	3/22/2017	5/18/2017	7/26/2017	2/8/2018	7/25/2018	1/17/2019	5/2/2019	7/31/2019
Boron, Total	mg/L	<.0500	<.0500	<.0500	<.0500	<.0500	<.0500	.0707	<.0500	<.0500	<.0500	<.0500	<.0500	<.0500
Calcium, Total	mg/L	905	949	925	978	1000	1030	1060	961	873	993	156	762	783
Chloride	mg/L	2300	2160	2290	2250	3200	2390	2420	2500	2480	1330	619	1910	2240
Fluoride	mg/L	<.250	<.500	<.500	<.250	.312	<.500	<.500	<.500	<.500	<.500	.219	.112	.051
pH	S.U.	6.33	6.26	5.95	6.23	6.26	6.31	5.95	6.02	6.17	6.04	7.16	6.14	6.19
Sulfate	mg/L	336	311	336	326	488	337	342	381	344	196	104	398	332
Total Dissolved Solids	mg/L	4380	5050	6020	4570	6140	6570	6430	4290	5120	5390	1460	5650	6040

* - The displayed value is the arithmetic mean of multiple database matches.

Table 1

Analytical Data Summary for CBL-301I

Constituents	1/28/2020	9/17/2020	1/26/2021
Boron, Total	<.0500	.0801	<.0500
Calcium, Total	851	1060	1130
Chloride	2360	2270	2420
Fluoride	.130	<.250	<.500
pH	6.26	6.13	6.06
Sulfate	349	350	374
Total Dissolved Solids	4790	6340	6060

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for CBL-302I

Constituents	Units	1/22/2016	5/4/2016	7/27/2016	10/24/2016	1/23/2017	3/22/2017	5/16/2017	7/27/2017	2/8/2018	7/27/2018	1/22/2019	7/31/2019	1/30/2020
Boron, Total	mg/L	<.050	<.050	<.050	.156	<.050	.297	<.050	<.050	<.050	<.050	<.050	<.050	<.050
Calcium, Total	mg/L	1030	1010	1030	1070	1100	1090	1100	1040	934	995	855	914	838
Chloride	mg/L	2190	2130	2210	2170	2080	2050	2230	2040	2080	1980	1960	1540	1540
Fluoride	mg/L	<.2500	<.5000	<.5000	<.2500	.3320	<.5000	<.5000	<.5000	.1120	<.5000	.0402	.0605	.1930
pH	S.U.	6.29	6.01	5.17	7.75	5.36	5.40	4.94	6.20	6.21	5.77	6.44	6.15	6.34
Sulfate	mg/L	1020	993	1090	1180	1150	1120	1230	1180	1240	1390	1250	1260	1350
Total Dissolved Solids	mg/L	5500	5390	6850	4210	6430	6460	5860	5120	6010	5510	5060	4190	4790

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for CBL-302I

Constituents	9/17/2020	1/28/2021
Boron, Total	<.050	<.050
Calcium, Total	853	1020
Chloride	1410	1370
Fluoride	<.2500	<.5000
pH	6.20	6.21
Sulfate	1280	1290
Total Dissolved Solids	4990	4800

* - The displayed value is the arithmetic mean of multiple database matches.

Table 3

Analytical Data Summary for CBL-306I

Constituents	Units	1/21/2016	5/4/2016	7/26/2016	10/24/2016	1/19/2017	3/22/2017	5/18/2017	7/27/2017	2/8/2018	7/27/2018	1/16/2019	7/31/2019	8/23/2019
Boron, Total	mg/L	<.0500	.0717	.0998	.0556	<.0500	.1240	.0832	.0531	<.0500	<.0500	<.0500	.0824	.0500
Calcium, Total	mg/L	137			198	174	204	205	234	230	275	180	106	226
Chloride	mg/L	155	20		330	197	231	289	350	385	283	215	538	318
Fluoride	mg/L	2.50	1.00	1.37	2.38	1.85	12.60	2.20	2.91	2.81	2.95	1.98	9.26	2.66
pH	S.U.	7.09	6.69	6.95	6.72	7.29	4.41	5.61	6.94	6.67	6.86	6.78	6.92	6.83
Sulfate	mg/L	266.0	29.5	139.0	432.0	270.0	340.0	412.0	513.0	493.0	406.0	292.0	816.0	387.0
Total Dissolved Solids	mg/L	1280	431	790	1150	1320	1460	1440	1280	1760	1450	1220	676	1710

* - The displayed value is the arithmetic mean of multiple database matches.

Table 3

Analytical Data Summary for CBL-306I

Constituents	1/29/2020	9/19/2020	1/28/2021
Boron, Total	<.0500	.0773	<.0500
Calcium, Total	247	260	257
Chloride	445	420	292
Fluoride	2.83	2.72	2.90
pH	6.70	7.16	6.84
Sulfate	561.0	506.0	388.0
Total Dissolved Solids	1830	1730	1420

* - The displayed value is the arithmetic mean of multiple database matches.

Table 4

Analytical Data Summary for CBL-308I

Constituents	Units	1/22/2016	5/4/2016	7/26/2016	10/24/2016	1/19/2017	3/22/2017	5/16/2017	7/26/2017	2/6/2018	7/25/2018	1/18/2019	7/31/2019	1/29/2020
Boron, Total	mg/L	<.0500	.1210	.1860	.2560	<.0500	.5450	.1090	.0799	<.0500	<.0500	<.0500	<.0500	<.0500
Calcium, Total	mg/L	903	870	911	939	919	947	954	878	859	863	760	840	745
Chloride	mg/L	2760	2580	2680	2870	2360	2530	2740	2760	2750	2680	2240	2290	2110
Fluoride	mg/L	1.49	2.30	1.64	1.59	1.33	9.05	1.70	1.90	1.76	2.10	1.68	1.62	1.60
pH	S.U.	6.36	6.13	5.95	6.27	6.83	6.27	5.54	6.27	6.26	6.07	6.39	6.25	6.37
Sulfate	mg/L	1490	1410	1490	1550	1320	1470	1580	1550	1570	1540	1520	1420	1340
Total Dissolved Solids	mg/L	6820	6120	7890	10200	9620	7260	6590	6480	6200	6320	4760	5820	5980

* - The displayed value is the arithmetic mean of multiple database matches.

Table 4

Analytical Data Summary for CBL-308I

Constituents	9/18/2020	1/28/2021
Boron, Total	.1030	<.0500
Calcium, Total	838	830
Chloride	2410	2200
Fluoride	1.33	1.44
pH	6.22	6.26
Sulfate	1310	1340
Total Dissolved Solids	6860	6190

* - The displayed value is the arithmetic mean of multiple database matches.

Table 5

Analytical Data Summary for CBL-341I

Constituents	Units	1/23/2017	2/23/2017	3/22/2017	4/20/2017	5/16/2017	6/20/2017	7/27/2017	2/8/2018	8/24/2018	1/22/2019	7/31/2019	1/30/2020	9/17/2020
Boron, Total	mg/L	<.0500	<.0500	<.0500	.0587	.0896	.0668	.0507	<.0500	<.0500	<.0500	<.0500	<.0500	.1020
Calcium, Total	mg/L	854	870	906	898	860	950	829	810	824	782	714	767	814
Chloride	mg/L	1600	2000	1780	1770	1900	1820	1970	2110	1910	1790	1650	1780	1700
Fluoride	mg/L	.5300	<.5000	<.5000	<.5000	<.5000	.3350	.0550	.1060	.1140	.0546	.1000	.1530	<.2500
pH	S.U.	5.74		5.72	5.73	5.54	6.19	6.21	6.18	5.82	6.38	6.23	6.27	6.14
Sulfate	mg/L	307	404	346	336	369	363	419	383	376	358	329	351	336
Total Dissolved Solids	mg/L	5000	4520	5110	4240	4840	5940	4150	4320	4800	3870	5370	4900	4930

* - The displayed value is the arithmetic mean of multiple database matches.

Table 5

Analytical Data Summary for CBL-341I

Constituents	1/27/2021
Boron, Total	<.0500
Calcium, Total	874
Chloride	1800
Fluoride	<.5000
pH	6.06
Sulfate	324
Total Dissolved Solids	3940

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment C

Summary Tables and Graphs for the Intrawell Comparisons

Table 1

Summary Statistics and Intermediate Computations for Combined Shewhart-CUSUM Control Charts

Constituent	Units	Well	N(back)	N(mon)	N(tot)	Mean	SD	R(i-1)	R(i)	S(i-1)	S(i)	Limit	Type	Conf	
Boron, Total	mg/L	CBL-301I	15	1	16			0.0801	0.0500			0.0801	nonpar	.99	**
Boron, Total	mg/L	CBL-302I	14	1	15			0.0500	0.0500			0.2970	nonpar	.99	**
Boron, Total	mg/L	CBL-306I	15	1	16	0.0665	0.0228	0.0773	0.0500		0.0665	0.1806	normal		
Boron, Total	mg/L	CBL-308I	14	1	15	0.1250	0.1357	0.1030	0.0500		0.1250	0.8036	normal		
Boron, Total	mg/L	CBL-341I	13	1	14	0.0591	0.0172	0.1020	0.0500		0.0591	0.1452	normal		
Calcium, Total	mg/L	CBL-301I	14	1	16	937.8571	94.2189	1060.0000	1130.0000		1059.3358	1408.9518	normal		
Calcium, Total	mg/L	CBL-302I	14	1	15	989.9286	94.3541	853.0000	1020.0000		989.9286	1461.6988	normal		
Calcium, Total	mg/L	CBL-306I	13	1	16	205.8462	47.9997	260.0000	257.0000		221.0002	445.8448	normal		
Calcium, Total	mg/L	CBL-308I	14	1	15	873.2857	63.6389	838.0000	830.0000		873.2857	1191.4803	normal		
Calcium, Total	mg/L	CBL-341I	13	1	14	836.7692	63.0491	814.0000	874.0000		836.7692	1152.0149	normal		
Chloride	mg/L	CBL-301I	14	1	16	2292.8571	394.9183	2270.0000	2420.0000		2292.8571	4267.4485	normal		
Chloride	mg/L	CBL-302I	14	1	15	1972.1429	271.4967	1410.0000	1370.0000		1972.1429	3329.6262	normal		
Chloride	mg/L	CBL-306I	13	1	16	319.6923	108.7837	420.0000	292.0000		319.6923	863.6109	normal		
Chloride	mg/L	CBL-308I	14	1	15	2554.2857	234.4458	2410.0000	2200.0000		2554.2857	3726.5147	normal		
Chloride	mg/L	CBL-341I	13	1	14	1829.2308	144.5373	1700.0000	1800.0000		1829.2308	2551.9172	normal		
Fluoride	mg/L	CBL-301I	15	1	16	0.3883	0.1724	0.5000	0.5000		0.3883	1.2502	normal		
Fluoride	mg/L	CBL-302I	14	1	15	0.3741	0.1872	0.5000	0.5000		0.3741	1.3103	normal		
Fluoride	mg/L	CBL-306I	13	1	16	2.3200	0.6159	2.7200	2.9000		2.4380	5.3997	normal		
Fluoride	mg/L	CBL-308I	13	1	15	1.6954	0.2759	1.3300	1.4400		1.6954	3.0751	normal		
Fluoride	mg/L	CBL-341I	13	1	14	0.3037	0.2058	0.5000	0.5000		0.3037	1.3325	normal		
pH	S.U.	CBL-301I	15	1	16	6.2267	0.2859	6.1300	6.0600		6.2267	4.80 - 7.66	normal		
pH	S.U.	CBL-302I	14	1	15	6.0164	0.6925	6.2000	6.2100		6.0164	2.55 - 9.48	normal		
pH	S.U.	CBL-306I	15	1	16	6.6413	0.7227	7.1600	6.8400		6.6413	3.03 - 10.25	normal		
pH	S.U.	CBL-308I	14	1	15	6.2271	0.2799	6.2200	6.2600		6.2271	4.83 - 7.63	normal		
pH	S.U.	CBL-341I	12	1	14	6.0125	0.2802	6.1400	6.0600		6.0125	4.61 - 7.41	normal		
Sulfate	mg/L	CBL-301I	14	1	16	344.7143	61.2164	350.0000	374.0000		344.7143	650.7964	normal		
Sulfate	mg/L	CBL-302I	14	1	15	1195.2143	114.4648	1280.0000	1290.0000		1204.1514	1767.5381	normal		
Sulfate	mg/L	CBL-306I	14	1	16	416.6429	163.4642	506.0000	388.0000		416.6429	1233.9640	normal		
Sulfate	mg/L	CBL-308I	14	1	15	1468.5714	93.7146	1310.0000	1340.0000		1468.5714	1937.1442	normal		
Sulfate	mg/L	CBL-341I	13	1	14	359.7692	30.9493	336.0000	324.0000		359.7692	514.5157	normal		
Total Dissolved Solids	mg/L	CBL-301I	14	1	16	5484.2857	791.9083	6340.0000	6060.0000		5484.2857	9443.8270	normal		
Total Dissolved Solids	mg/L	CBL-302I	14	1	15	5455.0000	806.9387	4990.0000	4800.0000		5455.0000	9489.6933	normal		
Total Dissolved Solids	mg/L	CBL-306I	15	1	16	1301.8000	409.5196	1730.0000	1420.0000		1301.8000	3349.3981	normal		
Total Dissolved Solids	mg/L	CBL-308I	14	1	15	6922.8571	1459.6756	6860.0000	6190.0000		6922.8571	14221.2350	normal		
Total Dissolved Solids	mg/L	CBL-341I	13	1	14	4768.4615	554.2239	4930.0000	3940.0000		4768.4615	7539.5809	normal		

N(back) and N(mon) = Non-outlier measurements in the background and monitoring periods.
N(tot) = All independent measurements for that constituent and well.
For transformed data, mean and SD in transformed units and control limit in original units.
Conf = confidence level for passing initial test or one of two verification resamples (nonparametric test only).
* - Insufficient Data.
** - Detection Frequency < 25%.
*** - Zero Variance.

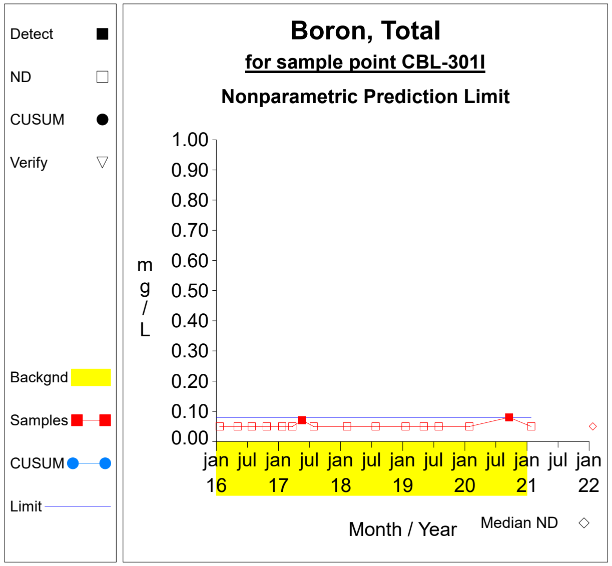
Table 4

Dixon's Test Outliers
1% Significance Level

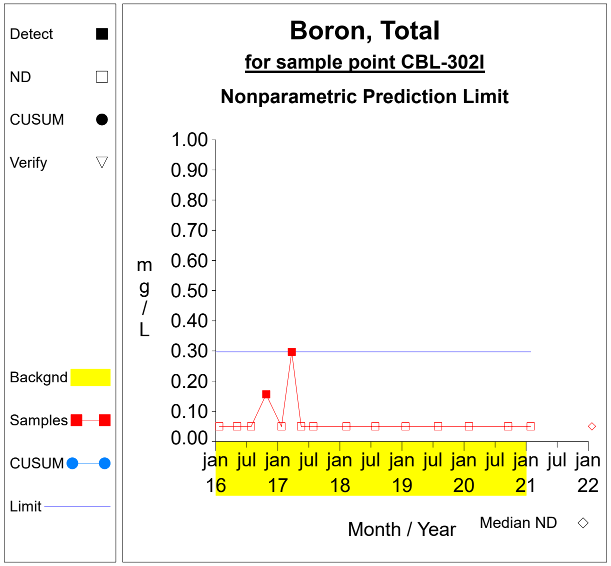
Constituent	Units	Well	Date	Result	ND Qualifier	Date Range	N	Critical Value
Calcium, Total	mg/L	CBL-301I	01/17/2019	156.0000		01/21/2016-09/17/2020	15	0.6177
Chloride	mg/L	CBL-301I	01/17/2019	619.0000		01/21/2016-09/17/2020	15	0.6177
Chloride	mg/L	CBL-306I	05/04/2016	20.0000		01/21/2016-09/19/2020	14	0.6403
Fluoride	mg/L	CBL-306I	03/22/2017	12.6000		01/21/2016-09/19/2020	15	0.6403
Fluoride	mg/L	CBL-306I	07/31/2019	9.2600		01/21/2016-09/19/2020	15	0.6403
Fluoride	mg/L	CBL-308I	03/22/2017	9.0500		01/22/2016-09/18/2020	14	0.6403
Sulfate	mg/L	CBL-301I	01/17/2019	104.0000		01/21/2016-09/17/2020	15	0.6177
Sulfate	mg/L	CBL-306I	05/04/2016	29.5000		01/21/2016-09/19/2020	15	0.6177
Total Dissolved Solids	mg/L	CBL-301I	01/17/2019	1460.0000		01/21/2016-09/17/2020	15	0.6177

N = Total number of independent measurements in background at each well.
Date Range = Dates of the first and last measurements included in background at each well.
Critical Value depends on the significance level and on N-1 when the two most extreme values are tested or N for the most extreme value.

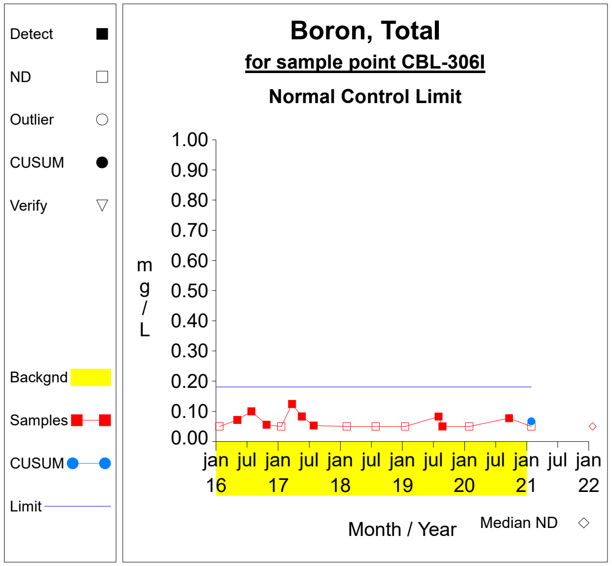
Intra-Well Control Charts / Prediction Limits



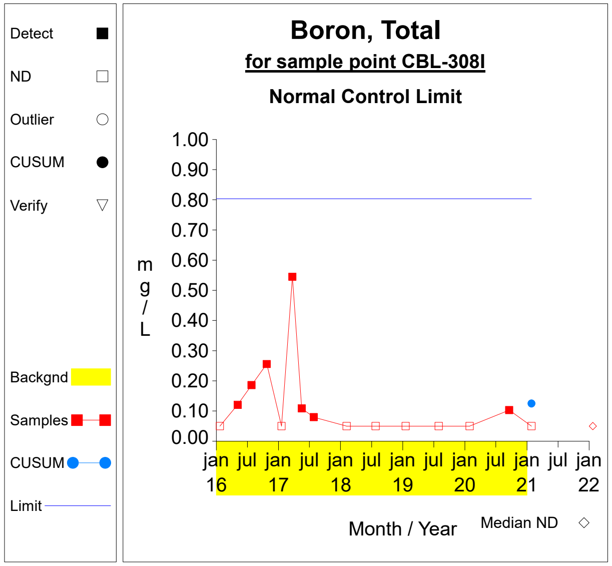
Graph 1



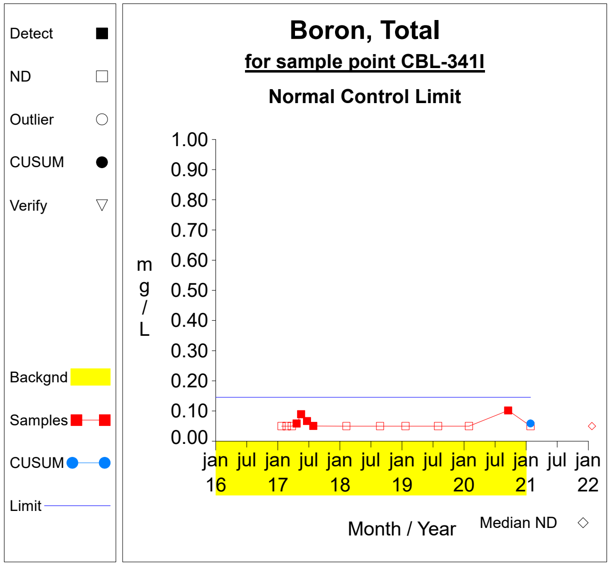
Graph 2



Graph 3



Graph 4

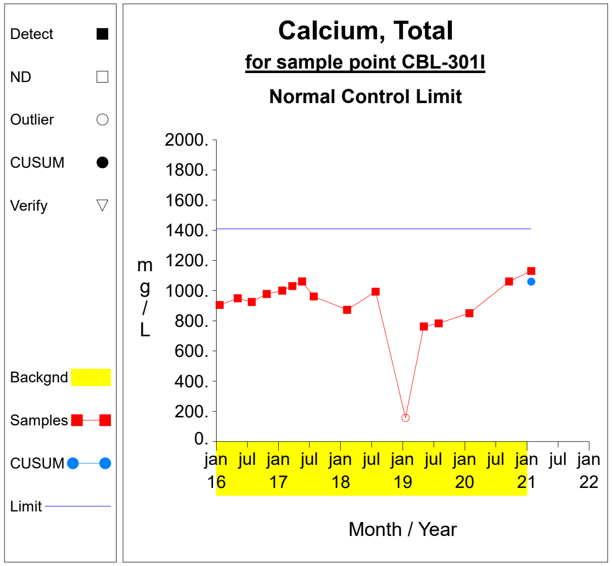


Graph 5

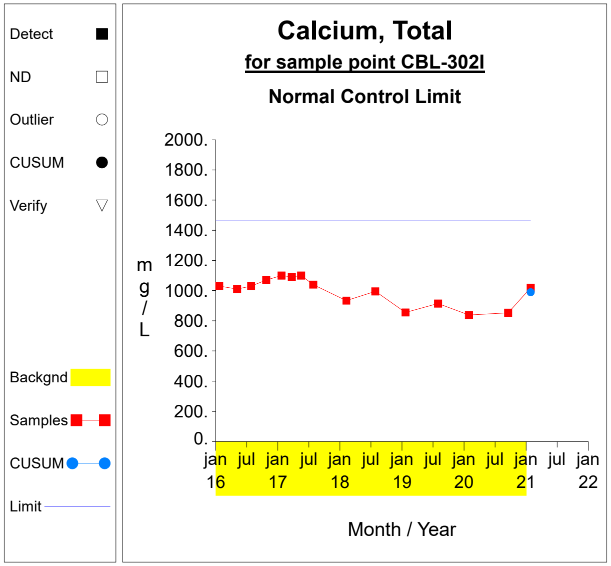
LCRA Fayette Power [GW]

May 2021

Intra-Well Control Charts / Prediction Limits



Graph 6



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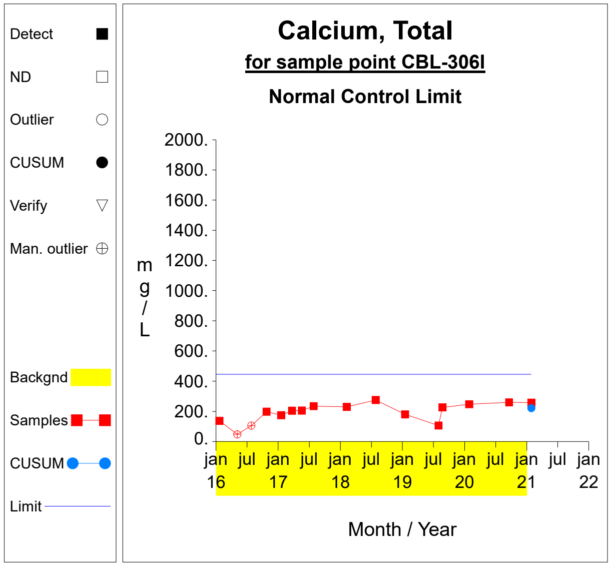

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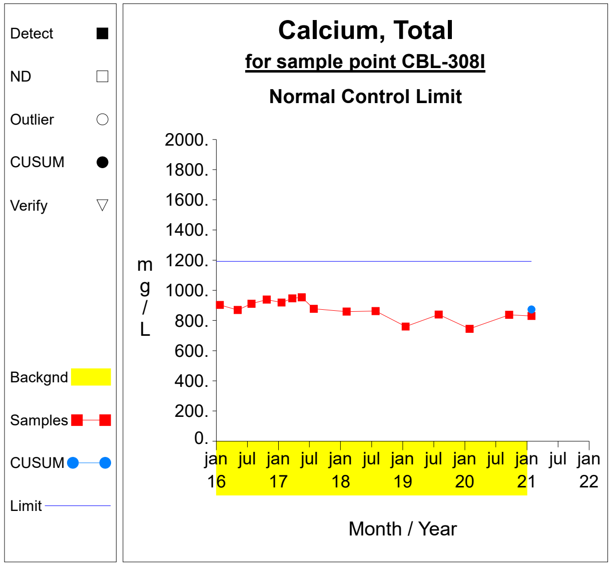
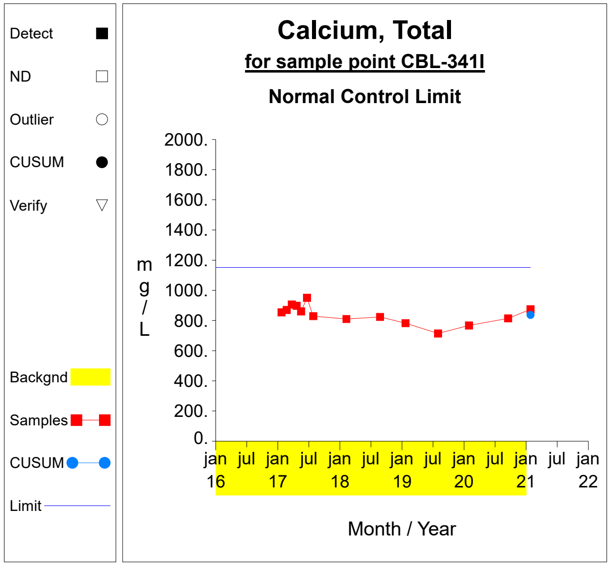


Graph 9



Graph 10

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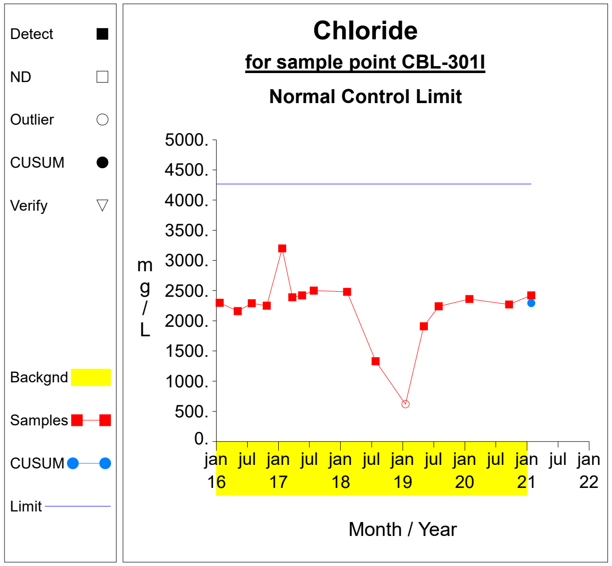
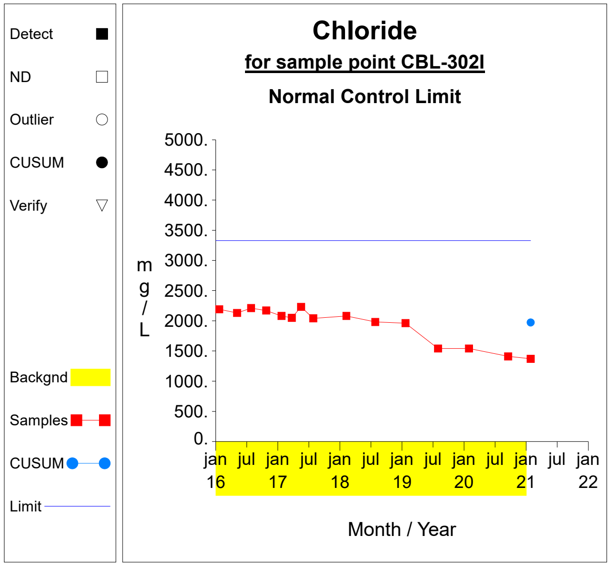
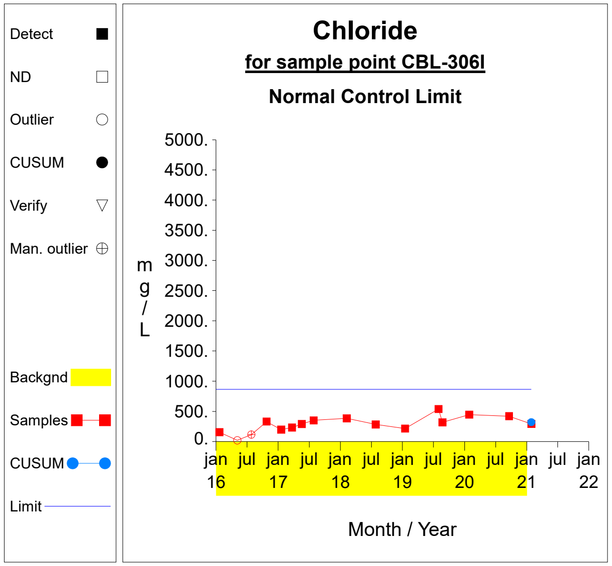
Intra-Well Control Charts / Prediction Limits



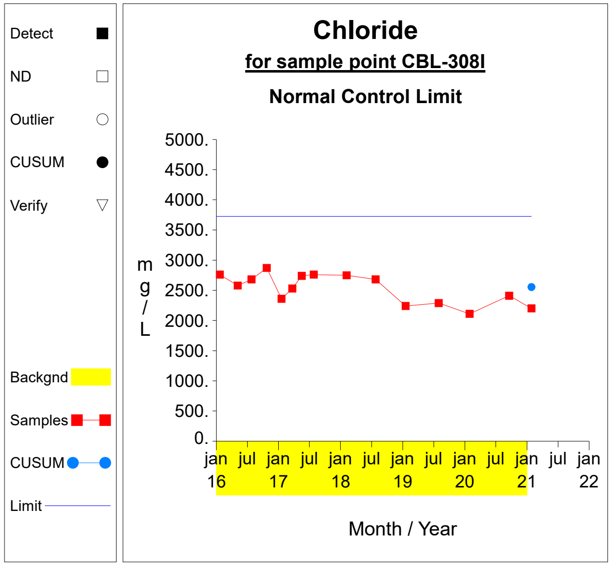
Graph 11



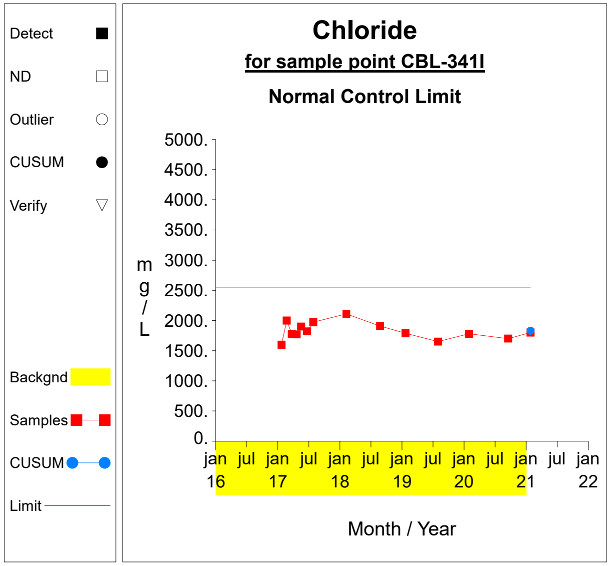
Graph 12



Graph 13

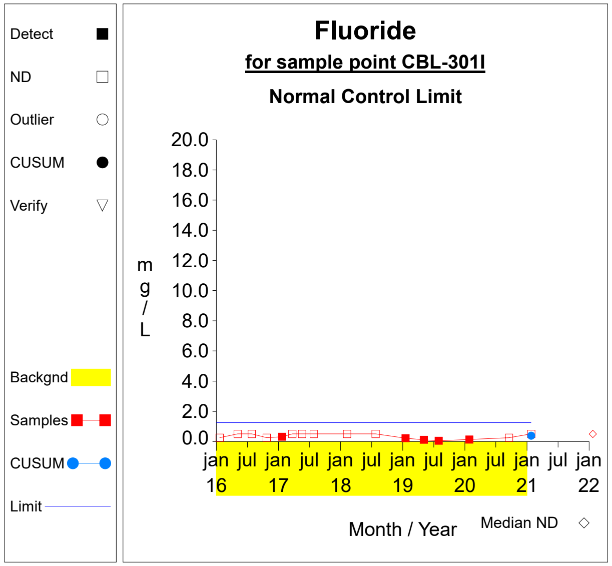


Graph 14

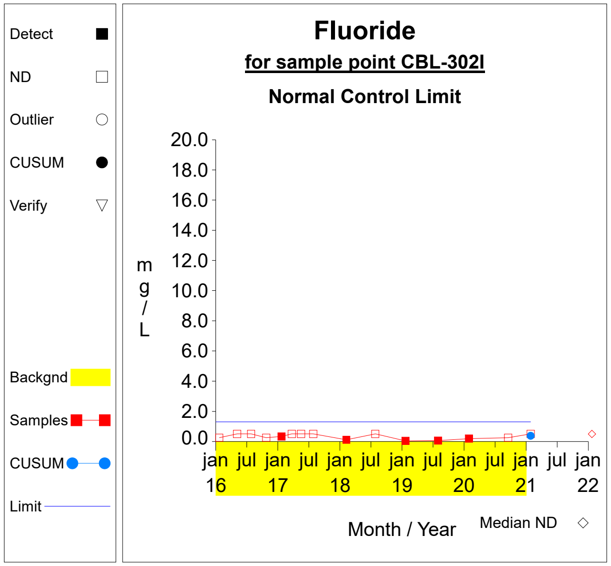


Graph 15

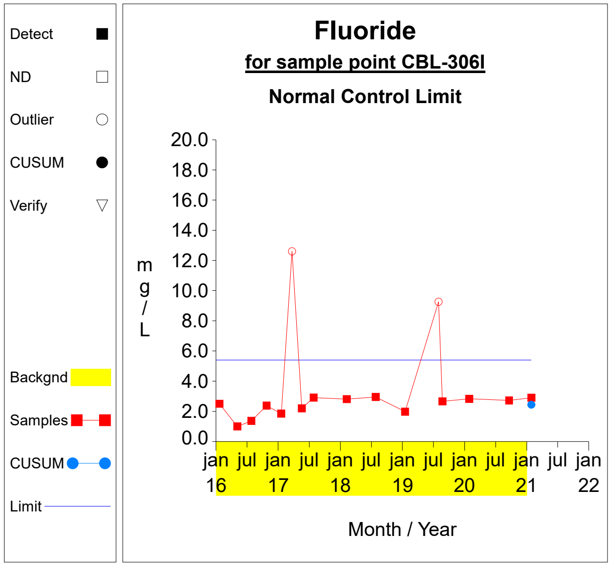
Intra-Well Control Charts / Prediction Limits



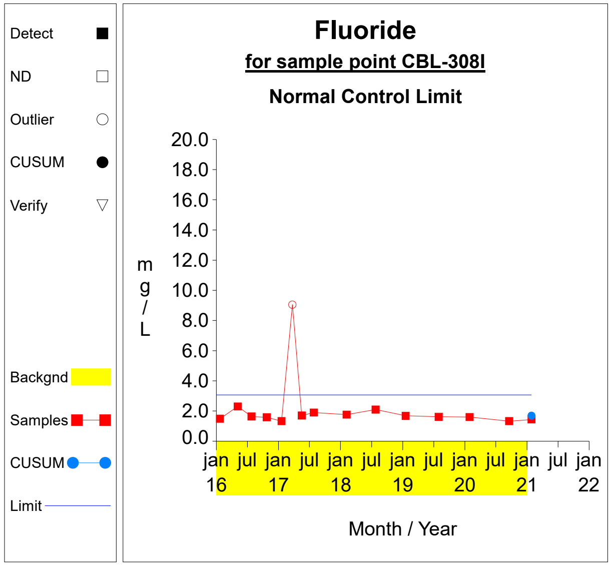
Graph 16



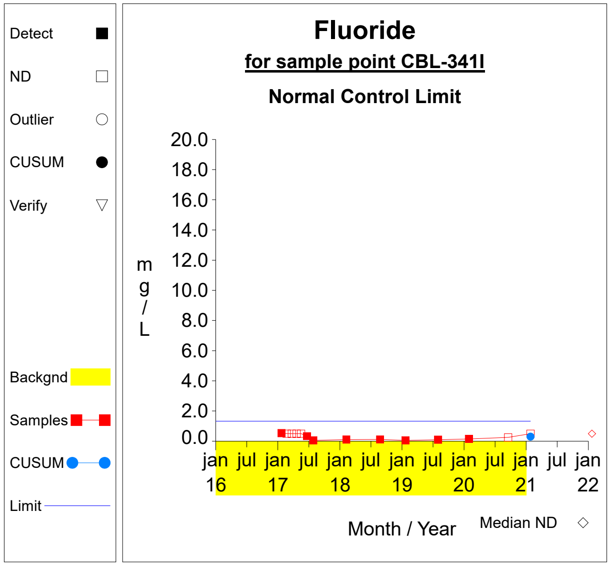
Graph 17



Graph 18

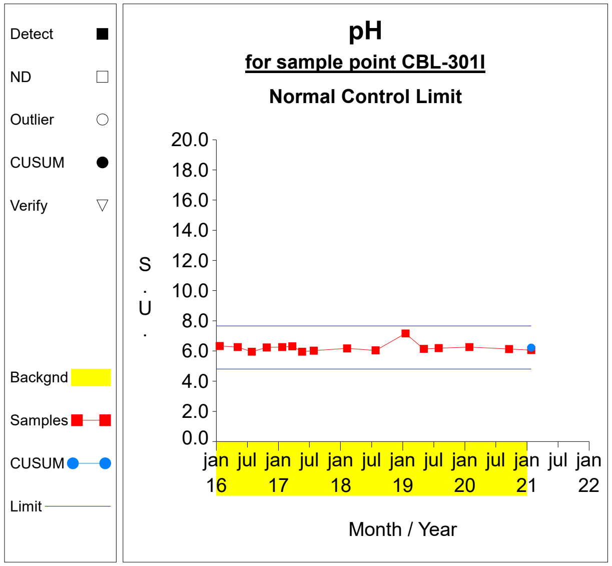


Graph 19



Graph 20

Intra-Well Control Charts / Prediction Limits



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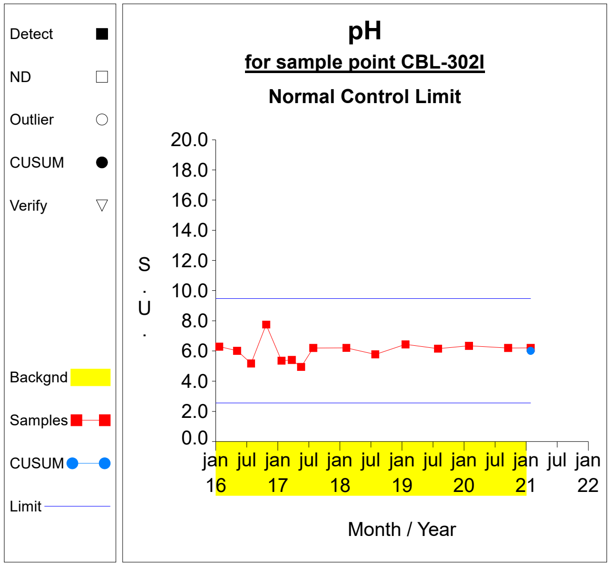
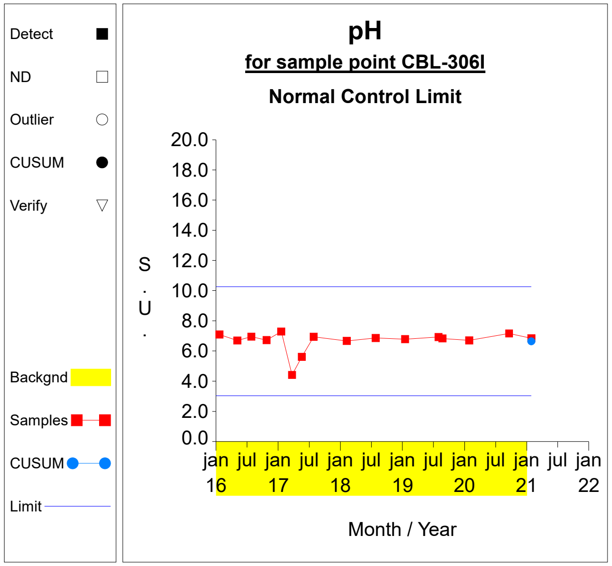
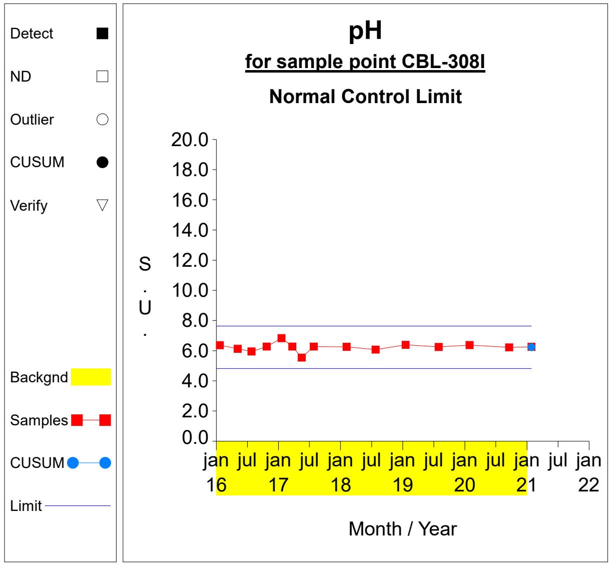


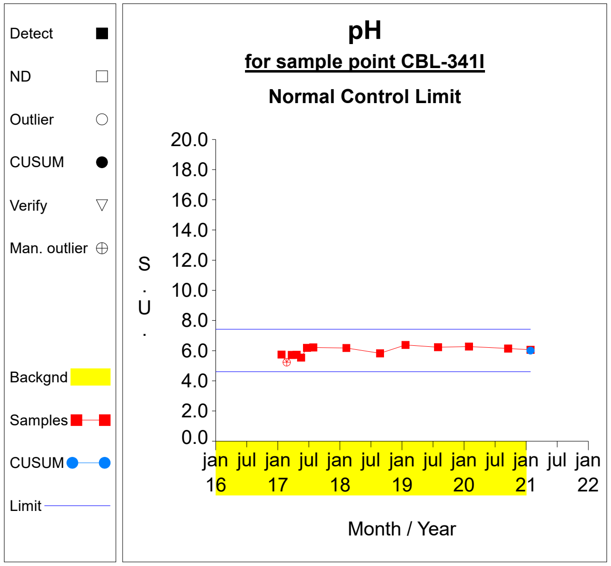
Graph 22



Graph 23

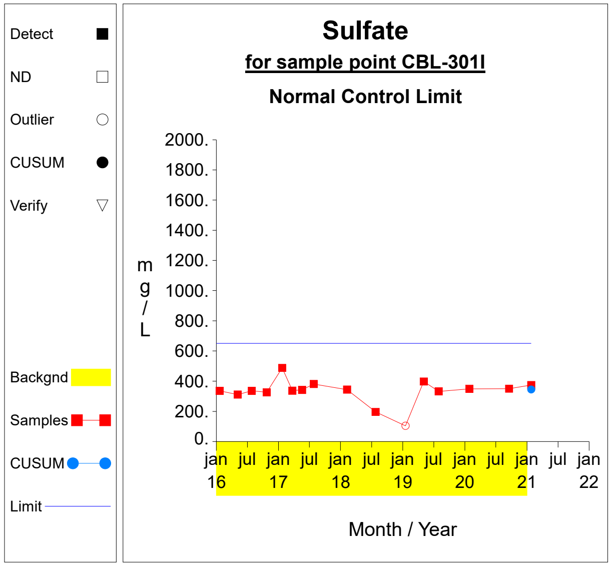


Graph 24

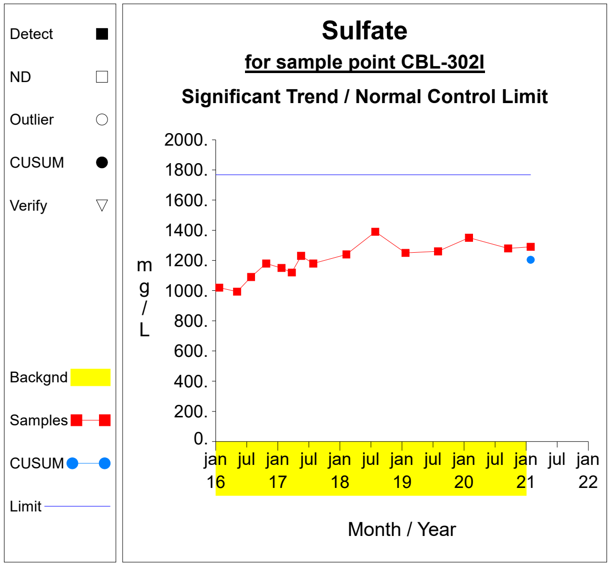


Graph 25

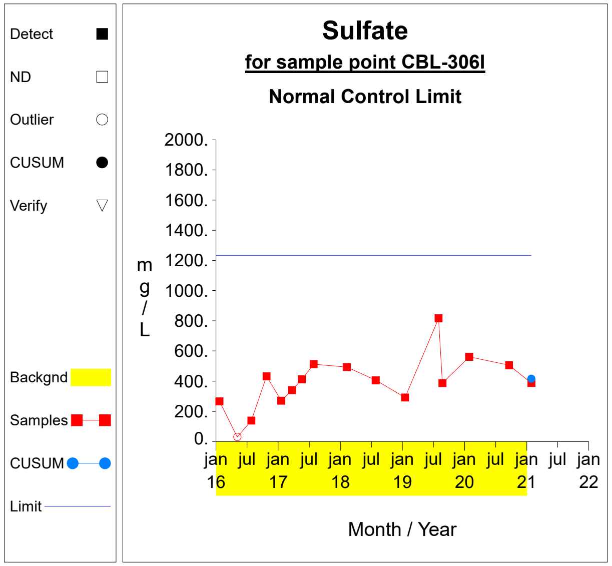
Intra-Well Control Charts / Prediction Limits



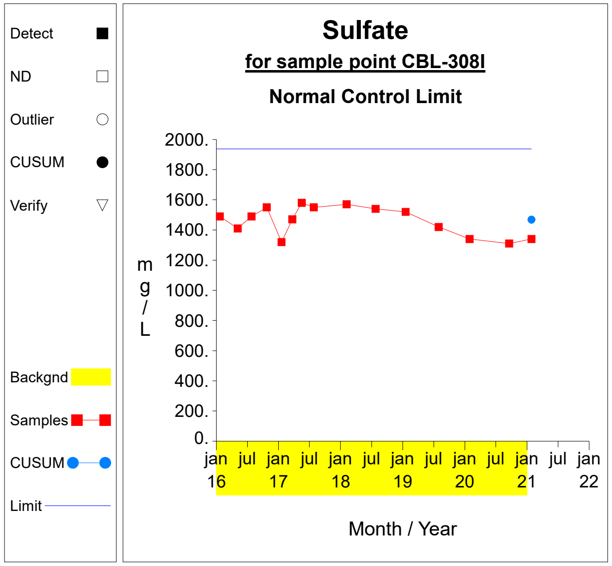
Graph 26



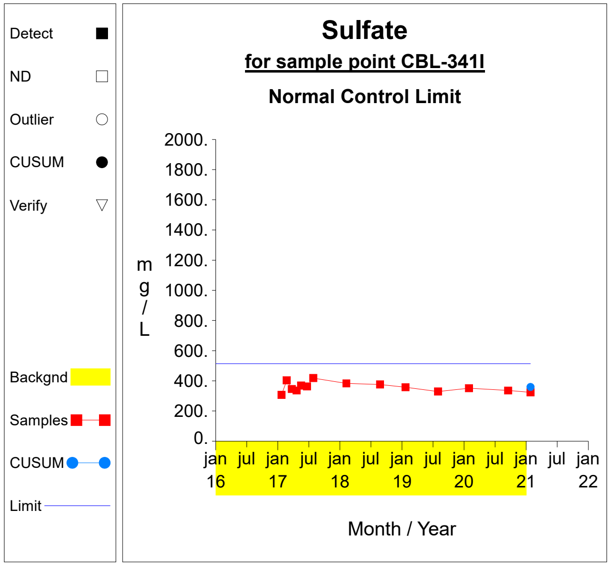
Graph 27



Graph 28



Graph 29



Graph 30

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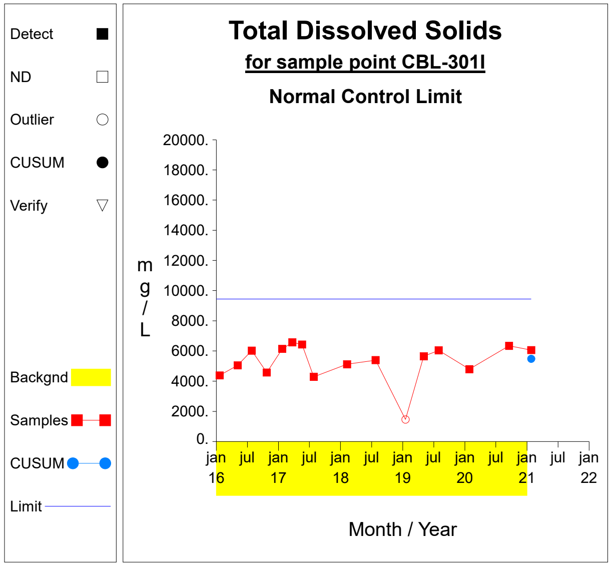
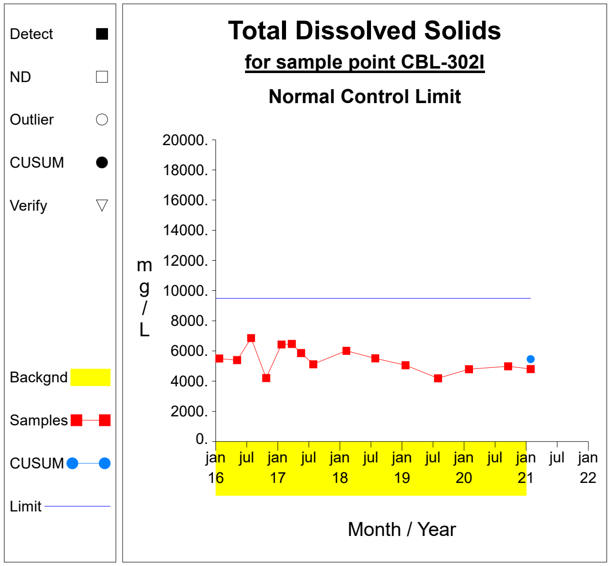
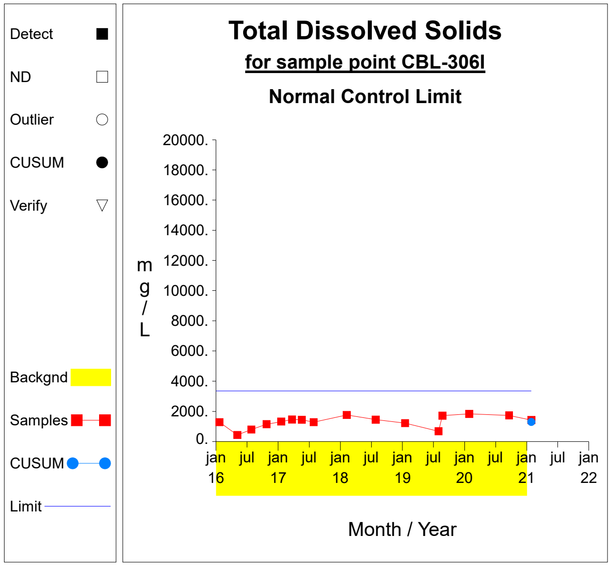
Intra-Well Control Charts / Prediction Limits



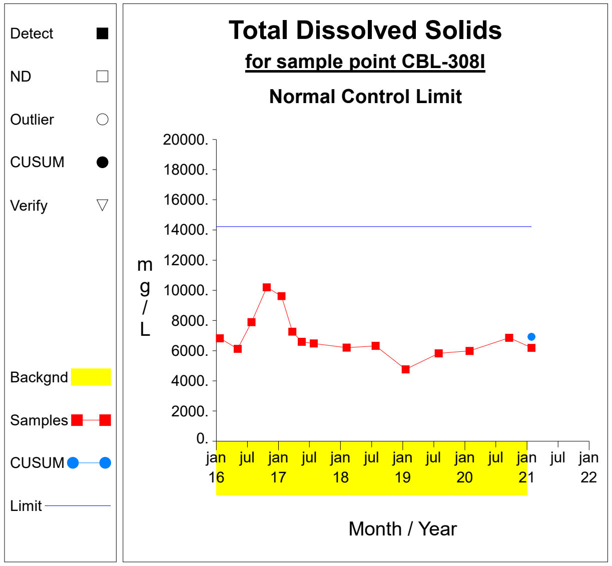
Graph 31



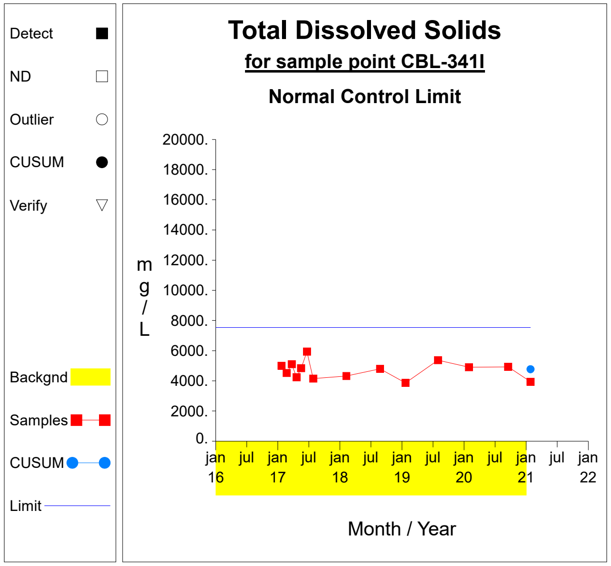
Graph 32



Graph 33

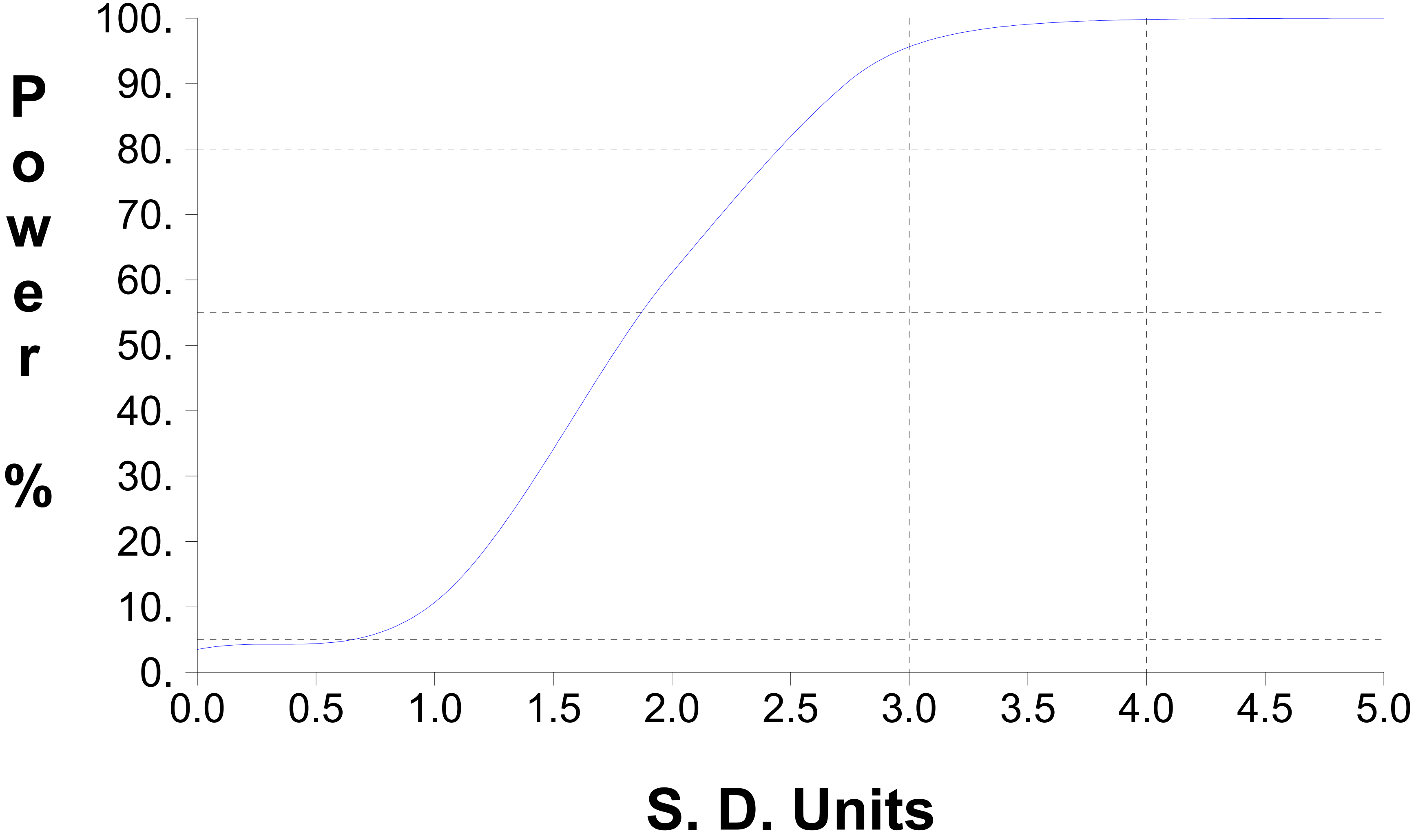


Graph 34



Graph 35

False Positive and False Negative Rates for Current Intra-Well Control Charts Monitoring Program



Results of the Groundwater Statistics

for Lower Colorado River Authority Fayette Power Project

Second Semi-Annual Monitoring Event in 2021

Prepared for:
Lower Colorado River Authority (LCRA)
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November 2021

Introduction

This report contains the results of the statistical analyses used to evaluate the groundwater data obtained during the second semi-annual monitoring event in 2021 at the Lower Colorado River Authority (LCRA) Fayette Power Project (FPP). The groundwater at the FPP is monitored by wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I. Statistical comparisons and evaluation for statistically significant increases (SSIs) were completed within 90 days of receipt of laboratory data.

The statistical plan is designed to detect a release from the facility at the earliest indication. An intrawell methodology is described and then applied to the FPP data. The statistical method conforms with the Coal Combustion Residual (CCR) rule (40 CFR 257), USEPA Guidance document ("*Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance*", March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, *Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs*.

Ground Water Monitoring Program

The groundwater monitoring network for FPP includes background well CBL-340I and downgradient wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I. Each of the groundwater monitoring wells is to be sampled at least semiannually and analyzed for the Detection Monitoring parameters listed in Appendix III of 40 CFR Part 257, as follows:

Boron
Calcium
Chloride
Fluoride
pH
Sulfate
Total Dissolved Solids

The groundwater data obtained during the second semi-annual monitoring event in 2021 are summarized in Attachment A. Historical Appendix III data is summarized in Attachment B.

STATISTICAL METHODOLOGIES FOR DETECTION MONITORING

The CCR rule for statistical analysis provides several options for evaluating the ground water data (40 CFR 257.93[f]. As referenced in Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (EPA 530/R-09-007), the preferred methods for comparing groundwater data are using either prediction limits or control charts. The control chart procedure offers an advantage over the prediction limits procedure as more data is generated over time, because they generate a graph of compliance data over time and allow for better identification of long-term trends.

An intrawell control chart method was applied to the FPP 2021 Q2 data using the DUMPStat® statistical program. DUMPStat® is a program for the statistical analysis of groundwater monitoring data using methods described in "Statistical Methods for Groundwater Monitoring" by Dr. Robert D. Gibbons. Groundwater statistical analyses are conducted on the Appendix III constituents listed above.

Intrawell statistics

Intrawell statistics compare new measurements to the historical data at each groundwater monitoring well independently. The Unified Guidance-recommended technique for intrawell comparisons is the combined Shewhart-CUSUM control chart. This control chart procedure is useful because it will detect changes in analyte concentrations both in terms of the constituent concentration and cumulative concentration increases. This method is also sensitive to sudden and gradual releases. A requirement for constructing these control charts is the parameter is detected at a frequency greater than or equal to 25%, otherwise data variance is not properly defined.

The combined Shewhart-CUSUM control chart assumes that the data are independent and normally distributed with a fixed mean and a constant variance. Independent data is much more critical than the normality assumption. To achieve independence, it is recommended that data are collected no more frequently than quarterly to account for seasonal variation. The combined Shewhart-CUSUM control chart is robust to deviations from normality. Because the control charts do not use a specific multiplier based on a normal distribution, it is more conservative to assume normality.

Groundwater monitoring parameters are not detected at a frequency great enough to generate the combined Shewhart-CUSUM control charts. For constituents that are detected less than 25% of the time at a particular well, the data are plotted as a time series until enough data points are available to provide a 99% confidence nonparametric prediction limit. Thirteen independent measurements (with 1 resample) are necessary to provide a 99% confidence (1% false positive rate) nonparametric prediction limit. Eight independent measurements (for pass 1 of 2 resamples) are necessary to achieve a 99% confidence nonparametric prediction limit. The nonparametric prediction limit is the largest determination out of the data set collected for that well and parameter. If the detection frequency is 0% after thirteen samples have been collected, the practical quantitation limit (PQL) becomes the nonparametric prediction limit.

In developing the statistical background, the historical data was thoroughly screened for anomalous data due to sampling error, analytical error, or simply by chance alone. An erroneous data point, if not removed prior to the mean and variance computations, would yield a larger control limit thus increasing the false negative rate. The DUMPStat® program screens for outliers using the Dixon test. If the Dixon test indicates an outlier, the value is compared to three times the median value for intrawell analyses. If the value fails both criteria of the two-stage screening, the value is considered a statistical outlier and will not be used in the mean and variance determinations. Anomalous data will still be plotted on the graphs (with a unique symbol) but will not be included in the calculations.

The verification resample plan is an integral function of the statistical plan to reduce the probability that anomalous data obtained after the background has been established, is indicative of a landfill release. Should an indication of a statistically significant increase be identified, the resampling plan is implemented by the operator to collect a verification sample within 60 days of identification.

Results of the Intrawell Statistics

The Appendix III parameter data from wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I were evaluated using the combined Shewhart-CUSUM control chart method.

The initial background data for each well was established with the ProUCL software using data obtained in 2016 and 2017. Initial exceedances for boron at CBL-301I and boron at CBL-341I were reported following the second semi-annual monitoring in 2020. Since the boron concentrations determined subsequently in January 2021 at CBL-301I (<0.050 mg/L) and CBL-341I (<0.050 mg/L) do not exceed the baseline threshold values (BTV), the previous exceedances are not statistically significant. BTV will be analogous to control limits in this report and future reports.

As groundwater monitoring at a CCR facility proceeds, it is recommended to update monitoring well background data sets periodically with valid detection monitoring results that are representative of background groundwater quality. Failure to update background data sets will exclude factors such as natural temporal variation, changes in field or laboratory methodologies, and changes in the water table due to meteorological conditions or other influences. Since there were no exceedances attributed to the unit, the groundwater monitoring well background data sets in this evaluation includes historical data obtained from 2016 through 2020 for wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I.

A summary of the intrawell statistics is included in Attachment C, Table 1 "Summary Statistics and Intermediate Computations for Combined Shewhart-CUSUM Control Charts." The control charts or time series graphs follow the summary table. For the parameters evaluated, the control limit exceedances detected are summarized in the table below.

Control Limit Exceedances during the Second Semi-Annual Monitoring Event in 2021 (initial sampling event)

Well	Parameter	Result	CUSUM Value	Control Limit	Control Limit Type	Verified/ Awaiting verification
CBL-301I	Boron, mg/L	0.0826	--	0.0801	Nonparametric	Awaiting verification
	Fluoride, mg/L	2.68	2.5507	1.2502	Normal	Awaiting verification
CBL-302I	Fluoride, mg/L	2.25	2.1096	1.3103	Normal	Awaiting verification

In addition to the cited Control Limit exceedances, a slight increasing trend was detected in the background data for sulfate at CBL-302I.

A control chart factor was selected to provide a balance of the site-wide false positive and false negative rates. A statistical power curve indicates the expected false assessments for the site as a whole. The site-wide false positive rate is 4% and the test becomes sensitive to 3 standard deviation units over background.

Based on the initial results, monitoring wells CBL-301I and CBL-302I were resampled on September 7, 2021, and analyzed for the parameters that exceeded control limits, consistent with the established retesting protocol described in the Unified Guidance document (EPA 530/R-09-007). The results of the statistics following the resample analyses are summarized in the table below.

Statistics Following Resample Analyses

Well	Parameter	Result	CUSUM Value	Control Limit	Control Limit Type	Comment
CBL-301I	Boron, mg/L	<0.050	--	0.0801	Nonparametric	Previous exceedance not verified
	Fluoride, mg/L	<0.50	0.3883	1.2502	Normal	Previous exceedance not verified
CBL-302I	Fluoride, mg/L	<0.25	0.3741	1.3103	Normal	Previous exceedance not verified

CONCLUSIONS

This document describes a comprehensive statistical plan designated for the FPP. The groundwater monitoring network for FPP consists of monitoring wells CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I. Each of the groundwater monitoring wells is sampled and analyzed for the detection monitoring parameters listed in Appendix III of 40 CFR Part 257. The current groundwater data was compared to background using intrawell control charts. Using intrawell comparisons, there were no confirmed control limit exceedances detected.

Attachment A

Groundwater Data obtained during the Second Semi-Annual Monitoring Event in 2021

Table 1

Analytical Data Summary for 7/20/2021 to 7/22/2021

Constituents	Units	CBL-301I	CBL-302I	CBL-306I	CBL-308I	CBL-341I
Boron, Total	mg/L	.0826	.0743	.0927	.1300	.1110
Calcium, Total	mg/L	1100	844	216	684	852
Chloride	mg/L	2590	1380	255	1780	1750
Fluoride	mg/L	2.68	2.25	2.42	1.74	1.16
pH	S.U.	6.13	6.06	6.55	6.16	5.98
Sulfate	mg/L	419	1350	336	1240	316
Total Dissolved Solids	mg/L	5870	4810	1320	5270	4520

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for 9/7/2021

Constituents	Units	CBL-301I	CBL-302I	CBL-341I
Boron, Total	mg/L	<.05		
Fluoride	mg/L	<.50	<.25	<.25
pH	S.U.	6.14	6.28	6.18

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment B

Historical Appendix III Groundwater Data

Table 1

Analytical Data Summary for CBL-301I

Constituents	Units	1/21/2016 1/22/2016	5/4/2016	7/26/2016 7/27/2016	10/24/2016	1/23/2017	3/22/2017	5/16/2017 5/18/2017	7/26/2017 7/27/2017	2/6/2018 2/8/2018	7/25/2018 7/27/2018	1/16/2019 1/18/2019	5/2/2019	7/31/2019
Boron, Total	mg/L	<.0500	<.0500	<.0500	<.0500	<.0500	<.0500	.0707	<.0500	<.0500	<.0500	<.0500	<.0500	<.0500
Calcium, Total	mg/L	905	949	925	978	1000	1030	1060	961	873	993	156	762	783
Chloride	mg/L	2300	2160	2290	2250	3200	2390	2420	2500	2480	1330	619	1910	2240
Fluoride	mg/L	<.250	<.500	<.500	<.250	.312	<.500	<.500	<.500	<.500	<.500	.219	.112	.051
pH	S.U.	6.33	6.26	5.95	6.23	6.26	6.31	5.95	6.02	6.17	6.04	7.16	6.14	6.19
Sulfate	mg/L	336	311	336	326	488	337	342	381	344	196	104	398	332
Total Dissolved Solids	mg/L	4380	5050	6020	4570	6140	6570	6430	4290	5120	5390	1460	5650	6040

* - The displayed value is the arithmetic mean of multiple database matches.

Table 1

Analytical Data Summary for CBL-301I

Constituents	1/28/2020 1/30/2020	9/17/2020 9/19/2020	1/26/2021 1/28/2021	7/20/2021 7/22/2021	9/7/2021
Boron, Total	<.0500	.0801	<.0500	.0826	<.0500
Calcium, Total	851	1060	1130	1100	
Chloride	2360	2270	2420	2590	
Fluoride	.130	<.250	<.500	2.680	<.500
pH	6.26	6.13	6.06	6.13	6.14
Sulfate	349	350	374	419	
Total Dissolved Solids	4790	6340	6060	5870	

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for CBL-302I

Constituents	Units	1/21/2016 1/22/2016	5/4/2016	7/26/2016 7/27/2016	10/24/2016	1/23/2017	3/22/2017	5/16/2017 5/18/2017	7/26/2017 7/27/2017	2/6/2018 2/8/2018	7/25/2018 7/27/2018	1/22/2019	7/31/2019	1/28/2020 1/30/2020
Boron, Total	mg/L	<.0500	<.0500	<.0500	.1560	<.0500	.2970	<.0500	<.0500	<.0500	<.0500	<.0500	<.0500	<.0500
Calcium, Total	mg/L	1030	1010	1030	1070	1100	1090	1100	1040	934	995	855	914	838
Chloride	mg/L	2190	2130	2210	2170	2080	2050	2230	2040	2080	1980	1960	1540	1540
Fluoride	mg/L	<.2500	<.5000	<.5000	<.2500	.3320	<.5000	<.5000	<.5000	.1120	<.5000	.0402	.0605	.1930
pH	S.U.	6.29	6.01	5.17	7.75	5.36	5.40	4.94	6.20	6.21	5.77	6.44	6.15	6.34
Sulfate	mg/L	1020	993	1090	1180	1150	1120	1230	1180	1240	1390	1250	1260	1350
Total Dissolved Solids	mg/L	5500	5390	6850	4210	6430	6460	5860	5120	6010	5510	5060	4190	4790

* - The displayed value is the arithmetic mean of multiple database matches.

Table 2

Analytical Data Summary for CBL-302I

Constituents	9/17/2020 9/19/2020	1/26/2021 1/28/2021	7/20/2021 7/22/2021	9/7/2021
Boron, Total	<.0500	<.0500	.0743	
Calcium, Total	853	1020	844	
Chloride	1410	1370	1380	
Fluoride	<.2500	<.5000	2.2500	<.2500
pH	6.20	6.21	6.06	6.28
Sulfate	1280	1290	1350	
Total Dissolved Solids	4990	4800	4810	

* - The displayed value is the arithmetic mean of multiple database matches.

Table 3

Analytical Data Summary for CBL-306I

Constituents	Units	1/21/2016 1/22/2016	5/4/2016	7/26/2016 7/27/2016	10/24/2016	1/19/2017	3/22/2017	5/16/2017 5/18/2017	7/26/2017 7/27/2017	2/6/2018 2/8/2018	7/25/2018 7/27/2018	1/16/2019 1/18/2019	7/31/2019	8/23/2019
Boron, Total	mg/L	<.0500	.0717	.0998	.0556	<.0500	.1240	.0832	.0531	<.0500	<.0500	<.0500	.0824	.0500
Calcium, Total	mg/L	137			198	174	204	205	234	230	275	180	106	226
Chloride	mg/L	155	20		330	197	231	289	350	385	283	215	538	318
Fluoride	mg/L	2.50	1.00	1.37	2.38	1.85	12.60	2.20	2.91	2.81	2.95	1.98	9.26	2.66
pH	S.U.	7.09	6.69	6.95	6.72	7.29	4.41	5.61	6.94	6.67	6.86	6.78	6.92	6.83
Sulfate	mg/L	266.0	29.5	139.0	432.0	270.0	340.0	412.0	513.0	493.0	406.0	292.0	816.0	387.0
Total Dissolved Solids	mg/L	1280	431	790	1150	1320	1460	1440	1280	1760	1450	1220	676	1710

* - The displayed value is the arithmetic mean of multiple database matches.

Table 3

Analytical Data Summary for CBL-306I

Constituents	1/28/2020 1/30/2020	9/17/2020 9/19/2020	1/26/2021 1/28/2021	7/20/2021 7/22/2021
Boron, Total	<.0500	.0773	<.0500	.0927
Calcium, Total	247	260	257	216
Chloride	445	420	292	255
Fluoride	2.83	2.72	2.90	2.42
pH	6.70	7.16	6.84	6.55
Sulfate	561.0	506.0	388.0	336.0
Total Dissolved Solids	1830	1730	1420	1320

* - The displayed value is the arithmetic mean of multiple database matches.

Table 4

Analytical Data Summary for CBL-308I

Constituents	Units	1/21/2016 1/22/2016	5/4/2016	7/26/2016 7/27/2016	10/24/2016	1/19/2017	3/22/2017	5/16/2017 5/18/2017	7/26/2017 7/27/2017	2/6/2018 2/8/2018	7/25/2018 7/27/2018	1/16/2019 1/18/2019	7/31/2019	1/28/2020 1/30/2020
Boron, Total	mg/L	<.0500	.1210	.1860	.2560	<.0500	.5450	.1090	.0799	<.0500	<.0500	<.0500	<.0500	<.0500
Calcium, Total	mg/L	903	870	911	939	919	947	954	878	859	863	760	840	745
Chloride	mg/L	2760	2580	2680	2870	2360	2530	2740	2760	2750	2680	2240	2290	2110
Fluoride	mg/L	1.49	2.30	1.64	1.59	1.33	9.05	1.70	1.90	1.76	2.10	1.68	1.62	1.60
pH	S.U.	6.36	6.13	5.95	6.27	6.83	6.27	5.54	6.27	6.26	6.07	6.39	6.25	6.37
Sulfate	mg/L	1490	1410	1490	1550	1320	1470	1580	1550	1570	1540	1520	1420	1340
Total Dissolved Solids	mg/L	6820	6120	7890	10200	9620	7260	6590	6480	6200	6320	4760	5820	5980

* - The displayed value is the arithmetic mean of multiple database matches.

Table 4

Analytical Data Summary for CBL-308I

Constituents	9/17/2020 9/19/2020	1/26/2021 1/28/2021	7/20/2021 7/22/2021
Boron, Total	.1030	<.0500	.1300
Calcium, Total	838	830	684
Chloride	2410	2200	1780
Fluoride	1.33	1.44	1.74
pH	6.22	6.26	6.16
Sulfate	1310	1340	1240
Total Dissolved Solids	6860	6190	5270

* - The displayed value is the arithmetic mean of multiple database matches.

Table 5

Analytical Data Summary for CBL-341I

Constituents	Units	1/23/2017	2/23/2017	3/22/2017	4/20/2017	5/16/2017 5/18/2017	6/20/2017	7/26/2017 7/27/2017	2/6/2018 2/8/2018	8/24/2018	1/22/2019	7/31/2019	1/28/2020 1/30/2020	9/17/2020 9/19/2020
Boron, Total	mg/L	<.0500	<.0500	<.0500	.0587	.0896	.0668	.0507	<.0500	<.0500	<.0500	<.0500	<.0500	.1020
Calcium, Total	mg/L	854	870	906	898	860	950	829	810	824	782	714	767	814
Chloride	mg/L	1600	2000	1780	1770	1900	1820	1970	2110	1910	1790	1650	1780	1700
Fluoride	mg/L	.5300	<.5000	<.5000	<.5000	<.5000	.3350	.0550	.1060	.1140	.0546	.1000	.1530	<.2500
pH	S.U.	5.74		5.72	5.73	5.54	6.19	6.21	6.18	5.82	6.38	6.23	6.27	6.14
Sulfate	mg/L	307	404	346	336	369	363	419	383	376	358	329	351	336
Total Dissolved Solids	mg/L	5000	4520	5110	4240	4840	5940	4150	4320	4800	3870	5370	4900	4930

* - The displayed value is the arithmetic mean of multiple database matches.

Table 5

Analytical Data Summary for CBL-341I

Constituents	1/26/2021 1/28/2021	7/20/2021 7/22/2021	9/7/2021
Boron, Total	<.0500	.1110	
Calcium, Total	874	852	
Chloride	1800	1750	
Fluoride	<.5000	1.1600	<.2500
pH	6.06	5.98	6.18
Sulfate	324	316	
Total Dissolved Solids	3940	4520	

* - The displayed value is the arithmetic mean of multiple database matches.

Attachment C

Summary Tables and Graphs for the Intrawell Comparisons

Table 1

Summary Statistics and Intermediate Computations for Combined Shewhart-CUSUM Control Charts

Constituent	Units	Well	N(back)	N(mon)	N(tot)	Mean	SD	R(i-1)	R(i)	S(i-1)	S(i)	Limit	Type	Conf	
Boron, Total	mg/L	CBL-301I	15	2	17			0.0500	0.0826			0.0801	nonpar	.99	**
Boron, Total	mg/L	CBL-302I	14	2	16			0.0500	0.0743			0.2970	nonpar	.99	**
Boron, Total	mg/L	CBL-306I	15	2	17	0.0665	0.0228	0.0500	0.0927	0.0665	0.0756	0.1806	normal		
Boron, Total	mg/L	CBL-308I	14	2	16	0.1250	0.1357	0.0500	0.1300	0.1250	0.1250	0.8036	normal		
Boron, Total	mg/L	CBL-341I	13	2	15	0.0591	0.0172	0.0500	0.1110	0.0591	0.0981	0.1452	normal		
Calcium, Total	mg/L	CBL-301I	14	2	17	937.8571	94.2189	1130.0000	1100.0000	1059.3358	1150.8144	1408.9518	normal		
Calcium, Total	mg/L	CBL-302I	14	2	16	989.9286	94.3541	1020.0000	844.0000	989.9286	989.9286	1461.6988	normal		
Calcium, Total	mg/L	CBL-306I	13	2	17	205.8462	47.9997	257.0000	216.0000	221.0002	205.8462	445.8448	normal		
Calcium, Total	mg/L	CBL-308I	14	2	16	873.2857	63.6389	830.0000	684.0000	873.2857	873.2857	1191.4803	normal		
Calcium, Total	mg/L	CBL-341I	13	2	15	836.7692	63.0491	874.0000	852.0000	836.7692	836.7692	1152.0149	normal		
Chloride	mg/L	CBL-301I	14	2	17	2292.8571	394.9183	2420.0000	2590.0000	2292.8571	2293.8113	4267.4485	normal		
Chloride	mg/L	CBL-302I	14	2	16	1972.1429	271.4967	1370.0000	1380.0000	1972.1429	1972.1429	3329.6262	normal		
Chloride	mg/L	CBL-306I	13	2	17	319.6923	108.7837	292.0000	255.0000	319.6923	319.6923	863.6109	normal		
Chloride	mg/L	CBL-308I	14	2	16	2554.2857	234.4458	2200.0000	1780.0000	2554.2857	2554.2857	3726.5147	normal		
Chloride	mg/L	CBL-341I	13	2	15	1829.2308	144.5373	1800.0000	1750.0000	1829.2308	1829.2308	2551.9172	normal		
Fluoride	mg/L	CBL-301I	15	2	17	0.3883	0.1724	0.5000	2.6800	0.3883	2.5507	1.2502	normal		
Fluoride	mg/L	CBL-302I	14	2	16	0.3741	0.1872	0.5000	2.2500	0.3741	2.1096	1.3103	normal		
Fluoride	mg/L	CBL-306I	13	2	17	2.3200	0.6159	2.9000	2.4200	2.4380	2.3200	5.3997	normal		
Fluoride	mg/L	CBL-308I	13	2	16	1.6954	0.2759	1.4400	1.7400	1.6954	1.6954	3.0751	normal		
Fluoride	mg/L	CBL-341I	13	2	15	0.3037	0.2058	0.5000	1.1600	0.3037	1.0057	1.3325	normal		
pH	S.U.	CBL-301I	15	2	17	6.2267	0.2859	6.0600	6.1300	6.2267	6.2267	4.80 - 7.66	normal		
pH	S.U.	CBL-302I	14	2	16	6.0164	0.6925	6.2100	6.0600	6.0164	6.0164	2.55 - 9.48	normal		
pH	S.U.	CBL-306I	15	2	17	6.6413	0.7227	6.8400	6.5500	6.6413	6.6413	3.03 - 10.25	normal		
pH	S.U.	CBL-308I	14	2	16	6.2271	0.2799	6.2600	6.1600	6.2271	6.2271	4.83 - 7.63	normal		
pH	S.U.	CBL-341I	12	2	15	6.0125	0.2802	6.0600	5.9800	6.0125	6.0125	4.61 - 7.41	normal		
Sulfate	mg/L	CBL-301I	14	2	17	344.7143	61.2164	374.0000	419.0000	344.7143	373.0877	650.7964	normal		
Sulfate	mg/L	CBL-302I	14	2	16	1195.2143	114.4648	1290.0000	1350.0000	1204.1514	1273.0886	1767.5381	normal		
Sulfate	mg/L	CBL-306I	14	2	17	416.6429	163.4642	388.0000	336.0000	416.6429	416.6429	1233.9640	normal		
Sulfate	mg/L	CBL-308I	14	2	16	1468.5714	93.7146	1340.0000	1240.0000	1468.5714	1468.5714	1937.1442	normal		
Sulfate	mg/L	CBL-341I	13	2	15	359.7692	30.9493	324.0000	316.0000	359.7692	359.7692	514.5157	normal		
Total Dissolved Solids	mg/L	CBL-301I	14	2	17	5484.2857	791.9083	6060.0000	5870.0000	5484.2857	5484.2857	9443.8270	normal		
Total Dissolved Solids	mg/L	CBL-302I	14	2	16	5455.0000	806.9387	4800.0000	4810.0000	5455.0000	5455.0000	9489.6933	normal		
Total Dissolved Solids	mg/L	CBL-306I	15	2	17	1301.8000	409.5196	1420.0000	1320.0000	1301.8000	1301.8000	3349.3981	normal		
Total Dissolved Solids	mg/L	CBL-308I	14	2	16	6922.8571	1459.6756	6190.0000	5270.0000	6922.8571	6922.8571	14221.2350	normal		
Total Dissolved Solids	mg/L	CBL-341I	13	2	15	4768.4615	554.2239	3940.0000	4520.0000	4768.4615	4768.4615	7539.5809	normal		

N(back) and N(mon) = Non-outlier measurements in the background and monitoring periods.
N(tot) = All independent measurements for that constituent and well.
For transformed data, mean and SD in transformed units and control limit in original units.
Conf = confidence level for passing initial test or one verification resample (nonparametric test only).
*   - Insufficient Data.
** - Detection Frequency < 25%.
*** - Zero Variance.

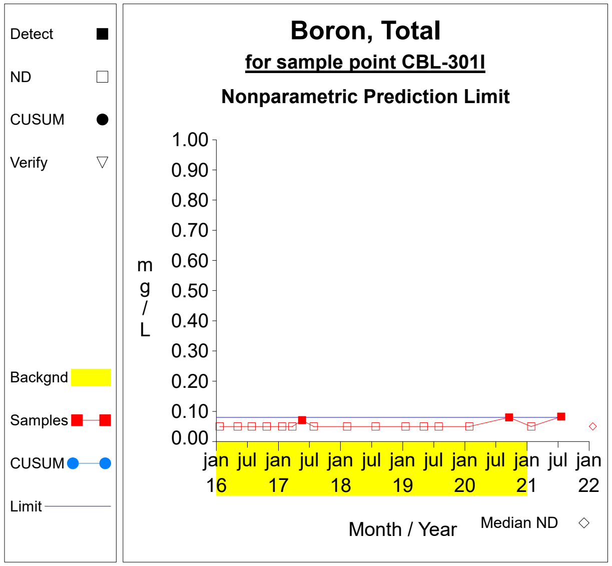
Table 4

Dixon's Test Outliers
1% Significance Level

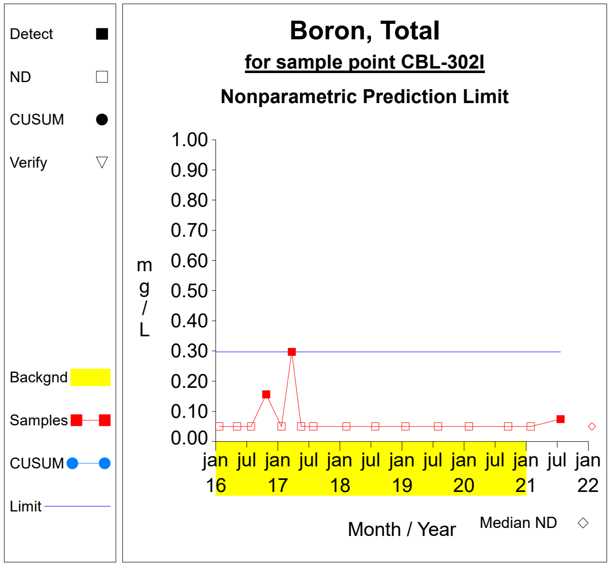
Constituent	Units	Well	Date	Result	ND Qualifier	Date Range	N	Critical Value
Calcium, Total	mg/L	CBL-301I	01/17/2019	156.0000		01/21/2016-09/17/2020	15	0.6177
Chloride	mg/L	CBL-301I	01/17/2019	619.0000		01/21/2016-09/17/2020	15	0.6177
Chloride	mg/L	CBL-306I	05/04/2016	20.0000		01/21/2016-09/19/2020	14	0.6403
Fluoride	mg/L	CBL-306I	03/22/2017	12.6000		01/21/2016-09/19/2020	15	0.6403
Fluoride	mg/L	CBL-306I	07/31/2019	9.2600		01/21/2016-09/19/2020	15	0.6403
Fluoride	mg/L	CBL-308I	03/22/2017	9.0500		01/22/2016-09/18/2020	14	0.6403
Sulfate	mg/L	CBL-301I	01/17/2019	104.0000		01/21/2016-09/17/2020	15	0.6177
Sulfate	mg/L	CBL-306I	05/04/2016	29.5000		01/21/2016-09/19/2020	15	0.6177
Total Dissolved Solids	mg/L	CBL-301I	01/17/2019	1460.0000		01/21/2016-09/17/2020	15	0.6177

N = Total number of independent measurements in background at each well.
Date Range = Dates of the first and last measurements included in background at each well.
Critical Value depends on the significance level and on N-1 when the two most extreme values are tested or N for the most extreme value.

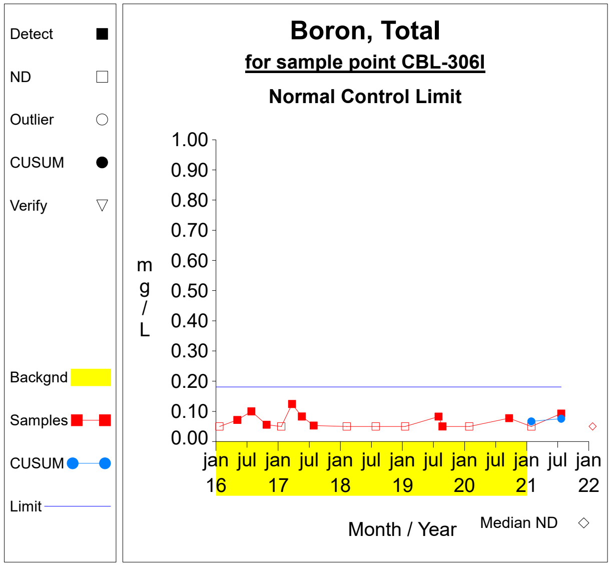
Intra-Well Control Charts / Prediction Limits



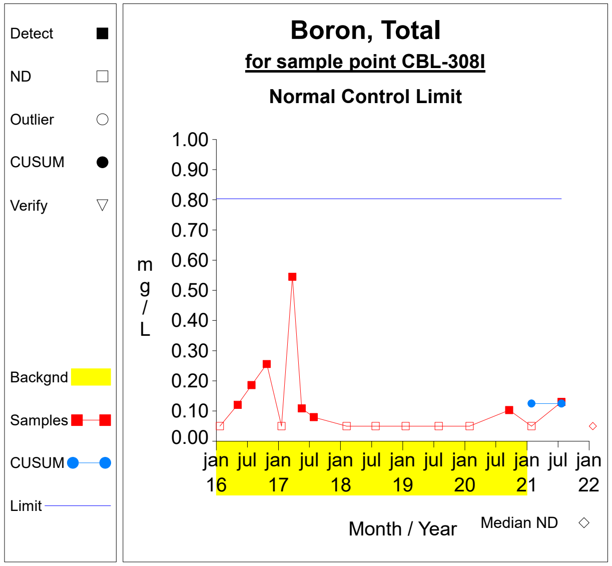
Graph 1



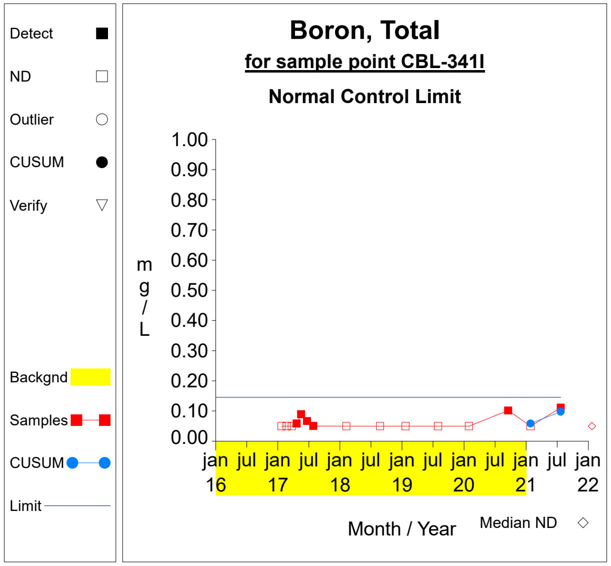
Graph 2



Graph 3

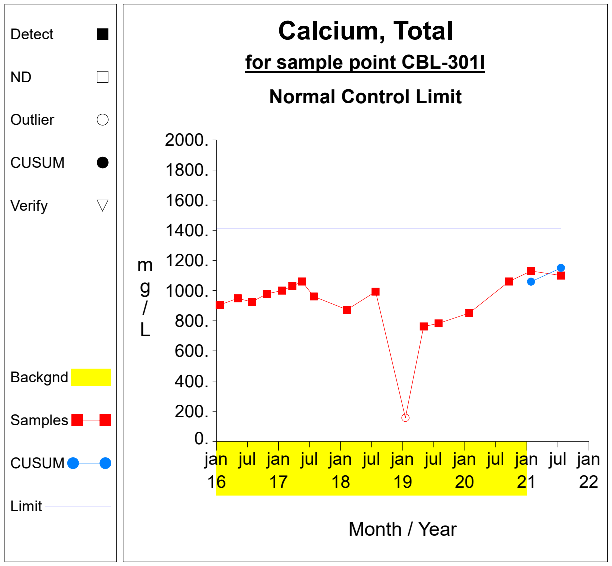


Graph 4

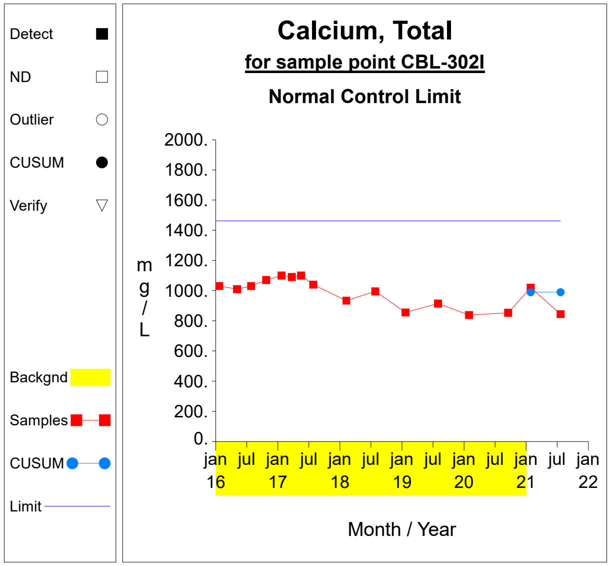


Graph 5

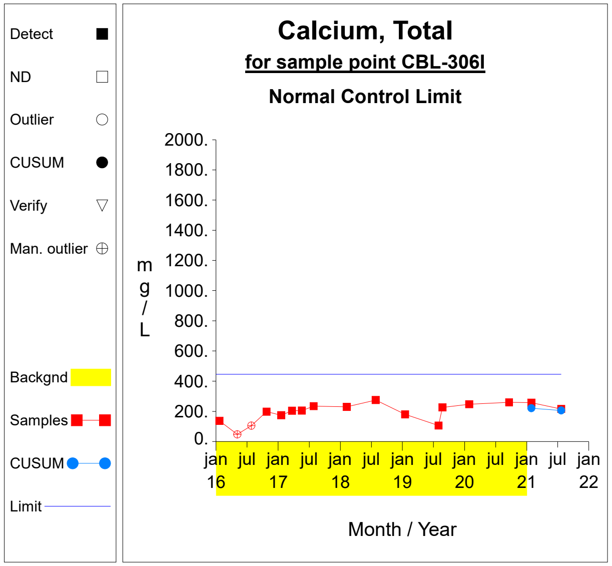
Intra-Well Control Charts / Prediction Limits



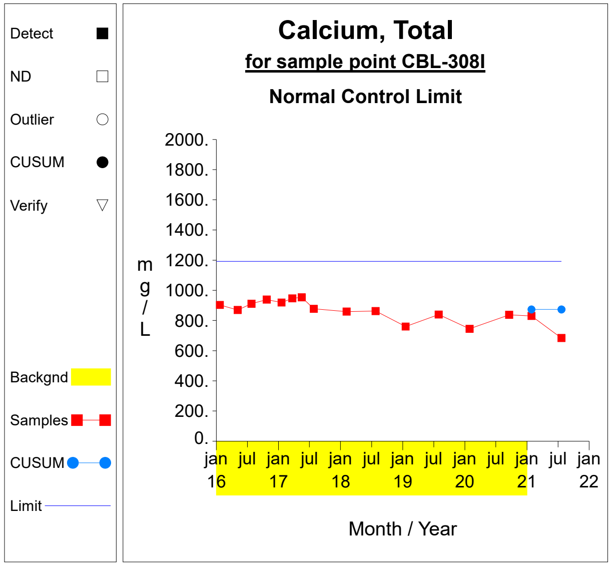
Graph 6



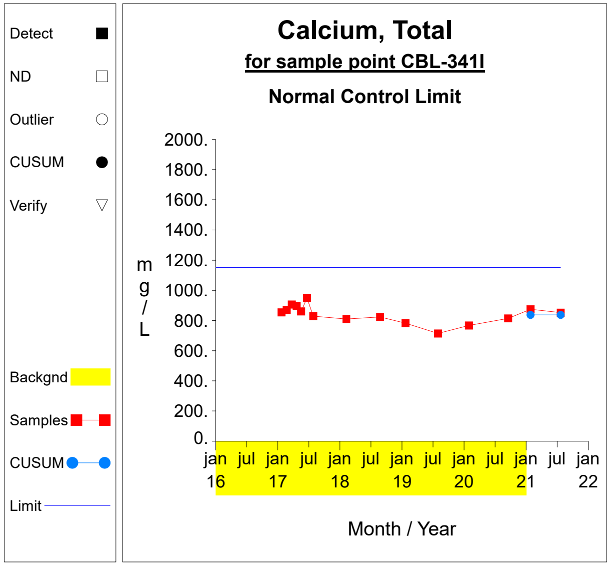
Graph 7



Graph 8

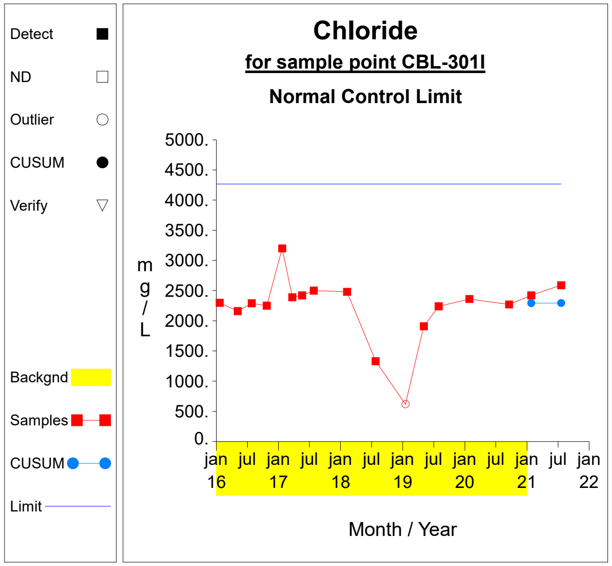


Graph 9

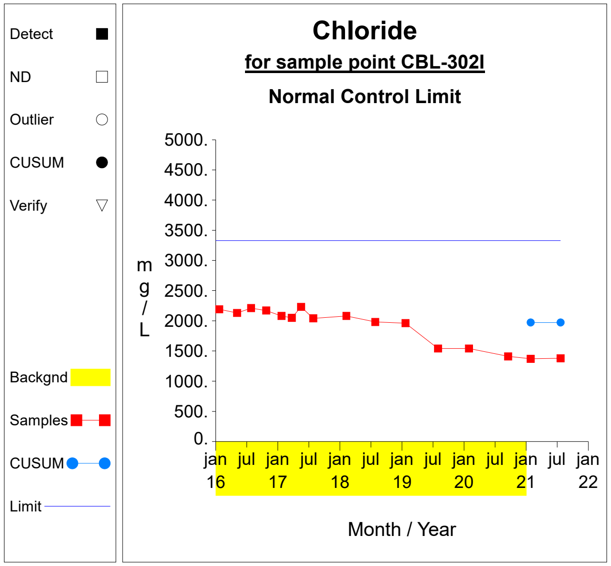


Graph 10

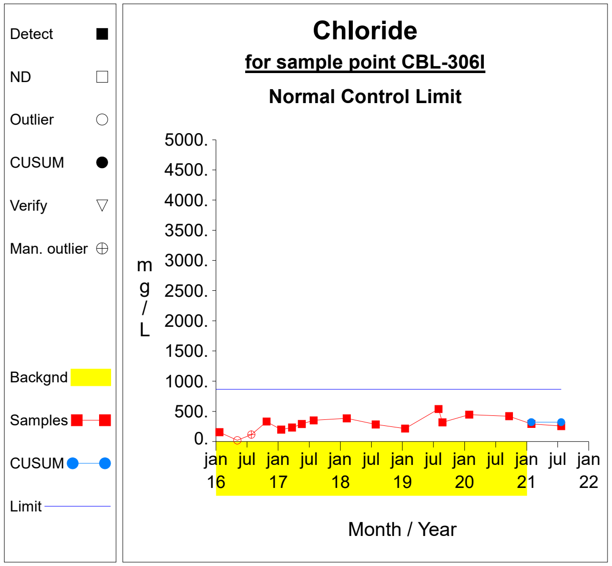
Intra-Well Control Charts / Prediction Limits



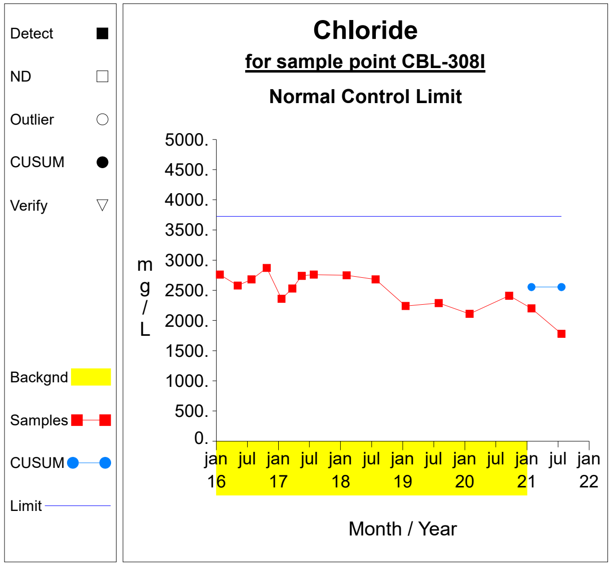
Graph 11



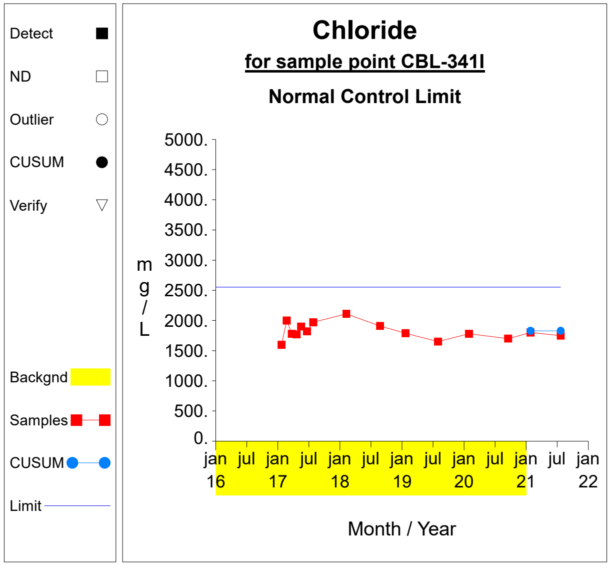
Graph 12



Graph 13

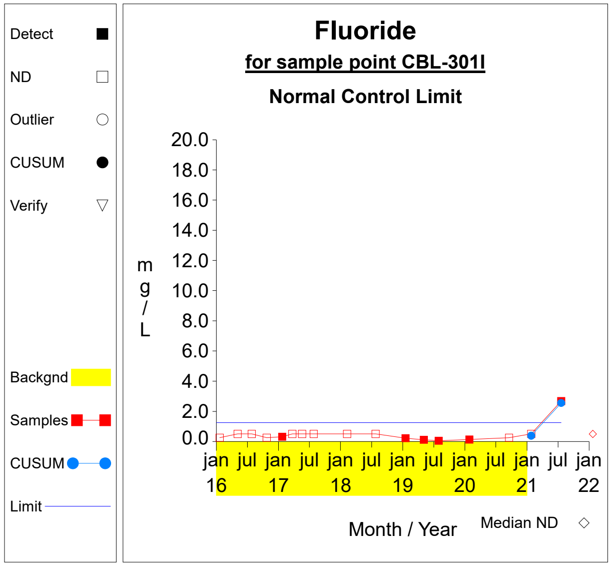


Graph 14

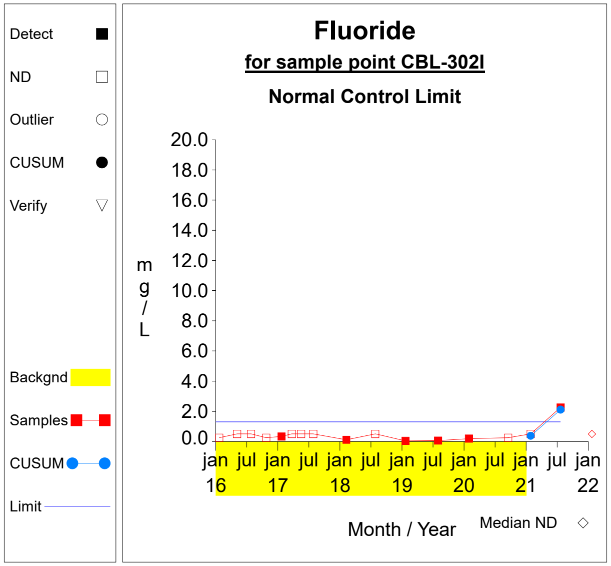


Graph 15

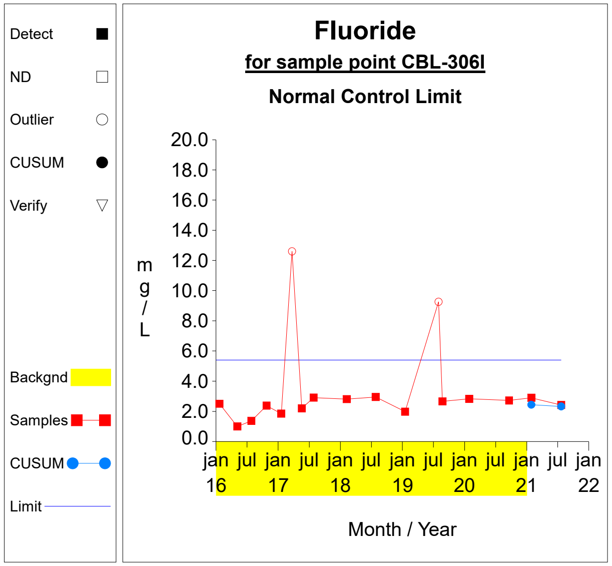
Intra-Well Control Charts / Prediction Limits



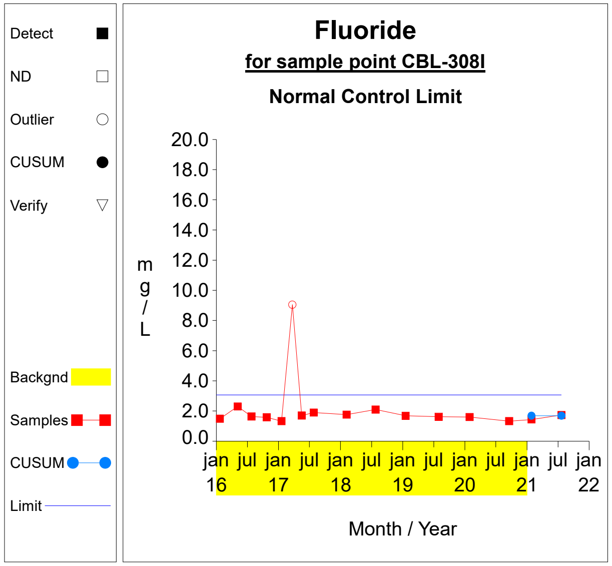
Graph 16



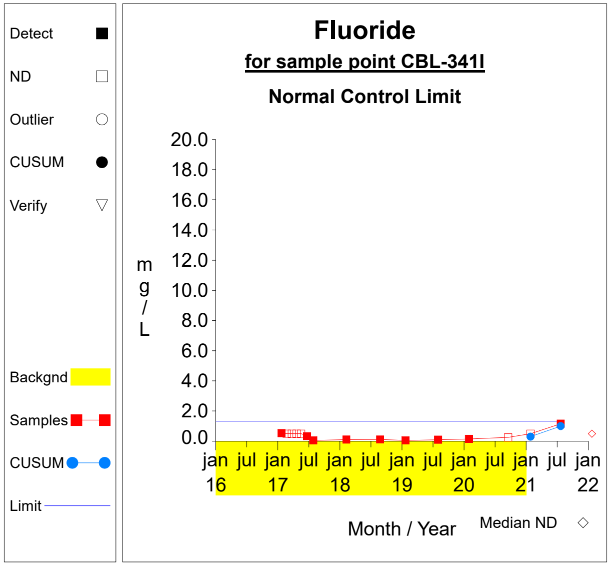
Graph 17



Graph 18

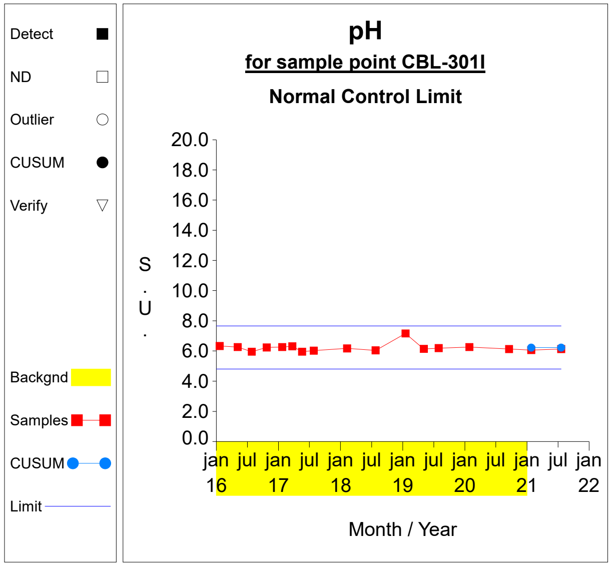


Graph 19

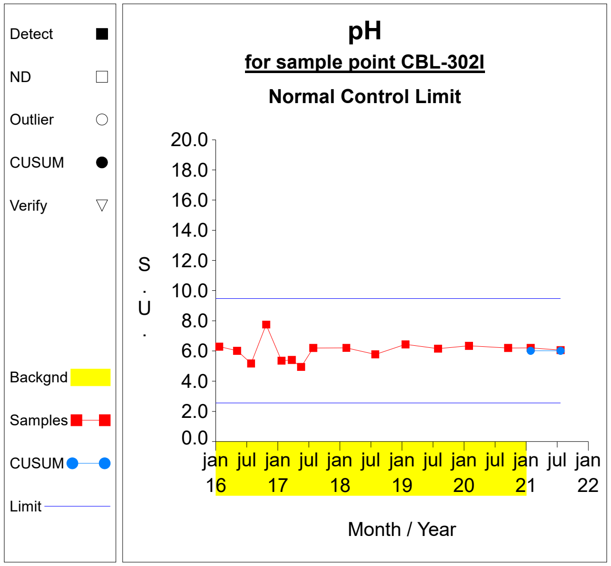


Graph 20

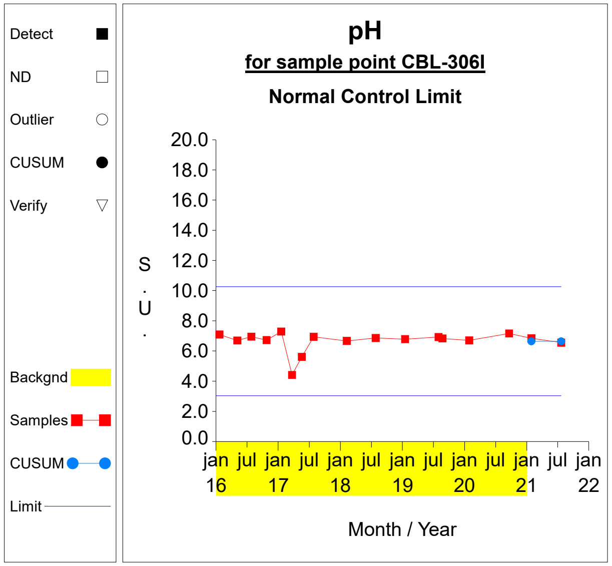
Intra-Well Control Charts / Prediction Limits



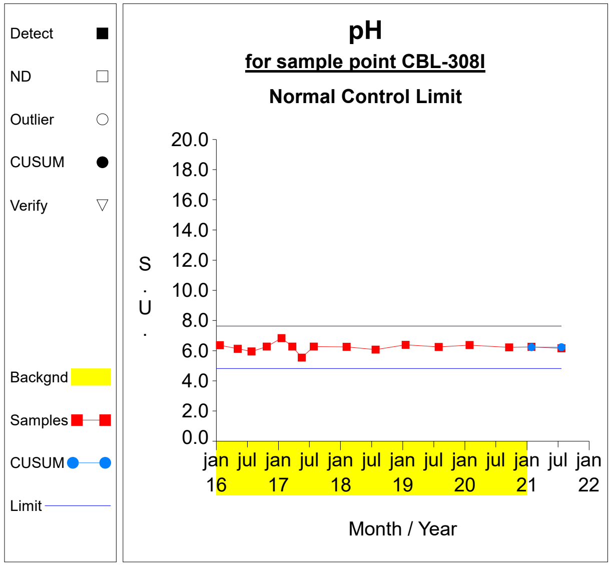
Graph 21



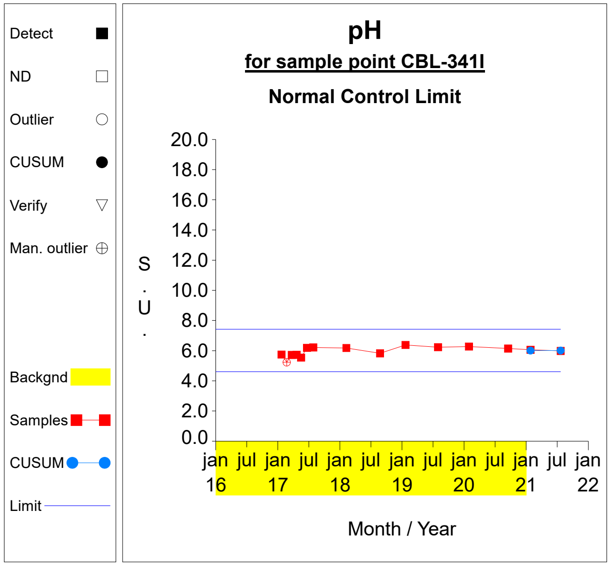
Graph 22



Graph 23

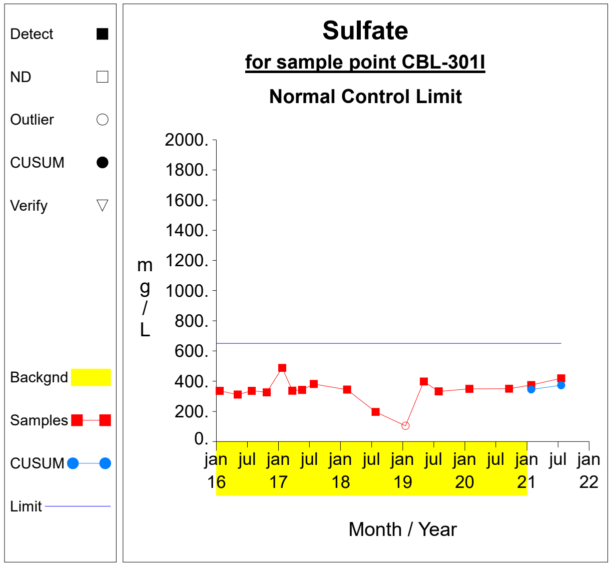


Graph 24

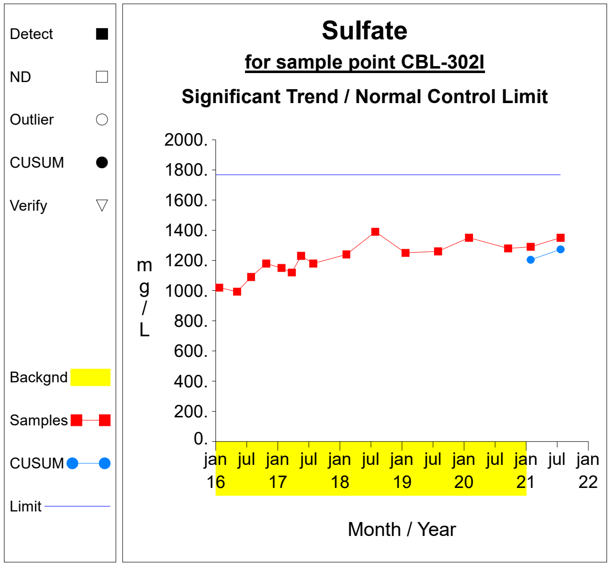


Graph 25

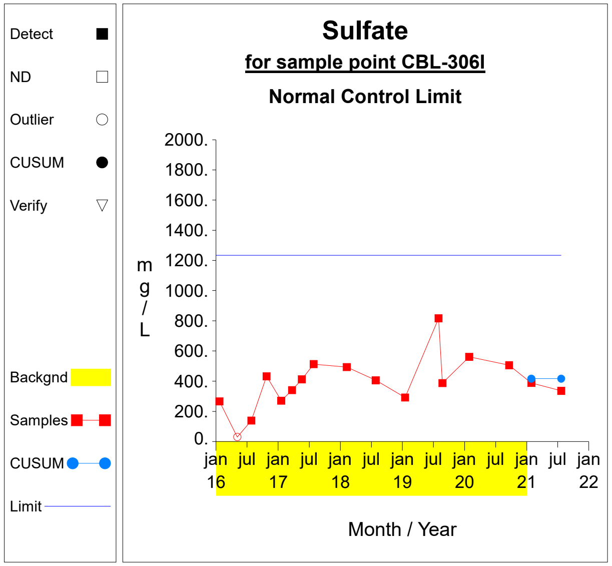
Intra-Well Control Charts / Prediction Limits



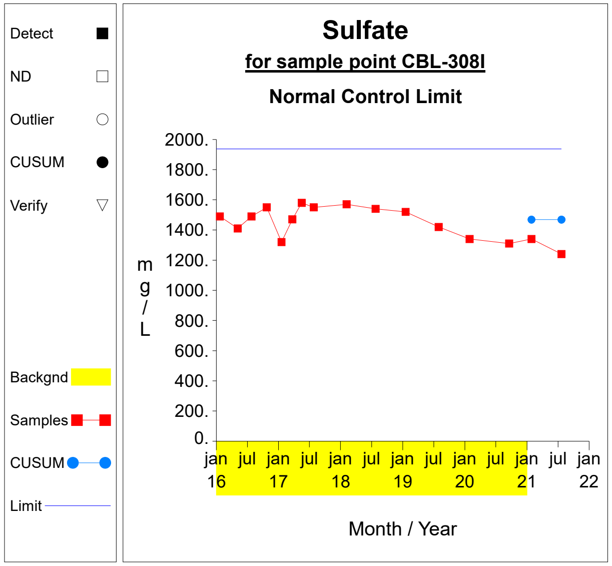
Graph 26



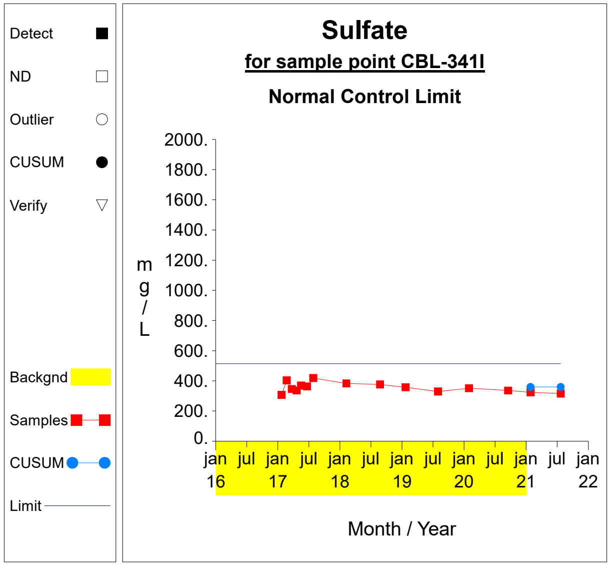
Graph 27



Graph 28

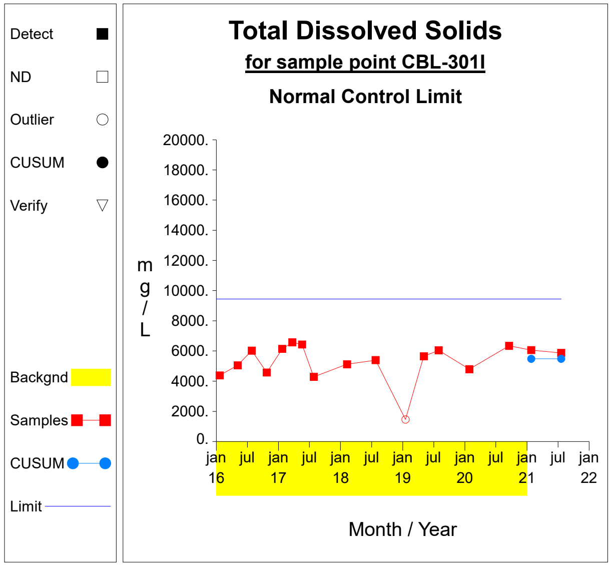


Graph 29



Graph 30

Intra-Well Control Charts / Prediction Limits



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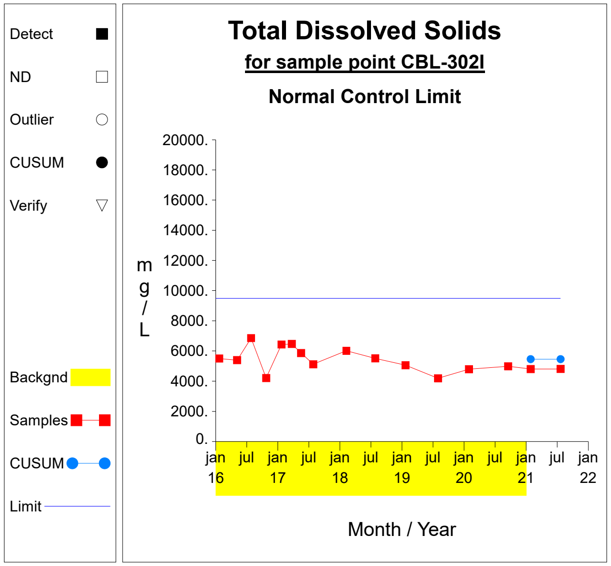

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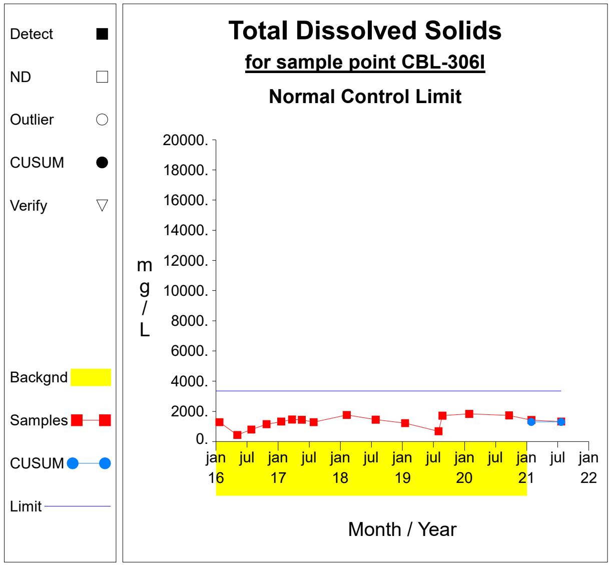
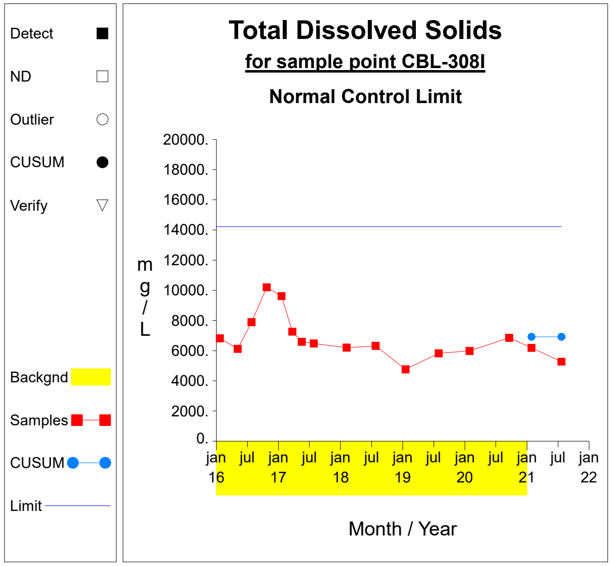
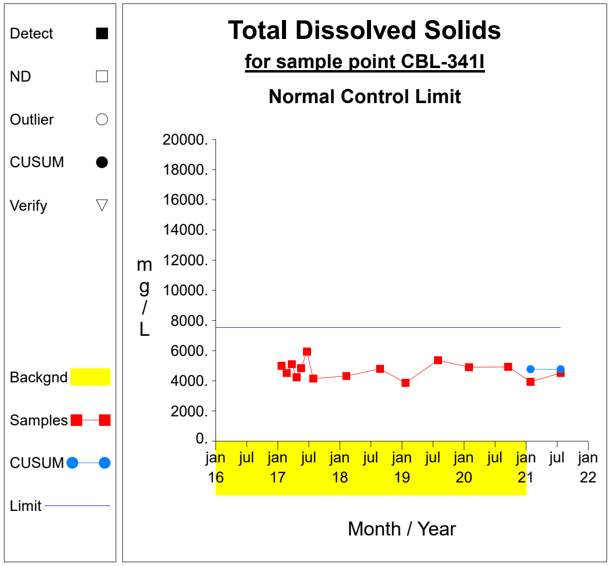


Graph 33



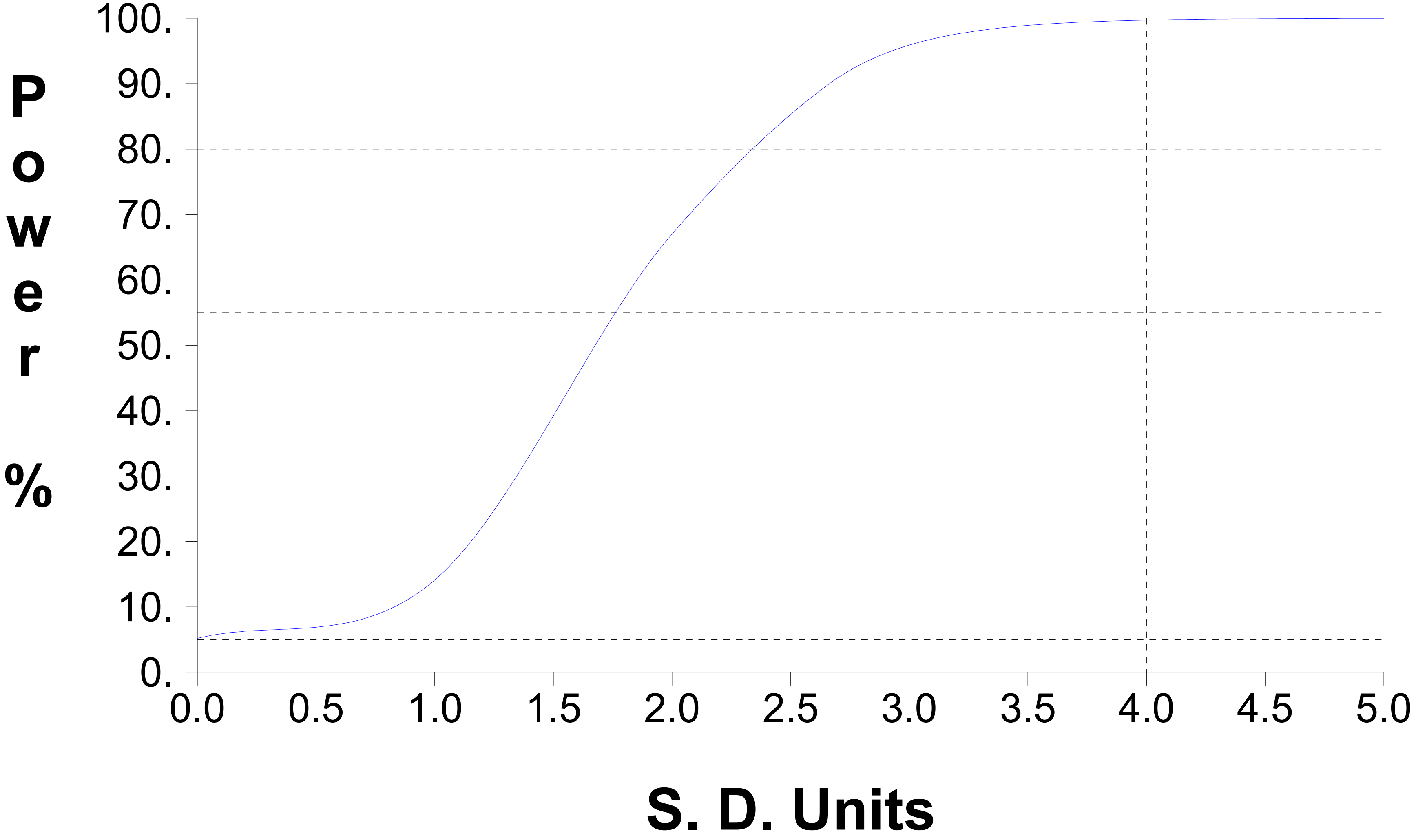
Graph 34



Graph 35

Prepared by: Otter Creek Environmental

False Positive and False Negative Rates for Current Intra-Well Control Charts Monitoring Program



Attachment D

Summary Tables and Graphs for the Intrawell Comparisons - Resamples

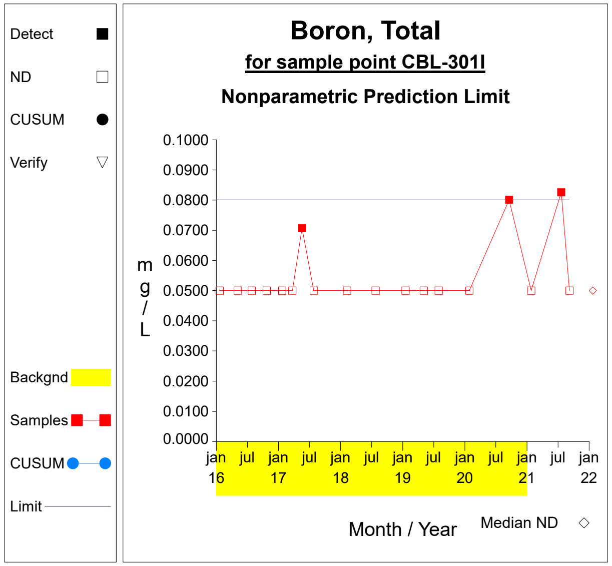
Table 1

Summary Statistics and Intermediate Computations for Combined Shewhart-CUSUM Control Charts

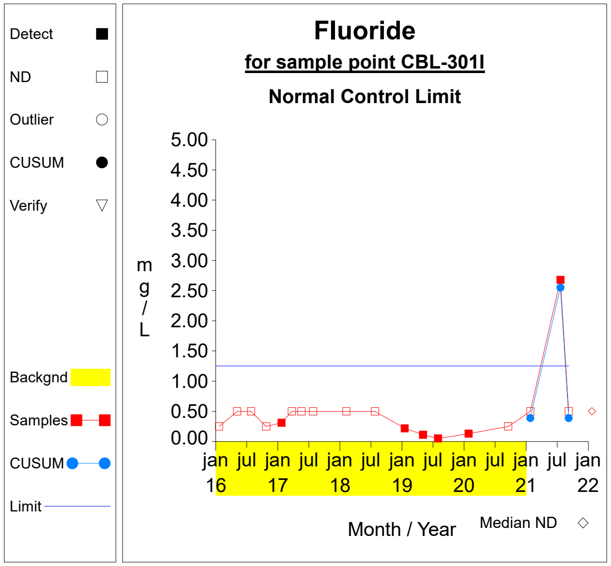
Constituent	Units	Well	N(back)	N(mon)	N(tot)	Mean	SD	R(i-1)	R(i)	S(i-1)	S(i)	Limit	Type	Conf	
Boron, Total	mg/L	CBL-301I	15	3	18			0.0826	0.0500			0.0801	nonpar	.99	**
Fluoride	mg/L	CBL-301I	15	3	18	0.3883	0.1724	2.6800	0.5000	2.5507	0.3883	1.2502	normal		
Fluoride	mg/L	CBL-302I	14	3	17	0.3741	0.1872	2.2500	0.2500	2.1096	0.3741	1.3103	normal		

N(back) and N(mon) = Non-outlier measurements in the background and monitoring periods.
N(tot) = All independent measurements for that constituent and well.
For transformed data, mean and SD in transformed units and control limit in original units.
Conf = confidence level for passing initial test or one verification resample (nonparametric test only).
* - Insufficient Data.
** - Detection Frequency < 25%.
*** - Zero Variance.

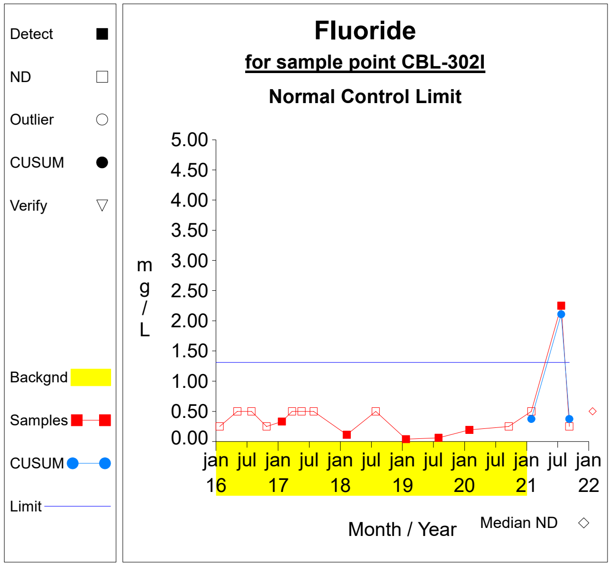
Intra-Well Sublist Control Charts / Prediction Limits



Graph 1



Graph 2



Graph 3

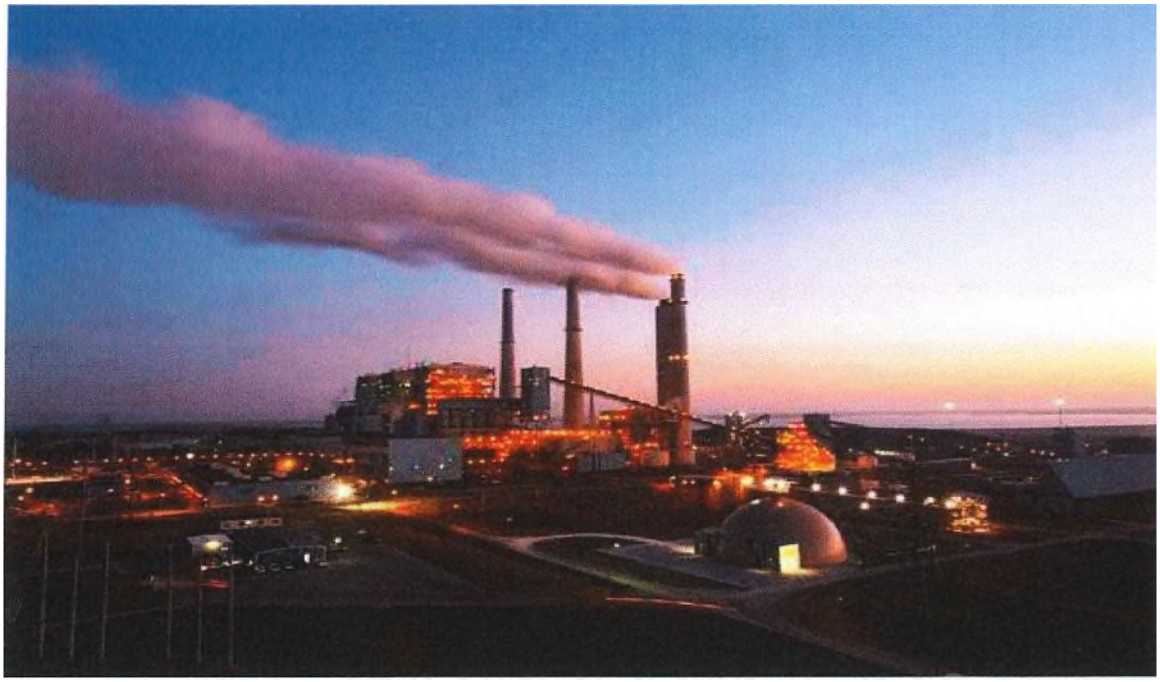
Attachment 5

Replacement Pages

Combustion Byproducts Landfill

GROUNDWATER MONITORING PLAN

LOWER COLORADO RIVER AUTHORITY (LCRA)
FAYETTE POWER PROJECT, LA GRANGE, TEXAS
JUNE 2021



Prepared by:
Rebecca D. Jones, P.G. # 12701

REBECCA D JONES
GEOLOGY
12701

Rebecca D Jones 10/26/2022

Lower Colorado River Authority
Fayette Power Plant Project
6549 Power Plant Rd.
La Grange, Texas 78945

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Combustion Byproducts Landfill
Groundwater Monitoring Plan
Fayette Power Project
La Grange, TX

1.0 PURPOSE

This Groundwater Monitoring Plan (GWMP) describes standardized groundwater sample collection and analyses protocols associated with the Lower Colorado River Authority's (LCRA's) groundwater monitoring program being implemented at their Fayette Power Plant (FPP) located near La Grange, Texas. Specifically, groundwater monitoring is being conducted pursuant to the Coal Combustion Residuals (CCR) Rule - 40 Code of Federal Regulation (CFR) 257.93. Use of this GWMP is intended to facilitate consistency in sample collection and analyses which, in turn, helps to ensure generation of representative data.

2.0 HISTORY OF MODIFICATIONS TO THE GWMP

In October 2017, the Tolerance or Prediction Interval Procedure statistical method, outlined in 40 C.F.R. § 257.93(f)(3), was the preliminarily selected method for evaluating the groundwater monitoring data. In January 2021, it was determined that control chart statistical method is more appropriate for the data set and was selected from the remaining methods listed in 257.93(f).

3.0 GROUNDWATER MONITORING WELLS

The current groundwater monitoring well system consists of six groundwater wells as summarized below and additionally in Table 1:

- Background well: CBL-3401
- Downgradient wells: CBL- 3011, 3021, 3061, 3081, and 3411.

The well casing diameter, total depth, screened interval, and the water-bearing unit in which each well is screened is provided in Table 1. Well locations are illustrated in Figure 1.

TABLE 1

CCR GROUNDWATER MONITORING WELLS

FAYETTE POWER PROJECT

Well ID	**CBL-340I (Background Well)**	**CBL-301I**	**CBL-302I**	**CBL-306I**	**CBL-308I**	**CBL -341I**
Installation Date	12/17/2015	5/23/2011	5/24/2011	6/3/2011	12/20/2011	11/14/2016
Hydrogeologic Unit Monitored	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand
Casing Type	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC
Total Well Depth (ft **bgs)**	37	51	24	12.5	32	43
Screened Interval (ft bgs)	22-37	41-51	14-24	9-14	22-32	33-43
Ground Surface Elevation (ft MSL)	374.69	369.75	355.99	337.93	364.93	364.03
TOC Elevation (ft MSL)	376.98	372.11	358.99	339.96	368.67	366.65
Northing	9949069.45	9946563.44	9947806.017	9946445.582	9947619.46	9947139.86
Easting	3428311.38	3429862.181	3429260.844	3428730.533	3428574.38	3429525.31
Survey Datum	Horizontal Datum: NAD83/2011-EPOCH 2012 Vertical Datum: NAVD88-GEOIDIZA	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/2011-EPOCH 2012 Vertical Datum: NAVD88-**GEOIDIZA**

Notes:

ft bgs	= feet below ground surface
ft NGVD	= feet above the National Geodetic Vertical Datum (NAVD 1988)

4.0 MONITORING FREQUENCY

In accordance with 40 CFR 257.94, a minimum of eight independent samples for each background well and downgradient well will be collected and analyzed for the constituents listed in appendix III and IV prior to October 17, 2017.

During detection monitoring, all wells will be sampled on a semi-annual basis for the constituents listed in appendix III. Detection monitoring samples will be collected in the first and third quarters of each year beginning in 2018.

5.0 LOW-FLOW GROUNDWATER SAMPLING PROCEDURES

Groundwater samples should be collected in accordance with the USEPA Low-Flow Groundwater Sampling Guidance included in Appendix 2 and as described in this section.

5.1 GROUNDWATER SAMPLING PREPARATION

The person performing groundwater sampling is responsible for ensuring that all the necessary measurement, purging, sampling supplies, and equipment are available, in good working order, and decontaminated prior to initiating sampling. At a minimum, the following equipment is required.

- A water level probe.
- A decontaminated, low-flow peristaltic or flow-controlled submersible pump.
- Dedicated bailers (in case of pump failure).
- Decontamination equipment (buckets, deionized water).
- A water quality meter (YSI 600 XL or similar) with the capability to measure temperature, pH, conductivity, oxidation-reduction potential, and dissolved oxygen.
- A decontaminated flow cell for the water quality meter.
- Laboratory-provided pre-cleaned sample containers, preferably pre-preserved.
    250 ml preserved with HNO3, for metals.
    500 ml plastic bottle, unpreserved, for sulfate
- Nitrile gloves.
- Coolers for sample preservation and transportation.
- Sample labels and chains of custody.

- Ice to cool collected samples.
- Field logbook or field information forms.

5.2 WATER-LEVEL MEASUREMENT PROCEDURE

The groundwater elevations must be measured and recorded in each well immediately prior to purging, each time groundwater is sampled. The following procedures shall be used:

1. Observe the area around each well and document and/or photograph any above-ground damage that may require repair to ensure the continued integrity of the well at the surface.

2. Open the outer casing top (if bolted, a wrench may be needed) and remove the well cap (may require wrench or key).

3. Measure the depth to groundwater in each well using an electronic water-level probe (e.g. Solinst Water-Level Indicator). **Do not measure the total depth at this time to reduce turbidity.** Take these measurements by carefully lowering the probe to the water level, reading the cable measurement to 0.01-feet accuracy against the surveyed mark or notch at the top of the well casing. Record the measurements and compare them to previous readings to identify any major discrepancies. Repeat the measurements if major discrepancies are identified.

5.3 GROUNDWATER PURGING PROCEDURE

The wells should be purged using the low-flow sampling procedure described in the USEPA guidance document attached as Appendix 1. The following procedures should be followed:

1. Obtain well logs and determine the screened interval, previous water levels, previous well yield, and previous purge volumes for each well. The pump or tubing will need to be placed in the center of the screened interval of the well for proper purging and sampling. In low yield wells the pump may need to be placed lower in the casing. The other information will provide useful guidelines for additional sampling.

2. Purge each well until the discharge becomes clear and water quality parameters including pH, conductivity, temperature, and dissolved oxygen stabilize. Lower a pump into the well such that the pump intake is located at the approximate center of the screened interval of the well. Purge each well using a low-flow pump at an approximate flow rate of less than 1.0 liter per minute. This can be performed with a peristaltic pump where the depth to groundwater is relatively shallow (less than 30 feet). A submersible pump with a flow controller is needed where the depth to water is greater than 30 feet.

3. Monitor the purged groundwater for water quality parameters including conductivity, pH, and temperature. This can be done using a YSI 600 XL or water quality probe of similar type. Preferably, the purge water should be collected in a flow-through cell as it discharges from the well in order to take these readings. Record the measured water quality parameters either electronically or in the field logbook.

4. During purging, periodically measure the water level in the well. The water column in the well should not be significantly drawn down using the low-flow procedure. Drawdown should be less than 0.5 feet. Record the water level and drawdown measurements in the field logbook.

5. Continue purging until the water quality parameters stabilize or until 3 to 5 well volumes of water have been purged. The water quality parameters most likely will stabilize before 3 to 5 well volumes are reached. Sufficient stabilization has occurred where three successive readings are within ± 2 degrees Celsius temperature, ± 3% conductivity, ± 10% dissolved oxygen, ±10 mV redox potential, and ± 0.1 pH. These are general guidelines; other data quality objectives may be established for a given project.

6. In the event that the well purges dry during the low-flow sampling procedures due to poor well yield, allow the well to recover to the approximate original water level. Then sample the well.

7. Record the amount of water purged from each well and contain all purge water for disposal according to the requirements of the project.

5.4 GROUNDWATER SAMPLING PROCEDURE

Groundwater samples should be collected from each well shortly after the water quality parameters have sufficiently stabilized or three to five well volumes have been purged. The following groundwater sampling procedures shall be used:

1. Use pre-cleaned sample bottles provided by the laboratory or bottle supplier. The bottles may be pre-preserved for specific analyses, depending on the requirements of the project.

2. Wear appropriate personal protective equipment based on the chemical properties of the contaminants of concern. At a minimum, wear latex gloves during sampling to prevent contact with groundwater and minimize the potential for cross-contamination. At a minimum, replace the gloves between sampling at each well.

3. Collect the groundwater sample directly from the dedicated pump tubing at each well while water continues to be pumped from the well (after purging) under the low-flow (less than 0.5 liters per minute) condition. Fill the sample bottles by allowing pump discharge to flow gently down the side of bottle with minimal entry turbulence.

4. **Do not filter the samples in the field.** If the sample is turbid (greater that 10 NTU), collect both an unfiltered sample and a filtered sample using a 10-micron filter that will trap the large-diameter solids in the sample. Do not use a 0.45-micron filter. The filtered sample will be analyzed if the unfiltered sample results in a statistically significant increase or as instructed by **FPP.**

5. Add preservatives to the samples (e.g., nitric acid for metals analyses) as required based on the analyses to be performed.

6. Label each sample immediately upon collection. Ensure that the label contains the sample name, sample location, date, time, preservatives, requested analyses, project identification, and sampler's name. Trip blanks, field blanks and duplicate samples should be numbered such that they are indistinguishable from other samples to be sent to the laboratory.

7. Fill out the chain-of-custody record and indicate each sample on that record. Enter any other pertinent information regarding the sample or requested analyses on the custody record.

8. Carefully package the samples for transportation to the laboratory. Glass bottles should be double-bagged in Ziploc bags before placing them in their respective shipping coolers to contain the water in the event of bottle breakage. Use ice to chill each sample cooler to approximately 6 degrees Celsius with ice, and seal the coolers for delivery to the laboratory.

9. Remove the pump and tubing from the well after sampling. The dedicated pump tubing shall be disposed of or properly stored for future sampling at the same monitoring well and new tubing used for the next monitoring well. Measure the total depth in each well using an electronic water-level probe (e.g. Solinst Water-Level Indicator). Take measurements by carefully lowering the probe first to the bottom of the well, reading the cable measurement to 0.01-feet accuracy against the surveyed mark or notch at the top of the well casing. Record the measurements and compare them to previous readings to identify any major discrepancies. Repeat the measurements if major discrepancies are identified.

10. Replace the well cap and lock the outer casing well top.

11. Decontaminate the pump between wells using ASTM D5088-02 Standard Practice for Decontamination of Field Equipment at Waste Sites.

12. Promptly deliver the samples to the laboratory either by direct drop off or delivery via a priority overnight service.

6.0 LABORATORY ANALYSES & QUALITY ASSURANCE

To ensure consistent, high-quality results, laboratory analyses must be performed using industry standard methods. To be acceptable to regulating agencies, the laboratory must provide quality assurance/quality control (QA/QC) documentation with each laboratory report. The QA/QC documentation must include matrix spike, surrogate recovery, and method blank results, as well as documentation of instrument calibration. The laboratory analytical methods to be used at the FPP CBL are listed in Table 2. At a minimum, one trip blank, one field blank, and one duplicate sample shall be collected in the field to assure quality during each sampling event.

TABLE 2
CCR GROUNDWATER ANALYTICAL METHODS
FAYETTE POWER PROJECT

Preparation Method	Analytical Method	CCR Appendix III Constituents
TCEQ SOP VI	TCEQ SOP VI	pH
SW 3010A	SW6010B	Boron
SW 3010A	SW6010B	Calcium
E300.0	E300.0	Chloride
E300.0	E300.0	Fluoride
E300.0	E300.0	Sulfate
SW 2540C	SW2540C	TDS(2540C)
		CCR Appendix IV Constituents
SW 3010A	SW6010B	Barium
SW 3010A	SW6010B	Beryllium
SW3010A	SW6020 ICP-MS	Antimony
SW3010A	SW6020 ICP-MS	Arsenic
SW3010A	SW6020 ICP-MS	Cadmium
SW3010A	SW6020 ICP-MS	Cobalt
SW3010A	SW6020 ICP-MS	Chromium
SW3010A	SW6020 ICP-MS	Lead
SW3010A	SW6020 ICP-MS	Lithium
SW3010A	SW6020 ICP-MS	Molybdenum
SW3010A	SW6020 ICP-MS	Selenium
SW3010A	SW6020 ICP-MS	Thallium
SW7470A	SW7470A	Mercury (7470)
E903.0	E903.0	Radium 226
E904.0	E904.0	Radium 228

7.0 Verification Resampling

In a detection monitoring program that incorporates verification resampling, an SSI is not declared unless the resample or resamples also exceed the background limit. The exceedance detected in the initial sample may be referred to as an “initial exceedance.” Verification resampling should be conducted to verify or disconfirm an initial exceedance. If a constituent in an original sample from a well exceeds its statistical limit, then one or more resamples are collected from that well and evaluated. A statistical test utilizing resampling is not complete until all necessary resamples have been evaluated.

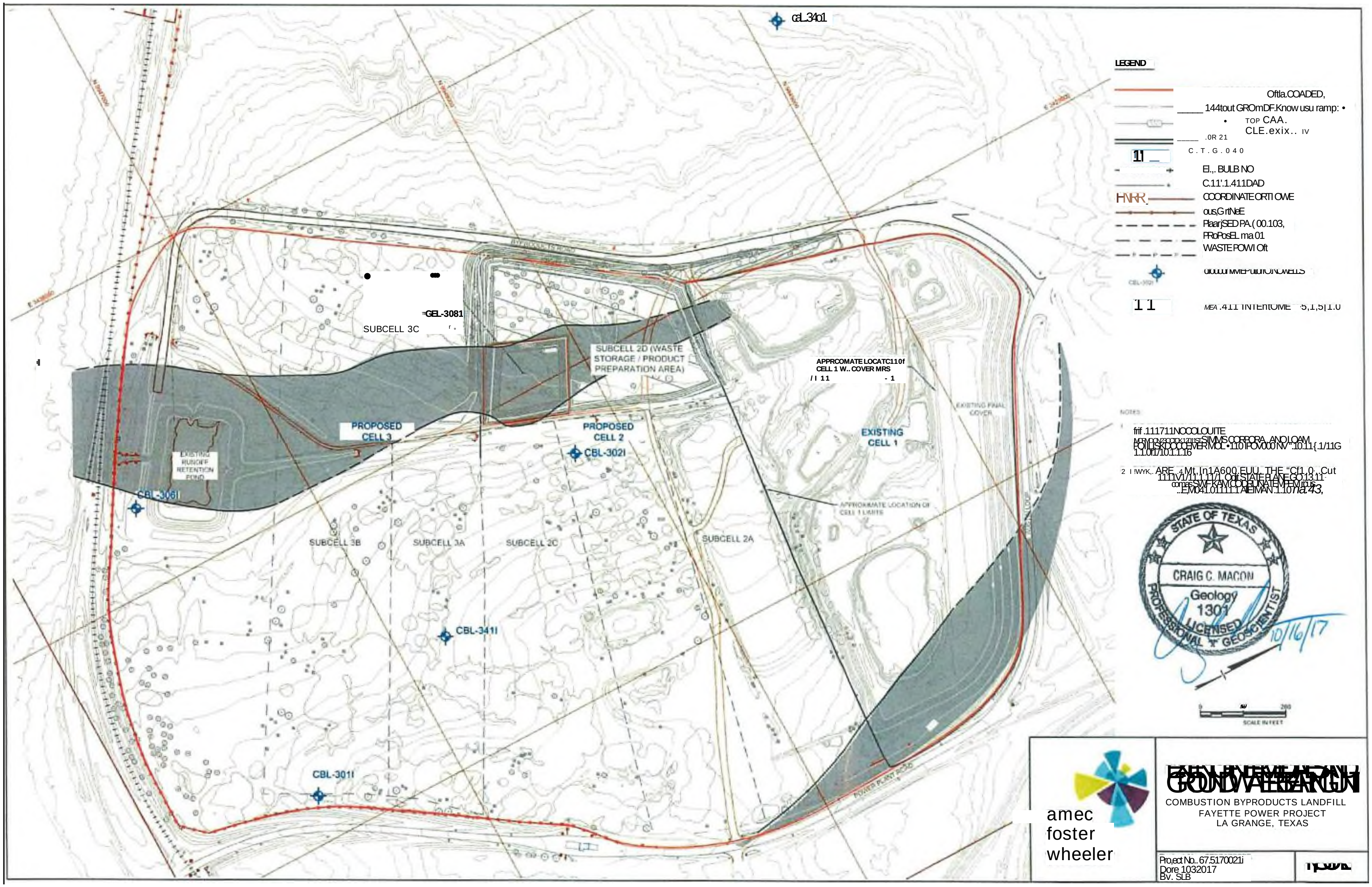
The retesting strategy is to allow for one resample for constituents evaluated using a parametric method with eight background measurements which will be all wells and constituents except boron in monitoring wells CBL-301I and CBL-302I. Two resamples for constituents evaluated using a nonparametric method with eight background measurements which is boron in monitoring wells CBL-301I and CBL-302I. If the retesting strategy involves one resample, the initial exceedance is disconfirmed if the constituent concentration in the resample does not exceed the prediction limit (pass one of one resample). If the retesting strategy involves two resamples, the initial exceedance is disconfirmed if the constituent concentration in the first or second resample does not exceed the prediction limit (pass one of two resamples); if the first resample passes, the second resample does not need to be taken. A resampling strategy will be periodically reevaluated and changed as necessary during a background update, which would include new sample results since the previous background evaluation and may include new wells or changes to the list of constituents monitored.

In accordance with 40 CFR 257.93, if an initial exceedance over a background limit is determined, the owner or operator may conduct verification resampling. The verification resampling results will confirm or disprove the initial exceedance. If an initial exceedance is verified, an SSI is declared, and assessment monitoring is triggered unless an “alternate source demonstration” is submitted and approved. Within 90 days after completing sampling and analysis, the owner or operator must determine whether there has been a statistically significant increase over background for any constituent at each monitoring well. If a verification resample does not confirm an exceedance, routine detection monitoring may continue.

8.0 STATISTICAL PROCEDURE

The CCR rule provides several options for evaluating the groundwater data (40 CFR 257.93[f]). As referenced in Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (EPA 530/R-09-007), the preferred methods for comparing groundwater data are using either prediction limits or using control charts. The control chart procedure offers an advantage over the prediction limits procedure as more data is generated over time, because they generate a graph of compliance data over time and allow for better identification of long-term trends. The control chart statistics conform to the Coal Combustion Residual (CCR) rule (40 CFR Part 257), USEPA Guidance document ("Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance," March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs.

As of this First Quarter 2021 statistical evaluation and moving forward, intrawell analysis will continue, using the control chart methodology referenced in 40 CFR 257.93(f)(4), instead of the prediction limits method previously used. In accordance with 40 CFR 257.93(f)(6), a new certification of the statistical method was issued by a professional engineer in May 2021



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COMBUSTION BYPRODUCTS LANDFILL
FAYETTE POWER PROJECT
LA GRANGE, TEXAS

Pro,ect No.. 67.5170021i
Dore 1032017
Bv. SLB

APPENDIX 1

USEPA LOW-FLOW GROUNDWATER SAMPLING GUIDANCE

United States
Environmental Protection
Agency

Office of
Research and
Development

Office of Solid Waste
and Emergency
Response

EPA/540/S-95/504
April 1996

:.EPA Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls' and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

For further information contact: Robert Puls, 405-436-8543, Subsurface Remediation and Protection Division, NRMRL, Ada, Oklahoma.

I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units.* With time it became apparent that conventional water supply generalizations of *homogeneity did* not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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'National Risk Management Research Laboratory, U.S. EPA [2]University of Michigan

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Superfund Technology Support Center for Ground Water

National Risk Management Research Laboratory
Subsurface Protection and Remediation Division
Robert S. Kerr Environmental Research Center
Ada, Oklahoma

Technology Innovation Office
Office of Solid Waste and Emergency Response, US EPA, Washington, DC

Walter W. Kovalick, Jr.,
Ph.D. Director

chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

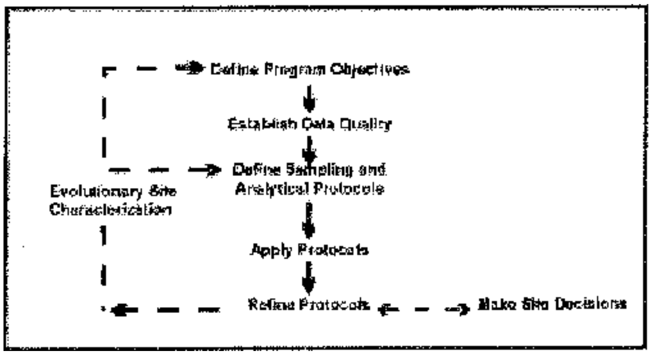

Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short,* of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action.*

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g. , pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;

  maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over <u>any</u> other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 pm filters]) concentrations of major ions and trace metals, 0.1 pm filters are recommended although 0.45 pm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO, composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 pm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 my for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe", CH,, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon ™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. *Low-Permeability Formations (<0.1 L/min recharge)*

1. Low-Flow Purging and Sampling with Pumps

   a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

   b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. *Fractured Rock*

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop -- A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

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Figure 2. **Ground Water Sampling Log**

Project________________**Site** _______________**Well No.** _____________ **Date** ________________________

Well Depth_____________**Screen Length**__________ **Well Diameter** _________**Casing Type**___________

Sampling Device _______________**Tubing type** _____________________ **Water Level** __________________

Measuring Point ___________________ **Other Infor**____

Sampling Personnel____

Time	**pH**	**Temp**	**Cond.**	Dis.0_2	**Turb.**	**[ ]Conc**			**Notes**

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: Vol_{cy}, = reh, $\text{Vol.}_{\text{pher}}$. = 4/3n r^3

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project__________________ **Site**_________________ **Well No.** ______________ **Date**___________________________

Well Depth ______________ **Screen Length**____________ **Well Diameter** ___________ **Casing Type** _____________

Sampling Device __________________**Tubing type** ______________________ **Water Level** ___________________

Measuring Point______________________ **Other Infor**____

Sampling Personnel ____

Time	Pump Rate	Turbidity	Alkalinity	[Conc	Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $\mathrm{Vol}_{co} = nr^2h$, $\mathrm{VoL}_{phere} = 413n\ r^3$

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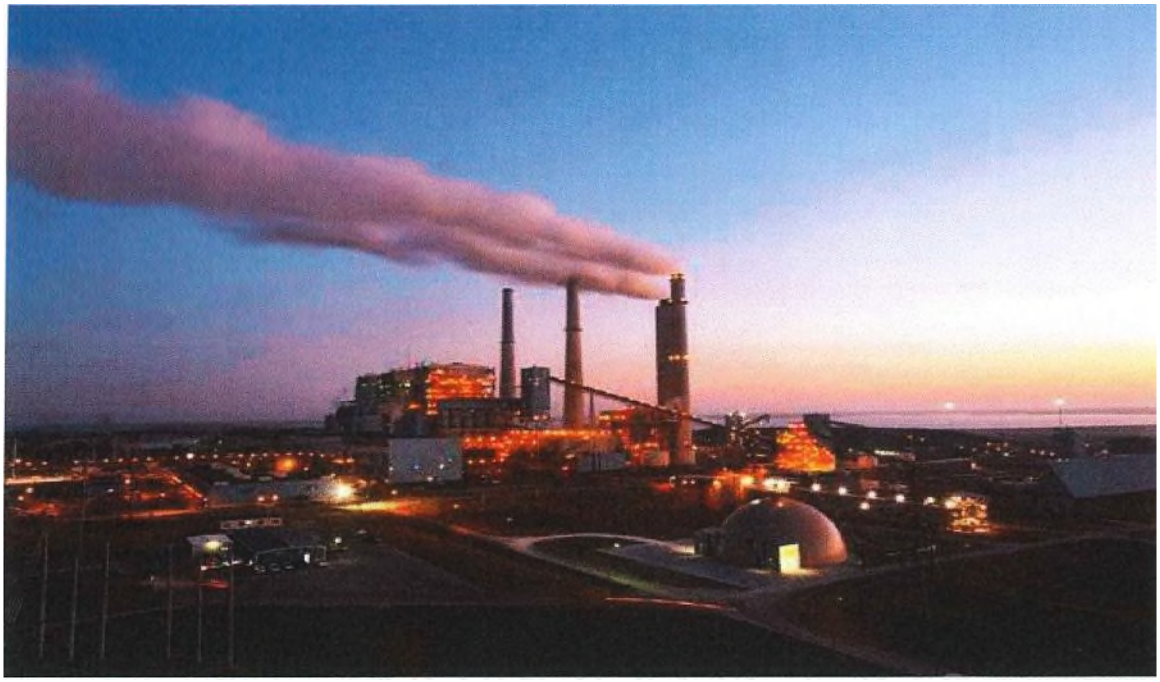
ENERGY • WATER • COMMUNITY SERVICES

Combustion Byproducts Landfill

GROUNDWATER MONITORING PLAN

LOWER COLORADO RIVER AUTHORITY (LCRA)
FAYETTE POWER PROJECT, LA GRANGE, TEXAS
JUNE 2021



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Rebecca D Jones 10/26/2022

Lower Colorado River Authority
Fayette Power Plant Project
6549 Power Plant Rd.
La Grange, Texas 78945

TABLE OF CONTENTS

Section Page

TABLES

FIGURES

APPENDICES

Combustion Byproducts Landfill
Groundwater Monitoring Plan
Fayette Power Project
La Grange, TX

1.0 PURPOSE

This Groundwater Monitoring Plan (GWMP) describes standardized groundwater sample collection and analyses protocols associated with the Lower Colorado River Authority's (LCRA's) groundwater monitoring program being implemented at their Fayette Power Plant (FPP) located near La Grange, Texas. Specifically, groundwater monitoring is being conducted pursuant to the Coal Combustion Residuals (CCR) Rule - 40 Code of Federal Regulation (CFR) 257.93. Use of this GWMP is intended to facilitate consistency in sample collection and analyses which, in turn, helps to ensure generation of representative data.

2.0 HISTORY OF MODIFICATIONS TO THE GWMP

In October 2017, the Tolerance or Prediction Interval Procedure statistical method, outlined in 40 C.F.R. § 257.93(f)(3), was the preliminarily selected method for evaluating the groundwater monitoring data. In January 2021, it was determined that control chart statistical method is more appropriate for the data set and was selected from the remaining methods listed in 257.93(f).

3.0 GROUNDWATER MONITORING WELLS

The current groundwater monitoring well system consists of six groundwater wells as summarized below and additionally in Table 1:

- Background well: CBL-3401
- Downgradient wells: CBL- 3011, 3021, 3061, 3081, and 3411.

The well casing diameter, total depth, screened interval, and the water-bearing unit in which each well is screened is provided in Table 1. Well locations are illustrated in Figure 1.

TABLE 1

CCR GROUNDWATER MONITORING WELLS

FAYETTE POWER PROJECT

Well ID	**CBL-340I (Background Well)**	**CBL-301I**	**CBL-302I**	**CBL-306I**	**CBL-308I**	**CBL -341I**
Installation Date	12/17/2015	5/23/2011	5/24/2011	6/3/2011	12/20/2011	11/14/2016
Hydrogeologic Unit Monitored	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand
Casing Type	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC
Total Well Depth (ft **bgs)**	37	51	24	12.5	32	43
Screened Interval (ft bgs)	22-37	41-51	14-24	9-14	22-32	33-43
Ground Surface Elevation (ft MSL)	374.69	369.75	355.99	337.93	364.93	364.03
TOC Elevation (ft MSL)	376.98	372.11	358.99	339.96	368.67	366.65
Northing	9949069.45	9946563.44	9947806.017	9946445.582	9947619.46	9947139.86
Easting	3428311.38	3429862.181	3429260.844	3428730.533	3428574.38	3429525.31
Survey Datum	Horizontal Datum: NAD83/2011-EPOCH 2012 Vertical Datum: NAVD88-GEOIDIZA	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/2011-EPOCH 2012 Vertical Datum: NAVD88-**GEOIDIZA**

Notes:

ft bgs = feet below ground surface

ft NGVD = feet above the National Geodetic Vertical Datum (NAVD 1988)

Rev. 1 10/26/2022

4.0 MONITORING FREQUENCY

In accordance with 40 CFR 257.94, a minimum of eight independent samples for each background well and downgradient well will be collected and analyzed for the constituents listed in appendix III and IV prior to October 17, 2017.

During detection monitoring, all wells will be sampled on a semi-annual basis for the constituents listed in appendix III. Detection monitoring samples will be collected in the first and third quarters of each year beginning in 2018.

5.0 LOW-FLOW GROUNDWATER SAMPLING PROCEDURES

Groundwater samples should be collected in accordance with the USEPA Low-Flow Groundwater Sampling Guidance included in Appendix 2 and as described in this section.

5.1 GROUNDWATER SAMPLING PREPARATION

The person performing groundwater sampling is responsible for ensuring that all the necessary measurement, purging, sampling supplies, and equipment are available, in good working order, and decontaminated prior to initiating sampling. At a minimum, the following equipment is required.

- A water level probe.
- A decontaminated, low-flow peristaltic or flow-controlled submersible pump.
- Dedicated bailers (in case of pump failure).
- Decontamination equipment (buckets, deionized water).
- A water quality meter (YSI 600 XL or similar) with the capability to measure temperature, pH, conductivity, oxidation-reduction potential, and dissolved oxygen.
- A decontaminated flow cell for the water quality meter.
- Laboratory-provided pre-cleaned sample containers, preferably pre-preserved.
  250 ml preserved with HNO3, for metals.
  500 ml plastic bottle, unpreserved, for sulfate
- Nitrile gloves.
- Coolers for sample preservation and transportation.
- Sample labels and chains of custody.

- Ice to cool collected samples.
- Field logbook or field information forms.

5.2 WATER-LEVEL MEASUREMENT PROCEDURE

The groundwater elevations must be measured and recorded in each well immediately prior to purging, each time groundwater is sampled~~groundwater elevation should be measured in each well and recorded prior to any groundwater sampling~~. The following procedures shall be used:

1. Observe the area around each well and document and/or photograph any above-ground damage that may require repair to ensure the continued integrity of the well at the surface.

2. Open the outer casing top (if bolted, a wrench may be needed) and remove the well cap (may require wrench or key).

3. Measure the depth to groundwater in each well using an electronic water-level probe (e.g. Solinst Water-Level Indicator). **Do not measure the total depth at this time to reduce turbidity.** Take these measurements by carefully lowering the probe to the water level, reading the cable measurement to 0.01-feet accuracy against the surveyed mark or notch at the top of the well casing. Record the measurements and compare them to previous readings to identify any major discrepancies. Repeat the measurements if major discrepancies are identified.

5.3 GROUNDWATER PURGING PROCEDURE

The wells should be purged using the low-flow sampling procedure described in the USEPA guidance document attached as Appendix 1. The following procedures should be followed:

1. Obtain well logs and determine the screened interval, previous water levels, previous well yield, and previous purge volumes for each well. The pump or tubing will need to be placed in the center of the screened interval of the well for proper purging and sampling. In low yield wells the pump may need to be placed lower in the casing. The other information will provide useful guidelines for additional sampling.

2. Purge each well until the discharge becomes clear and water quality parameters including pH, conductivity, temperature, and dissolved oxygen stabilize. Lower a pump into the well such that the pump intake is located at the approximate center of the screened interval of the well. Purge each well using a low-flow pump at an approximate flow rate of less than 1.0 liter per minute. This can be performed with a peristaltic pump where the depth to groundwater is relatively shallow (less than 30 feet). A submersible pump with a flow controller is needed where the depth to water is greater than 30 feet.

3. Monitor the purged groundwater for water quality parameters including conductivity, pH, and temperature. This can be done using a YSI 600 XL or water quality probe of similar type. Preferably, the purge water should be collected in a flow-through cell as it discharges from

the well in order to take these readings. Record the measured water quality parameters either electronically or in the field logbook.

4. During purging, periodically measure the water level in the well. The water column in the well should not be significantly drawn down using the low-flow procedure. Drawdown should be less than 0.5 feet. Record the water level and drawdown measurements in the field logbook.

5. Continue purging until the water quality parameters stabilize or until 3 to 5 well volumes of water have been purged. The water quality parameters most likely will stabilize before 3 to 5 well volumes are reached. Sufficient stabilization has occurred where three successive readings are within ± 2 degrees Celsius temperature, ± 3% conductivity, ± 10% dissolved oxygen, ±10 mV redox potential, and ± 0.1 pH. These are general guidelines; other data quality objectives may be established for a given project.

6. In the event that the well purges dry during the low-flow sampling procedures due to poor well yield, allow the well to recover to the approximate original water level. Then sample the well.

7. Record the amount of water purged from each well and contain all purge water for disposal according to the requirements of the project.

5.4 GROUNDWATER SAMPLING PROCEDURE

Groundwater samples should be collected from each well shortly after the water quality parameters have sufficiently stabilized or three to five well volumes have been purged. The following groundwater sampling procedures shall be used:

1. Use pre-cleaned sample bottles provided by the laboratory or bottle supplier. The bottles may be pre-preserved for specific analyses, depending on the requirements of the project.

2. Wear appropriate personal protective equipment based on the chemical properties of the contaminants of concern. At a minimum, wear latex gloves during sampling to prevent contact with groundwater and minimize the potential for cross-contamination. At a minimum, replace the gloves between sampling at each well.

3. Collect the groundwater sample directly from the dedicated pump tubing at each well while water continues to be pumped from the well (after purging) under the low-flow (less than 0.5 liters per minute) condition. Fill the sample bottles by allowing pump discharge to flow gently down the side of bottle with minimal entry turbulence.

4. **Do not filter the samples in the field.** If the sample is turbid (greater that 10 NTU), collect both an unfiltered sample and a filtered sample using a 10-micron filter that will trap the large-diameter solids in the sample. Do not use a 0.45-micron filter. The filtered sample will be analyzed if the unfiltered sample results in a statistically significant increase or as instructed by **FPP.**

5. Add preservatives to the samples (e.g., nitric acid for metals analyses) as required based on the analyses to be performed.

6. Label each sample immediately upon collection. Ensure that the label contains the sample name, sample location, date, time, preservatives, requested analyses, project identification, and sampler's name. Trip blanks, field blanks and duplicate samples should be numbered such that they are indistinguishable from other samples to be sent to the laboratory.

7. Fill out the chain-of-custody record and indicate each sample on that record. Enter any other pertinent information regarding the sample or requested analyses on the custody record.

8. Carefully package the samples for transportation to the laboratory. Glass bottles should be double-bagged in Ziploc bags before placing them in their respective shipping coolers to contain the water in the event of bottle breakage. Use ice to chill each sample cooler to approximately 6 degrees Celsius with ice, and seal the coolers for delivery to the laboratory.

9. Remove the pump and tubing from the well after sampling. The dedicated pump tubing shall be disposed of or properly stored for future sampling at the same monitoring well and new tubing used for the next monitoring well. Measure the total depth in each well using an electronic water-level probe (e.g. Solinst Water-Level Indicator). Take measurements by carefully lowering the probe first to the bottom of the well, reading the cable measurement to 0.01-feet accuracy against the surveyed mark or notch at the top of the well casing. Record the measurements and compare them to previous readings to identify any major discrepancies. Repeat the measurements if major discrepancies are identified.

10. Replace the well cap and lock the outer casing well top.

11. Decontaminate the pump between wells using ASTM D5088-02 Standard Practice for Decontamination of Field Equipment at Waste Sites.

12. Promptly deliver the samples to the laboratory either by direct drop off or delivery via a priority overnight service.

6.0 LABORATORY ANALYSES & QUALITY ASSURANCE

To ensure consistent, ~~high quality~~high-quality results, laboratory analyses must be performed using industry standard methods. To be acceptable to regulating agencies, the laboratory must provide quality assurance/quality control (QA/QC) documentation with each laboratory report. The QA/QC documentation must include matrix spike, surrogate recovery, and method blank results, as well as documentation of instrument calibration. The laboratory analytical methods to be used at the FPP CBL are listed in Table 2. At a minimum, one trip blank, one field blank, and one duplicate sample shall be collected in the field to assure quality during each sampling event.

TABLE 2
CCR GROUNDWATER ANALYTICAL METHODS
FAYETTE POWER PROJECT

Preparation Method	Analytical Method	CCR Appendix III Constituents
TCEQ SOP VI	TCEQ SOP VI	pH
SW 3010A	SW6010B	Boron
SW 3010A	SW6010B	Calcium
E300.0	E300.0	Chloride
E300.0	E300.0	Fluoride
E300.0	E300.0	Sulfate
SW 2540C	SW2540C	TDS(2540C)
		CCR Appendix IV Constituents
SW 3010A	SW6010B	Barium
SW 3010A	SW6010B	Beryllium
SW3010A	SW6020 ICP-MS	Antimony
SW3010A	SW6020 ICP-MS	Arsenic
SW3010A	SW6020 ICP-MS	Cadmium
SW3010A	SW6020 ICP-MS	Cobalt
SW3010A	SW6020 ICP-MS	Chromium
SW3010A	SW6020 ICP-MS	Lead
SW3010A	SW6020 ICP-MS	Lithium
SW3010A	SW6020 ICP-MS	Molybdenum
SW3010A	SW6020 ICP-MS	Selenium
SW3010A	SW6020 ICP-MS	Thallium
SW7470A	SW7470A	Mercury (7470)
E903.0	E903.0	Radium 226
E904.0	E904.0	Radium 228

Rev. 1 10/26/2022

7.0 Verification Resampling

In a detection monitoring program that incorporates verification resampling, an SSI is not declared unless the resample or resamples also exceed the background limit. The exceedance detected in the initial sample may be referred to as an “initial exceedance.” Verification resampling should be conducted to verify or disconfirm an initial exceedance. If a constituent in an original sample from a well exceeds its statistical limit, then one or more resamples are collected from that well and evaluated. A statistical test utilizing resampling is not complete until all necessary resamples have been evaluated.

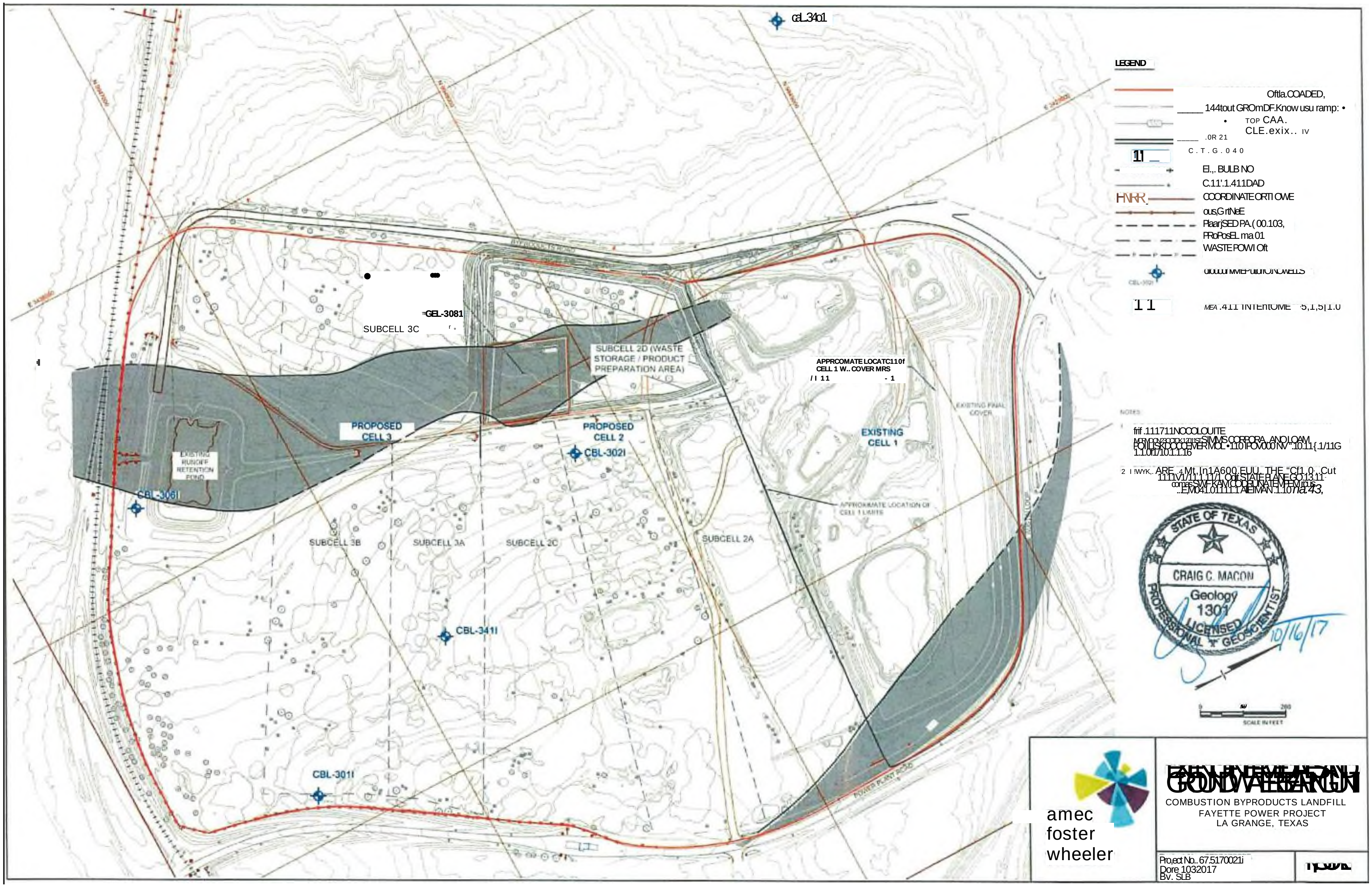
The retesting strategy is to allow for one resample for constituents evaluated using a parametric method with eight background measurements which will be all wells and constituents except boron in monitoring wells CBL-301I and CBL-302I. Two resamples for constituents evaluated using a nonparametric method with eight background measurements which is boron in monitoring wells CBL-301I and CBL-302I. If the retesting strategy involves one resample, the initial exceedance is disconfirmed if the constituent concentration in the resample does not exceed the prediction limit (pass one of one resample). If the retesting strategy involves two resamples, the initial exceedance is disconfirmed if the constituent concentration in the first or second resample does not exceed the prediction limit (pass one of two resamples); if the first resample passes, the second resample does not need to be taken. A resampling strategy will be periodically reevaluated and changed as necessary during a background update, which would include new sample results since the previous background evaluation and may include new wells or changes to the list of constituents monitored.

In accordance with 40 CFR ~~[30 TAC 330.407(b)],~~ 257.93, if an initial exceedance over a background limit is determined, the owner or operator may conduct verification resampling. ~~and submit the results within 60 days of the initial exceedance determination.~~ The verification resampling results will confirm or disprove the initial exceedance. If an initial exceedance is verified, an SSI is declared, and assessment monitoring is triggered unless an “alternate source demonstration” is submitted and approved. Within 90 days after completing sampling and analysis, the owner or operator must determine whether there has been a statistically significant increase over background for any constituent at each monitoring well. If a verification resample does not confirm an exceedance, routine detection monitoring may continue.

8.0 STATISTICAL PROCEDURE

The CCR rule provides several options for evaluating the groundwater data (40 CFR 257.93[f]). As referenced in Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (EPA 530/R-09-007), the preferred methods for comparing groundwater data are using either prediction limits or using control charts. The control chart procedure offers an advantage over the prediction limits procedure as more data is generated over time, because they generate a graph of compliance data over time and allow for better identification of long-term trends. The control chart statistics conform to the Coal Combustion Residual (CCR) rule (40 CFR Part 257), USEPA Guidance document (“Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance,” March 2009), and the American Society for Testing and Materials (ASTM) standard D6312-98, Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs.

As of this First Quarter 2021 statistical evaluation and moving forward, intrawell analysis will continue, using the control chart methodology referenced in 40 CFR 257.93(f)(4), instead of the prediction limits method previously used. In accordance with 40 CFR 257.93(f)(6), a new certification of the statistical method was issued by a professional engineer in May 2021~~.~~



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COMBUSTION BYPRODUCTS LANDFILL
FAYETTE POWER PROJECT
LA GRANGE, TEXAS

Pro,ect No.. 67.5170021i
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Bv. SLB

APPENDIX 1

USEPA LOW-FLOW GROUNDWATER SAMPLING GUIDANCE

United States
Environmental Protection
Agency

Office of
Research and
Development

Office of Solid Waste
and Emergency
Response

EPA/540/S-95/504
April 1996

:.EPA Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls' and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

For further information contact: Robert Puls, 405-436-8543, Subsurface Remediation and Protection Division, NRMRL, Ada, Oklahoma.

I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units.* With time it became apparent that conventional water supply generalizations of *homogeneity did* not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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'National Risk Management Research Laboratory, U.S. EPA [2]University of Michigan

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Superfund Technology Support Center for Ground Water

**National Risk Management Research Laboratory
Subsurface Protection and Remediation Division
Robert S. Kerr Environmental Research Center
Ada, Oklahoma**

Technology Innovation Office
Office of Solid Waste and Emergency
Response, US EPA, Washington, DC

Walter W. Kovalick, Jr.,
Ph.D. Director

chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

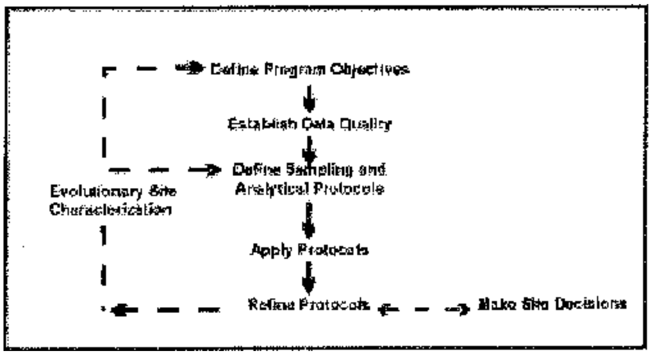

Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short,* of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action.*

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g. , pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;

  maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over <u>any</u> other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 pm filters]) concentrations of major ions and trace metals, 0.1 pm filters are recommended although 0.45 pm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO, composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 pm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 my for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe", CH,, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon ™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. *Low-Permeability Formations (<0.1 L/min recharge)*

1. Low-Flow Purging and Sampling with Pumps

a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. *Fractured Rock*

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop -- A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

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Figure 2. **Ground Water Sampling Log**

Project________________**Site** _______________**Well No.** _____________**Date** ________________________

Well Depth_____________**Screen Length**__________ **Well Diameter** _________**Casing Type**___________

Sampling Device _______________**Tubing type** _____________________**Water Level** __________________

Measuring Point ___________________ **Other Infor**____

Sampling Personnel____

Time	**pH**	**Temp**	**Cond.**	Dis.0_2	**Turb.**	**[ ]Conc**			**Notes**

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: Vol$_{cy}$, = reh, Vol.$_{pher}$. = 4/3n r^3

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project__________________ **Site**_________________ **Well No.** ______________ **Date**___________________________

Well Depth ______________ **Screen Length**____________ **Well Diameter** ___________ **Casing Type** _____________

Sampling Device __________________**Tubing type** ______________________ **Water Level** ___________________

Measuring Point______________________ **Other Infor**____

Sampling Personnel ____

Time	Pump Rate	Turbidity	Alkalinity	[Conc	Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{co} = nr^2h$, $VoL_{phere} = 413n\ r^3$

Attachment 6

Replacement Pages

Fayette Power Project Post Closure Care Costs

Cells 1 and 2D: 38 acres — Additional Costs for Cells 2(A-C) and Cell 3: 72 acres[8]

Engineering and Inspection Costs	Unit	Unit costs	Cost per event	events/ year	Cost per year	Unit	Unit costs	Cost per event	events/ year	Cost per year
Annual Site Inspection and Report[1]	each	$5,000.00	$5,000.00	1	$5,000.00		$ 2,500.00	$2,500.00	1	$2,500.00
Quarterly site inspections[1]	each	$1,000.00	$1,000.00	4	$4,000.00		No additional cost			
Repair design, plan and certification (engineering for "Construction and Maintenance")[1]	each	$15,000.00	$15,000.00	0.5	$7,500.00		No additional cost			
Engineering and inspection costs total per year:					**$16,500.00**					**$2,500.00**
Groundwater Monitoring	Unit	Unit costs	Cost per event	events/ year	Cost per year	Unit	Unit costs	Cost per event	events/ year	Cost per year
Based on the sampling of 6 groundwater monitoring wells plus the analysis for a duplicate, field blank and equipment blank per sampling event. Cost of analysis of 6010 metals, anions, TDS, pH is $185 per sample and labor cost is $200 per well.[2]	9 samples	$185.00	$1,665.00	2	$3,330.00		No additional cost			
	6 wells - labor	$200.00	$1,200.00	2	$2,400.00		No additional cost			
Annual and semi-annual Statistical Analysis and Reporting including Groundwater Potentiometric Analysis and	annual	$19,000.00	$19,000.00	1	$19,000.00		No additional cost			
Groundwater monitoring costs total per year:					**$24,730.00**					**$0.00**
Construction and Maintenance	Unit	Unit costs	Cost per event	events/ year	Cost per year	Unit	Unit costs	Cost per event	events/ year	Cost per year
Mowing and vegetation management[4]	38 acres	$160.00	$6,080.00	1	$6,080.00	72 acres	$ 160.00	$11,520.00	1	$11,520.00
Leachate Collection System Maintenance and Inspections[5]	Not Applicable for existing cells					once per year	$2,000.00	$2,000.00	1	$2,000.00
Leachate collection and disposal[6]	Not Applicable for existing cells					To be determined at the time of cell design[6]				TBD
Groundwater monitoring system maintenance[1]		$500.00	$500.00	1	$500.00		No additional cost			
Perimeter fence and gate maintenance[1]		$2,000.00	$2,000.00	0.33	$666.60		No additional cost			
Access road maintenance[1]		$10,000.00	$10,000.00	0.2	$2,000.00		No additional cost			
Drainage system cleanout/repairs[1]		$5,000.00	$5,000.00	0.33	$1,666.50		No additional cost			
Const. & maintenance costs total per year:					**$10,913.10**					**$13,520.00**
Total of recurring costs per year (excluding leachate disposal):					$52,143.10					$16,020.00
Total of recurring costs over 30 years (excluding leachate disposal):					**$1,564,293.00**					**$480,600.00**
One time costs	Unit	Unit costs	Cost per event	events/ year	Cost per year	Unit	Unit costs	Cost per event	events/ year	Cost per year
Cap and side slope repairs and revegetation - soil (Assumes 10 cu yd/ acre over 30 years)[3]	38 acres over 30 years	$12.00	$4,560.00	1	$4,560.00	72 acres over 30 years	$12.00	$8,640.00	1	$8,640.00
Cap and side slope repairs and revegetation- reseed (Assumes 20% of acreage over 30 yrs)[3]	38 acres over 30 years	$400.00	$3,040.00	1	$3,040.00	72 acres over 30 years	$400.00	$5,760.00	1	$5,760.00
Clean Leachate Collection Lines[5]	Not Applicable for existing cells					once over 30 years	$1,000.00	$1,000.00	1	$1,000.00
Monitor well replacement - assume 3 over 30 years[2]	3	$3,785.00	$11,355.00	1	$11,355.00		No additional cost			
Contractor oversight of well installation and certification[2]	3	$ 15,000.00	$45,000.00	1	$45,000.00		No additional cost			
Final plugging of groundwater wells[2]	6	$1,500.00	$9,000.00	1	$9,000.00		No additional cost			
Total on One-time costs:					**$72,955.00**					**$15,400.00**
Total Post Closure Care Cost for 30 years, Unadjusted; excludes leachate disposal:					**$1,637,248.00**					**$496,000.00**
Adjustments										
Contingency[7]		10%			$163,724.80					$49,600.00
Administrative services[7]		6%			$98,234.88					$29,760.00
Technical and professional services[7]		7%			$114,607.36					$34,720.00
Total Post Closure Care costs for 30 years, Adjusted; excludes leachate disposal:					**$2,013,815.04**					**$610,080.00**

Notes:

1	Cost estimate based on current FPP internal costs to perform these tasks, scaled up to adjust for third party support.
2	Cost estimate based on current FPP third party support.
3	Cost from "Solid Waste Financial Assurance Program Report" Sections 4.13.2 and 4.13.3; Oklahoma Department of Environmental Quality and Cardinal Engineering; 12/22/2000.
4	Cost from "Solid Waste Financial Assurance Program Report" Sections 4.13.1; Oklahoma Department of Environmental Quality and Cardinal Engineering; 12/22/2000.
5	Cost from "Solid Waste Financial Assurance Program Report" Sections 4.14.1 and 4.14.2; Oklahoma Department of Environmental Quality and Cardinal Engineering; 12/22/2000.
6	The amount of leachate created by the CBL lateral expansion will be calculated at the time of final design. The registration will be amended to include a post-closure care cost estimate for collection and disposal of leachate and financial assurance will be in place prior to construction and operation of the proposed landfill lateral expansion.
7	Factor from "Solid Waste Financial Assurance Program Report" Sections 4.15 through 4.17; Oklahoma Department of Environmental Quality and Cardinal Engineering; 12/22/2000.
8	Post closure care costs for future landfill cells may be adjusted at the time of construction and CCR Registration modification.
Other Notes:	Costs are based on the cost of hiring a third-party to conduct post-closure care. **Costs are in 2021 dollars.**

Redlined Pages

Fayette Power Project Post Closure Care Costs

Cells 1 and 2D: 38 acres

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8 Post closure care costs for future landfill cells may be adjusted at the time of construction and CCR Registration modification.

Other Notes: Costs are based on the cost of hiring a third-party to conduct post-closure care.

Costs are in 2021 dollars.

Rev. 1 10/26/2022

Attachment 7

COAL COMBUSTION RESIDUAL LANDFILL

ANNUAL GROUNDWATER MONITORING REPORT

Calendar Year 2018

LOWER COLORADO RIVER AUTHORITY (LCRA)
FAYETTE POWER PROJECT, LA GRANGE, TEXAS
JANUARY 31, 2019

Prepared by:

Nancy Overesch, P.G. # 2043 Nancy Ove

STATE OF TEXAS
1/31/19
NANCY E. OVERESCH
GEOLOGY
No. 2043
LICENSED
PROFESSIONAL GEOSCIENTIST

Lower Colorado River Authority
Fayette Power Plant Project
6549 Power Plant Rd.
La Grange, Texas 78945

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

APPENDIX A	CCR Groundwater Detection Monitoring Program Evaluation of First and Third Quarter 2018 Potentiometric Surface Data Collected from the CBL, Wood Environmental and Infrastructure Solutions, Inc, November, 5, 2018
APPENDIX B	Statistical Analysis of Initial Detection Monitoring Appendix III Constituent Data, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – January 14, 2018
APPENDIX C	Groundwater Monitoring System Certification of Alternate Source Demonstration, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018
APPENDIX D	Groundwater Geotechnical Evaluation at the Lower Colorado River Authority, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018
APPENDIX E	Groundwater Monitoring System Addendum Certification, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018
APPENDIX F	Statistical Analysis Updates of Detection Monitoring Appendix III Constituent Data, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018
APPENDIX G	CCR Groundwater Detection Monitoring Evaluation of Third Quarter 2018 Data Collected from the CBL, Wood Environmental and Infrastructure Solutions, Inc., November, 5, 2018
APPENDIX H	Analytical Data for Calendar Year 2018

2018 Groundwater Monitoring Report
Fayette Power Project
La Grange, TX

1.0 BACKGROUND

The LCRA Fayette Power Project (FPP) is a coal-fired power plant located east of La Grange in Fayette County, Texas. Coal Combustion Residuals (CCRs) generated at the facility are disposed of in the Combustion Byproducts Landfill (CBL) located south of the power plant and north of the railroad that borders the FPP site (Figure 1). The existing CBL consists of Cell 1 and Sub-cell 2D. Cell 1 was constructed in 1988 and sub-cell 2 D in 2015, therefore both active cells are considered existing units under the U.S. Environmental Protection Agency's Coal Combustion Residuals (CCR) Rules as codified in Title 40 of the Code of Federal Regulations (CFR), Chapter 257, Subpart D.

2.0 PURPOSE

This report was prepared pursuant to 40 CFR § 257.90(e), which requires the owner or operator of an existing CCR landfill to prepare an annual groundwater monitoring report for the preceding calendar year.

3.0 GROUNDWATER MONITORING SYSTEM

The groundwater monitoring well network for 2018 consisted of six wells as described below and additionally in Table 1:

- Background – CBL-340I
- Down-gradient - CBL-301I, CBL-302I, CBL-306I, CBL-308I and CBL-341I

No groundwater monitoring wells were installed or decommissioned in 2018. The location of the monitoring wells are shown on Figure 1.

In accordance with 40 CFR § 257.93(c), groundwater elevations were measured in each monitor well prior to purging and sampling for each semi-annual sampling event. Consistent with prior CBL potentiometric surface elevation maps, the inferred groundwater flow direction is towards the south-southwest at an approximate rate of 24 feet per year. Detailed information is contained in the November 5, 2018 Technical Memorandum prepared by Wood Environmental and Infrastructure Solutions, Inc. (Wood), which is included in Appendix A. It should be noted that Wood acquired AMEC Foster Wheeler Environmental and Infrastructure, Inc. (AMEC) in October 2017 with AMEC transitioning to the new name during 2018.

During the 2018 First Quarter sampling event, samples were collected from each of the monitor wells for both total and dissolved constituents to evaluate the effects of turbidly. In accordance with 40 CFR § 257.93(i), only the non-filtered (total) sample results were used in the statistical evaluation.

During the 2018 Third Quarter sampling event, groundwater monitoring well CBP-341I was not sampled due to an oversight by LCRA's Environmental Laboratory Services. Upon discovery of the oversight, the well was sampled approximately 30 days later than the other wells but within the Third Quarter.

4.0 STATUS OF THE GROUNDWATER MONITORING PROGRAM

During calendar year 2018, all groundwater sampling was conducted in accordance with 40 CFR § 257.93 - Groundwater sampling and analysis requirements and § 257.94. - Detection Monitoring. Table 2 summarizes the sampling events. As discussed in Section 5, the CBL will remain in Detection Monitoring for 2019.

5.0 STATISTICAL EVALUATIONS AND ALTERNATE SOURCE DETERMINATION

5.1 Statistical Analysis of 2016 and 2017 Initial Data

In January 2018 AMEC conducted the statistical analysis for the Detection Monitoring Appendix III constituent data collected from the eight initial rounds of monitoring. The results suggested that there was enough preliminary evidence to indicate a Statistically Significant Increase (SSI) over background for two Appendix III constituents (calcium and sulfate) and AMEC recommended conducting an Alternate Source Demonstration (ASD) in accordance with 40 CFR § 257.94(e)(2). Detailed information is contained the January 14, 2018 Technical Memorandum prepared by AMEC which is included in Appendix B.

On April 14, 2018, AMEC completed the ASD. Based on the findings of the ASD, AMEC determined that the natural groundwater geochemistry within the area monitored by the CBL's groundwater monitoring system is of a heterogeneous nature, with at least two different groundwater types identified by analysis of the calculated milliequivalents of the major cations (sodium, potassium, calcium, and magnesium) and major anions (chloride, bicarbonate-carbonate, and sulfate). These major cations and anions are naturally present in soils at the Fayette Power Project facility, commonly in calcium carbonate and sulfide-sulfate minerals. It was also determined that background monitoring well CBL-340I is located in an area of a different groundwater type from the groundwater type below the CBL. Therefore, it cannot be reliably used to characterize the background geochemistry of the groundwater flowing beneath the CBL. Attempts to locate a new upgradient well in the intermediate sand failed. Accordingly, Wood determined that the initial use of prediction limit interwell groundwater analysis was in error and resulted in the incorrect identification of an SSI. As a result, Wood recommended and certified the use of the prediction limit intrawell analysis when making SSI determinations. Existing background monitoring well CBL-340I will no longer be utilized for statistical evaluations but will remain a part of the CBL groundwater monitoring system. Detailed information is contained in: Appendix C - April 13, 2018 Groundwater Monitoring System Certification of Alternate Source Demonstration prepared and sealed by AMEC; Appendix D - April 13, 2018 Technical Memorandum, Groundwater Geotechnical Evaluation at the Lower Colorado River Authority prepared by AMEC; and Appendix E - April 13, 2018 Groundwater Monitoring System Addendum Certification prepared and sealed by AMEC.

5.2 Statistical Analysis of First Quarter 2018 Data

In April 2018 AMEC completed the statistical analysis of the First Quarter Detection Monitoring Appendix III constituent data utilizing the prediction limit intrawell method. The results indicated that there were no SSIs for any constituents in any well. Detailed information is contained the April 13, 2018 Technical Memorandum prepared by AMEC which is included in Appendix F.

5.3 Statistical Analysis Third Quarter 2018 Data

In November 2018 Wood completed the statistical analysis of the Third Quarter Detection Monitoring Appendix III constituent data utilizing the prediction limit intrawell method. The results indicated that there were no SSI for any constituents in any well. Detailed information is contained the November 5, 2018 Technical Memorandum prepared by Wood which is included in Appendix G.

6.0 KEY ACTIONS

Key actions for 2018 are detailed in Section 5. Key actions for 2019 include continued semi-annual detection monitoring with associated statistical analysis and responding in accordance with the CCR rules as new information is developed.

TABLE 1

MONITORING WELL DETAILS

Well ID	**CBL-340i (Background Well)**	**CBL-301i**	**CBL-302i**	**CBL-306i**	**CBL-308i**	**CBL -341i**
Installation Date	12/17/2015	5/23/2011	5/24/2011	6/3/2011	12/20/2011	11/14/2016
Hydrogeologic Unit Monitored	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand	Intermediate Sand
Casing Type	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC
Total Well Depth (ft bgs)	37	51	24	12.5	32	43
Screened Interval (ft bgs)	22-37	41-51	14-24	9-14	22-32	33-43
Ground Surface Elevation (ft MSL)	374.69	369.75	355.99	337.93	364.93	364.03
TOC Elevation (ft MSL)	376.98	372.11	358.99	339.96	368.67	366.65
Northing	9949069.45	9946563.44	9947806.017	9946445.582	9947619.46	9947139.86
Easting	3428311.38	3429862.181	3429260.844	3428730.533	3428574.38	3429525.31
Survey Datum	Horizontal Datum: NAD83/2011-EPOCH 2012 Vertical Datum: NAVD88-GEOIDIZA	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/NSRS 2007 Vertical Datum: NAVD88	Horizontal Datum: NAD83/2011-EPOCH 2012 Vertical Datum: NAVD88-GEOIDIZA

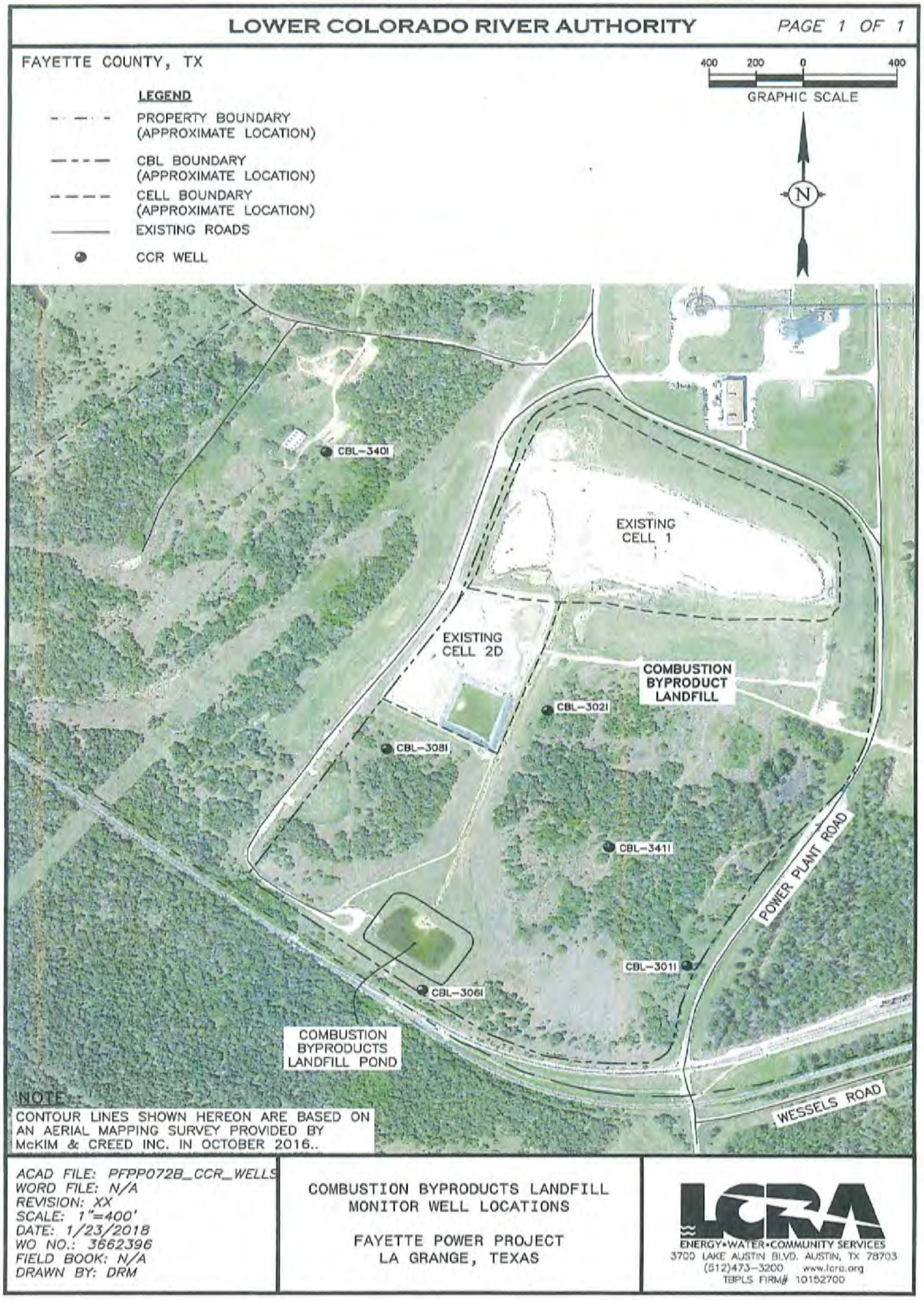
TABLE 2

2018 CCR GROUNDWATER MONITORING EVENTS

Well #	Date of sample collection	# samples collected for analysis	Monitoring program
CBL 340I	2/7/2018	1	Detection monitoring
	7/27/2018	1	Detection monitoring
CBL 301I	2/7/2018	1	Detection monitoring
	7/25/2018	1	Detection monitoring
CBL 302I	2/7/2018	1	Detection monitoring
	7/27/2018	1	Detection monitoring
CBL 306I	2/7/2018	1	Detection monitoring
	7/27/2018	1	Detection monitoring
CBL 308I	2/6/2018	1	Detection monitoring
	7/25/2018	1	Detection monitoring
CBL 341I	2/6/2018	1	Detection monitoring
	8/24/2018	1	Detection monitoring

FIGURE 1

MONITOR WELL LOCATION MAP



APPENDIX A

CCR Groundwater Detection Monitoring Program Evaluation of First and Third Quarter 2018 Potentiometric Surface Data Collected form the CBL, Wood Environmental and Infrastructure Solutions, Inc., November, 5, 2018

Technical Memorandum

To:	Nancy Overesch, PG	**File No:**	6706180078
From:	Charlie Macon, PG	**cc:**	File
Date:	November 5, 2018		

Subject: **CCR GROUNDWATER DETECTION MONITORING PROGRAM**
EVALUATION OF FIRST AND THIRD QUARTER 2018 POTENTIOMETRIC SURFACE DATA COLLECTED FROM THE CBL
Fayette Power Project – La Grange, Texas

1.0 INTRODUCTION

This Technical Memorandum (Tech Memo) documents the evaluation of the Intermediate Sand groundwater bearing unit potentiometric surface data obtained during completion of the first quarter and third quarter 2018 groundwater monitoring events. The monitoring is being performed, as part of the Combustion Byproducts Landfill (CBL) Groundwater Monitoring Program (GMP) pursuant to the Coal Combustion Residuals (CCR) regulations as codified in 40 Code of Federal Regulations (CFR) 257.93.. The CBL is located at the Lower Colorado River Authority's (LCRA's) Fayette Power Project (FPP) facility near La Grange, Texas. This potentiometric surface evaluation, and subsequent determination of groundwater flow rate and direction, is conducted for each groundwater monitoring event pursuant to the GMP requirements of 40 CFR 257.93(c).

2.0 POTENTIOMETRIC SURFACE DATA COLLECTION AND MAPPING

All groundwater monitoring and sampling activities were performed by an LCRA technician. Prior to conducting well purging and collection of groundwater samples for chemical analysis, the technician used an electronic well probe to determine depth to the Intermediate Sand groundwater surface below the surveyed top of casing elevation. Table 1 presents the summary of groundwater measurements obtained from the CBL Groundwater Monitoring Well network in 2018.

Based on the measured groundwater elevations, potentiometric surface maps were prepared to document the February-First Quarter 2018 monitoring event (Figure 1), and the July-August-Third Quarter 2018 monitoring event (Figure 2). These maps show a relatively consistent groundwater potentiometric surface, and are similar to those presented for the January 2017 and July 2017 monitoring events.

3.0 GROUNDWATER FLOW DIRECTION AND FLOW RATE CALCULATION

Consistent with prior CBL GMP maps, a groundwater flow direction inferred by potentiometric surface elevation, is toward the south-southwest (Figures 1 and 2). The inferred groundwater gradient is slightly less to the west, consistent with past findings.

Groundwater flow rate was estimated along two transects for each event, one along the western area having a lesser gradient, and one along the eastern area. As documented in the CBL Hydrogeology Report (Amec, 2013), a hydraulic conductivity value (K) of 6.3 x 10^{-4} centimeters per second (cm/sec) has been estimated for the Intermediate Sand, based on rising-head slug test data obtained from monitoring well CBL-302I. In calculating groundwater flow rate, this hydraulic conductivity value was utilized for the February 2018 and July-August 2018 events, consistent with past evaluations of the Intermediate Sand. In addition, also consistent with past evaluations, an assumed porosity value of 0.30 was utilized.

Groundwater gradients for the February 2018, and July-August 2018 events are estimated as follows:

February 2018 Event
Eastern Transect: 0.0302 feet/foot (ft/ft)
Western Transect: 0.0107 ft/ft

July-August 2018 Event
Eastern Transect: 0.0202 ft/ft
Western Transect: 0.0109 ft/ft

Given the constants K= 6.3 x 10^{-4} cm/sec, and Porosity = 0.30, the following groundwater flow velocities are calculated:

February 2018 Event
Eastern Transect: 66 feet per year (ft/yr)
Western Transect: 23 ft/yr

July-August 2018 Event
Eastern Tract: 44 ft/yr
Western Transect: 24 ft/yr

4.0 REFERENCES

Amec Environment & Infrastructure, Inc. (Amec), 2013: *Hydrogeologic Evaluation of Combustion Byproducts Landfill (CBL) Area Report, Fayette Power Project*, December 2013.

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LEGEND

	CBL UNIT BOUNDARY
350	EXISTING GROUND ELEVATION (FT.MSL) (NOTES 1,2)
(350)	EXISTING TOP OF CLAY LINER ELEVATION (FT.MSL) (NOTE 2)
	EXISTING ROAD
	EXISTING BUILDING
	EXISTING RAILROAD
	EXISTING VEGETATION / TREE
N 9949000 E 3428000	COORDINATE GRID (NOTE 2)
	EXISTING FENCE
	PROPOSED PHASE BOUNDARY
	PROPOSED LIMIT OF WASTE
— P — P — P —	POWER LINE
	WELLS
CBL-302I 347.90	CBL GROUNDWATER MONITORING WELL WITH POTENTIOMETRIC SURFACE ELEVATION INDICATED IN FEET ABOVE NAVD 1988.
350	POTENTIOMETRIC SURFACE CONTOUR LINE

NOTES:

1. THE EXISTING CONTOUR BASE MAP SHOWN ON THIS DRAWING WAS COMPILED USING AN AERIAL SURVEY BASED ON PHOTOGRAPHY PERFORMED ON 23 OCTOBER 2013 BY SURDEX CORPORATION AND LIDAR DATA PUBLISHED DECEMBER 2008 AND PROVIDED BY LCRA SURVEYING, MAPPING, AND GIS.
2. ELEVATIONS ARE IN FEET (FT) AS DEFINED BY THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988. STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM 83 (NAD-83) 1983.

STATE OF TEXAS
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LICENSED
PROFESSIONAL GEOSCIENTIST
12/6/18

wood.

POTENTIOMETRIC SURFACE MAP
FEBRUARY 2018
OF THE INTERMEDIATE SAND

COMBUSTION BYPRODUCTS LANDFILL
FAYETTE POWER PROJECT
LA GRANGE, TEXAS

Project No.: 6706180078
Date: 12/06/2018
By: BRJ

FIGURE 1

Plot Date: 12/07/18 - 11:51am, Plotted by: brian.johnson
Drawing Path: \\por-fs1\Clientdata\AMEC US OFFICES\Austin\6706180078 - LCRA\dwg\20181206\, Drawing Name: Figure 1 - Potentiometric Map February 2018.dwg

LEGEND

	CBL UNIT BOUNDARY
350	EXISTING GROUND ELEVATION (FT.MSL) (NOTES 1.2)
(350)	EXISTING TOP OF CLAY LINER ELEVATION (FT.MSL) (NOTE 2)
	EXISTING ROAD
▭	EXISTING BUILDING
++++++++++++	EXISTING RAILROAD
⊙	EXISTING VEGETATION / TREE
N 9949000 E 3428000	COORDINATE GRID (NOTE 2)
—x—x—x—	EXISTING FENCE
— — — — —	PROPOSED PHASE BOUNDARY
—— —— ——	PROPOSED LIMIT OF WASTE
— P — P — P —	POWER LINE
⊕	WELLS
CBL-302I 347.49	CBL GROUNDWATER MONITORING WELL WITH POTENTIOMETRIC SURFACE ELEVATION INDICATED IN FEET ABOVE NAVD 1988.
350	POTENTIOMETRIC SURFACE CONTOUR LINE

NOTES:

1. THE EXISTING CONTOUR BASE MAP SHOWN ON THIS DRAWING WAS COMPILED USING AN AERIAL SURVEY BASED ON PHOTOGRAPHY PERFORMED ON 23 OCTOBER 2013 BY SURDEX CORPORATION AND LIDAR DATA PUBLISHED DECEMBER 2008 AND PROVIDED BY LCRA SURVEYING, MAPPING, AND GIS.
2. ELEVATIONS ARE IN FEET (FT) AS DEFINED BY THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988. STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS STATE PLANE COORDINATE SYSTEM, TEXAS CENTRAL ZONE (4203), NORTH AMERICAN DATUM 83 (NAD-83) 1983.

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12/6/18

0 140 280
SCALE IN FEET

wood.

POTENTIOMETRIC SURFACE MAP
JULY-AUGUST 2018
OF THE INTERMEDIATE SAND
COMBUSTION BYPRODUCTS LANDFILL
FAYETTE POWER PROJECT
LA GRANGE, TEXAS

Project No.: 6706180078
Date: 12/06/2018
By: BRJ

FIGURE 2

Plot Date: 12/07/18 - 11:48am, Plotted by: brian.johnson
Drawing Path: \\por-fs1\clientdata\AMEC US OFFICES\Austin\6706180078 - LCRA\dwg\20181206\, Drawing Name: Figure 2 - Potentiometric Map July-August 2018.dwg

TABLE 1
Combustion Byproducts Landfill Groundwater Monitoring Well System 2018 Potentiometric Surface Data

Fayette Power Project
La Grange, Texas

Well ID	CBL-340I		CBL-301I		CBL-302I		CBL-306I		CBL-308I		CBL -341I	
Well Top of Casing Elevation	376.98		372.11		358.99		339.96		368.67		366.65	
Date	DTW (ft btoc)	Elevation (ft NGVD)	DTW (ft btoc)	Elevation (ft NGVD)	DTW (ft btoc)	Elevation (ft NGVD)	DTW (ft btoc)	Elevation (ft NGVD)	DTW (ft btoc)	Elevation (ft NGVD)	DTW (ft btoc)	Elevation (ft NGVD)
2/6/2018	NM	NM	NM	NM	NM	NM	NM	NM	24.90	343.77	16.32	350.33
2/7/2018	23.98	353.00	36.48	335.63	11.09	347.90	9.11	330.85	NM	NM	NM	NM
7/25/2018	NM	NM	35.88	336.23	NM	NM	NM	NM	24.87	343.80	NM	NM
7/27/2018	23.79	353.19	NM	NM	11.50	347.49	10.29	329.67	NM	NM	NM	NM
8/24/2018	NM	NM	NM	NM	NM	NM	NM	NM	24.87	343.80	16.47	350.18

Notes:

NM = Not Measured
ft btoc = feet below top of casing
ft NGVD = feet above National Geodetic Vertical Datum

APPENDIX B

Statistical Analysis of Initial Detection Monitoring Appendix III Constituent Data, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – January 14, 2018

Technical Memorandum

PRIVILEDGED AND CONFIDENTIAL CLIENT/ATTORNEY INFORMATION:

To:	Nancy Overesch, P.G. , Lower Colorado River Authority
From:	Carla Landrum, PhD., Amec Foster Wheeler C. Charles Macon, P.G., Amec Foster Wheeler
Project:	Fayette Power Project, La Grange, Texas
Date:	January 14, 2018
Subject:	**Statistical Analysis of Initial Detection Monitoring Appendix III constituent Data** **Fayette Power Project – La Grange, Texas**

This Technical Memorandum (Memo) summarizes the methods and findings of a statistical analysis of Detection Monitoring Appendix III constituent data collected during eight initial rounds of sampling conducted by Lower Colorado River Authority (LCRA) at the Combustion Byproducts Landfill (CBL) at their Fayette Power Project (FPP) property. The methods and findings detailed herein were developed in accordance with Coal Combustion Residuals (CCR) groundwater monitoring requirements set forth in 40 Code of Federal Regulation Section 257.93 (40CFR 257.93).

This Memo summarizes the subject analysis for the Fayette CCR unit including data inputs, methods, and results. This Memo also provides recommendations that we have developed based on the results.

DATA INPUTS

There are seven constituents of concern (COCs) listed in Appendix III for Detection Monitoring Assessment: boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids (TDS). Laboratory reports for each constituent were provided by LCRA in pdf and Excel format. Data were pre-formatted and incorporated into an MS Access database for easy data compilation, merging, formatting, and organization. Samples analyzed using test method "6010" were removed for statistical evaluation. Samples qualified as "filtered" or "blank" were excluded from statistical analysis. Non-detects were identified via a "<" in the data values. If duplicate records were present, the maximum concentration value was retained for statistical evaluation. The minimum requirement of eight samples collected from each monitoring well was met for each constituent.

The FPP CCR groundwater monitoring network consists of one background well (CBL-340I) and five downgradient wells (CBL-301I, CBL-302I, CBL-306I, CBL-308I and CBL-341I). The sampling frequency set forth in the CCR groundwater sampling plan is semi-annual, however, modifications to this sampling frequency were made to meet the mandatory 8 sample minimum by October 17, 2017. All wells were sampled between January 2016 and September 2017. Five of the six monitoring wells were sampled on an approximate bi-monthly (once every two months) basis. Well CBL-341I transitioned to a monthly sampling frequency in 2017.

METHODS

Exploratory data analysis (EDA) is a data diagnostic step that generates qualitative and quantitative information necessary to select a defensible statistical method for determining if there is a statistical significant increase (SSI) over background levels. Figure 1 generalizes the EDA Detection Monitoring Assessment methods, including assessment of spatial heterogeneity, trend detection, data distribution assessment, and outlier detection. Sample number, monitoring well network configuration, sampling frequency and non-detect frequency determine which EDA methods are most adequate. The final EDA step is selecting an adequate statistical method for determining if an SSI has occurred.

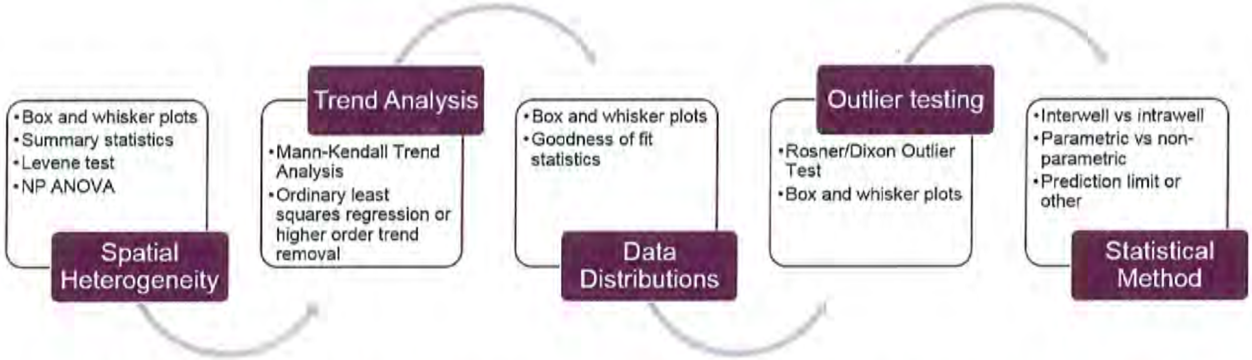


Figure 1. Detection monitoring EDA and statistical method workflow procedures. Each box represent as separate step in the EDA workflow process. The items listed in each box identifies the statistical method(s) applied for each step. Both quantitative and qualitative methods are listed.

The statistical Standard Operating Procedure (SOP) (AMECFW, 2017) outlines using the prediction limit method with possible resampling to confirm if there is an SSI. Figure 2 generalizes the decision process for selecting an appropriate prediction limit method.

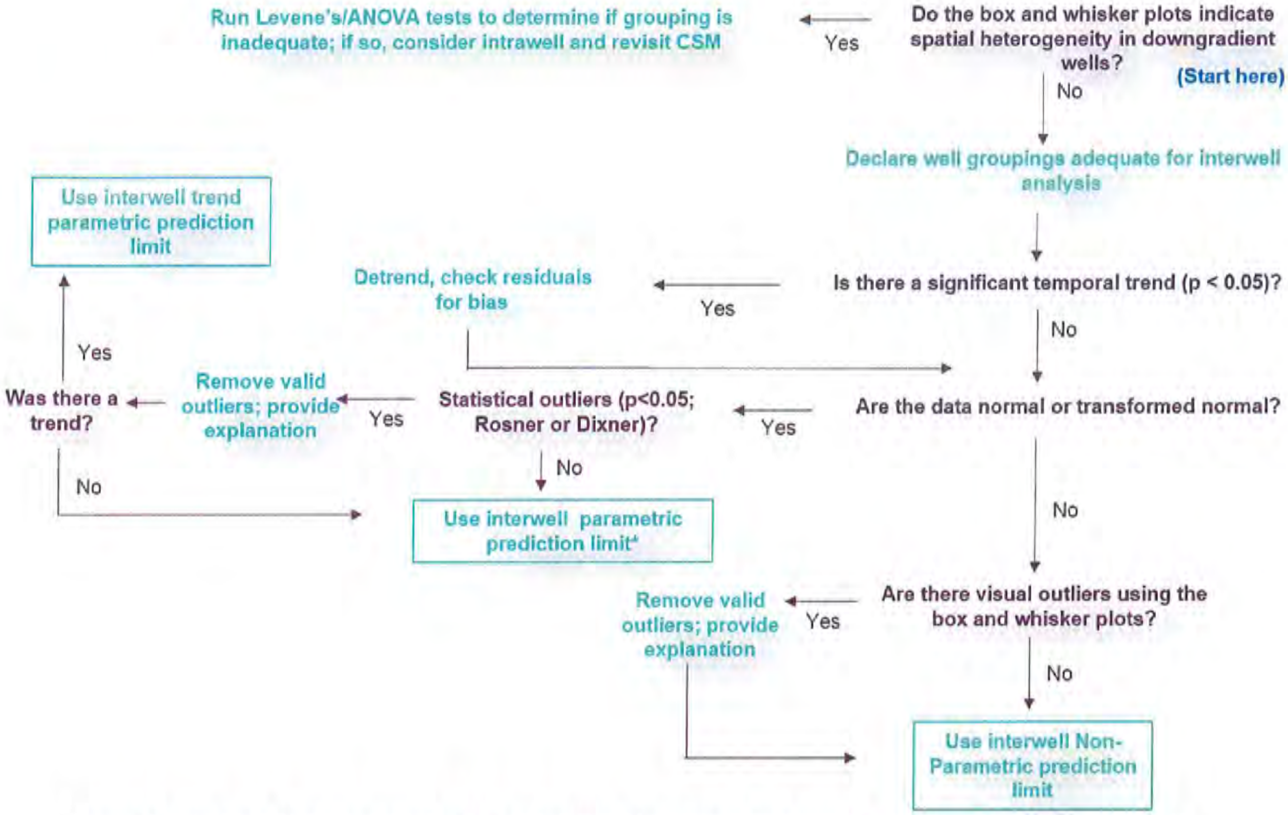


Figure 2. Generalized decision matrix for EDA and statistical prediction limit method selection. Matrix does not include resampling strategies. Any background constituent with a non-detect frequency 50%<ND<100% was automatically qualified for non-parametric prediction limit. Background constituents with a non-detect frequency <50% were processed using the Kaplan-Meier method or regression order statistic. The Double Quantification rule is used for 100% background non-detect frequency.

A resampling strategy is appropriate to reduce the overall false positive occurrences (falsely identifying an SSI) while maintaining adequate statistical power. Resampling strategies depend on several criteria, such as the size of the background dataset, sampling frequency, acceptable site-wide false positive error rate (SWFPR), and number of active monitoring wells, among other considerations. For parametric inter-well prediction limits, a 1 of 2 resampling strategy was selected for two primary reasons. First, this sampling strategy assumes the collection of two statistically independent samples is possible under the current CCR groundwater sampling plan (semi-annual sampling frequency). Second, the 1 of 2 resampling strategy achieves a site-wide false positive rate less than 10% and maintains "good" statistical power, as declared in the U.S. EPA's Unified Guidance (U.S. EPA, 2009). To clarify, for a 1 of 2 resampling strategy, if an initial exceedance is declared during the analysis documented herein, the collection of a second statistically independent sample is necessary prior to the next regular sampling event and subsequently compared to the relevant background prediction limit. If both the results for the initial sample and resample are in exceedance of the background prediction limit, then an SSI is declared. If only one of the two samples are in exceedance, then an SSI is not declared.

Resampling strategies are established prior to performing statistical compliance testing. The overall defensibility of a resampling strategy decreases when the sample data are statistically dependent (i.e., sampled so close in time that they are correlated), which is usually the case when sampling at a frequency higher than quarterly. Note: CBL 341I was sampled monthly in 2017 and the other wells were sampled more frequently than quarterly in order to meet the timeline of the regulation. The value of a resampling strategy generally decreases when the observed concentrations in downgradient wells are distinctly higher than concentrations observed in background wells (e.g., all samples are order(s) of magnitude higher); in this case, background might not be representative of groundwater beneath the CCR unit and downgradient wells or a release from the CCR unit has occurred.

Overall, the non-parametric inter-well prediction limit is not as robust as its parametric counterparts. To offset this deficiency, higher sample counts are often necessary to achieve an acceptable SWFPR and statistical power. Several retesting strategies were explored, including 1 of 2, 1 of 3 and 1 of 4 with maximum and second-order maximum values, to determine which strategy could achieve an acceptable SWFPR and acceptable statistical power. No resampling strategy could achieve these criteria with the current dataset. Additional sampling is necessary to achieve these criteria using non-parametric resampling. Resampling is still advised, however. A 1 of 2 resampling strategy is in place for parametric prediction limits and is applied here using the maximum observed concentration to reduce the chance of a false positive SSI for non-parametric prediction limits. A higher order (1 of 3 and 1 of 4) will achieve lower SWFPRs, even though they still exceed the 0.10 SWFPR criterion.

EDA RESULTS

The results of the Detection Monitoring Assessment EDA follow. Reference to the FPP conceptual site model (CSM) is necessary to support interpretation of results.

Appendix A includes ProUCL 5.1 box and whisker plots for all seven constituents. Box and whisker plots are a qualitative tool to screen spatial heterogeneity in the sample data. Inter-well testing assumes that the background well and downgradient wells are observing the same groundwater type. Spatial heterogeneity is an indication that the groundwater monitoring network is sampling more than one groundwater type, thereby violating this assumption. In general, the box and whisker plots do not provide strong evidence of spatial heterogeneity at the FPP. The box and whisker plots do indicate that CBL-306I is suspect for calcium and chloride, however, and this occurrence should be investigated further. If spatial heterogeneity proves relevant, spatial heterogeneity should be more rigidly tested using an appropriate ANOVA-type test. Intrawell prediction limits are appropriate when spatial heterogeneity is present. For this data evaluation, the monitoring well network is assumed to be sampling the same groundwater type.

Appendix B includes a ProUCL 5.1 printout of summary statistics for the FPP monitoring well network. Statistical parameters of interest include mean, variance, non-detect frequency and sample number.

Appendix C includes ProUCL 5.1 printouts for the Mann-Kendall trend tests. No statistically significant trends ($p<0.05$) were detected in background. Statistically significant ($p<0.05$: which translates to >95% confidence) increasing trends were detected in downgradient wells for calcium (CBL 301I and CBL 306I), chloride (CBL 306I) and sulfate (CBL-306I and CBL-302I). A statistically significant ($p<0.05$) decreasing trend was observed in CBL-340I for fluoride. Trend detection is sensitive to the sample number, detection and collection frequency. Trend behaviors and their significance can change as additional data are sampled over time.

Appendix D includes ProUCL 5.1 printouts for goodness of fit calculations for both raw and natural log transformed constituents. A normal or log transformed normal distribution was identified for boron, calcium, chloride, pH sulfate and TDS in the background sample dataset. No discernable distribution was identified for fluoride in the background sample dataset.

Appendix E includes ProUCL 5.1 printouts of statistical outlier evaluations relevant to normally distributed background constituents; statistically significant ($p<0.05$) outliers were identified for chloride. Box and whisker plots (Appendix A) were used to assess for outliers in cases where the data distributions were not normal. Potential outliers are visible (as dots below or above the box and whisker diagrams) in the box and whisker plots for fluoride. For background, interpreted outliers were removed and goodness of fit calculations were performed a second time to ensure data distributions did not change in response to outlier removal.

PREDICTION LIMIT METHOD SELECTION AND CALCULATIONS

Based on the FPP EDA results, an inter-well non-parametric prediction limit with 1 of 2 resampling was calculated for fluoride. Inter-well parametric prediction limits with 1 of 2 resampling were calculated for boron, calcium, chloride, pH, sulfate and TDS.

Calculations for the FPP prediction limits and associated k values are included in the attached Practitioner's Notes. The Practitioner's Notes are technical and provide transparency regarding prediction limit calculations and decision matrix workflow outputs (Figure 2). The Practitioner's Notes include a list of wells and constituents that are in initial or potential exceedance of their respective prediction limit(s). Calcium and sulfate exhibit concentrations an order of magnitude above their respective upper predictions limit for at least two downgradient wells. The results from this evaluation suggest there might be enough evidence to declare an SSI over background for these constituents without the need for resampling. If an SSI is declared for these two constituents, thereby foregoing resampling for calcium and sulfate, an investigation for possible alternative sources for these UPL exceedances, referenced as an Alternate Source Demonstration (ASD) [40CFR 257.94(e)(2)] would be the next step. In addition to non-comparable background water type, other issues to be examined include suspected sample matrix issues (e.g., suspended solids) and additional non-unit sources of calcium and sulfate. If another source proves to be the source of exceedances then an SSI cannot be declared for these constituents.

Boron, chloride, pH and TDS also exhibit initial exceedances and resampling is advocated for these constituents; the resample will consist of collecting one statistically independent sample before the next regularly scheduled sampling event; the next regularly scheduled sampling event should be in accordance with the CCR groundwater sampling plan (e.g. semi-annual sampling frequency). If the resample is in exceedance of the prediction limit, then an SSI is declared because both the initial and second sample are in exceedance. If the second sample is not in exceedance, an SSI is not declared and these constituents can continue with Detection Monitoring Assessment if not precluded by the declaration of an SSI for calcium or sulfate.

Initial exceedances are present for fluoride; however, an initial exceedance cannot be declared with acceptable statistical confidence for this constituent because there is no resampling strategy for non-parametric tests that can achieve the SWFPR <0.01 criterion using the current background data set. Essentially, more sampling is necessary to achieve acceptable statistical confidence.

Outliers are interpreted for some downgradient wells that exhibit initial exceedances; in particular, the sampling event on March 22, 2017 identifies potential outliers for fluoride (several wells) and pH. Outliers in downgradient wells should be investigated to ensure elevated values are not due to sample or laboratory error or result from some other anomaly.

RECOMMENDATIONS AND UPDATES

The results from this evaluation suggest spatial heterogeneity potentially exists between downgradient wells. Results from this work need CSM integration to help explain suspected spatial heterogeneity as it might relate to site geochemistry, hydrogeology, and management operations. Intra-well prediction limits are recommended if spatial heterogeneity proves relevant.

Preliminary results indicate there is enough evidence to declare an SSI for calcium and sulfate without resampling, albeit resampling is put forth according to the Unified Guidance (US EPA, 2009). With this said, it will be prudent to pursue an ASD for calcium and sulfate congruent with implementing resampling for all seven Appendix III constituents. In addition to non-comparable background water type, other alternative sources needing examination include suspected sample matrix issues (e.g., suspended solids) and additional non-unit sources of calcium and sulfate.

Statistically independent sampling is generally unlikely with a sampling frequency higher than quarterly. This means sample data collected on a bi-monthly or monthly frequency tend to produce data that are dependent and generally fail to provide an adequate representation of constituent concentration variance within the groundwater system. Moreover, data dependence can cause biased prediction limits and increase the chance of a false positive SSI (e.g. falsely declaring an SSI). More consistent and statistically independent sampling is necessary to ensure the sample data are representative of temporal variation intrinsic to the monitored groundwater system.

Statistical method selection and background threshold values should be updated once a consistent sampling frequency is in place, as prescribed in the CCR groundwater sampling plan (e.g. semiannual sampling frequency). A minimum of 8 samples is not deemed adequate to provide a statistically representative background threshold value for groundwater conditions beneath the FPP nor declare an SSI with satisfactory confidence (SWFPR < 0.10) in cases where non-parametric calculations are necessary.

CONCLUSIONS

This Memo summarizes methods, findings and recommendations of statistical analysis for Detection Monitoring Appendix III constituent data collected from the eight initial rounds of monitoring. The results from this evaluation suggest:

- Boron, calcium, chloride, sulfate, TDS and pH data exhibit initial exceedances at the FPP CCR Unit and resampling is appropriate.
- There is enough preliminary evidence to indicate an SSI over background for two Appendix III constituents (calcium and sulfate) at the FPP CCR Unit with the current groundwater monitoring system. It is advised that an ASD be conducted concurrently with resampling to determine alternative source(s) for elevated concentrations of calcium and sulfate at the FPP CCR Unit.

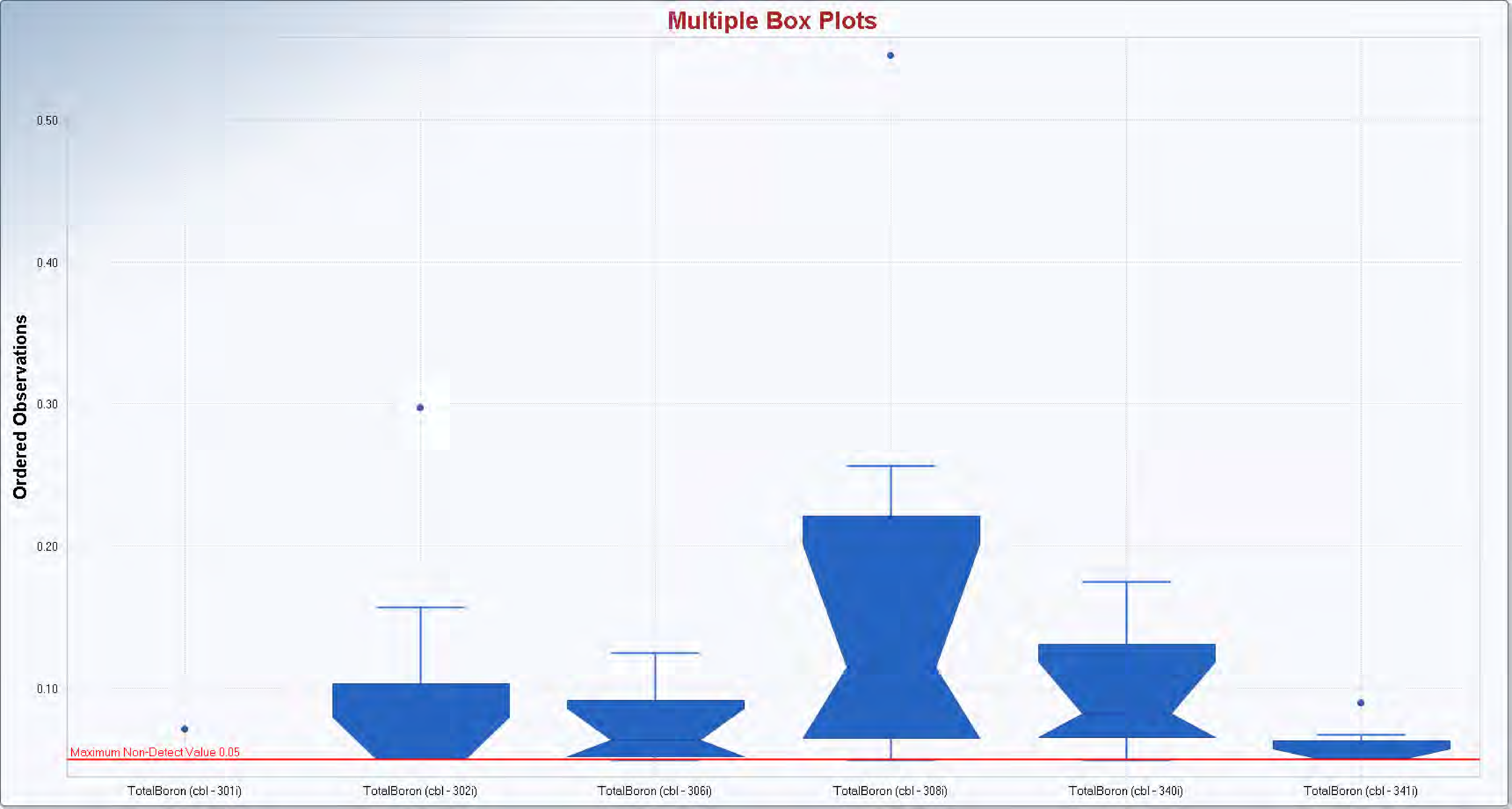
Statistical method selection and background threshold values should be updated once a consistent sampling frequency is in place, as prescribed in the CCR groundwater sampling plan (e.g. semiannual sampling frequency).

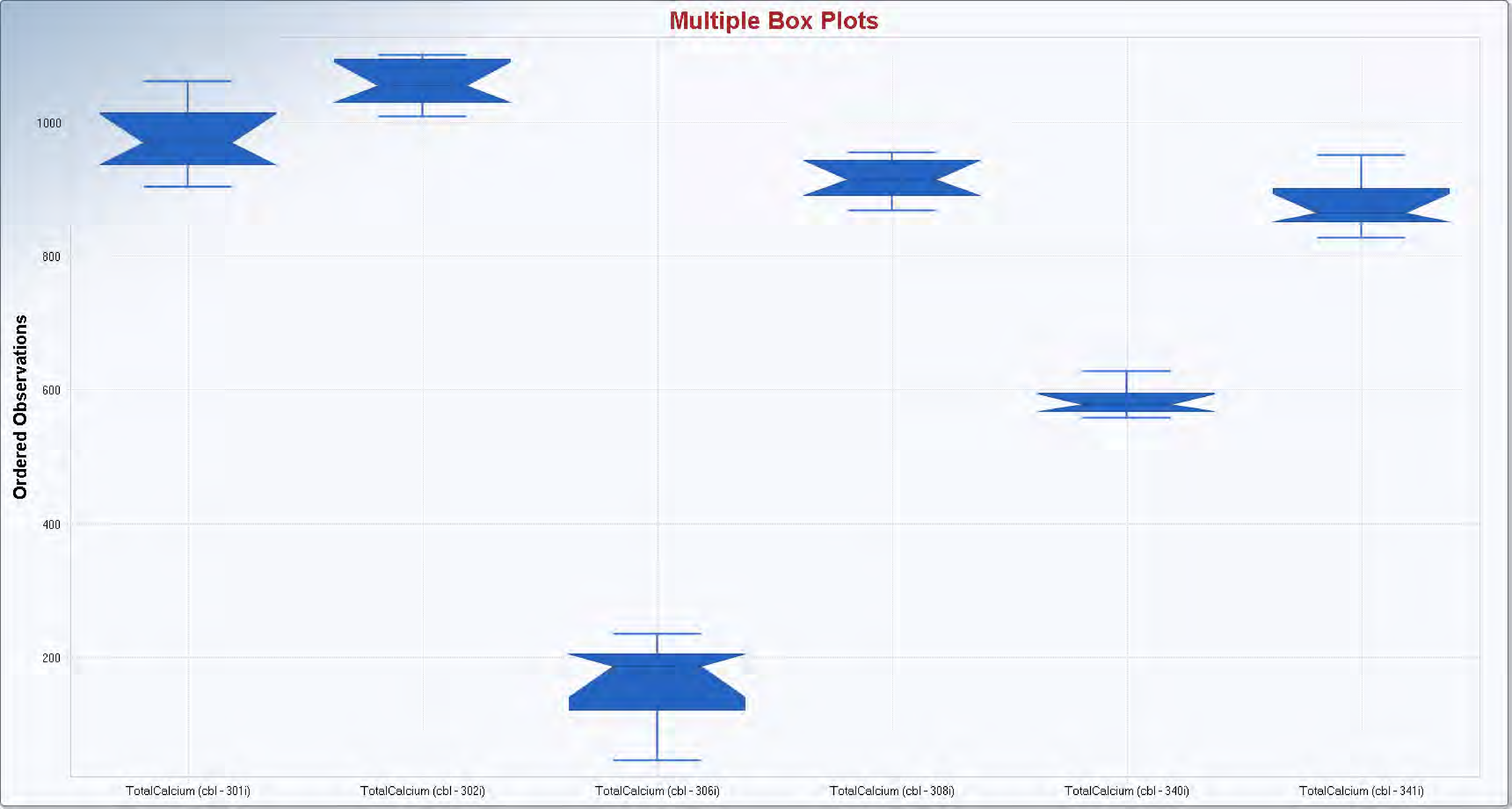
REFERENCES

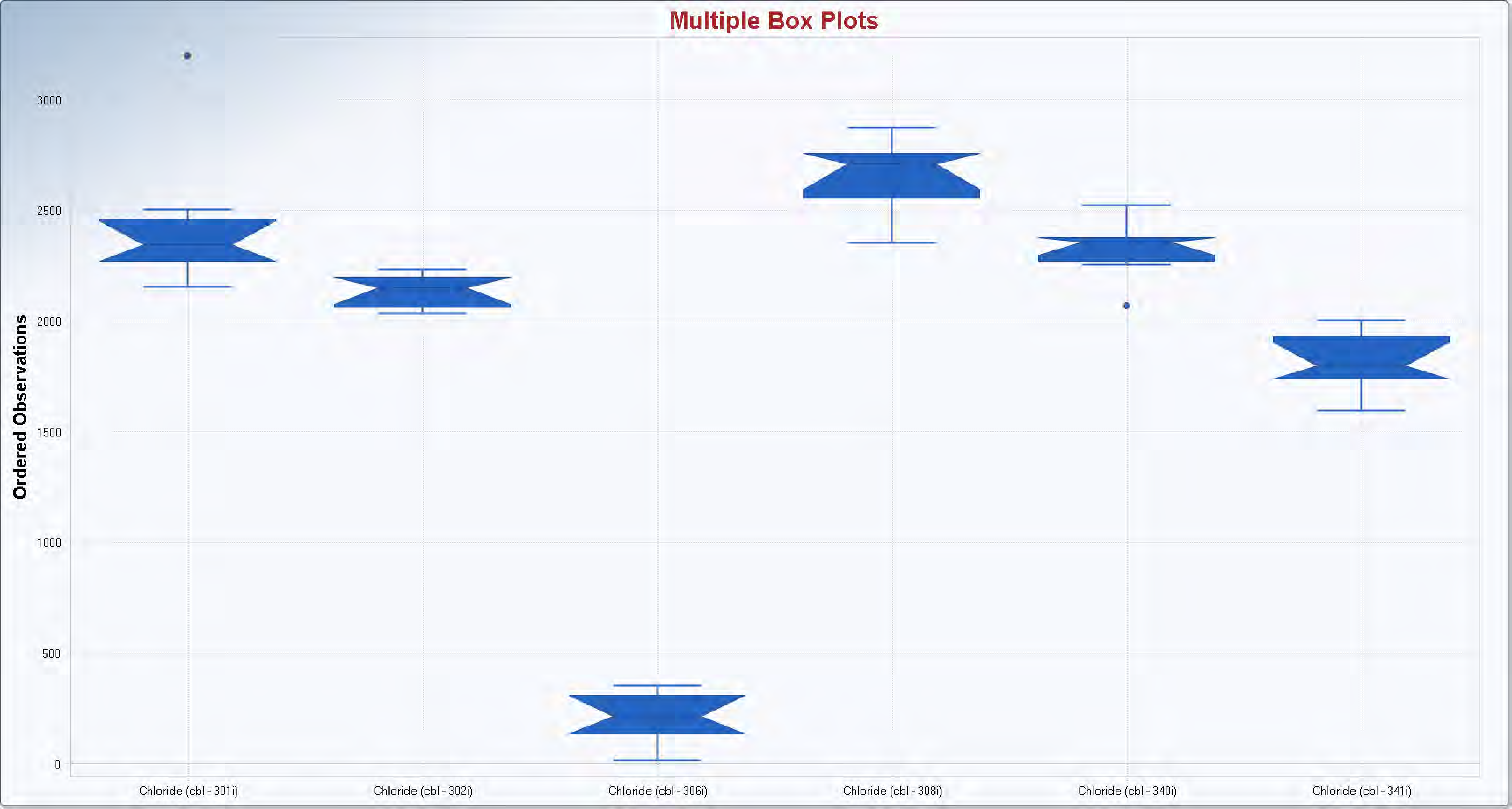
Amec Foster Wheeler (AMECFW), Environment and Infrastructure, Inc., 2017. Statistical Data Analysis System of Procedure (SOP). Coal Combustion Residual Rule Groundwater Monitoring System Compliance. Fayette Power Project, La Grange, Texas.

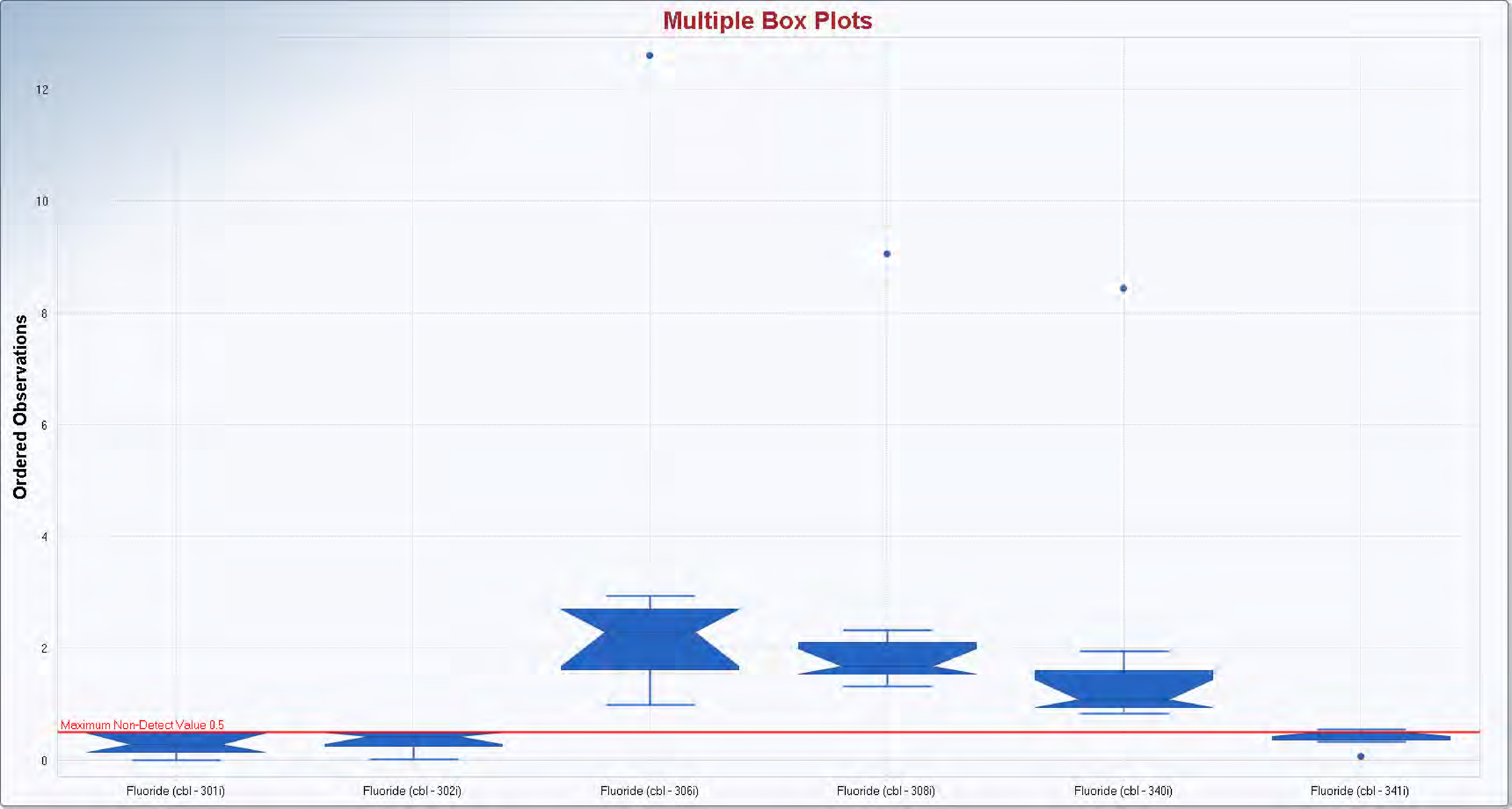
U.S. Environmental Protection Agency (U.S. EPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance. EPA 530/R-09-007. Environmental Protection Agency Office of Resource Conservation and Recovery.

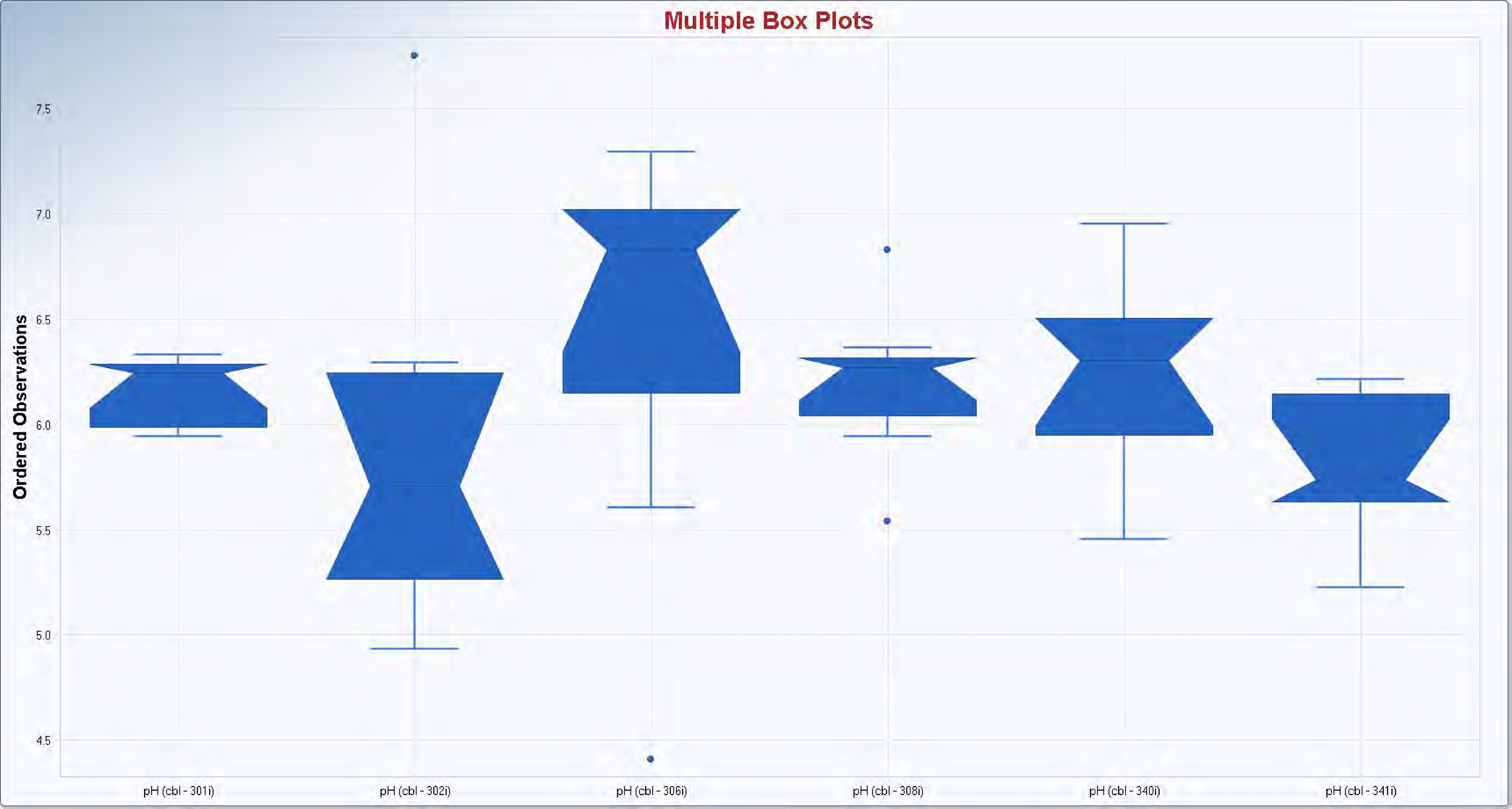
Appendix A


Multiple Box Plots
Ordered Observations
0.50
0.40
0.30
0.20
0.10
Maximum Non-Detect Value 0.05
TotalBoron (cbl - 301i)
TotalBoron (cbl - 302i)
TotalBoron (cbl - 306i)
TotalBoron (cbl - 308i)
TotalBoron (cbl - 340i)
TotalBoron (cbl - 341i)

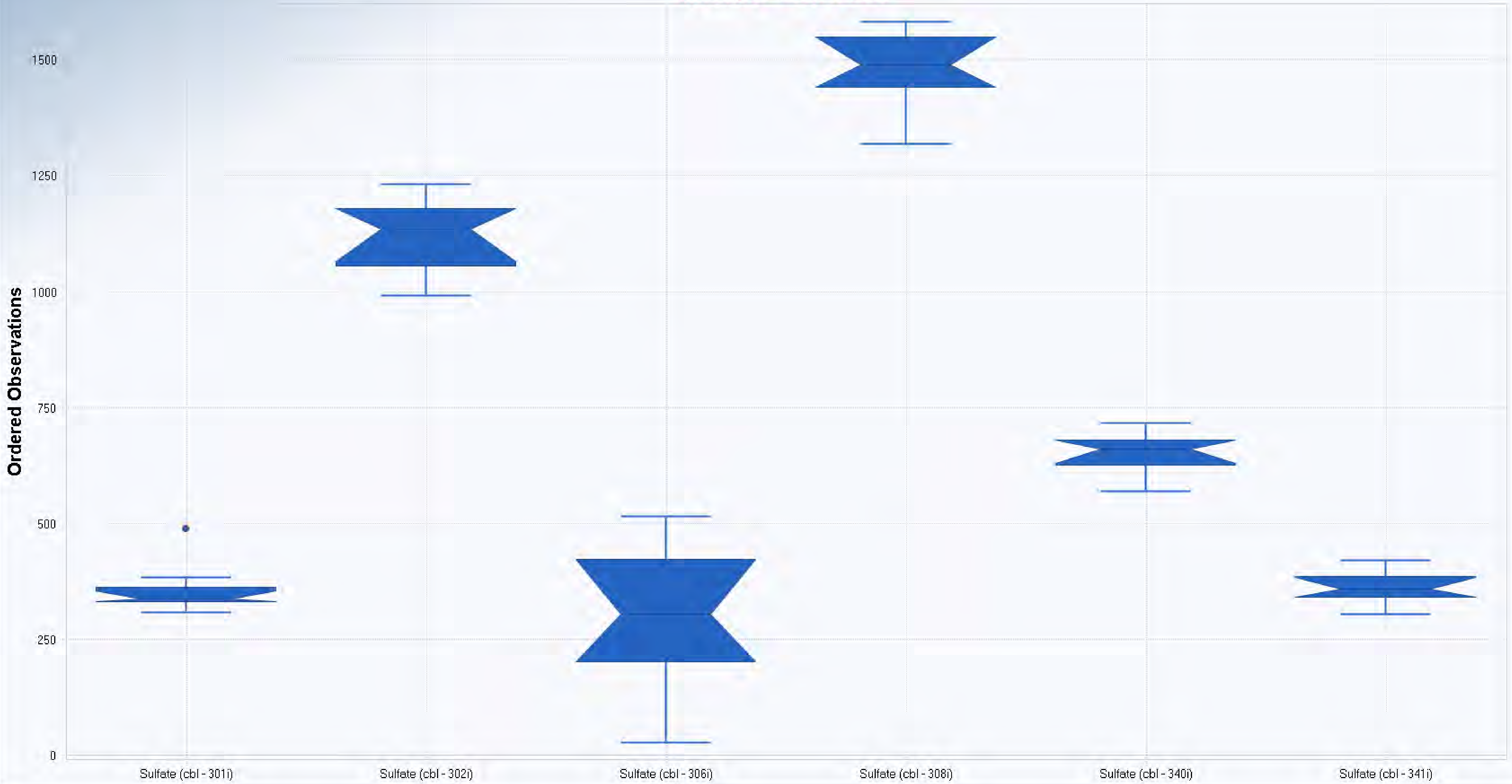

Multiple Box Plots
Ordered Observations
1000
800
600
400
200
TotalCalcium (cbl - 301i)
TotalCalcium (cbl - 302i)
TotalCalcium (cbl - 306i)
TotalCalcium (cbl - 308i)
TotalCalcium (cbl - 340i)
TotalCalcium (cbl - 341i)


Multiple Box Plots
Ordered Observations
3000
2500
2000
1500
1000
500
0
Chloride (cbl - 301i)
Chloride (cbl - 302i)
Chloride (cbl - 306i)
Chloride (cbl - 308i)
Chloride (cbl - 340i)
Chloride (cbl - 341i)


Multiple Box Plots
Ordered Observations
12
10
8
6
4
2
0
Maximum Non-Detect Value 0.5
Fluoride (cbl - 301i)
Fluoride (cbl - 302i)
Fluoride (cbl - 306i)
Fluoride (cbl - 308i)
Fluoride (cbl - 340i)
Fluoride (cbl - 341i)


Multiple Box Plots
Ordered Observations
7.5
7.0
6.5
6.0
5.5
5.0
4.5
pH (cbl - 301i)
pH (cbl - 302i)
pH (cbl - 306i)
pH (cbl - 308i)
pH (cbl - 340i)
pH (cbl - 341i)

Multiple Box Plots



Appendix B

General Statistics on Uncensored Data

Date/Time of Computation	ProUCL 5.11/10/2018 9:16:11 PM
User Selected Options	
From File	DetectionMonitoring_ProUCLUploadRawData_11272017.xls
Full Precision	OFF

From File: DetectionMonitoring_ProUCLUploadRawData_11272017.xls

General Statistics for Censored Data Set (with NDs) using Kaplan Meier Method

Variable	NumObs	# Missing	Num Ds	NumNDs	% NDs	Min ND	Max ND	KM Mean	KM Var	KM SD	KM CV
TotalBoron (cbl - 301i)	8	0	1	7	87.50%	0.05	0.05	0.0526	4.6866E-5	0.00685	0.13
TotalBoron (cbl - 302i)	8	0	2	6	75.00%	0.05	0.05	0.0941	0.00708	0.0842	0.894
TotalBoron (cbl - 306i)	8	0	6	2	25.00%	0.05	0.05	0.0734	6.4754E-4	0.0254	0.347
TotalBoron (cbl - 308i)	8	0	6	2	25.00%	0.05	0.05	0.175	0.0239	0.155	0.885
TotalBoron (cbl - 340i)	8	0	6	2	25.00%	0.05	0.05	0.0977	0.00185	0.043	0.44
TotalBoron (cbl - 341i)	8	0	4	4	50.00%	0.05	0.05	0.0582	1.7317E-4	0.0132	0.226
TotalCalcium (cbl - 301i)	8	0	8	0	0.00%	N/A	N/A	976	2735	52.3	0.0536
TotalCalcium (cbl - 302i)	8	0	8	0	0.00%	N/A	N/A	1059	1270	35.63	0.0337
TotalCalcium (cbl - 306i)	8	0	8	0	0.00%	N/A	N/A	163	3897	62.43	0.383
TotalCalcium (cbl - 308i)	8	0	8	0	0.00%	N/A	N/A	915.1	955.8	30.92	0.0338
TotalCalcium (cbl - 340i)	8	0	8	0	0.00%	N/A	N/A	583.6	516	22.72	0.0389
TotalCalcium (cbl - 341i)	8	0	8	0	0.00%	N/A	N/A	876.9	1518	38.96	0.0444
Chloride (cbl - 301i)	8	0	8	0	0.00%	N/A	N/A	2439	105813	325.3	0.133
Chloride (cbl - 302i)	8	0	8	0	0.00%	N/A	N/A	2138	5450	73.82	0.0345
Chloride (cbl - 306i)	8	0	8	0	0.00%	N/A	N/A	210.8	12741	112.9	0.536
Chloride (cbl - 308i)	8	0	8	0	0.00%	N/A	N/A	2660	26314	162.2	0.061
Chloride (cbl - 340i)	8	0	8	0	0.00%	N/A	N/A	2326	16855	129.8	0.0558
Chloride (cbl - 341i)	8	0	8	0	0.00%	N/A	N/A	1819	17984	134.1	0.0737
Fluoride (cbl - 301i)	8	0	1	7	87.50%	0.01	0.5	0.0704	0.0146	0.121	1.716
Fluoride (cbl - 302i)	8	0	1	7	87.50%	0.02	0.5	0.098	0.0183	0.135	1.379
Fluoride (cbl - 306i)	8	0	8	0	0.00%	N/A	N/A	3.351	14.35	3.788	1.13
Fluoride (cbl - 308i)	8	0	8	0	0.00%	N/A	N/A	2.625	6.825	2.612	0.995
Fluoride (cbl - 340i)	8	0	8	0	0.00%	N/A	N/A	2.059	6.766	2.601	1.263
Fluoride (cbl - 341i)	8	0	4	4	50.00%	0.5	0.5	0.287	0.0256	0.16	0.558
Sulfate (cbl - 301i)	8	0	8	0	0.00%	N/A	N/A	357.1	3189	56.47	0.158
Sulfate (cbl - 302i)	8	0	8	0	0.00%	N/A	N/A	1120	6747	82.14	0.0733
Sulfate (cbl - 306i)	8	0	8	0	0.00%	N/A	N/A	300.2	25441	159.5	0.531
Sulfate (cbl - 308i)	8	0	8	0	0.00%	N/A	N/A	1483	7221	84.98	0.0573
Sulfate (cbl - 340i)	8	0	8	0	0.00%	N/A	N/A	652.1	1998	44.7	0.0686
Sulfate (cbl - 341i)	8	0	8	0	0.00%	N/A	N/A	362.3	1298	36.02	0.0994
pH (cbl - 301i)	8	0	8	0	0.00%	N/A	N/A	6.164	0.0263	0.162	0.0263
pH (cbl - 302i)	8	0	8	0	0.00%	N/A	N/A	5.89	0.81	0.9	0.153
pH (cbl - 306i)	8	0	8	0	0.00%	N/A	N/A	6.463	0.943	0.971	0.15
pH (cbl - 308i)	8	0	8	0	0.00%	N/A	N/A	6.203	0.134	0.366	0.0591
pH (cbl - 340i)	8	0	8	0	0.00%	N/A	N/A	6.241	0.217	0.466	0.0747
pH (cbl - 341i)	8	0	8	0	0.00%	N/A	N/A	5.808	0.117	0.342	0.0588

General Statistics for Raw Data Sets using Detected Data Only

Variable	NumObs	# Missing	Minimum	Maximum	Mean	Median	Var	SD	MAD/0.675	Skewness	CV
TotalBoron (cbl - 301i)	1	0	0.0707	0.0707	0.0707	0.0707	N/A	N/A	0	N/A	N/A
TotalBoron (cbl - 302i)	2	0	0.156	0.297	0.227	0.227	0.00994	0.0997	0.105	N/A	0.44
TotalBoron (cbl - 306i)	6	0	0.0531	0.124	0.0812	0.0775	7.4340E-4	0.0273	0.0328	0.661	0.336
TotalBoron (cbl - 308i)	6	0	0.0799	0.545	0.216	0.154	0.0299	0.173	0.0875	1.793	0.801
TotalBoron (cbl - 340i)	6	0	0.081	0.174	0.114	0.0936	0.00174	0.0418	0.0182	0.867	0.368
TotalBoron (cbl - 341i)	4	0	0.0507	0.0896	0.0665	0.0628	2.8139E-4	0.0168	0.0119	1.135	0.252
TotalCalcium (cbl - 301i)	8	0	905	1060	976	969.5	2735	52.3	55.6	0.333	0.0536
TotalCalcium (cbl - 302i)	8	0	1010	1100	1059	1055	1270	35.63	44.48	0.00987	0.0337
TotalCalcium (cbl - 306i)	8	0	47.2	234	163	186	3897	62.43	49.67	-0.957	0.383
TotalCalcium (cbl - 308i)	8	0	870	954	915.1	915	955.8	30.92	41.51	-0.258	0.0338
TotalCalcium (cbl - 340i)	8	0	560	627	583.6	578	516	22.72	15.57	1.153	0.0389
TotalCalcium (cbl - 341i)	8	0	829	950	876.9	865	1518	38.96	37.06	0.884	0.0444
Chloride (cbl - 301i)	8	0	2160	3200	2439	2345	105813	325.3	126	2.252	0.133
Chloride (cbl - 302i)	8	0	2040	2230	2138	2150	5450	73.82	96.37	-0.206	0.0345
Chloride (cbl - 306i)	8	0	20	350	210.8	214	12741	112.9	129.7	-0.416	0.536
Chloride (cbl - 308i)	8	0	2360	2870	2660	2710	26314	162.2	133.4	-0.8	0.061

	A	B	C	D	E	F	G	H	I	J	K	L	M
68		Chloride (cbl - 340i)	8	0	2070	2520	2326	2360	16855	129.8	74.13	-0.83	0.0558
69		Chloride (cbl - 341i)	8	0	1600	2000	1819	1800	17984	134.1	140.8	-0.156	0.0737
70		Fluoride (cbl - 301i)	1	0	0.312	0.312	0.312	0.312	N/A	N/A	0	N/A	N/A
71		Fluoride (cbl - 302i)	1	0	0.332	0.332	0.332	0.332	N/A	N/A	0	N/A	N/A
72		Fluoride (cbl - 306i)	8	0	1	12.6	3.351	2.29	14.35	3.788	0.786	2.677	1.13
73		Fluoride (cbl - 308i)	8	0	1.33	9.05	2.625	1.67	6.825	2.612	0.304	2.76	0.995
74		Fluoride (cbl - 340i)	8	0	0.84	8.44	2.059	1.075	6.766	2.601	0.304	2.735	1.263
75		Fluoride (cbl - 341i)	4	0	0.055	0.53	0.322	0.351	0.0389	0.197	0.145	-0.856	0.613
76		Sulfate (cbl - 301i)	8	0	311	488	357.1	336.5	3189	56.47	11.86	2.218	0.158
77		Sulfate (cbl - 302i)	8	0	993	1230	1120	1135	6747	82.14	66.72	-0.46	0.0733
78		Sulfate (cbl - 306i)	8	0	29.5	513	300.2	305	25441	159.5	173.5	-0.502	0.531
79		Sulfate (cbl - 308i)	8	0	1320	1580	1483	1490	7221	84.98	88.95	-0.972	0.0573
80		Sulfate (cbl - 340i)	8	0	571	715	652.1	660	1998	44.7	37.06	-0.61	0.0686
81		Sulfate (cbl - 341i)	8	0	307	419	362.3	358.5	1298	36.02	25.95	0.262	0.0994
82		pH (cbl - 301i)	8	0	5.95	6.33	6.164	6.245	0.0263	0.162	0.111	-0.568	0.0263
83		pH (cbl - 302i)	8	0	4.94	7.75	5.89	5.705	0.81	0.9	0.764	1.314	0.153
84		pH (cbl - 306i)	8	0	4.41	7.29	6.463	6.83	0.943	0.971	0.297	-1.705	0.15
85		pH (cbl - 308i)	8	0	5.54	6.83	6.203	6.27	0.134	0.366	0.17	-0.214	0.0591
86		pH (cbl - 340i)	8	0	5.46	6.95	6.241	6.305	0.217	0.466	0.297	-0.346	0.0747
87		pH (cbl - 341i)	8	0	5.23	6.21	5.808	5.735	0.117	0.342	0.415	-0.32	0.0588
88													
89	Percentiles using all Detects (Ds) and Non-Detects (NDs)												
90													
91	Variable		NumObs	# Missing	10%ile	20%ile	25%ile(Q1	50%ile(Q2	75%ile(Q3	80%ile	90%ile	95%ile	99%ile
92		TotalBoron (cbl - 301i)	8	0	0.05	0.05	0.05	0.05	0.05	0.05	0.0562	0.0635	0.0693
93		TotalBoron (cbl - 302i)	8	0	0.05	0.05	0.05	0.05	0.0765	0.114	0.198	0.248	0.287
94		TotalBoron (cbl - 306i)	8	0	0.05	0.0512	0.0523	0.0637	0.0874	0.0932	0.107	0.116	0.122
95		TotalBoron (cbl - 308i)	8	0	0.05	0.062	0.0724	0.115	0.204	0.228	0.343	0.444	0.525
96		TotalBoron (cbl - 340i)	8	0	0.05	0.0624	0.0733	0.0824	0.118	0.136	0.163	0.168	0.173
97		TotalBoron (cbl - 341i)	8	0	0.05	0.05	0.05	0.0504	0.0607	0.0636	0.0736	0.0816	0.088
98		TotalCalcium (cbl - 301i)	8	0	919	934.6	943	969.5	1008	1018	1039	1050	1058
99		TotalCalcium (cbl - 302i)	8	0	1024	1030	1030	1055	1093	1096	1100	1100	1100
100		TotalCalcium (cbl - 306i)	8	0	87.66	117.8	129	186	204.3	204.6	213.7	223.9	232
101		TotalCalcium (cbl - 308i)	8	0	875.6	888	896.8	915	941	943.8	949.1	951.6	953.5
102		TotalCalcium (cbl - 340i)	8	0	562.8	566.8	569.3	578	589.8	597.8	613	620	625.6
103		TotalCalcium (cbl - 341i)	8	0	842.3	850.4	852.5	865	900	902.8	919.2	934.6	946.9
104		Chloride (cbl - 301i)	8	0	2223	2266	2280	2345	2440	2468	2710	2955	3151
105		Chloride (cbl - 302i)	8	0	2047	2062	2073	2150	2195	2202	2216	2223	2229
106		Chloride (cbl - 306i)	8	0	85.8	130.4	144.8	214	299.3	313.6	336	343	348.6
107		Chloride (cbl - 308i)	8	0	2479	2550	2568	2710	2760	2760	2793	2832	2862
108		Chloride (cbl - 340i)	8	0	2203	2268	2275	2360	2380	2380	2422	2471	2510
109		Chloride (cbl - 341i)	8	0	1677	1734	1755	1800	1918	1942	1979	1990	1998
110		Fluoride (cbl - 301i)	8	0	0.017	0.112	0.193	0.281	0.5	0.5	0.5	0.5	0.5
111		Fluoride (cbl - 302i)	8	0	0.181	0.25	0.25	0.416	0.5	0.5	0.5	0.5	0.5
112		Fluoride (cbl - 306i)	8	0	1.259	1.562	1.73	2.29	2.603	2.746	5.817	9.208	11.92
113		Fluoride (cbl - 308i)	8	0	1.442	1.53	1.565	1.67	2	2.14	4.325	6.688	8.578
114		Fluoride (cbl - 340i)	8	0	0.847	0.914	0.97	1.075	1.425	1.656	3.876	6.158	7.984
115		Fluoride (cbl - 341i)	8	0	0.251	0.348	0.359	0.5	0.5	0.5	0.509	0.52	0.528
116		Sulfate (cbl - 301i)	8	0	321.5	330	333.5	336.5	351.8	365.4	413.1	450.6	480.5
117		Sulfate (cbl - 302i)	8	0	1012	1048	1073	1135	1180	1180	1195	1213	1227
118		Sulfate (cbl - 306i)	8	0	106.2	189.8	234.3	305	417	424	456.3	484.7	507.3
119		Sulfate (cbl - 308i)	8	0	1383	1434	1455	1490	1550	1550	1559	1570	1578
120		Sulfate (cbl - 340i)	8	0	602.5	623.6	630.3	660	677.5	681	694	704.5	712.9
121		Sulfate (cbl - 341i)	8	0	327.3	340	343.5	358.5	377.8	390	408.5	413.8	418
122		pH (cbl - 301i)	8	0	5.95	5.978	6.003	6.245	6.273	6.29	6.316	6.323	6.329
123		pH (cbl - 302i)	8	0	5.101	5.246	5.313	5.705	6.223	6.254	6.728	7.239	7.648
124		pH (cbl - 306i)	8	0	5.25	6.042	6.42	6.83	6.985	7.034	7.15	7.22	7.276
125		pH (cbl - 308i)	8	0	5.827	6.022	6.085	6.27	6.293	6.324	6.501	6.666	6.797
126		pH (cbl - 340i)	8	0	5.677	5.914	6.04	6.305	6.498	6.508	6.649	6.8	6.92
127		pH (cbl - 341i)	8	0	5.447	5.612	5.675	5.735	6.123	6.154	6.196	6.203	6.209

Appendix C

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.11/10/2018 9:26:00 PM
From File	DetectionMonitoring_ProUCLUploadRawData_11272017.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

TotalBoron-cbl - 301i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	0.05
Maximum	0.0707
Mean	0.0526
Geometric Mean	0.0522
Median	0.05
Standard Deviation	0.00732
Coefficient of Variation	0.139

Mann-Kendall Test

M-K Test Value (S)	5
Tabulated p-value	0.36
Standard Deviation of S	4.583
Standardized Value of S	0.873
Approximate p-value	0.191

Insufficient evidence to identify a significant trend at the specified level of significance.

TotalBoron-cbl - 302i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	0.05
Maximum	0.297
Mean	0.0941
Geometric Mean	0.072
Median	0.05
Standard Deviation	0.09
Coefficient of Variation	0.956

Mann-Kendall Test

M-K Test Value (S)	3
Tabulated p-value	0.452
Standard Deviation of S	6.083
Standardized Value of S	0.329
Approximate p-value	0.371

Insufficient evidence to identify a significant trend at the specified level of significance.

TotalBoron-cbl - 306i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	0.05

	A	B	C	D	E	F	G	H	I	J	K	L
65				Maximum	0.124							
66				Mean	0.0734							
67				Geometric Mean	0.0695							
68				Median	0.0637							
69				Standard Deviation	0.0272							
70				Coefficient of Variation	0.37							
71												
72			**Mann-Kendall Test**									
73				M-K Test Value (S)	3							
74				Tabulated p-value	0.452							
75				Standard Deviation of S	8.021							
76				Standardized Value of S	0.249							
77				Approximate p-value	0.402							
78												
79	Insufficient evidence to identify a significant											
80	trend at the specified level of significance.											
81			**TotalBoron-cbl - 308i**									
82												
83			**General Statistics**									
84				Number of Events Reported (m)	8							
85				Number of Missing Events	0							
86				Number or Reported Events Used	8							
87				Number Values Reported (n)	8							
88				Minimum	0.05							
89				Maximum	0.545							
90				Mean	0.175							
91				Geometric Mean	0.127							
92				Median	0.115							
93				Standard Deviation	0.165							
94				Coefficient of Variation	0.946							
95												
96			**Mann-Kendall Test**									
97				M-K Test Value (S)	3							
98				Tabulated p-value	0.452							
99				Standard Deviation of S	8.021							
100				Standardized Value of S	0.249							
101				Approximate p-value	0.402							
102												
103	Insufficient evidence to identify a significant											
104	trend at the specified level of significance.											
105			**TotalBoron-cbl - 340i**									
106												
107			**General Statistics**									
108				Number of Events Reported (m)	8							
109				Number of Missing Events	0							
110				Number or Reported Events Used	8							
111				Number Values Reported (n)	8							
112				Minimum	0.05							
113				Maximum	0.174							
114				Mean	0.0977							
115				Geometric Mean	0.089							
116				Median	0.0824							
117				Standard Deviation	0.046							
118				Coefficient of Variation	0.47							
119												
120			**Mann-Kendall Test**									
121				M-K Test Value (S)	7							
122				Tabulated p-value	0.274							
123				Standard Deviation of S	8.021							
124				Standardized Value of S	0.748							
125				Approximate p-value	0.227							
126												
127	Insufficient evidence to identify a significant											
128	trend at the specified level of significance.											

TotalBoron-cbl - 341i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	0.05
Maximum	0.0896
Mean	0.0582
Geometric Mean	0.057
Median	0.0504
Standard Deviation	0.0141
Coefficient of Variation	0.242

Mann-Kendall Test

M-K Test Value (S)	6
Tabulated p-value	0.274
Standard Deviation of S	7.528
Standardized Value of S	0.664
Approximate p-value	0.253

Insufficient evidence to identify a significant trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.11/10/2018 9:32:26 PM
From File	DetectionMonitoring_ProUCLUploadRawData_11272017.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

TotalCalcium-cbl - 301i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	905
Maximum	1060
Mean	976
Geometric Mean	974.8
Median	969.5
Standard Deviation	52.3
Coefficient of Variation	0.0536

Mann-Kendall Test

M-K Test Value (S)	18
Tabulated p-value	0.016
Standard Deviation of S	8.083
Standardized Value of S	2.103
Approximate p-value	0.0177

Statistically significant evidence of an increasing
trend at the specified level of significance.

TotalCalcium-cbl - 302i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	1010
Maximum	1100
Mean	1059
Geometric Mean	1058
Median	1055
Standard Deviation	35.63
Coefficient of Variation	0.0337

Mann-Kendall Test

M-K Test Value (S)	14
Tabulated p-value	0.054
Standard Deviation of S	7.958
Standardized Value of S	1.634
Approximate p-value	0.0512

Insufficient evidence to identify a significant
trend at the specified level of significance.

TotalCalcium-cbl - 306i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	47.2

	A	B	C	D	E	F	G	H	I	J	K	L
65				Maximum	234							
66				Mean	163							
67				Geometric Mean	147.9							
68				Median	186							
69				Standard Deviation	62.43							
70				Coefficient of Variation	0.383							
71												
72			**Mann-Kendall Test**									
73				M-K Test Value (S)	22							
74				Tabulated p-value	0.002							
75				Standard Deviation of S	8.083							
76				Standardized Value of S	2.598							
77				Approximate p-value	0.00469							
78												
79	Statistically significant evidence of an increasing											
80	trend at the specified level of significance.											
81			**TotalCalcium-cbl - 308i**									
82												
83			**General Statistics**									
84				Number of Events Reported (m)	8							
85				Number of Missing Events	0							
86				Number or Reported Events Used	8							
87				Number Values Reported (n)	8							
88				Minimum	870							
89				Maximum	954							
90				Mean	915.1							
91				Geometric Mean	914.7							
92				Median	915							
93				Standard Deviation	30.92							
94				Coefficient of Variation	0.0338							
95												
96			**Mann-Kendall Test**									
97				M-K Test Value (S)	12							
98				Tabulated p-value	0.089							
99				Standard Deviation of S	8.083							
100				Standardized Value of S	1.361							
101				Approximate p-value	0.0868							
102												
103	Insufficient evidence to identify a significant											
104	trend at the specified level of significance.											
105			**TotalCalcium-cbl - 340i**									
106												
107			**General Statistics**									
108				Number of Events Reported (m)	8							
109				Number of Missing Events	0							
110				Number or Reported Events Used	8							
111				Number Values Reported (n)	8							
112				Minimum	560							
113				Maximum	627							
114				Mean	583.6							
115				Geometric Mean	583.2							
116				Median	578							
117				Standard Deviation	22.72							
118				Coefficient of Variation	0.0389							
119												
120			**Mann-Kendall Test**									
121				M-K Test Value (S)	8							
122				Tabulated p-value	0.119							
123				Standard Deviation of S	8.083							
124				Standardized Value of S	0.866							
125				Approximate p-value	0.193							
126												
127	Insufficient evidence to identify a significant											
128	trend at the specified level of significance.											

TotalCalcium-cbl - 341i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	829
Maximum	950
Mean	876.9
Geometric Mean	876.1
Median	865
Standard Deviation	38.96
Coefficient of Variation	0.0444

Mann-Kendall Test

M-K Test Value (S)	-4
Tabulated p-value	0.36
Standard Deviation of S	8.083
Standardized Value of S	-0.371
Approximate p-value	0.355

Insufficient evidence to identify a significant trend at the specified level of significance.

	A	B	C	D	E	F	G	H	I	J	K	L
1				Mann-Kendall Trend Test Analysis								
2	User Selected Options											
3	Date/Time of Computation			ProUCL 5.11/10/2018 9:50:31 PM								
4	From File			DetectionMonitoring_ProUCLUploadRawData_11272017.xls								
5	Full Precision			OFF								
6	Confidence Coefficient			0.95								
7	Level of Significance			0.05								
8												
9	**Chloride-cbl - 301i**											
10												
11	**General Statistics**											
12	Number of Events Reported (m)				8							
13	Number of Missing Events				0							
14	Number or Reported Events Used				8							
15	Number Values Reported (n)				8							
16	Minimum				2160							
17	Maximum				3200							
18	Mean				2439							
19	Geometric Mean				2422							
20	Median				2345							
21	Standard Deviation				325.3							
22	Coefficient of Variation				0.133							
23												
24	**Mann-Kendall Test**											
25	M-K Test Value (S)				14							
26	Tabulated p-value				0.054							
27	Standard Deviation of S				8.083							
28	Standardized Value of S				1.608							
29	Approximate p-value				0.0539							
30												
31	Insufficient evidence to identify a significant											
32	trend at the specified level of significance.											
33	**Chloride-cbl - 302i**											
34												
35	**General Statistics**											
36	Number of Events Reported (m)				8							
37	Number of Missing Events				0							
38	Number or Reported Events Used				8							
39	Number Values Reported (n)				8							
40	Minimum				2040							
41	Maximum				2230							
42	Mean				2138							
43	Geometric Mean				2136							
44	Median				2150							
45	Standard Deviation				73.82							
46	Coefficient of Variation				0.0345							
47												
48	**Mann-Kendall Test**											
49	M-K Test Value (S)				-10							
50	Tabulated p-value				0.138							
51	Standard Deviation of S				8.083							
52	Standardized Value of S				-1.113							
53	Approximate p-value				0.133							
54												
55	Insufficient evidence to identify a significant											
56	trend at the specified level of significance.											
57	**Chloride-cbl - 306i**											
58												
59	**General Statistics**											
60	Number of Events Reported (m)				8							
61	Number of Missing Events				0							
62	Number or Reported Events Used				8							
63	Number Values Reported (n)				8							
64	Minimum				20							

Maximum	350
Mean	210.8
Geometric Mean	164.5
Median	214
Standard Deviation	112.9
Coefficient of Variation	0.536

Mann-Kendall Test

M-K Test Value (S)	18
Tabulated p-value	0.016
Standard Deviation of S	8.083
Standardized Value of S	2.103
Approximate p-value	0.0177

Statistically significant evidence of an increasing
trend at the specified level of significance.

Chloride-cbl - 308i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	2360
Maximum	2870
Mean	2660
Geometric Mean	2656
Median	2710
Standard Deviation	162.2
Coefficient of Variation	0.061

Mann-Kendall Test

M-K Test Value (S)	1
Tabulated p-value	0.548
Standard Deviation of S	8.021
Standardized Value of S	0
Approximate p-value	0.5

Insufficient evidence to identify a significant
trend at the specified level of significance.

Chloride-cbl - 340i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	2070
Maximum	2520
Mean	2326
Geometric Mean	2323
Median	2360
Standard Deviation	129.8
Coefficient of Variation	0.0558

Mann-Kendall Test

M-K Test Value (S)	7
Tabulated p-value	0.274
Standard Deviation of S	8.021
Standardized Value of S	0.748
Approximate p-value	0.227

Insufficient evidence to identify a significant
trend at the specified level of significance.

	A	B	C	D	E	F	G	H	I	J	K	L
129	**Chloride-cbl - 341i**											
130												
131	**General Statistics**											
132	Number of Events Reported (m)				8							
133	Number of Missing Events				0							
134	Number or Reported Events Used				8							
135	Number Values Reported (n)				8							
136	Minimum				1600							
137	Maximum				2000							
138	Mean				1819							
139	Geometric Mean				1814							
140	Median				1800							
141	Standard Deviation				134.1							
142	Coefficient of Variation				0.0737							
143												
144	**Mann-Kendall Test**											
145	M-K Test Value (S)				2							
146	Tabulated p-value				0.452							
147	Standard Deviation of S				8.083							
148	Standardized Value of S				0.124							
149	Approximate p-value				0.451							
150												
151	**Insufficient evidence to identify a significant**											
152	**trend at the specified level of significance.**											

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.11/10/2018 9:52:26 PM
From File	DetectionMonitoring_ProUCLUploadRawData_11272017.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Fluoride-cbl - 301i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	0.01
Maximum	0.5
Mean	0.293
Geometric Mean	0.163
Median	0.281
Standard Deviation	0.203
Coefficient of Variation	0.692

Mann-Kendall Test

M-K Test Value (S)	4
Tabulated p-value	0.36
Standard Deviation of S	7.789
Standardized Value of S	0.385
Approximate p-value	0.35

Insufficient evidence to identify a significant
trend at the specified level of significance.

Fluoride-cbl - 302i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	0.02
Maximum	0.5
Mean	0.357
Geometric Mean	0.267
Median	0.416
Standard Deviation	0.177
Coefficient of Variation	0.496

Mann-Kendall Test

M-K Test Value (S)	-1
Tabulated p-value	0.548
Standard Deviation of S	7.461
Standardized Value of S	0
Approximate p-value	0.5

Insufficient evidence to identify a significant
trend at the specified level of significance.

Fluoride-cbl - 306i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	1

65	Maximum	12.6
66	Mean	3.351
67	Geometric Mean	2.43
68	Median	2.29
69	Standard Deviation	3.788
70	Coefficient of Variation	1.13
71		
72	**Mann-Kendall Test**	
73	M-K Test Value (S)	10
74	Tabulated p-value	0.138
75	Standard Deviation of S	8.083
76	Standardized Value of S	1.113
77	Approximate p-value	0.133
78		
79	Insufficient evidence to identify a significant	
80	trend at the specified level of significance.	
81	**Fluoride-cbl - 308i**	
82		
83	**General Statistics**	
84	Number of Events Reported (m)	8
85	Number of Missing Events	0
86	Number or Reported Events Used	8
87	Number Values Reported (n)	8
88	Minimum	1.33
89	Maximum	9.05
90	Mean	2.625
91	Geometric Mean	2.078
92	Median	1.67
93	Standard Deviation	2.612
94	Coefficient of Variation	0.995
95		
96	**Mann-Kendall Test**	
97	M-K Test Value (S)	6
98	Tabulated p-value	0.274
99	Standard Deviation of S	8.083
100	Standardized Value of S	0.619
101	Approximate p-value	0.268
102		
103	Insufficient evidence to identify a significant	
104	trend at the specified level of significance.	
105	**Fluoride-cbl - 340i**	
106		
107	**General Statistics**	
108	Number of Events Reported (m)	8
109	Number of Missing Events	0
110	Number or Reported Events Used	8
111	Number Values Reported (n)	8
112	Minimum	0.84
113	Maximum	8.44
114	Mean	2.059
115	Geometric Mean	1.425
116	Median	1.075
117	Standard Deviation	2.601
118	Coefficient of Variation	1.263
119		
120	**Mann-Kendall Test**	
121	M-K Test Value (S)	-8
122	Tabulated p-value	0.119
123	Standard Deviation of S	8.083
124	Standardized Value of S	-0.866
125	Approximate p-value	0.193
126		
127	Insufficient evidence to identify a significant	
128	trend at the specified level of significance.	

	A	B	C	D	E	F	G	H	I	J	K	L
129	**Fluoride-cbl - 341i**											
130												
131	**General Statistics**											
132	Number of Events Reported (m)				8							
133	Number of Missing Events				0							
134	Number or Reported Events Used				8							
135	Number Values Reported (n)				8							
136	Minimum				0.055							
137	Maximum				0.53							
138	Mean				0.411							
139	Geometric Mean				0.35							
140	Median				0.5							
141	Standard Deviation				0.16							
142	Coefficient of Variation				0.391							
143												
144	**Mann-Kendall Test**											
145	M-K Test Value (S)				-18							
146	Tabulated p-value				0.016							
147	Standard Deviation of S				7.528							
148	Standardized Value of S				-2.258							
149	Approximate p-value				0.012							
150												
151	Statistically significant evidence of a decreasing											
152	trend at the specified level of significance.											

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.11/10/2018 9:53:55 PM
From File	DetectionMonitoring_ProUCLUploadRawData_11272017.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

Sulfate-cbl - 301i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	311
Maximum	488
Mean	357.1
Geometric Mean	353.8
Median	336.5
Standard Deviation	56.47
Coefficient of Variation	0.158

Mann-Kendall Test

M-K Test Value (S)	15
Tabulated p-value	0.054
Standard Deviation of S	8.021
Standardized Value of S	1.745
Approximate p-value	0.0405

Insufficient evidence to identify a significant
trend at the specified level of significance.

Sulfate-cbl - 302i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	993
Maximum	1230
Mean	1120
Geometric Mean	1118
Median	1135
Standard Deviation	82.14
Coefficient of Variation	0.0733

Mann-Kendall Test

M-K Test Value (S)	17
Tabulated p-value	0.031
Standard Deviation of S	8.021
Standardized Value of S	1.995
Approximate p-value	0.023

Statistically significant evidence of an increasing
trend at the specified level of significance.

Sulfate-cbl - 306i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	29.5

Maximum	513
Mean	300.2
Geometric Mean	234.5
Median	305
Standard Deviation	159.5
Coefficient of Variation	0.531

Mann-Kendall Test

M-K Test Value (S)	18
Tabulated p-value	0.016
Standard Deviation of S	8.083
Standardized Value of S	2.103
Approximate p-value	0.0177

Statistically significant evidence of an increasing
trend at the specified level of significance.

Sulfate-cbl - 308i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	1320
Maximum	1580
Mean	1483
Geometric Mean	1480
Median	1490
Standard Deviation	84.98
Coefficient of Variation	0.0573

Mann-Kendall Test

M-K Test Value (S)	8
Tabulated p-value	0.119
Standard Deviation of S	7.958
Standardized Value of S	0.88
Approximate p-value	0.19

Insufficient evidence to identify a significant
trend at the specified level of significance.

Sulfate-cbl - 340i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	571
Maximum	715
Mean	652.1
Geometric Mean	650.8
Median	660
Standard Deviation	44.7
Coefficient of Variation	0.0686

Mann-Kendall Test

M-K Test Value (S)	10
Tabulated p-value	0.138
Standard Deviation of S	8.083
Standardized Value of S	1.113
Approximate p-value	0.133

Insufficient evidence to identify a significant
trend at the specified level of significance.

Sulfate-cbl - 341i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	307
Maximum	419
Mean	362.3
Geometric Mean	360.7
Median	358.5
Standard Deviation	36.02
Coefficient of Variation	0.0994

Mann-Kendall Test

M-K Test Value (S)	8
Tabulated p-value	0.119
Standard Deviation of S	8.083
Standardized Value of S	0.866
Approximate p-value	0.193

Insufficient evidence to identify a significant trend at the specified level of significance.

Mann-Kendall Trend Test Analysis

User Selected Options	
Date/Time of Computation	ProUCL 5.11/10/2018 9:55:01 PM
From File	DetectionMonitoring_ProUCLUploadRawData_11272017.xls
Full Precision	OFF
Confidence Coefficient	0.95
Level of Significance	0.05

TotalTDS-cbl - 301i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	4290
Maximum	6570
Mean	5431
Geometric Mean	5356
Median	5535
Standard Deviation	959
Coefficient of Variation	0.177

Mann-Kendall Test

M-K Test Value (S)	8
Tabulated p-value	0.119
Standard Deviation of S	8.083
Standardized Value of S	0.866
Approximate p-value	0.193

Insufficient evidence to identify a significant trend at the specified level of significance.

TotalTDS-cbl - 302i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	4210
Maximum	6850
Mean	5728
Geometric Mean	5668
Median	5680
Standard Deviation	857.3
Coefficient of Variation	0.15

Mann-Kendall Test

M-K Test Value (S)	-2
Tabulated p-value	0.452
Standard Deviation of S	8.083
Standardized Value of S	-0.124
Approximate p-value	0.451

Insufficient evidence to identify a significant trend at the specified level of significance.

TotalTDS-cbl - 306i

General Statistics

Number of Events Reported (m)	8
Number of Missing Events	0
Number or Reported Events Used	8
Number Values Reported (n)	8
Minimum	431

65	Maximum	1460
66	Mean	1144
67	Geometric Mean	1075
68	Median	1280
69	Standard Deviation	356.4
70	Coefficient of Variation	0.312
71		
72	**Mann-Kendall Test**	
73	M-K Test Value (S)	13
74	Tabulated p-value	0.089
75	Standard Deviation of S	8.021
76	Standardized Value of S	1.496
77	Approximate p-value	0.0673
78		
79	Insufficient evidence to identify a significant	
80	trend at the specified level of significance.	
81	**TotalTDS-cbl - 308i**	
82		
83	**General Statistics**	
84	Number of Events Reported (m)	8
85	Number of Missing Events	0
86	Number or Reported Events Used	8
87	Number Values Reported (n)	8
88	Minimum	6120
89	Maximum	10200
90	Mean	7623
91	Geometric Mean	7501
92	Median	7040
93	Standard Deviation	1517
94	Coefficient of Variation	0.199
95		
96	**Mann-Kendall Test**	
97	M-K Test Value (S)	-4
98	Tabulated p-value	0.36
99	Standard Deviation of S	8.083
100	Standardized Value of S	-0.371
101	Approximate p-value	0.355
102		
103	Insufficient evidence to identify a significant	
104	trend at the specified level of significance.	
105	**TotalTDS-cbl - 340i**	
106		
107	**General Statistics**	
108	Number of Events Reported (m)	8
109	Number of Missing Events	0
110	Number or Reported Events Used	8
111	Number Values Reported (n)	8
112	Minimum	4880
113	Maximum	6250
114	Mean	5525
115	Geometric Mean	5504
116	Median	5475
117	Standard Deviation	512.4
118	Coefficient of Variation	0.0927
119		
120	**Mann-Kendall Test**	
121	M-K Test Value (S)	-4
122	Tabulated p-value	0.36
123	Standard Deviation of S	8.083
124	Standardized Value of S	-0.371
125	Approximate p-value	0.355
126		
127	Insufficient evidence to identify a significant	
128	trend at the specified level of significance.	

	A–D	E
129	**TotalTDS-cbl - 341i**	
130		
131	**General Statistics**	
132	Number of Events Reported (m)	8
133	Number of Missing Events	0
134	Number or Reported Events Used	8
135	Number Values Reported (n)	8
136	Minimum	4150
137	Maximum	5940
138	Mean	4833
139	Geometric Mean	4805
140	Median	4850
141	Standard Deviation	566.6
142	Coefficient of Variation	0.117
143		
144	**Mann-Kendall Test**	
145	M-K Test Value (S)	-2
146	Tabulated p-value	0.452
147	Standard Deviation of S	8.083
148	Standardized Value of S	-0.124
149	Approximate p-value	0.451
150		
151	Insufficient evidence to identify a significant	
152	trend at the specified level of significance.	

Appendix D

1		Goodness-of-Fit Test Statistics for Data Sets with Non-Detects
2	**User Selected Options**	
3	Date/Time of Computation	ProUCL 5.112/3/2017 4:27:12 PM
4	From File	DetectionMonitoring_ProUCLUploadDeTrendResiduals_11272017_a.xls
5	Full Precision	OFF
6	Confidence Coefficient	0.95
7		
8		
9	**Chloride (cbl - 301i)**	
10		
11	**Raw Statistics**	
12	Number of Valid Observations	8
13	Number of Distinct Observations	8
14	Minimum	2160
15	Maximum	3200
16	Mean of Raw Data	2439
17	Standard Deviation of Raw Data	325.3
18	Khat	73.05
19	Theta hat	33.39
20	Kstar	45.74
21	Theta star	53.32
22	Mean of Log Transformed Data	7.792
23	Standard Deviation of Log Transformed Data	0.121
24		
25	**Normal GOF Test Results**	
26		
27	Correlation Coefficient R	0.84
28	Shapiro Wilk Test Statistic	0.732
29	Shapiro Wilk Critical (0.05) Value	0.818
30	Approximate Shapiro Wilk P Value	0.00327
31	Lilliefors Test Statistic	0.3
32	Lilliefors Critical (0.05) Value	0.283
33	**Data not Normal at (0.05) Significance Level**	
34		
35	**Gamma GOF Test Results**	
36		
37	Correlation Coefficient R	0.865
38	A-D Test Statistic	0.865
39	A-D Critical (0.05) Value	0.715
40	K-S Test Statistic	0.276
41	K-S Critical(0.05) Value	0.293
42	**Data follow Appr. Gamma Distribution at (0.05) Significance Le**	
43		
44	**Lognormal GOF Test Results**	
45		
46	Correlation Coefficient R	0.867
47	Shapiro Wilk Test Statistic	0.777
48	Shapiro Wilk Critical (0.05) Value	0.818
49	Approximate Shapiro Wilk P Value	0.01
50	Lilliefors Test Statistic	0.272
51	Lilliefors Critical (0.05) Value	0.283
52	**Data appear Approximate_Lognormal at (0.05) Significance Le**	
53		
54	**Chloride (cbl - 302i)**	
55		
56	**Raw Statistics**	
57	Number of Valid Observations	8
58	Number of Distinct Observations	8
59	Minimum	2040
60	Maximum	2230
61	Mean of Raw Data	2138
62	Standard Deviation of Raw Data	73.82
63	Khat	954.1
64	Theta hat	2.24
65	Kstar	596.4
66	Theta star	3.584
67	Mean of Log Transformed Data	7.667

	A	B	C	D	E	F	G	H	I	J	K	L
68	Standard Deviation of Log Transformed Data					0.0346						
69												
70	**Normal GOF Test Results**											
71												
72	Correlation Coefficient R					0.971						
73	Shapiro Wilk Test Statistic					0.917						
74	Shapiro Wilk Critical (0.05) Value					0.818						
75	Approximate Shapiro Wilk P Value					0.619						
76	Lilliefors Test Statistic					0.17						
77	Lilliefors Critical (0.05) Value					0.283						
78	**Data appear Normal at (0.05) Significance Level**											
79												
80	**Gamma GOF Test Results**											
81												
82	Correlation Coefficient R					0.968						
83	A-D Test Statistic					0.359						
84	A-D Critical (0.05) Value					0.715						
85	K-S Test Statistic					0.184						
86	K-S Critical(0.05) Value					0.294						
87	**Data appear Gamma Distributed at (0.05) Significance Level**											
88												
89	**Lognormal GOF Test Results**											
90												
91	Correlation Coefficient R					0.97						
92	Shapiro Wilk Test Statistic					0.915						
93	Shapiro Wilk Critical (0.05) Value					0.818						
94	Approximate Shapiro Wilk P Value					0.602						
95	Lilliefors Test Statistic					0.174						
96	Lilliefors Critical (0.05) Value					0.283						
97	**Data appear Lognormal at (0.05) Significance Level**											
98												
99	**Chloride (cbl - 306i)**											
100												
101	**Raw Statistics**											
102	Number of Valid Observations					8						
103	Number of Distinct Observations					8						
104	Minimum					-105.2						
105	Maximum					129						
106	Mean of Raw Data					0.00312						
107	Standard Deviation of Raw Data					75.08						
108	**Data contains values <= 0**											
109	**Data not gamma or lognormal**											
110												
111	**Normal GOF Test Results**											
112												
113	Correlation Coefficient R					0.979						
114	Shapiro Wilk Test Statistic					0.961						
115	Shapiro Wilk Critical (0.05) Value					0.818						
116	Approximate Shapiro Wilk P Value					0.806						
117	Lilliefors Test Statistic					0.181						
118	Lilliefors Critical (0.05) Value					0.283						
119	**Data appear Normal at (0.05) Significance Level**											
120												
121	**Chloride (cbl - 308i)**											
122												
123	**Raw Statistics**											
124	Number of Valid Observations					8						
125	Number of Distinct Observations					7						
126	Minimum					2360						
127	Maximum					2870						
128	Mean of Raw Data					2660						
129	Standard Deviation of Raw Data					162.2						
130	Khat					298.9						
131	Theta hat					8.9						
132	Kstar					186.9						
133	Theta star					14.23						
134	Mean of Log Transformed Data					7.884						

	A	B	C	D	E	F	G	H	I	J	K	L
135	Standard Deviation of Log Transformed Data					0.0623						
136												
137	Normal GOF Test Results											
138												
139	Correlation Coefficient R					0.967						
140	Shapiro Wilk Test Statistic					0.94						
141	Shapiro Wilk Critical (0.05) Value					0.818						
142	Approximate Shapiro Wilk P Value					0.578						
143	Lilliefors Test Statistic					0.189						
144	Lilliefors Critical (0.05) Value					0.283						
145	Data appear Normal at (0.05) Significance Level											
146												
147	Gamma GOF Test Results											
148												
149	Correlation Coefficient R					0.963						
150	A-D Test Statistic					0.342						
151	A-D Critical (0.05) Value					0.715						
152	K-S Test Statistic					0.203						
153	K-S Critical(0.05) Value					0.294						
154	Data appear Gamma Distributed at (0.05) Significance Level											
155												
156	Lognormal GOF Test Results											
157												
158	Correlation Coefficient R					0.961						
159	Shapiro Wilk Test Statistic					0.93						
160	Shapiro Wilk Critical (0.05) Value					0.818						
161	Approximate Shapiro Wilk P Value					0.475						
162	Lilliefors Test Statistic					0.192						
163	Lilliefors Critical (0.05) Value					0.283						
164	Data appear Lognormal at (0.05) Significance Level											
165												
166	Chloride (cbl - 340i)											
167												
168	Raw Statistics											
169	Number of Valid Observations					7						
170	Number of Missing Observations					1						
171	Number of Distinct Observations					6						
172	Minimum					2260						
173	Maximum					2520						
174	Mean of Raw Data					2363						
175	Standard Deviation of Raw Data					84.6						
176	Khat					922.3						
177	Theta hat					2.562						
178	Kstar					527.1						
179	Theta star					4.482						
180	Mean of Log Transformed Data					7.767						
181	Standard Deviation of Log Transformed Data					0.0355						
182												
183	Normal GOF Test Results											
184												
185	Correlation Coefficient R					0.941						
186	Shapiro Wilk Test Statistic					0.9						
187	Shapiro Wilk Critical (0.05) Value					0.803						
188	Approximate Shapiro Wilk P Value					0.263						
189	Lilliefors Test Statistic					0.277						
190	Lilliefors Critical (0.05) Value					0.304						
191	Data appear Normal at (0.05) Significance Level											
192												
193	Gamma GOF Test Results											
194												
195	Correlation Coefficient R					0.945						
196	A-D Test Statistic					0.424						
197	A-D Critical (0.05) Value					0.708						
198	K-S Test Statistic					0.266						
199	K-S Critical(0.05) Value					0.311						
200	Data appear Gamma Distributed at (0.05) Significance Level											
201												

	A	B	C	D	E	F	G	H	I	J	K	L
202	**Lognormal GOF Test Results**											
203												
204	Correlation Coefficient R					0.944						
205	Shapiro Wilk Test Statistic					0.906						
206	Shapiro Wilk Critical (0.05) Value					0.803						
207	Approximate Shapiro Wilk P Value					0.3						
208	Lilliefors Test Statistic					0.27						
209	Lilliefors Critical (0.05) Value					0.304						
210	**Data appear Lognormal at (0.05) Significance Level**											
211												
212	**Chloride (cbl - 341i)**											
213												
214	**Raw Statistics**											
215	Number of Valid Observations					8						
216	Number of Distinct Observations					8						
217	Minimum					1600						
218	Maximum					2000						
219	Mean of Raw Data					1819						
220	Standard Deviation of Raw Data					134.1						
221	Khat					208.1						
222	Theta hat					8.739						
223	Kstar					130.2						
224	Theta star					13.97						
225	Mean of Log Transformed Data					7.504						
226	Standard Deviation of Log Transformed Data					0.0743						
227												
228	**Normal GOF Test Results**											
229												
230	Correlation Coefficient R					0.988						
231	Shapiro Wilk Test Statistic					0.969						
232	Shapiro Wilk Critical (0.05) Value					0.818						
233	Approximate Shapiro Wilk P Value					0.933						
234	Lilliefors Test Statistic					0.121						
235	Lilliefors Critical (0.05) Value					0.283						
236	**Data appear Normal at (0.05) Significance Level**											
237												
238	**Gamma GOF Test Results**											
239												
240	Correlation Coefficient R					0.985						
241	A-D Test Statistic					0.198						
242	A-D Critical (0.05) Value					0.715						
243	K-S Test Statistic					0.133						
244	K-S Critical(0.05) Value					0.294						
245	**Data appear Gamma Distributed at (0.05) Significance Level**											
246												
247	**Lognormal GOF Test Results**											
248												
249	Correlation Coefficient R					0.986						
250	Shapiro Wilk Test Statistic					0.967						
251	Shapiro Wilk Critical (0.05) Value					0.818						
252	Approximate Shapiro Wilk P Value					0.912						
253	Lilliefors Test Statistic					0.12						
254	Lilliefors Critical (0.05) Value					0.283						
255	**Data appear Lognormal at (0.05) Significance Level**											

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2017 7:54:24 PM
From File	DetectionMonitoring_ProUCLUploadDeTrendResiduals_11272017_a.xls
Full Precision	OFF
Confidence Coefficient	0.95

Fluoride (cbl - 301i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

gested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EP

The data set for variable Fluoride (cbl - 301i) was not processed!

Fluoride (cbl - 302i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

gested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EP

The data set for variable Fluoride (cbl - 302i) was not processed!

Fluoride (cbl - 306i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	1
Maximum	12.6
Mean of Raw Data	3.351
Standard Deviation of Raw Data	3.788
Khat	1.703
Theta hat	1.967
Kstar	1.148
Theta star	2.919
Mean of Log Transformed Data	0.888
Standard Deviation of Log Transformed Data	0.751

Normal GOF Test Results

Correlation Coefficient R	0.741
Shapiro Wilk Test Statistic	0.58
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	7.5132E-5
Lilliefors Test Statistic	0.421
Lilliefors Critical (0.05) Value	0.283

Data not Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.883
A-D Test Statistic	0.96
A-D Critical (0.05) Value	0.727
K-S Test Statistic	0.343
K-S Critical(0.05) Value	0.298

Data not Gamma Distributed at (0.05) Significance Level

	A	B	C	D	E	F	G	H	I	J	K	L
68	Lognormal GOF Test Results											
69												
70					Correlation Coefficient R	0.906						
71					Shapiro Wilk Test Statistic	0.848						
72					Shapiro Wilk Critical (0.05) Value	0.818						
73					Approximate Shapiro Wilk P Value	0.054						
74					Lilliefors Test Statistic	0.28						
75					Lilliefors Critical (0.05) Value	0.283						
76	Data appear Lognormal at (0.05) Significance Level											
77												
78	Fluoride (cbl - 308i)											
79												
80	Raw Statistics											
81					Number of Valid Observations	8						
82					Number of Distinct Observations	8						
83					Minimum	1.33						
84					Maximum	9.05						
85					Mean of Raw Data	2.625						
86					Standard Deviation of Raw Data	2.612						
87					Khat	2.292						
88					Theta hat	1.145						
89					Kstar	1.516						
90					Theta star	1.732						
91					Mean of Log Transformed Data	0.731						
92					Standard Deviation of Log Transformed Data	0.617						
93												
94	Normal GOF Test Results											
95												
96					Correlation Coefficient R	0.7						
97					Shapiro Wilk Test Statistic	0.52						
98					Shapiro Wilk Critical (0.05) Value	0.818						
99					Approximate Shapiro Wilk P Value	1.8716E-5						
100					Lilliefors Test Statistic	0.425						
101					Lilliefors Critical (0.05) Value	0.283						
102	Data not Normal at (0.05) Significance Level											
103												
104	Gamma GOF Test Results											
105												
106					Correlation Coefficient R	0.844						
107					A-D Test Statistic	1.525						
108					A-D Critical (0.05) Value	0.723						
109					K-S Test Statistic	0.364						
110					K-S Critical(0.05) Value	0.297						
111	Data not Gamma Distributed at (0.05) Significance Level											
112												
113	Lognormal GOF Test Results											
114												
115					Correlation Coefficient R	0.799						
116					Shapiro Wilk Test Statistic	0.666						
117					Shapiro Wilk Critical (0.05) Value	0.818						
118					Approximate Shapiro Wilk P Value	6.4279E-4						
119					Lilliefors Test Statistic	0.31						
120					Lilliefors Critical (0.05) Value	0.283						
121	Data not Lognormal at (0.05) Significance Level											
122												
123	Non-parametric GOF Test Results											
124												
125	Data do not follow a discernible distribution at (0.05) Level of S											
126												
127	Fluoride (cbl - 340i)											
128												
129	Raw Statistics											
130					Number of Valid Observations	7						
131					Number of Missing Observations	1						
132					Number of Distinct Observations	7						
133					Minimum	0.84						
134					Maximum	1.92						

Mean of Raw Data	1.147
Standard Deviation of Raw Data	0.37
Khat	13.63
Theta hat	0.0842
Kstar	7.883
Theta star	0.146
Mean of Log Transformed Data	0.1
Standard Deviation of Log Transformed Data	0.282

Normal GOF Test Results

Correlation Coefficient R	0.883
Shapiro Wilk Test Statistic	0.795
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.0261
Lilliefors Test Statistic	0.276
Lilliefors Critical (0.05) Value	0.304

Data appear Approximate Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.927
A-D Test Statistic	0.518
A-D Critical (0.05) Value	0.708
K-S Test Statistic	0.253
K-S Critical(0.05) Value	0.312

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.93
Shapiro Wilk Test Statistic	0.874
Shapiro Wilk Critical (0.05) Value	0.803
Approximate Shapiro Wilk P Value	0.176
Lilliefors Test Statistic	0.234
Lilliefors Critical (0.05) Value	0.304

Data appear Lognormal at (0.05) Significance Level

Fluoride (cbl - 341i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	1	7	3	4	57.14%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	4	-0.0184	0.0982	0.0403	0.0406	0.0505
Statistics (Non-Detects Only)	3	-0.0325	0.133	0.0278	-0.017	0.0914
Statistics (All: NDs treated as DL value)	7	-0.0325	0.133	0.0349	0.02	0.0641
Statistics (All: NDs treated as DL/2 value)	7	N/A	N/A	N/A	N/A	N/A
Statistics (Normal ROS Imputed Data)	7	-0.055	0.133	-0.00653	-0.0247	0.0627

Normal GOF Test Results

	No NDs	NDs = DL	Ds = DL/	ormal RO
Correlation Coefficient R	0.905	0.963	0.936	0.772

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.82	0.767	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.907	0.803	Data Appear Normal
Shapiro-Wilk (NDs = DL/2)	0.886	0.803	Data Appear Normal
Shapiro-Wilk (Normal ROS Estimates)	0.63	0.803	Data Not Normal
Lilliefors (Detects Only)	0.355	0.425	Data Appear Normal
Lilliefors (NDs = DL)	0.22	0.304	Data Appear Normal
Lilliefors (NDs = DL/2)	0.18	0.304	Data Appear Normal
Lilliefors (Normal ROS Estimates)	0.423	0.304	Data Not Normal

Gamma GOF Test Results

	A	B	C	D	E	F	G	H	I	J	K	L
202					No NDs	NDs = DL	NDs = DL/	amma RO				
203	Correlation Coefficient R				N/A	N/A	N/A	N/A				
204												
205					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
206	Anderson-Darling (Detects Only)				N/A	N/A						
207	Kolmogorov-Smirnov (Detects Only)				N/A	N/A						
208	Anderson-Darling (NDs = DL)				N/A	N/A						
209	Kolmogorov-Smirnov (NDs = DL)				N/A	N/A						
210	Anderson-Darling (NDs = DL/2)				N/A	N/A						
211	Kolmogorov-Smirnov (NDs = DL/2)				N/A	N/A						
212	nderson-Darling (Gamma ROS Estimates)				N/A	N/A						
213	Kolmogorov-Smirnov (Gamma ROS Est.)				N/A	N/A						
214												
215	Note: Substitution methods such as DL or DL/2 are not recommended.											

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.111/27/2017 7:31:11 PM
From File	DetectionMonitoring_ProUCLUpload_11272017_a.xls
Full Precision	OFF
Confidence Coefficient	0.95

TotalBoron (cbl - 301i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable TotalBoron (cbl - 301i) was not processed!

TotalBoron (cbl - 302i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	2	6	75.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	6	0.05	0.05	0.05	0.05	7.601E-18
Statistics (Non-Detects Only)	2	0.156	0.297	0.227	0.227	0.0997
Statistics (All: NDs treated as DL value)	8	0.05	0.297	0.0941	0.05	0.09
Statistics (All: NDs treated as DL/2 value)	8	0.025	0.297	0.0754	0.025	0.101
Statistics (Normal ROS Imputed Data)	8	-0.594	0.297	-0.167	-0.188	0.298
Statistics (Gamma ROS Imputed Data)	8	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Imputed Data)	8	0.00509	0.297	0.0766	0.0332	0.101

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (NDs = DL)	2.019	1.345	0.0466	-2.631	0.697	-0.265
Statistics (NDs = DL/2)	1.019	0.72	0.074	-3.151	1.011	-0.321
Statistics (Gamma ROS Estimates)	N/A	N/A	N/A	N/A	N/A	N/A
Statistics (Lognormal ROS Estimates)	--	--	--	-3.332	1.361	-0.409

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	1	0.759	0.766	0.995

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (NDs = DL)	0.591	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.599	0.818	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.983	0.818	Data Appear Normal
Lilliefors (Detects Only)	N/A	N/A	
Lilliefors (NDs = DL)	0.438	0.283	Data Not Normal
Lilliefors (NDs = DL/2)	0.442	0.283	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.111	0.283	Data Appear Normal

Gamma GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Gamma ROS
Correlation Coefficient R	N/A	0.904	0.942	0.964

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	N/A	N/A	
Kolmogorov-Smirnov (Detects Only)	N/A	N/A	
Anderson-Darling (NDs = DL)	1.702	0.724	
Kolmogorov-Smirnov (NDs = DL)	0.465	0.297	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	1.731	0.735	

	A	B	C	D	E	F	G	H	I	J
67	Kolmogorov-Smirnov (NDs = DL/2)				0.472	0.301	Data Not Gamma Distributed			
68	Anderson-Darling (Gamma ROS Estimates)				N/A	0.715				
69	Kolmogorov-Smirnov (Gamma ROS Est.)				N/A	0.294				
70										
71	**Lognormal GOF Test Results**									
72										
73					No NDs	NDs = DL	NDs = DL/2	Log ROS		
74	Correlation Coefficient R				1	0.776	0.776	N/A		
75										
76					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
77	Shapiro-Wilk (NDs = DL)				0.608	0.818	Data Not Lognormal			
78	Shapiro-Wilk (NDs = DL/2)				0.603	0.818	Data Not Lognormal			
79	Shapiro-Wilk (Lognormal ROS Estimates)				0.983	0.818	Data Appear Lognormal			
80	Lilliefors (Detects Only)				N/A	N/A				
81	Lilliefors (NDs = DL)				0.45	0.283	Data Not Lognormal			
82	Lilliefors (NDs = DL/2)				0.453	0.283	Data Not Lognormal			
83	Lilliefors (Lognormal ROS Estimates)				0.111	0.283	Data Appear Lognormal			
84										
85	**Note: Substitution methods such as DL or DL/2 are not recommended.**									
86										
87	**TotalBoron (cbl - 306i)**									
88										
89					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
90	Raw Statistics				8	0	8	6	2	25.00%
91										
92					Number	Minimum	Maximum	Mean	Median	SD
93	Statistics (Non-Detects Only)				2	0.05	0.05	0.05	0.05	0
94	Statistics (Non-Detects Only)				6	0.0531	0.124	0.0812	0.0775	0.0273
95	Statistics (All: NDs treated as DL value)				8	0.05	0.124	0.0734	0.0637	0.0272
96	Statistics (All: NDs treated as DL/2 value)				8	0.025	0.124	0.0672	0.0637	0.0348
97	Statistics (Normal ROS Imputed Data)				8	8.3753E-4	0.124	0.0635	0.0637	0.0404
98	Statistics (Gamma ROS Imputed Data)				8	0.0135	0.124	0.066	0.0637	0.0366
99	Statistics (Lognormal ROS Imputed Data)				8	0.0292	0.124	0.0692	0.0637	0.0322
100										
101					K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
102	Statistics (Non-Detects Only)				11.02	5.62	0.00737	-2.556	0.331	-0.13
103	Statistics (NDs = DL)				9.285	5.887	0.00791	-2.666	0.346	-0.13
104	Statistics (NDs = DL/2)				3.752	2.428	0.0179	-2.84	0.594	-0.209
105	Statistics (Gamma ROS Estimates)				2.798	1.832	0.0236	-2.908	0.732	-0.252
106	Statistics (Lognormal ROS Estimates)				--	--	--	-2.772	0.492	-0.177
107										
108	**Normal GOF Test Results**									
109										
110					No NDs	NDs = DL	NDs = DL/2	Normal ROS		
111	Correlation Coefficient R				0.974	0.933	0.982	0.993		
112										
113					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
114	Shapiro-Wilk (Detects Only)				0.937	0.788	Data Appear Normal			
115	Shapiro-Wilk (NDs = DL)				0.859	0.818	Data Appear Normal			
116	Shapiro-Wilk (NDs = DL/2)				0.952	0.818	Data Appear Normal			
117	Shapiro-Wilk (Normal ROS Estimates)				0.982	0.818	Data Appear Normal			
118	Lilliefors (Detects Only)				0.16	0.325	Data Appear Normal			
119	Lilliefors (NDs = DL)				0.244	0.283	Data Appear Normal			
120	Lilliefors (NDs = DL/2)				0.137	0.283	Data Appear Normal			
121	Lilliefors (Normal ROS Estimates)				0.148	0.283	Data Appear Normal			
122										
123	**Gamma GOF Test Results**									
124										
125					No NDs	NDs = DL	NDs = DL/2	Gamma ROS		
126	Correlation Coefficient R				0.991	0.969	0.982	0.973		
127										
128					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
129	Anderson-Darling (Detects Only)				0.237	0.698				
130	Kolmogorov-Smirnov (Detects Only)				0.193	0.332	Detected Data Appear Gamma Distributed			
131	Anderson-Darling (NDs = DL)				0.484	0.716				
132	Kolmogorov-Smirnov (NDs = DL)				0.257	0.294	Data Appear Gamma Distributed			
133	Anderson-Darling (NDs = DL/2)				0.291	0.719				

	A	B	C	D	E	F	G	H	I	J
134	Kolmogorov-Smirnov (NDs = DL/2)				0.178	0.296	Data Appear Gamma Distributed			
135	Anderson-Darling (Gamma ROS Estimates)				0.251	0.722				
136	Kolmogorov-Smirnov (Gamma ROS Est.)				0.192	0.297	Data Appear Gamma Distributed			
137										
138	**Lognormal GOF Test Results**									
139										
140					No NDs	NDs = DL	NDs = DL/2	Log ROS		
141	Correlation Coefficient R				0.984	0.951	0.963	0.992		
142										
143					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
144	Shapiro-Wilk (Detects Only)				0.951	0.788	Data Appear Lognormal			
145	Shapiro-Wilk (NDs = DL)				0.884	0.818	Data Appear Lognormal			
146	Shapiro-Wilk (NDs = DL/2)				0.91	0.818	Data Appear Lognormal			
147	Shapiro-Wilk (Lognormal ROS Estimates)				0.975	0.818	Data Appear Lognormal			
148	Lilliefors (Detects Only)				0.176	0.325	Data Appear Lognormal			
149	Lilliefors (NDs = DL)				0.241	0.283	Data Appear Lognormal			
150	Lilliefors (NDs = DL/2)				0.186	0.283	Data Appear Lognormal			
151	Lilliefors (Lognormal ROS Estimates)				0.12	0.283	Data Appear Lognormal			
152										
153	**Note: Substitution methods such as DL or DL/2 are not recommended.**									
154										
155	**TotalBoron (cbl - 308i)**									
156										
157					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
158	Raw Statistics				8	0	8	6	2	25.00%
159										
160					Number	Minimum	Maximum	Mean	Median	SD
161	Statistics (Non-Detects Only)				2	0.05	0.05	0.05	0.05	0
162	Statistics (Non-Detects Only)				6	0.0799	0.545	0.216	0.154	0.173
163	Statistics (All: NDs treated as DL value)				8	0.05	0.545	0.175	0.115	0.165
164	Statistics (All: NDs treated as DL/2 value)				8	0.025	0.545	0.168	0.115	0.171
165	Statistics (Normal ROS Imputed Data)				8	-0.257	0.545	0.112	0.115	0.244
166	Statistics (Gamma ROS Imputed Data)				8	0.01	0.545	0.165	0.115	0.175
167	Statistics (Lognormal ROS Imputed Data)				8	0.0225	0.545	0.169	0.115	0.17
168										
169					K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
170	Statistics (Non-Detects Only)				2.433	1.328	0.0888	-1.751	0.695	-0.397
171	Statistics (NDs = DL)				1.725	1.161	0.101	-2.062	0.823	-0.399
172	Statistics (NDs = DL/2)				1.242	0.859	0.136	-2.236	1.072	-0.48
173	Statistics (Gamma ROS Estimates)				0.887	0.638	0.186	-2.465	1.446	-0.587
174	Statistics (Lognormal ROS Estimates)				--	--	--	-2.201	1.027	-0.467
175										
176	**Normal GOF Test Results**									
177										
178					No NDs	NDs = DL	NDs = DL/2	Normal ROS		
179	Correlation Coefficient R				0.888	0.871	0.893	0.971		
180										
181					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
182	Shapiro-Wilk (Detects Only)				0.8	0.788	Data Appear Normal			
183	Shapiro-Wilk (NDs = DL)				0.771	0.818	Data Not Normal			
184	Shapiro-Wilk (NDs = DL/2)				0.81	0.818	Data Not Normal			
185	Shapiro-Wilk (Normal ROS Estimates)				0.956	0.818	Data Appear Normal			
186	Lilliefors (Detects Only)				0.242	0.325	Data Appear Normal			
187	Lilliefors (NDs = DL)				0.252	0.283	Data Appear Normal			
188	Lilliefors (NDs = DL/2)				0.234	0.283	Data Appear Normal			
189	Lilliefors (Normal ROS Estimates)				0.198	0.283	Data Appear Normal			
190										
191	**Gamma GOF Test Results**									
192										
193					No NDs	NDs = DL	NDs = DL/2	Gamma ROS		
194	Correlation Coefficient R				0.976	0.976	0.989	0.992		
195										
196					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
197	Anderson-Darling (Detects Only)				0.358	0.703				
198	Kolmogorov-Smirnov (Detects Only)				0.226	0.335	Detected Data Appear Gamma Distributed			
199	Anderson-Darling (NDs = DL)				0.354	0.726				
200	Kolmogorov-Smirnov (NDs = DL)				0.201	0.298	Data Appear Gamma Distributed			

	A	B	C	D	E	F	G	H	I	J
201	Anderson-Darling (NDs = DL/2)				0.245	0.732				
202	Kolmogorov-Smirnov (NDs = DL/2)				0.152	0.3	Data Appear Gamma Distributed			
203	Anderson-Darling (Gamma ROS Estimates)				0.293	0.74				
204	Kolmogorov-Smirnov (Gamma ROS Est.)				0.174	0.303	Data Appear Gamma Distributed			
205										
206	Lognormal GOF Test Results									
207										
208					No NDs	NDs = DL	NDs = DL/2	Log ROS		
209	Correlation Coefficient R				0.973	0.977	0.976	0.993		
210										
211					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
212	Shapiro-Wilk (Detects Only)				0.947	0.788	Data Appear Lognormal			
213	Shapiro-Wilk (NDs = DL)				0.945	0.818	Data Appear Lognormal			
214	Shapiro-Wilk (NDs = DL/2)				0.943	0.818	Data Appear Lognormal			
215	Shapiro-Wilk (Lognormal ROS Estimates)				0.984	0.818	Data Appear Lognormal			
216	Lilliefors (Detects Only)				0.198	0.325	Data Appear Lognormal			
217	Lilliefors (NDs = DL)				0.149	0.283	Data Appear Lognormal			
218	Lilliefors (NDs = DL/2)				0.162	0.283	Data Appear Lognormal			
219	Lilliefors (Lognormal ROS Estimates)				0.126	0.283	Data Appear Lognormal			
220										
221	Note: Substitution methods such as DL or DL/2 are not recommended.									
222										
223	TotalBoron (cbl - 340i)									
224										
225					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
226	Raw Statistics				8	0	8	6	2	25.00%
227										
228					Number	Minimum	Maximum	Mean	Median	SD
229	Statistics (Non-Detects Only)				2	0.05	0.05	0.05	0.05	0
230	Statistics (Non-Detects Only)				6	0.081	0.174	0.114	0.0936	0.0418
231	Statistics (All: NDs treated as DL value)				8	0.05	0.174	0.0977	0.0824	0.046
232	Statistics (All: NDs treated as DL/2 value)				8	0.025	0.174	0.0915	0.0824	0.0541
233	Statistics (Normal ROS Imputed Data)				8	-0.00248	0.174	0.088	0.0824	0.0595
234	Statistics (Gamma ROS Imputed Data)				8	0.0163	0.174	0.0917	0.0824	0.0541
235	Statistics (Lognormal ROS Imputed Data)				8	0.0408	0.174	0.0967	0.0824	0.0472
236										
237					K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
238	Statistics (Non-Detects Only)				9.709	4.966	0.0117	-2.227	0.347	-0.156
239	Statistics (NDs = DL)				5.497	3.519	0.0178	-2.419	0.461	-0.191
240	Statistics (NDs = DL/2)				2.644	1.736	0.0346	-2.593	0.738	-0.284
241	Statistics (Gamma ROS Estimates)				2.499	1.645	0.0367	-2.603	0.783	-0.301
242	Statistics (Lognormal ROS Estimates)				--	--	--	-2.441	0.497	-0.204
243										
244	Normal GOF Test Results									
245										
246					No NDs	NDs = DL	NDs = DL/2	Normal ROS		
247	Correlation Coefficient R				0.902	0.938	0.959	0.974		
248										
249					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
250	Shapiro-Wilk (Detects Only)				0.791	0.788	Data Appear Normal			
251	Shapiro-Wilk (NDs = DL)				0.868	0.818	Data Appear Normal			
252	Shapiro-Wilk (NDs = DL/2)				0.907	0.818	Data Appear Normal			
253	Shapiro-Wilk (Normal ROS Estimates)				0.943	0.818	Data Appear Normal			
254	Lilliefors (Detects Only)				0.267	0.325	Data Appear Normal			
255	Lilliefors (NDs = DL)				0.249	0.283	Data Appear Normal			
256	Lilliefors (NDs = DL/2)				0.186	0.283	Data Appear Normal			
257	Lilliefors (Normal ROS Estimates)				0.203	0.283	Data Appear Normal			
258										
259	Gamma GOF Test Results									
260										
261					No NDs	NDs = DL	NDs = DL/2	Gamma ROS		
262	Correlation Coefficient R				0.932	0.964	0.952	0.954		
263										
264					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
265	Anderson-Darling (Detects Only)				0.671	0.698				
266	Kolmogorov-Smirnov (Detects Only)				0.292	0.332	Detected Data Appear Gamma Distributed			
267	Anderson-Darling (NDs = DL)				0.425	0.719				

	A	B	C	D	E	F	G	H	I	J
268	Kolmogorov-Smirnov (NDs = DL)				0.213	0.295	Data Appear Gamma Distributed			
269	Anderson-Darling (NDs = DL/2)				0.49	0.722				
270	Kolmogorov-Smirnov (NDs = DL/2)				0.256	0.297	Data Appear Gamma Distributed			
271	Anderson-Darling (Gamma ROS Estimates)				0.369	0.723				
272	Kolmogorov-Smirnov (Gamma ROS Est.)				0.259	0.297	Data Appear Gamma Distributed			
273										
274	Lognormal GOF Test Results									
275										
276					No NDs	NDs = DL	NDs = DL/2	Log ROS		
277	Correlation Coefficient R				0.912	0.962	0.932	0.975		
278										
279					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
280	Shapiro-Wilk (Detects Only)				0.805	0.788	Data Appear Lognormal			
281	Shapiro-Wilk (NDs = DL)				0.909	0.818	Data Appear Lognormal			
282	Shapiro-Wilk (NDs = DL/2)				0.853	0.818	Data Appear Lognormal			
283	Shapiro-Wilk (Lognormal ROS Estimates)				0.944	0.818	Data Appear Lognormal			
284	Lilliefors (Detects Only)				0.272	0.325	Data Appear Lognormal			
285	Lilliefors (NDs = DL)				0.183	0.283	Data Appear Lognormal			
286	Lilliefors (NDs = DL/2)				0.293	0.283	Data Not Lognormal			
287	Lilliefors (Lognormal ROS Estimates)				0.193	0.283	Data Appear Lognormal			
288										
289	Note: Substitution methods such as DL or DL/2 are not recommended.									
290										
291	TotalBoron (cbl - 341i)									
292										
293					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
294	Raw Statistics				8	0	8	4	4	50.00%
295										
296					Number	Minimum	Maximum	Mean	Median	SD
297	Statistics (Non-Detects Only)				4	0.05	0.05	0.05	0.05	0
298	Statistics (Non-Detects Only)				4	0.0507	0.0896	0.0665	0.0628	0.0168
299	Statistics (All: NDs treated as DL value)				8	0.05	0.0896	0.0582	0.0504	0.0141
300	Statistics (All: NDs treated as DL/2 value)				8	0.025	0.0896	0.0457	0.0379	0.0247
301	Statistics (Normal ROS Imputed Data)				8	-0.00857	0.0896	0.0393	0.0403	0.0328
302	Statistics (Gamma ROS Imputed Data)				8	0.01	0.0896	0.0431	0.0414	0.028
303	Statistics (Lognormal ROS Imputed Data)				8	0.0218	0.0896	0.0483	0.0444	0.0228
304										
305					K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
306	Statistics (Non-Detects Only)				22.3	5.741	0.00298	-2.734	0.242	-0.0886
307	Statistics (NDs = DL)				23.56	14.81	0.00247	-2.865	0.211	-0.0738
308	Statistics (NDs = DL/2)				4.119	2.658	0.0111	-3.211	0.535	-0.166
309	Statistics (Gamma ROS Estimates)				2.284	1.511	0.0189	-3.379	0.786	-0.233
310	Statistics (Lognormal ROS Estimates)				--	--	--	-3.129	0.478	-0.153
311										
312	Normal GOF Test Results									
313										
314					No NDs	NDs = DL	NDs = DL/2	Normal ROS		
315	Correlation Coefficient R				0.964	0.822	0.92	0.994		
316										
317					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
318	Shapiro-Wilk (Detects Only)				0.935	0.748	Data Appear Normal			
319	Shapiro-Wilk (NDs = DL)				0.686	0.818	Data Not Normal			
320	Shapiro-Wilk (NDs = DL/2)				0.831	0.818	Data Appear Normal			
321	Shapiro-Wilk (Normal ROS Estimates)				0.981	0.818	Data Appear Normal			
322	Lilliefors (Detects Only)				0.242	0.375	Data Appear Normal			
323	Lilliefors (NDs = DL)				0.329	0.283	Data Not Normal			
324	Lilliefors (NDs = DL/2)				0.299	0.283	Data Not Normal			
325	Lilliefors (Normal ROS Estimates)				0.135	0.283	Data Appear Normal			
326										
327	Gamma GOF Test Results									
328										
329					No NDs	NDs = DL	NDs = DL/2	Gamma ROS		
330	Correlation Coefficient R				0.986	0.868	0.961	0.977		
331										
332					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
333	Anderson-Darling (Detects Only)				0.263	0.657				
334	Kolmogorov-Smirnov (Detects Only)				0.212	0.394	Detected Data Appear Gamma Distributed			

	A	B	C	D	E	F	G	H	I	J
335	Anderson-Darling (NDs = DL)				1.119	0.716				
336	Kolmogorov-Smirnov (NDs = DL)				0.346	0.294	Data Not Gamma Distributed			
337	Anderson-Darling (NDs = DL/2)				0.757	0.719				
338	Kolmogorov-Smirnov (NDs = DL/2)				0.327	0.295	Data Not Gamma Distributed			
339	Anderson-Darling (Gamma ROS Estimates)				0.241	0.723				
340	Kolmogorov-Smirnov (Gamma ROS Est.)				0.181	0.297	Data Appear Gamma Distributed			
341										
342	Lognormal GOF Test Results									
343										
344					No NDs	NDs = DL	NDs = DL/2	Log ROS		
345	Correlation Coefficient R				0.983	0.843	0.913	0.995		
346										
347					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
348	Shapiro-Wilk (Detects Only)				0.97	0.748	Data Appear Lognormal			
349	Shapiro-Wilk (NDs = DL)				0.716	0.818	Data Not Lognormal			
350	Shapiro-Wilk (NDs = DL/2)				0.809	0.818	Data Not Lognormal			
351	Shapiro-Wilk (Lognormal ROS Estimates)				0.981	0.818	Data Appear Lognormal			
352	Lilliefors (Detects Only)				0.204	0.375	Data Appear Lognormal			
353	Lilliefors (NDs = DL)				0.335	0.283	Data Not Lognormal			
354	Lilliefors (NDs = DL/2)				0.314	0.283	Data Not Lognormal			
355	Lilliefors (Lognormal ROS Estimates)				0.121	0.283	Data Appear Lognormal			
356										
357	Note: Substitution methods such as DL or DL/2 are not recommended.									
358										
359	TotalCalcium (cbl - 301i)									
360										
361	Raw Statistics									
362	Number of Valid Observations					8				
363	Number of Distinct Observations					8				
364	Minimum					-65.93				
365	Maximum					47				
366	Mean of Raw Data					-8.750E-4				
367	Standard Deviation of Raw Data					35.03				
368	Data contains values <= 0									
369	Data not gamma or lognormal									
370										
371	Normal GOF Test Results									
372										
373	Correlation Coefficient R					0.973				
374	Shapiro Wilk Test Statistic					0.955				
375	Shapiro Wilk Critical (0.05) Value					0.818				
376	Approximate Shapiro Wilk P Value					0.687				
377	Lilliefors Test Statistic					0.2				
378	Lilliefors Critical (0.05) Value					0.283				
379	Data appear Normal at (0.05) Significance Level									
380										
381	TotalCalcium (cbl - 302i)									
382										
383	Raw Statistics									
384	Number of Valid Observations					8				
385	Number of Distinct Observations					6				
386	Minimum					1010				
387	Maximum					1100				
388	Mean of Raw Data					1059				
389	Standard Deviation of Raw Data					35.63				
390	Khat					1009				
391	Theta hat					1.05				
392	Kstar					630.5				
393	Theta star					1.679				
394	Mean of Log Transformed Data					6.964				
395	Standard Deviation of Log Transformed Data					0.0337				
396										
397	Normal GOF Test Results									
398										
399	Correlation Coefficient R					0.955				
400	Shapiro Wilk Test Statistic					0.886				
401	Shapiro Wilk Critical (0.05) Value					0.818				

	A	B	C	D	E	F	G	H	I	J
402					Approximate Shapiro Wilk P Value	0.357				
403					Lilliefors Test Statistic	0.201				
404					Lilliefors Critical (0.05) Value	0.283				
405	Data appear Normal at (0.05) Significance Level									
406										
407		Gamma GOF Test Results								
408										
409					Correlation Coefficient R	0.952				
410					A-D Test Statistic	0.485				
411					A-D Critical (0.05) Value	0.715				
412					K-S Test Statistic	0.211				
413					K-S Critical(0.05) Value	0.294				
414	Data appear Gamma Distributed at (0.05) Significance Level									
415										
416		Lognormal GOF Test Results								
417										
418					Correlation Coefficient R	0.956				
419					Shapiro Wilk Test Statistic	0.888				
420					Shapiro Wilk Critical (0.05) Value	0.818				
421					Approximate Shapiro Wilk P Value	0.363				
422					Lilliefors Test Statistic	0.197				
423					Lilliefors Critical (0.05) Value	0.283				
424	Data appear Lognormal at (0.05) Significance Level									
425										
426	TotalCalcium (cbl - 306i)									
427										
428		Raw Statistics								
429					Number of Valid Observations	8				
430					Number of Distinct Observations	8				
431					Minimum	-64.78				
432					Maximum	52.22				
433					Mean of Raw Data	-0.001				
434					Standard Deviation of Raw Data	36.96				
435						Data contains values <= 0				
436						Data not gamma or lognormal				
437										
438		Normal GOF Test Results								
439										
440					Correlation Coefficient R	0.977				
441					Shapiro Wilk Test Statistic	0.96				
442					Shapiro Wilk Critical (0.05) Value	0.818				
443					Approximate Shapiro Wilk P Value	0.765				
444					Lilliefors Test Statistic	0.185				
445					Lilliefors Critical (0.05) Value	0.283				
446	Data appear Normal at (0.05) Significance Level									
447										
448	TotalCalcium (cbl - 308i)									
449										
450		Raw Statistics								
451					Number of Valid Observations	8				
452					Number of Distinct Observations	8				
453					Minimum	870				
454					Maximum	954				
455					Mean of Raw Data	915.1				
456					Standard Deviation of Raw Data	30.92				
457					Khat	996.3				
458					Theta hat	0.919				
459					Kstar	622.7				
460					Theta star	1.47				
461					Mean of Log Transformed Data	6.819				
462					Standard Deviation of Log Transformed Data	0.0339				
463										
464		Normal GOF Test Results								
465										
466					Correlation Coefficient R	0.981				
467					Shapiro Wilk Test Statistic	0.942				
468					Shapiro Wilk Critical (0.05) Value	0.818				

	A	B	C	D	E	F	G	H	I	J
469					Approximate Shapiro Wilk P Value	0.811				
470					Lilliefors Test Statistic	0.155				
471					Lilliefors Critical (0.05) Value	0.283				
472	Data appear Normal at (0.05) Significance Level									
473										
474			Gamma GOF Test Results							
475										
476					Correlation Coefficient R	0.978				
477					A-D Test Statistic	0.264				
478					A-D Critical (0.05) Value	0.715				
479					K-S Test Statistic	0.171				
480					K-S Critical(0.05) Value	0.294				
481	Data appear Gamma Distributed at (0.05) Significance Level									
482										
483			Lognormal GOF Test Results							
484										
485					Correlation Coefficient R	0.98				
486					Shapiro Wilk Test Statistic	0.94				
487					Shapiro Wilk Critical (0.05) Value	0.818				
488					Approximate Shapiro Wilk P Value	0.794				
489					Lilliefors Test Statistic	0.156				
490					Lilliefors Critical (0.05) Value	0.283				
491	Data appear Lognormal at (0.05) Significance Level									
492										
493	TotalCalcium (cbl - 340i)									
494										
495			Raw Statistics							
496					Number of Valid Observations	8				
497					Number of Distinct Observations	8				
498					Minimum	560				
499					Maximum	627				
500					Mean of Raw Data	583.6				
501					Standard Deviation of Raw Data	22.72				
502					Khat	770.6				
503					Theta hat	0.757				
504					Kstar	481.7				
505					Theta star	1.212				
506					Mean of Log Transformed Data	6.369				
507					Standard Deviation of Log Transformed Data	0.0383				
508										
509			Normal GOF Test Results							
510										
511					Correlation Coefficient R	0.945				
512					Shapiro Wilk Test Statistic	0.892				
513					Shapiro Wilk Critical (0.05) Value	0.818				
514					Approximate Shapiro Wilk P Value	0.254				
515					Lilliefors Test Statistic	0.243				
516					Lilliefors Critical (0.05) Value	0.283				
517	Data appear Normal at (0.05) Significance Level									
518										
519			Gamma GOF Test Results							
520										
521					Correlation Coefficient R	0.95				
522					A-D Test Statistic	0.434				
523					A-D Critical (0.05) Value	0.715				
524					K-S Test Statistic	0.238				
525					K-S Critical(0.05) Value	0.294				
526	Data appear Gamma Distributed at (0.05) Significance Level									
527										
528			Lognormal GOF Test Results							
529										
530					Correlation Coefficient R	0.949				
531					Shapiro Wilk Test Statistic	0.9				
532					Shapiro Wilk Critical (0.05) Value	0.818				
533					Approximate Shapiro Wilk P Value	0.302				
534					Lilliefors Test Statistic	0.237				
535					Lilliefors Critical (0.05) Value	0.283				

	A	B	C	D	E	F	G	H	I	J
536	Data appear Lognormal at (0.05) Significance Level									
537										
538	TotalCalcium (cbl - 341i)									
539										
540		Raw Statistics								
541					Number of Valid Observations	8				
542					Number of Distinct Observations	8				
543					Minimum	829				
544					Maximum	950				
545					Mean of Raw Data	876.9				
546					Standard Deviation of Raw Data	38.96				
547					Khat	589.6				
548					Theta hat	1.487				
549					Kstar	368.6				
550					Theta star	2.379				
551					Mean of Log Transformed Data	6.776				
552					Standard Deviation of Log Transformed Data	0.0438				
553										
554		Normal GOF Test Results								
555										
556					Correlation Coefficient R	0.967				
557					Shapiro Wilk Test Statistic	0.938				
558					Shapiro Wilk Critical (0.05) Value	0.818				
559					Approximate Shapiro Wilk P Value	0.571				
560					Lilliefors Test Statistic	0.195				
561					Lilliefors Critical (0.05) Value	0.283				
562	Data appear Normal at (0.05) Significance Level									
563										
564		Gamma GOF Test Results								
565										
566					Correlation Coefficient R	0.971				
567					A-D Test Statistic	0.298				
568					A-D Critical (0.05) Value	0.715				
569					K-S Test Statistic	0.195				
570					K-S Critical(0.05) Value	0.294				
571	Data appear Gamma Distributed at (0.05) Significance Level									
572										
573		Lognormal GOF Test Results								
574										
575					Correlation Coefficient R	0.971				
576					Shapiro Wilk Test Statistic	0.945				
577					Shapiro Wilk Critical (0.05) Value	0.818				
578					Approximate Shapiro Wilk P Value	0.651				
579					Lilliefors Test Statistic	0.189				
580					Lilliefors Critical (0.05) Value	0.283				
581	Data appear Lognormal at (0.05) Significance Level									
582										
583	Chloride (cbl - 301i)									
584										
585		Raw Statistics								
586					Number of Valid Observations	8				
587					Number of Distinct Observations	8				
588					Minimum	2160				
589					Maximum	3200				
590					Mean of Raw Data	2439				
591					Standard Deviation of Raw Data	325.3				
592					Khat	73.05				
593					Theta hat	33.39				
594					Kstar	45.74				
595					Theta star	53.32				
596					Mean of Log Transformed Data	7.792				
597					Standard Deviation of Log Transformed Data	0.121				
598										
599		Normal GOF Test Results								
600										
601					Correlation Coefficient R	0.84				
602					Shapiro Wilk Test Statistic	0.732				

	A	B	C	D	E	F	G	H	I	J
603	Shapiro Wilk Critical (0.05) Value					0.818				
604	Approximate Shapiro Wilk P Value					0.00327				
605	Lilliefors Test Statistic					0.3				
606	Lilliefors Critical (0.05) Value					0.283				
607	Data not Normal at (0.05) Significance Level									
608										
609	**Gamma GOF Test Results**									
610										
611	Correlation Coefficient R					0.865				
612	A-D Test Statistic					0.865				
613	A-D Critical (0.05) Value					0.715				
614	K-S Test Statistic					0.276				
615	K-S Critical(0.05) Value					0.293				
616	Data follow Appr. Gamma Distribution at (0.05) Significance Level									
617										
618	**Lognormal GOF Test Results**									
619										
620	Correlation Coefficient R					0.867				
621	Shapiro Wilk Test Statistic					0.777				
622	Shapiro Wilk Critical (0.05) Value					0.818				
623	Approximate Shapiro Wilk P Value					0.01				
624	Lilliefors Test Statistic					0.272				
625	Lilliefors Critical (0.05) Value					0.283				
626	Data appear Approximate_Lognormal at (0.05) Significance Level									
627										
628	Chloride (cbl - 302i)									
629										
630	**Raw Statistics**									
631	Number of Valid Observations					8				
632	Number of Distinct Observations					8				
633	Minimum					2040				
634	Maximum					2230				
635	Mean of Raw Data					2138				
636	Standard Deviation of Raw Data					73.82				
637	Khat					954.1				
638	Theta hat					2.24				
639	Kstar					596.4				
640	Theta star					3.584				
641	Mean of Log Transformed Data					7.667				
642	Standard Deviation of Log Transformed Data					0.0346				
643										
644	**Normal GOF Test Results**									
645										
646	Correlation Coefficient R					0.971				
647	Shapiro Wilk Test Statistic					0.917				
648	Shapiro Wilk Critical (0.05) Value					0.818				
649	Approximate Shapiro Wilk P Value					0.619				
650	Lilliefors Test Statistic					0.17				
651	Lilliefors Critical (0.05) Value					0.283				
652	Data appear Normal at (0.05) Significance Level									
653										
654	**Gamma GOF Test Results**									
655										
656	Correlation Coefficient R					0.968				
657	A-D Test Statistic					0.359				
658	A-D Critical (0.05) Value					0.715				
659	K-S Test Statistic					0.184				
660	K-S Critical(0.05) Value					0.294				
661	Data appear Gamma Distributed at (0.05) Significance Level									
662										
663	**Lognormal GOF Test Results**									
664										
665	Correlation Coefficient R					0.97				
666	Shapiro Wilk Test Statistic					0.915				
667	Shapiro Wilk Critical (0.05) Value					0.818				
668	Approximate Shapiro Wilk P Value					0.602				
669	Lilliefors Test Statistic					0.174				

	A	B	C	D	E	F	G	H	I	J
670	Lilliefors Critical (0.05) Value					0.283				
671	Data appear Lognormal at (0.05) Significance Level									
672										
673	Chloride (cbl - 306i)									
674										
675	Raw Statistics									
676	Number of Valid Observations					8				
677	Number of Distinct Observations					8				
678	Minimum					-105.2				
679	Maximum					129				
680	Mean of Raw Data					0.00312				
681	Standard Deviation of Raw Data					75.08				
682	Data contains values <= 0									
683	Data not gamma or lognormal									
684										
685	Normal GOF Test Results									
686										
687	Correlation Coefficient R					0.979				
688	Shapiro Wilk Test Statistic					0.961				
689	Shapiro Wilk Critical (0.05) Value					0.818				
690	Approximate Shapiro Wilk P Value					0.806				
691	Lilliefors Test Statistic					0.181				
692	Lilliefors Critical (0.05) Value					0.283				
693	Data appear Normal at (0.05) Significance Level									
694										
695	Chloride (cbl - 308i)									
696										
697	Raw Statistics									
698	Number of Valid Observations					8				
699	Number of Distinct Observations					7				
700	Minimum					2360				
701	Maximum					2870				
702	Mean of Raw Data					2660				
703	Standard Deviation of Raw Data					162.2				
704	Khat					298.9				
705	Theta hat					8.9				
706	Kstar					186.9				
707	Theta star					14.23				
708	Mean of Log Transformed Data					7.884				
709	Standard Deviation of Log Transformed Data					0.0623				
710										
711	Normal GOF Test Results									
712										
713	Correlation Coefficient R					0.967				
714	Shapiro Wilk Test Statistic					0.94				
715	Shapiro Wilk Critical (0.05) Value					0.818				
716	Approximate Shapiro Wilk P Value					0.578				
717	Lilliefors Test Statistic					0.189				
718	Lilliefors Critical (0.05) Value					0.283				
719	Data appear Normal at (0.05) Significance Level									
720										
721	Gamma GOF Test Results									
722										
723	Correlation Coefficient R					0.963				
724	A-D Test Statistic					0.342				
725	A-D Critical (0.05) Value					0.715				
726	K-S Test Statistic					0.203				
727	K-S Critical(0.05) Value					0.294				
728	Data appear Gamma Distributed at (0.05) Significance Level									
729										
730	Lognormal GOF Test Results									
731										
732	Correlation Coefficient R					0.961				
733	Shapiro Wilk Test Statistic					0.93				
734	Shapiro Wilk Critical (0.05) Value					0.818				
735	Approximate Shapiro Wilk P Value					0.475				
736	Lilliefors Test Statistic					0.192				

Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

Chloride (cbl - 340i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	7
Minimum	2070
Maximum	2520
Mean of Raw Data	2326
Standard Deviation of Raw Data	129.8
Khat	357.1
Theta hat	6.514
Kstar	223.3
Theta star	10.42
Mean of Log Transformed Data	7.751
Standard Deviation of Log Transformed Data	0.057

Normal GOF Test Results

Correlation Coefficient R	0.944
Shapiro Wilk Test Statistic	0.917
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.259
Lilliefors Test Statistic	0.214
Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.943
A-D Test Statistic	0.457
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.208
K-S Critical(0.05) Value	0.294

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.937
Shapiro Wilk Test Statistic	0.904
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.197
Lilliefors Test Statistic	0.21
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

Chloride (cbl - 341i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	1600
Maximum	2000
Mean of Raw Data	1819
Standard Deviation of Raw Data	134.1
Khat	208.1
Theta hat	8.739
Kstar	130.2
Theta star	13.97
Mean of Log Transformed Data	7.504
Standard Deviation of Log Transformed Data	0.0743

Normal GOF Test Results

Correlation Coefficient R	0.988

Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.933
Lilliefors Test Statistic	0.121
Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.985
A-D Test Statistic	0.198
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.133
K-S Critical(0.05) Value	0.294

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.986
Shapiro Wilk Test Statistic	0.967
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.912
Lilliefors Test Statistic	0.12
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

Fluoride (cbl - 301i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Fluoride (cbl - 301i) was not processed!

Fluoride (cbl - 302i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Fluoride (cbl - 302i) was not processed!

Fluoride (cbl - 306i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	1
Maximum	12.6
Mean of Raw Data	3.351
Standard Deviation of Raw Data	3.788
Khat	1.703
Theta hat	1.967
Kstar	1.148
Theta star	2.919
Mean of Log Transformed Data	0.888
Standard Deviation of Log Transformed Data	0.751

	A	B	C	D	E	F	G	H	I	J
869										
870	Normal GOF Test Results									
871										
872					Correlation Coefficient R	0.741				
873					Shapiro Wilk Test Statistic	0.58				
874					Shapiro Wilk Critical (0.05) Value	0.818				
875					Approximate Shapiro Wilk P Value	7.5132E-5				
876					Lilliefors Test Statistic	0.421				
877					Lilliefors Critical (0.05) Value	0.283				
878	Data not Normal at (0.05) Significance Level									
879										
880	Gamma GOF Test Results									
881										
882					Correlation Coefficient R	0.883				
883					A-D Test Statistic	0.96				
884					A-D Critical (0.05) Value	0.727				
885					K-S Test Statistic	0.343				
886					K-S Critical(0.05) Value	0.298				
887	Data not Gamma Distributed at (0.05) Significance Level									
888										
889	Lognormal GOF Test Results									
890										
891					Correlation Coefficient R	0.906				
892					Shapiro Wilk Test Statistic	0.848				
893					Shapiro Wilk Critical (0.05) Value	0.818				
894					Approximate Shapiro Wilk P Value	0.054				
895					Lilliefors Test Statistic	0.28				
896					Lilliefors Critical (0.05) Value	0.283				
897	Data appear Lognormal at (0.05) Significance Level									
898										
899	Fluoride (cbl - 308i)									
900										
901	Raw Statistics									
902					Number of Valid Observations	8				
903					Number of Distinct Observations	8				
904					Minimum	1.33				
905					Maximum	9.05				
906					Mean of Raw Data	2.625				
907					Standard Deviation of Raw Data	2.612				
908					Khat	2.292				
909					Theta hat	1.145				
910					Kstar	1.516				
911					Theta star	1.732				
912					Mean of Log Transformed Data	0.731				
913					Standard Deviation of Log Transformed Data	0.617				
914										
915	Normal GOF Test Results									
916										
917					Correlation Coefficient R	0.7				
918					Shapiro Wilk Test Statistic	0.52				
919					Shapiro Wilk Critical (0.05) Value	0.818				
920					Approximate Shapiro Wilk P Value	1.8716E-5				
921					Lilliefors Test Statistic	0.425				
922					Lilliefors Critical (0.05) Value	0.283				
923	Data not Normal at (0.05) Significance Level									
924										
925	Gamma GOF Test Results									
926										
927					Correlation Coefficient R	0.844				
928					A-D Test Statistic	1.525				
929					A-D Critical (0.05) Value	0.723				
930					K-S Test Statistic	0.364				
931					K-S Critical(0.05) Value	0.297				
932	Data not Gamma Distributed at (0.05) Significance Level									
933										
934	Lognormal GOF Test Results									
935										

	A	B	C	D	E	F	G	H	I	J
936					Correlation Coefficient R	0.799				
937					Shapiro Wilk Test Statistic	0.666				
938					Shapiro Wilk Critical (0.05) Value	0.818				
939					Approximate Shapiro Wilk P Value	6.4279E-4				
940					Lilliefors Test Statistic	0.31				
941					Lilliefors Critical (0.05) Value	0.283				
942	Data not Lognormal at (0.05) Significance Level									
943										
944	Non-parametric GOF Test Results									
945										
946	Data do not follow a discernible distribution at (0.05) Level of Significance									
947										
948	Fluoride (cbl - 340i)									
949										
950			Raw Statistics							
951					Number of Valid Observations	8				
952					Number of Distinct Observations	8				
953					Minimum	0.84				
954					Maximum	8.44				
955					Mean of Raw Data	2.059				
956					Standard Deviation of Raw Data	2.601				
957					Khat	1.504				
958					Theta hat	1.369				
959					Kstar	1.023				
960					Theta star	2.012				
961					Mean of Log Transformed Data	0.354				
962					Standard Deviation of Log Transformed Data	0.765				
963										
964			Normal GOF Test Results							
965										
966					Correlation Coefficient R	0.704				
967					Shapiro Wilk Test Statistic	0.524				
968					Shapiro Wilk Critical (0.05) Value	0.818				
969					Approximate Shapiro Wilk P Value	2.1286E-5				
970					Lilliefors Test Statistic	0.396				
971					Lilliefors Critical (0.05) Value	0.283				
972	Data not Normal at (0.05) Significance Level									
973										
974			Gamma GOF Test Results							
975										
976					Correlation Coefficient R	0.876				
977					A-D Test Statistic	1.416				
978					A-D Critical (0.05) Value	0.728				
979					K-S Test Statistic	0.358				
980					K-S Critical(0.05) Value	0.299				
981	Data not Gamma Distributed at (0.05) Significance Level									
982										
983			Lognormal GOF Test Results							
984										
985					Correlation Coefficient R	0.826				
986					Shapiro Wilk Test Statistic	0.701				
987					Shapiro Wilk Critical (0.05) Value	0.818				
988					Approximate Shapiro Wilk P Value	0.00179				
989					Lilliefors Test Statistic	0.314				
990					Lilliefors Critical (0.05) Value	0.283				
991	Data not Lognormal at (0.05) Significance Level									
992										
993	Non-parametric GOF Test Results									
994										
995	Data do not follow a discernible distribution at (0.05) Level of Significance									
996										
997	Fluoride (cbl - 341i)									
998										
999					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
1000				Raw Statistics	8	0	8	4	4	50.00%
1001										
1002					Number	Minimum	Maximum	Mean	Median	SD

	A	B	C	D	E	F	G	H	I	J
1003	Statistics (Non-Detects Only)				4	-0.0184	0.0982	0.0403	0.0406	0.0505
1004	Statistics (Non-Detects Only)				4	-0.244	0.133	-0.0401	-0.0248	0.155
1005	Statistics (All: NDs treated as DL value)				8	-0.244	0.133	6.2500E-5	0.0015	0.115
1006	Statistics (All: NDs treated as DL/2 value)				8	N/A	N/A	N/A	N/A	N/A
1007	Statistics (Normal ROS Imputed Data)				8	-0.244	0.133	-0.0803	-0.11	0.111
1008										
1009	Normal GOF Test Results									
1010										
1011					No NDs	NDs = DL	NDs = DL/2	Normal ROS		
1012	Correlation Coefficient R				0.966	0.928	0.906	0.957		
1013										
1014					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
1015	Shapiro-Wilk (Detects Only)				0.949	0.748	Data Appear Normal			
1016	Shapiro-Wilk (NDs = DL)				0.879	0.818	Data Appear Normal			
1017	Shapiro-Wilk (NDs = DL/2)				0.853	0.818	Data Appear Normal			
1018	Shapiro-Wilk (Normal ROS Estimates)				0.936	0.818	Data Appear Normal			
1019	Lilliefors (Detects Only)				0.27	0.375	Data Appear Normal			
1020	Lilliefors (NDs = DL)				0.264	0.283	Data Appear Normal			
1021	Lilliefors (NDs = DL/2)				0.292	0.283	Data Not Normal			
1022	Lilliefors (Normal ROS Estimates)				0.231	0.283	Data Appear Normal			
1023										
1024	Gamma GOF Test Results									
1025										
1026					No NDs	NDs = DL	NDs = DL/2	Gamma ROS		
1027	Correlation Coefficient R				N/A	N/A	N/A	N/A		
1028										
1029					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
1030	Anderson-Darling (Detects Only)				N/A	N/A				
1031	Kolmogorov-Smirnov (Detects Only)				N/A	N/A				
1032	Anderson-Darling (NDs = DL)				N/A	N/A				
1033	Kolmogorov-Smirnov (NDs = DL)				N/A	N/A				
1034	Anderson-Darling (NDs = DL/2)				N/A	N/A				
1035	Kolmogorov-Smirnov (NDs = DL/2)				N/A	N/A				
1036	Anderson-Darling (Gamma ROS Estimates)				N/A	N/A				
1037	Kolmogorov-Smirnov (Gamma ROS Est.)				N/A	N/A				
1038										
1039	Note: Substitution methods such as DL or DL/2 are not recommended.									
1040										
1041	Sulfate (cbl - 301i)									
1042										
1043	Raw Statistics									
1044	Number of Valid Observations					8				
1045	Number of Distinct Observations					7				
1046	Minimum					311				
1047	Maximum					488				
1048	Mean of Raw Data					357.1				
1049	Standard Deviation of Raw Data					56.47				
1050	Khat					52.96				
1051	Theta hat					6.743				
1052	Kstar					33.18				
1053	Theta star					10.76				
1054	Mean of Log Transformed Data					5.869				
1055	Standard Deviation of Log Transformed Data					0.142				
1056										
1057	Normal GOF Test Results									
1058										
1059	Correlation Coefficient R					0.826				
1060	Shapiro Wilk Test Statistic					0.707				
1061	Shapiro Wilk Critical (0.05) Value					0.818				
1062	Approximate Shapiro Wilk P Value					0.00182				
1063	Lilliefors Test Statistic					0.356				
1064	Lilliefors Critical (0.05) Value					0.283				
1065	Data not Normal at (0.05) Significance Level									
1066										
1067	Gamma GOF Test Results									
1068										
1069	Correlation Coefficient R					0.856				

	A	B	C	D	E	F	G	H	I	J
1070					A-D Test Statistic	1.036				
1071					A-D Critical (0.05) Value	0.715				
1072					K-S Test Statistic	0.355				
1073					K-S Critical(0.05) Value	0.293				
1074	Data not Gamma Distributed at (0.05) Significance Level									
1075										
1076		Lognormal GOF Test Results								
1077										
1078					Correlation Coefficient R	0.852				
1079					Shapiro Wilk Test Statistic	0.75				
1080					Shapiro Wilk Critical (0.05) Value	0.818				
1081					Approximate Shapiro Wilk P Value	0.00533				
1082					Lilliefors Test Statistic	0.344				
1083					Lilliefors Critical (0.05) Value	0.283				
1084	Data not Lognormal at (0.05) Significance Level									
1085										
1086	Non-parametric GOF Test Results									
1087										
1088	Data do not follow a discernible distribution at (0.05) Level of Significance									
1089										
1090	Sulfate (cbl - 302i)									
1091										
1092		Raw Statistics								
1093					Number of Valid Observations	8				
1094					Number of Distinct Observations	8				
1095					Minimum	-56.17				
1096					Maximum	67.9				
1097					Mean of Raw Data	2.5000E-4				
1098					Standard Deviation of Raw Data	43.21				
1099						Data contains values <= 0				
1100						Data not gamma or lognormal				
1101										
1102		Normal GOF Test Results								
1103										
1104					Correlation Coefficient R	0.978				
1105					Shapiro Wilk Test Statistic	0.946				
1106					Shapiro Wilk Critical (0.05) Value	0.818				
1107					Approximate Shapiro Wilk P Value	0.776				
1108					Lilliefors Test Statistic	0.169				
1109					Lilliefors Critical (0.05) Value	0.283				
1110	Data appear Normal at (0.05) Significance Level									
1111										
1112	Sulfate (cbl - 306i)									
1113										
1114		Raw Statistics								
1115					Number of Valid Observations	8				
1116					Number of Distinct Observations	8				
1117					Minimum	-153.3				
1118					Maximum	145.8				
1119					Mean of Raw Data	-0.004				
1120					Standard Deviation of Raw Data	109.8				
1121						Data contains values <= 0				
1122						Data not gamma or lognormal				
1123										
1124		Normal GOF Test Results								
1125										
1126					Correlation Coefficient R	0.978				
1127					Shapiro Wilk Test Statistic	0.938				
1128					Shapiro Wilk Critical (0.05) Value	0.818				
1129					Approximate Shapiro Wilk P Value	0.764				
1130					Lilliefors Test Statistic	0.157				
1131					Lilliefors Critical (0.05) Value	0.283				
1132	Data appear Normal at (0.05) Significance Level									
1133										
1134	Sulfate (cbl - 308i)									
1135										
1136		Raw Statistics								

	A	B	C	D	E	F	G	H	I	J
1137	Number of Valid Observations					8				
1138	Number of Distinct Observations					6				
1139	Minimum					1320				
1140	Maximum					1580				
1141	Mean of Raw Data					1483				
1142	Standard Deviation of Raw Data					84.98				
1143	Khat					337.2				
1144	Theta hat					4.396				
1145	Kstar					210.8				
1146	Theta star					7.031				
1147	Mean of Log Transformed Data					7.3				
1148	Standard Deviation of Log Transformed Data					0.0587				
1149										
1150	**Normal GOF Test Results**									
1151										
1152	Correlation Coefficient R					0.958				
1153	Shapiro Wilk Test Statistic					0.919				
1154	Shapiro Wilk Critical (0.05) Value					0.818				
1155	Approximate Shapiro Wilk P Value					0.416				
1156	Lilliefors Test Statistic					0.192				
1157	Lilliefors Critical (0.05) Value					0.283				
1158	**Data appear Normal at (0.05) Significance Level**									
1159										
1160	**Gamma GOF Test Results**									
1161										
1162	Correlation Coefficient R					0.952				
1163	A-D Test Statistic					0.379				
1164	A-D Critical (0.05) Value					0.715				
1165	K-S Test Statistic					0.195				
1166	K-S Critical(0.05) Value					0.294				
1167	**Data appear Gamma Distributed at (0.05) Significance Level**									
1168										
1169	**Lognormal GOF Test Results**									
1170										
1171	Correlation Coefficient R					0.951				
1172	Shapiro Wilk Test Statistic					0.908				
1173	Shapiro Wilk Critical (0.05) Value					0.818				
1174	Approximate Shapiro Wilk P Value					0.326				
1175	Lilliefors Test Statistic					0.203				
1176	Lilliefors Critical (0.05) Value					0.283				
1177	**Data appear Lognormal at (0.05) Significance Level**									
1178										
1179	**Sulfate (cbl - 340i)**									
1180										
1181	**Raw Statistics**									
1182	Number of Valid Observations					8				
1183	Number of Distinct Observations					8				
1184	Minimum					571				
1185	Maximum					715				
1186	Mean of Raw Data					652.1				
1187	Standard Deviation of Raw Data					44.7				
1188	Khat					237.1				
1189	Theta hat					2.75				
1190	Kstar					148.3				
1191	Theta star					4.398				
1192	Mean of Log Transformed Data					6.478				
1193	Standard Deviation of Log Transformed Data					0.0699				
1194										
1195	**Normal GOF Test Results**									
1196										
1197	Correlation Coefficient R					0.985				
1198	Shapiro Wilk Test Statistic					0.976				
1199	Shapiro Wilk Critical (0.05) Value					0.818				
1200	Approximate Shapiro Wilk P Value					0.9				
1201	Lilliefors Test Statistic					0.139				
1202	Lilliefors Critical (0.05) Value					0.283				
1203	**Data appear Normal at (0.05) Significance Level**									

Gamma GOF Test Results

Correlation Coefficient R	0.981
A-D Test Statistic	0.206
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.153
K-S Critical(0.05) Value	0.294

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.978
Shapiro Wilk Test Statistic	0.965
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.796
Lilliefors Test Statistic	0.146
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

Sulfate (cbl - 341i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	307
Maximum	419
Mean of Raw Data	362.3
Standard Deviation of Raw Data	36.02
Khat	116.1
Theta hat	3.12
Kstar	72.66
Theta star	4.986
Mean of Log Transformed Data	5.888
Standard Deviation of Log Transformed Data	0.0993

Normal GOF Test Results

Correlation Coefficient R	0.984
Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.883
Lilliefors Test Statistic	0.176
Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.986
A-D Test Statistic	0.209
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.159
K-S Critical(0.05) Value	0.294

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.986
Shapiro Wilk Test Statistic	0.974
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.916
Lilliefors Test Statistic	0.159
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

pH (cbl - 301i)

	A	B	C	D	E	F	G	H	I	J
1271	Raw Statistics									
1272	Number of Valid Observations					8				
1273	Number of Distinct Observations					6				
1274	Minimum					5.95				
1275	Maximum					6.33				
1276	Mean of Raw Data					6.164				
1277	Standard Deviation of Raw Data					0.162				
1278	Khat					1639				
1279	Theta hat					0.00376				
1280	Kstar					1025				
1281	Theta star					0.00602				
1282	Mean of Log Transformed Data					1.818				
1283	Standard Deviation of Log Transformed Data					0.0265				
1284										
1285	Normal GOF Test Results									
1286										
1287	Correlation Coefficient R					0.919				
1288	Shapiro Wilk Test Statistic					0.816				
1289	Shapiro Wilk Critical (0.05) Value					0.818				
1290	Approximate Shapiro Wilk P Value					0.0783				
1291	Lilliefors Test Statistic					0.284				
1292	Lilliefors Critical (0.05) Value					0.283				
1293	Data not Normal at (0.05) Significance Level									
1294										
1295	Gamma GOF Test Results									
1296										
1297	Correlation Coefficient R					0.914				
1298	A-D Test Statistic					0.778				
1299	A-D Critical (0.05) Value					0.715				
1300	K-S Test Statistic					0.296				
1301	K-S Critical(0.05) Value					0.294				
1302	Data not Gamma Distributed at (0.05) Significance Level									
1303										
1304	Lognormal GOF Test Results									
1305										
1306	Correlation Coefficient R					0.917				
1307	Shapiro Wilk Test Statistic					0.814				
1308	Shapiro Wilk Critical (0.05) Value					0.818				
1309	Approximate Shapiro Wilk P Value					0.0744				
1310	Lilliefors Test Statistic					0.286				
1311	Lilliefors Critical (0.05) Value					0.283				
1312	Data not Lognormal at (0.05) Significance Level									
1313										
1314	Non-parametric GOF Test Results									
1315										
1316	Data do not follow a discernible distribution at (0.05) Level of Significance									
1317										
1318	pH (cbl - 302i)									
1319										
1320	Raw Statistics									
1321	Number of Valid Observations					8				
1322	Number of Distinct Observations					8				
1323	Minimum					4.94				
1324	Maximum					7.75				
1325	Mean of Raw Data					5.89				
1326	Standard Deviation of Raw Data					0.9				
1327	Khat					52.92				
1328	Theta hat					0.111				
1329	Kstar					33.16				
1330	Theta star					0.178				
1331	Mean of Log Transformed Data					1.764				
1332	Standard Deviation of Log Transformed Data					0.145				
1333										
1334	Normal GOF Test Results									
1335										
1336	Correlation Coefficient R					0.934				
1337	Shapiro Wilk Test Statistic					0.881				

	A	B	C	D	E	F	G	H	I	J
1338					Shapiro Wilk Critical (0.05) Value	0.818				
1339					Approximate Shapiro Wilk P Value	0.166				
1340					Lilliefors Test Statistic	0.207				
1341					Lilliefors Critical (0.05) Value	0.283				
1342	Data appear Normal at (0.05) Significance Level									
1343										
1344	**Gamma GOF Test Results**									
1345										
1346					Correlation Coefficient R	0.951				
1347					A-D Test Statistic	0.39				
1348					A-D Critical (0.05) Value	0.715				
1349					K-S Test Statistic	0.218				
1350					K-S Critical(0.05) Value	0.293				
1351	Data appear Gamma Distributed at (0.05) Significance Level									
1352										
1353	**Lognormal GOF Test Results**									
1354										
1355					Correlation Coefficient R	0.954				
1356					Shapiro Wilk Test Statistic	0.915				
1357					Shapiro Wilk Critical (0.05) Value	0.818				
1358					Approximate Shapiro Wilk P Value	0.364				
1359					Lilliefors Test Statistic	0.204				
1360					Lilliefors Critical (0.05) Value	0.283				
1361	Data appear Lognormal at (0.05) Significance Level									
1362										
1363	pH (cbl - 306i)									
1364										
1365	**Raw Statistics**									
1366					Number of Valid Observations	8				
1367					Number of Distinct Observations	8				
1368					Minimum	4.41				
1369					Maximum	7.29				
1370					Mean of Raw Data	6.463				
1371					Standard Deviation of Raw Data	0.971				
1372					Khat	43.28				
1373					Theta hat	0.149				
1374					Kstar	27.14				
1375					Theta star	0.238				
1376					Mean of Log Transformed Data	1.854				
1377					Standard Deviation of Log Transformed Data	0.17				
1378										
1379	**Normal GOF Test Results**									
1380										
1381					Correlation Coefficient R	0.877				
1382					Shapiro Wilk Test Statistic	0.78				
1383					Shapiro Wilk Critical (0.05) Value	0.818				
1384					Approximate Shapiro Wilk P Value	0.0148				
1385					Lilliefors Test Statistic	0.343				
1386					Lilliefors Critical (0.05) Value	0.283				
1387	Data not Normal at (0.05) Significance Level									
1388										
1389	**Gamma GOF Test Results**									
1390										
1391					Correlation Coefficient R	0.85				
1392					A-D Test Statistic	0.967				
1393					A-D Critical (0.05) Value	0.715				
1394					K-S Test Statistic	0.36				
1395					K-S Critical(0.05) Value	0.294				
1396	Data not Gamma Distributed at (0.05) Significance Level									
1397										
1398	**Lognormal GOF Test Results**									
1399										
1400					Correlation Coefficient R	0.854				
1401					Shapiro Wilk Test Statistic	0.743				
1402					Shapiro Wilk Critical (0.05) Value	0.818				
1403					Approximate Shapiro Wilk P Value	0.00569				
1404					Lilliefors Test Statistic	0.357				

1405	Lilliefors Critical (0.05) Value	0.283
1406	Data not Lognormal at (0.05) Significance Level	
1407		
1408	Non-parametric GOF Test Results	
1409		
1410	Data do not follow a discernible distribution at (0.05) Level of Significance	
1411		
1412	pH (cbl - 308i)	
1413		
1414	Raw Statistics	
1415	Number of Valid Observations	8
1416	Number of Distinct Observations	6
1417	Minimum	5.54
1418	Maximum	6.83
1419	Mean of Raw Data	6.203
1420	Standard Deviation of Raw Data	0.366
1421	Khat	323.9
1422	Theta hat	0.0192
1423	Kstar	202.5
1424	Theta star	0.0306
1425	Mean of Log Transformed Data	1.823
1426	Standard Deviation of Log Transformed Data	0.0596
1427		
1428	Normal GOF Test Results	
1429		
1430	Correlation Coefficient R	0.949
1431	Shapiro Wilk Test Statistic	0.93
1432	Shapiro Wilk Critical (0.05) Value	0.818
1433	Approximate Shapiro Wilk P Value	0.323
1434	Lilliefors Test Statistic	0.209
1435	Lilliefors Critical (0.05) Value	0.283
1436	Data appear Normal at (0.05) Significance Level	
1437		
1438	Gamma GOF Test Results	
1439		
1440	Correlation Coefficient R	0.951
1441	A-D Test Statistic	0.436
1442	A-D Critical (0.05) Value	0.715
1443	K-S Test Statistic	0.21
1444	K-S Critical(0.05) Value	0.294
1445	Data appear Gamma Distributed at (0.05) Significance Level	
1446		
1447	Lognormal GOF Test Results	
1448		
1449	Correlation Coefficient R	0.947
1450	Shapiro Wilk Test Statistic	0.925
1451	Shapiro Wilk Critical (0.05) Value	0.818
1452	Approximate Shapiro Wilk P Value	0.297
1453	Lilliefors Test Statistic	0.207
1454	Lilliefors Critical (0.05) Value	0.283
1455	Data appear Lognormal at (0.05) Significance Level	
1456		
1457	pH (cbl - 340i)	
1458		
1459	Raw Statistics	
1460	Number of Valid Observations	8
1461	Number of Distinct Observations	8
1462	Minimum	5.46
1463	Maximum	6.95
1464	Mean of Raw Data	6.241
1465	Standard Deviation of Raw Data	0.466
1466	Khat	201.2
1467	Theta hat	0.031
1468	Kstar	125.8
1469	Theta star	0.0496
1470	Mean of Log Transformed Data	1.829
1471	Standard Deviation of Log Transformed Data	0.0758

1472		
1473	Normal GOF Test Results	
1474		
1475	Correlation Coefficient R	0.982
1476	Shapiro Wilk Test Statistic	0.97
1477	Shapiro Wilk Critical (0.05) Value	0.818
1478	Approximate Shapiro Wilk P Value	0.857
1479	Lilliefors Test Statistic	0.156
1480	Lilliefors Critical (0.05) Value	0.283
1481	Data appear Normal at (0.05) Significance Level	
1482		
1483	Gamma GOF Test Results	
1484		
1485	Correlation Coefficient R	0.98
1486	A-D Test Statistic	0.249
1487	A-D Critical (0.05) Value	0.715
1488	K-S Test Statistic	0.165
1489	K-S Critical(0.05) Value	0.294
1490	Data appear Gamma Distributed at (0.05) Significance Level	
1491		
1492	Lognormal GOF Test Results	
1493		
1494	Correlation Coefficient R	0.978
1495	Shapiro Wilk Test Statistic	0.963
1496	Shapiro Wilk Critical (0.05) Value	0.818
1497	Approximate Shapiro Wilk P Value	0.79
1498	Lilliefors Test Statistic	0.169
1499	Lilliefors Critical (0.05) Value	0.283
1500	Data appear Lognormal at (0.05) Significance Level	
1501		
1502	pH (cbl - 341i)	
1503		
1504	Raw Statistics	
1505	Number of Valid Observations	8
1506	Number of Distinct Observations	8
1507	Minimum	5.23
1508	Maximum	6.21
1509	Mean of Raw Data	5.808
1510	Standard Deviation of Raw Data	0.342
1511	Khat	326.2
1512	Theta hat	0.0178
1513	Kstar	204
1514	Theta star	0.0285
1515	Mean of Log Transformed Data	1.758
1516	Standard Deviation of Log Transformed Data	0.0594
1517		
1518	Normal GOF Test Results	
1519		
1520	Correlation Coefficient R	0.962
1521	Shapiro Wilk Test Statistic	0.917
1522	Shapiro Wilk Critical (0.05) Value	0.818
1523	Approximate Shapiro Wilk P Value	0.474
1524	Lilliefors Test Statistic	0.203
1525	Lilliefors Critical (0.05) Value	0.283
1526	Data appear Normal at (0.05) Significance Level	
1527		
1528	Gamma GOF Test Results	
1529		
1530	Correlation Coefficient R	0.958
1531	A-D Test Statistic	0.393
1532	A-D Critical (0.05) Value	0.715
1533	K-S Test Statistic	0.201
1534	K-S Critical(0.05) Value	0.294
1535	Data appear Gamma Distributed at (0.05) Significance Level	
1536		
1537	Lognormal GOF Test Results	
1538		

	A	B	C	D	E	F	G	H	I	J
1539	Correlation Coefficient R					0.96				
1540	Shapiro Wilk Test Statistic					0.915				
1541	Shapiro Wilk Critical (0.05) Value					0.818				
1542	Approximate Shapiro Wilk P Value					0.451				
1543	Lilliefors Test Statistic					0.193				
1544	Lilliefors Critical (0.05) Value					0.283				
1545	**Data appear Lognormal at (0.05) Significance Level**									

Goodness-of-Fit Test Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.112/2/2017 9:07:28 PM
From File	DetectionMonitoring_ProUCLUploadDeTrendResiduals_11272017_a.xls
Full Precision	OFF
Confidence Coefficient	0.95

LnB (cbl - 301i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable LnB (cbl - 301i) was not processed!

LnB (cbl - 302i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	2	6	75.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	6	-2.996	-2.996	-2.996	-2.996	0
Statistics (Non-Detects Only)	2	-1.858	-1.214	-1.536	-1.536	0.455
Statistics (All: NDs treated as DL value)	8	-2.996	-1.214	-2.631	-2.996	0.697
Statistics (All: NDs treated as DL/2 value)	8	N/A	N/A	N/A	N/A	N/A
Statistics (Normal ROS Imputed Data)	8	-5.281	-1.214	-3.332	-3.427	1.361

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	1	0.776	0.82	0.995

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (NDs = DL)	0.608	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.725	0.818	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.983	0.818	Data Appear Normal
Lilliefors (Detects Only)	N/A	N/A	
Lilliefors (NDs = DL)	0.45	0.283	Data Not Normal
Lilliefors (NDs = DL/2)	0.397	0.283	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.111	0.283	Data Appear Normal

Gamma GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Gamma ROS
Correlation Coefficient R	N/A	N/A	N/A	N/A

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	N/A	N/A	
Kolmogorov-Smirnov (Detects Only)	N/A	N/A	
Anderson-Darling (NDs = DL)	N/A	N/A	
Kolmogorov-Smirnov (NDs = DL)	N/A	N/A	
Anderson-Darling (NDs = DL/2)	N/A	N/A	
Kolmogorov-Smirnov (NDs = DL/2)	N/A	N/A	
nderson-Darling (Gamma ROS Estimates)	N/A	N/A	
Kolmogorov-Smirnov (Gamma ROS Est.)	N/A	N/A	

Note: Substitution methods such as DL or DL/2 are not recommended.

LnB (cbl - 306i)

	A	B	C	D	E	F	G	H	I	J	K	L
66					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
67	Raw Statistics				8	0	8	6	2	25.00%		
68												
69					Number	Minimum	Maximum	Mean	Median	SD		
70	Statistics (Non-Detects Only)				2	-2.996	-2.996	-2.996	-2.996	0		
71	Statistics (Non-Detects Only)				6	-2.936	-2.087	-2.556	-2.561	0.331		
72	Statistics (All: NDs treated as DL value)				8	-2.996	-2.087	-2.666	-2.762	0.346		
73	Statistics (All: NDs treated as DL/2 value)				8	N/A	N/A	N/A	N/A	N/A		
74	Statistics (Normal ROS Imputed Data)				8	-3.535	-2.087	-2.772	-2.762	0.492		
75												
76	**Normal GOF Test Results**											
77												
78					No NDs	NDs = DL	NDs = DL/2	Normal ROS				
79	Correlation Coefficient R				0.984	0.951	0.962	0.992				
80												
81					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
82	Shapiro-Wilk (Detects Only)				0.951	0.788	Data Appear Normal					
83	Shapiro-Wilk (NDs = DL)				0.884	0.818	Data Appear Normal					
84	Shapiro-Wilk (NDs = DL/2)				0.899	0.818	Data Appear Normal					
85	Shapiro-Wilk (Normal ROS Estimates)				0.975	0.818	Data Appear Normal					
86	Lilliefors (Detects Only)				0.176	0.325	Data Appear Normal					
87	Lilliefors (NDs = DL)				0.241	0.283	Data Appear Normal					
88	Lilliefors (NDs = DL/2)				0.17	0.283	Data Appear Normal					
89	Lilliefors (Normal ROS Estimates)				0.12	0.283	Data Appear Normal					
90												
91	**Gamma GOF Test Results**											
92												
93					No NDs	NDs = DL	NDs = DL/2	Gamma ROS				
94	Correlation Coefficient R				N/A	N/A	N/A	N/A				
95												
96					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
97	Anderson-Darling (Detects Only)				N/A	N/A						
98	Kolmogorov-Smirnov (Detects Only)				N/A	N/A						
99	Anderson-Darling (NDs = DL)				N/A	N/A						
100	Kolmogorov-Smirnov (NDs = DL)				N/A	N/A						
101	Anderson-Darling (NDs = DL/2)				N/A	N/A						
102	Kolmogorov-Smirnov (NDs = DL/2)				N/A	N/A						
103	nderson-Darling (Gamma ROS Estimates)				N/A	N/A						
104	Kolmogorov-Smirnov (Gamma ROS Est.)				N/A	N/A						
105												
106	**Note: Substitution methods such as DL or DL/2 are not recommended.**											
107												
108	**LnB (cbl - 308i)**											
109												
110					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
111	Raw Statistics				8	0	8	6	2	25.00%		
112												
113					Number	Minimum	Maximum	Mean	Median	SD		
114	Statistics (Non-Detects Only)				2	-2.996	-2.996	-2.996	-2.996	0		
115	Statistics (Non-Detects Only)				6	-2.527	-0.607	-1.751	-1.897	0.695		
116	Statistics (All: NDs treated as DL value)				8	-2.996	-0.607	-2.062	-2.164	0.823		
117	Statistics (All: NDs treated as DL/2 value)				8	N/A	N/A	N/A	N/A	N/A		
118	Statistics (Normal ROS Imputed Data)				8	-3.793	-0.607	-2.201	-2.164	1.027		
119												
120	**Normal GOF Test Results**											
121												
122					No NDs	NDs = DL	NDs = DL/2	Normal ROS				
123	Correlation Coefficient R				0.973	0.977	0.974	0.993				
124												
125					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
126	Shapiro-Wilk (Detects Only)				0.947	0.788	Data Appear Normal					
127	Shapiro-Wilk (NDs = DL)				0.945	0.818	Data Appear Normal					
128	Shapiro-Wilk (NDs = DL/2)				0.957	0.818	Data Appear Normal					
129	Shapiro-Wilk (Normal ROS Estimates)				0.984	0.818	Data Appear Normal					
130	Lilliefors (Detects Only)				0.198	0.325	Data Appear Normal					
131	Lilliefors (NDs = DL)				0.149	0.283	Data Appear Normal					
132	Lilliefors (NDs = DL/2)				0.168	0.283	Data Appear Normal					

	A	B	C	D	E	F	G	H	I	J	K	L
133	Lilliefors (Normal ROS Estimates)				0.126	0.283	Data Appear Normal					
134												
135	**Gamma GOF Test Results**											
136												
137					No NDs	NDs = DL	NDs = DL/2	Gamma ROS				
138	Correlation Coefficient R				N/A	N/A	N/A	N/A				
139												
140					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
141	Anderson-Darling (Detects Only)				N/A	N/A						
142	Kolmogorov-Smirnov (Detects Only)				N/A	N/A						
143	Anderson-Darling (NDs = DL)				N/A	N/A						
144	Kolmogorov-Smirnov (NDs = DL)				N/A	N/A						
145	Anderson-Darling (NDs = DL/2)				N/A	N/A						
146	Kolmogorov-Smirnov (NDs = DL/2)				N/A	N/A						
147	nderson-Darling (Gamma ROS Estimates)				N/A	N/A						
148	Kolmogorov-Smirnov (Gamma ROS Est.)				N/A	N/A						
149												
150	**Note: Substitution methods such as DL or DL/2 are not recommended.**											
151												
152	**LnB (cbl - 340i)**											
153												
154					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
155	Raw Statistics				8	0	8	6	2	25.00%		
156												
157					Number	Minimum	Maximum	Mean	Median	SD		
158	Statistics (Non-Detects Only)				2	-2.996	-2.996	-2.996	-2.996	0		
159	Statistics (Non-Detects Only)				6	-2.513	-1.749	-2.227	-2.375	0.347		
160	Statistics (All: NDs treated as DL value)				8	-2.996	-1.749	-2.419	-2.496	0.461		
161	Statistics (All: NDs treated as DL/2 value)				8	N/A	N/A	N/A	N/A	N/A		
162	Statistics (Normal ROS Imputed Data)				8	-3.2	-1.749	-2.441	-2.496	0.497		
163												
164	**Normal GOF Test Results**											
165												
166					No NDs	NDs = DL	NDs = DL/2	Normal ROS				
167	Correlation Coefficient R				0.912	0.962	0.936	0.975				
168												
169					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
170	Shapiro-Wilk (Detects Only)				0.805	0.788	Data Appear Normal					
171	Shapiro-Wilk (NDs = DL)				0.909	0.818	Data Appear Normal					
172	Shapiro-Wilk (NDs = DL/2)				0.841	0.818	Data Appear Normal					
173	Shapiro-Wilk (Normal ROS Estimates)				0.944	0.818	Data Appear Normal					
174	Lilliefors (Detects Only)				0.272	0.325	Data Appear Normal					
175	Lilliefors (NDs = DL)				0.183	0.283	Data Appear Normal					
176	Lilliefors (NDs = DL/2)				0.213	0.283	Data Appear Normal					
177	Lilliefors (Normal ROS Estimates)				0.193	0.283	Data Appear Normal					
178												
179	**Gamma GOF Test Results**											
180												
181					No NDs	NDs = DL	NDs = DL/2	Gamma ROS				
182	Correlation Coefficient R				N/A	N/A	N/A	N/A				
183												
184					Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
185	Anderson-Darling (Detects Only)				N/A	N/A						
186	Kolmogorov-Smirnov (Detects Only)				N/A	N/A						
187	Anderson-Darling (NDs = DL)				N/A	N/A						
188	Kolmogorov-Smirnov (NDs = DL)				N/A	N/A						
189	Anderson-Darling (NDs = DL/2)				N/A	N/A						
190	Kolmogorov-Smirnov (NDs = DL/2)				N/A	N/A						
191	nderson-Darling (Gamma ROS Estimates)				N/A	N/A						
192	Kolmogorov-Smirnov (Gamma ROS Est.)				N/A	N/A						
193												
194	**Note: Substitution methods such as DL or DL/2 are not recommended.**											
195												
196	**LnB (cbl - 341i)**											
197												
198					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
199	Raw Statistics				8	0	8	4	4	50.00%		

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	4	-2.996	-2.996	-2.996	-2.996	0
Statistics (Non-Detects Only)	4	-2.982	-2.412	-2.734	-2.771	0.242
Statistics (All: NDs treated as DL value)	8	-2.996	-2.412	-2.865	-2.989	0.211
Statistics (All: NDs treated as DL/2 value)	8	N/A	N/A	N/A	N/A	N/A
Statistics (Normal ROS Imputed Data)	8	-3.828	-2.412	-3.129	-3.125	0.478

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.983	0.843	0.899	0.995

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.97	0.748	Data Appear Normal
Shapiro-Wilk (NDs = DL)	0.716	0.818	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.776	0.818	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.981	0.818	Data Appear Normal
Lilliefors (Detects Only)	0.204	0.375	Data Appear Normal
Lilliefors (NDs = DL)	0.335	0.283	Data Not Normal
Lilliefors (NDs = DL/2)	0.318	0.283	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.121	0.283	Data Appear Normal

Gamma GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Gamma ROS
Correlation Coefficient R	N/A	N/A	N/A	N/A

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	N/A	N/A	
Kolmogorov-Smirnov (Detects Only)	N/A	N/A	
Anderson-Darling (NDs = DL)	N/A	N/A	
Kolmogorov-Smirnov (NDs = DL)	N/A	N/A	
Anderson-Darling (NDs = DL/2)	N/A	N/A	
Kolmogorov-Smirnov (NDs = DL/2)	N/A	N/A	
nderson-Darling (Gamma ROS Estimates)	N/A	N/A	
Kolmogorov-Smirnov (Gamma ROS Est.)	N/A	N/A	

Note: Substitution methods such as DL or DL/2 are not recommended.

LnCa (cbl - 301i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	0	8	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable LnCa (cbl - 301i) was not processed!

LnCa (cbl - 302i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	6
Minimum	6.918
Maximum	7.003
Mean of Raw Data	6.964
Standard Deviation of Raw Data	0.0337
Khat	48899
Theta hat	1.4242E-4

Kstar	30562
Theta star	2.2788E-4
Mean of Log Transformed Data	1.941
Standard Deviation of Log Transformed Data	0.00483

Normal GOF Test Results

Correlation Coefficient R	0.956
Shapiro Wilk Test Statistic	0.888
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.363
Lilliefors Test Statistic	0.197
Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.953
A-D Test Statistic	1.27
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.366
K-S Critical(0.05) Value	0.294

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.956
Shapiro Wilk Test Statistic	0.888
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.364
Lilliefors Test Statistic	0.197
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

LnCa (cbl - 306i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	0	8	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable LnCa (cbl - 306i) was not processed!

LnCa (cbl - 308i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	6.768
Maximum	6.861
Mean of Raw Data	6.819
Standard Deviation of Raw Data	0.0339
Khat	46153
Theta hat	1.4774E-4
Kstar	28846
Theta star	2.3638E-4
Mean of Log Transformed Data	1.92
Standard Deviation of Log Transformed Data	0.00498

Normal GOF Test Results

	A	B	C	D	E	F	G	H	I	J	K	L
329	Correlation Coefficient R					0.98						
330	Shapiro Wilk Test Statistic					0.94						
331	Shapiro Wilk Critical (0.05) Value					0.818						
332	Approximate Shapiro Wilk P Value					0.794						
333	Lilliefors Test Statistic					0.156						
334	Lilliefors Critical (0.05) Value					0.283						
335	**Data appear Normal at (0.05) Significance Level**											
336												
337	**Gamma GOF Test Results**											
338												
339	Correlation Coefficient R					0.978						
340	A-D Test Statistic					0.932						
341	A-D Critical (0.05) Value					0.715						
342	K-S Test Statistic					0.326						
343	K-S Critical(0.05) Value					0.294						
344	**Data not Gamma Distributed at (0.05) Significance Level**											
345												
346	**Lognormal GOF Test Results**											
347												
348	Correlation Coefficient R					0.98						
349	Shapiro Wilk Test Statistic					0.94						
350	Shapiro Wilk Critical (0.05) Value					0.818						
351	Approximate Shapiro Wilk P Value					0.791						
352	Lilliefors Test Statistic					0.156						
353	Lilliefors Critical (0.05) Value					0.283						
354	**Data appear Lognormal at (0.05) Significance Level**											
355												
356	**LnCa (cbl - 340i)**											
357												
358	**Raw Statistics**											
359	Number of Valid Observations					8						
360	Number of Distinct Observations					8						
361	Minimum					6.328						
362	Maximum					6.441						
363	Mean of Raw Data					6.369						
364	Standard Deviation of Raw Data					0.0383						
365	Khat					31679						
366	Theta hat					2.0103E-4						
367	Kstar					19800						
368	Theta star					3.2165E-4						
369	Mean of Log Transformed Data					1.851						
370	Standard Deviation of Log Transformed Data					0.006						
371												
372	**Normal GOF Test Results**											
373												
374	Correlation Coefficient R					0.949						
375	Shapiro Wilk Test Statistic					0.9						
376	Shapiro Wilk Critical (0.05) Value					0.818						
377	Approximate Shapiro Wilk P Value					0.302						
378	Lilliefors Test Statistic					0.237						
379	Lilliefors Critical (0.05) Value					0.283						
380	**Data appear Normal at (0.05) Significance Level**											
381												
382	**Gamma GOF Test Results**											
383												
384	Correlation Coefficient R					0.95						
385	A-D Test Statistic					1.469						
386	A-D Critical (0.05) Value					0.715						
387	K-S Test Statistic					0.418						
388	K-S Critical(0.05) Value					0.294						
389	**Data not Gamma Distributed at (0.05) Significance Level**											
390												
391	**Lognormal GOF Test Results**											
392												
393	Correlation Coefficient R					0.95						
394	Shapiro Wilk Test Statistic					0.901						

	A	B	C	D	E	F	G	H	I	J	K	L
395					Shapiro Wilk Critical (0.05) Value	0.818						
396					Approximate Shapiro Wilk P Value	0.311						
397					Lilliefors Test Statistic	0.235						
398					Lilliefors Critical (0.05) Value	0.283						
399	**Data appear Lognormal at (0.05) Significance Level**											
400												
401	**LnCa (cbl - 341i)**											
402												
403	**Raw Statistics**											
404					Number of Valid Observations	8						
405					Number of Distinct Observations	8						
406					Minimum	6.72						
407					Maximum	6.856						
408					Mean of Raw Data	6.776						
409					Standard Deviation of Raw Data	0.0438						
410					Khat	27364						
411					Theta hat	2.4761E-4						
412					Kstar	17103						
413					Theta star	3.9617E-4						
414					Mean of Log Transformed Data	1.913						
415					Standard Deviation of Log Transformed Data	0.00646						
416												
417	**Normal GOF Test Results**											
418												
419					Correlation Coefficient R	0.971						
420					Shapiro Wilk Test Statistic	0.945						
421					Shapiro Wilk Critical (0.05) Value	0.818						
422					Approximate Shapiro Wilk P Value	0.651						
423					Lilliefors Test Statistic	0.189						
424					Lilliefors Critical (0.05) Value	0.283						
425	**Data appear Normal at (0.05) Significance Level**											
426												
427	**Gamma GOF Test Results**											
428												
429					Correlation Coefficient R	0.972						
430					A-D Test Statistic	1.233						
431					A-D Critical (0.05) Value	0.715						
432					K-S Test Statistic	0.41						
433					K-S Critical(0.05) Value	0.294						
434	**Data not Gamma Distributed at (0.05) Significance Level**											
435												
436	**Lognormal GOF Test Results**											
437												
438					Correlation Coefficient R	0.972						
439					Shapiro Wilk Test Statistic	0.947						
440					Shapiro Wilk Critical (0.05) Value	0.818						
441					Approximate Shapiro Wilk P Value	0.662						
442					Lilliefors Test Statistic	0.188						
443					Lilliefors Critical (0.05) Value	0.283						
444	**Data appear Lognormal at (0.05) Significance Level**											
445												
446	**LnCl (cbl - 301i)**											
447												
448	**Raw Statistics**											
449					Number of Valid Observations	8						
450					Number of Distinct Observations	8						
451					Minimum	7.678						
452					Maximum	8.071						
453					Mean of Raw Data	7.792						
454					Standard Deviation of Raw Data	0.121						
455					Khat	4786						
456					Theta hat	0.00163						
457					Kstar	2991						
458					Theta star	0.00261						
459					Mean of Log Transformed Data	2.053						
460					Standard Deviation of Log Transformed Data	0.0154						
461												

Normal GOF Test Results

Correlation Coefficient R	0.867
Shapiro Wilk Test Statistic	0.777
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.01
Lilliefors Test Statistic	0.272
Lilliefors Critical (0.05) Value	0.283

Data appear Approximate Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.873
A-D Test Statistic	1.01
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.324
K-S Critical(0.05) Value	0.294

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.87
Shapiro Wilk Test Statistic	0.782
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.0116
Lilliefors Test Statistic	0.268
Lilliefors Critical (0.05) Value	0.283

Data appear Approximate_Lognormal at (0.05) Significance Level

LnCl (cbl - 302i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	7.621
Maximum	7.71
Mean of Raw Data	7.667
Standard Deviation of Raw Data	0.0346
Khat	55923
Theta hat	1.3710E-4
Kstar	34952
Theta star	2.1935E-4
Mean of Log Transformed Data	2.037
Standard Deviation of Log Transformed Data	0.00452

Normal GOF Test Results

Correlation Coefficient R	0.97
Shapiro Wilk Test Statistic	0.915
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.602
Lilliefors Test Statistic	0.174
Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.967
A-D Test Statistic	1.203
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.338
K-S Critical(0.05) Value	0.294

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.97

	A	B	C	D	E	F	G	H	I	J	K	L
529	Shapiro Wilk Test Statistic					0.915						
530	Shapiro Wilk Critical (0.05) Value					0.818						
531	Approximate Shapiro Wilk P Value					0.6						
532	Lilliefors Test Statistic					0.174						
533	Lilliefors Critical (0.05) Value					0.283						
534	Data appear Lognormal at (0.05) Significance Level											
535												
536	LnCl (cbl - 306i)											
537												
538					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
539	Raw Statistics				8	0	8	0	8	100.00%		
540												
541	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
542	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
543	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
544												
545	The data set for variable LnCl (cbl - 306i) was not processed!											
546												
547												
548												
549	LnCl (cbl - 308i)											
550												
551	Raw Statistics											
552	Number of Valid Observations					8						
553	Number of Distinct Observations					7						
554	Minimum					7.766						
555	Maximum					7.962						
556	Mean of Raw Data					7.884						
557	Standard Deviation of Raw Data					0.0623						
558	Khat					18235						
559	Theta hat					4.3238E-4						
560	Kstar					11397						
561	Theta star					6.9180E-4						
562	Mean of Log Transformed Data					2.065						
563	Standard Deviation of Log Transformed Data					0.00792						
564												
565	Normal GOF Test Results											
566												
567	Correlation Coefficient R					0.961						
568	Shapiro Wilk Test Statistic					0.93						
569	Shapiro Wilk Critical (0.05) Value					0.818						
570	Approximate Shapiro Wilk P Value					0.475						
571	Lilliefors Test Statistic					0.192						
572	Lilliefors Critical (0.05) Value					0.283						
573	Data appear Normal at (0.05) Significance Level											
574												
575	Gamma GOF Test Results											
576												
577	Correlation Coefficient R					0.961						
578	A-D Test Statistic					0.443						
579	A-D Critical (0.05) Value					0.715						
580	K-S Test Statistic					0.205						
581	K-S Critical(0.05) Value					0.294						
582	Data appear Gamma Distributed at (0.05) Significance Level											
583												
584	Lognormal GOF Test Results											
585												
586	Correlation Coefficient R					0.96						
587	Shapiro Wilk Test Statistic					0.928						
588	Shapiro Wilk Critical (0.05) Value					0.818						
589	Approximate Shapiro Wilk P Value					0.462						
590	Lilliefors Test Statistic					0.193						
591	Lilliefors Critical (0.05) Value					0.283						
592	Data appear Lognormal at (0.05) Significance Level											
593												

594	LnCl (cbl - 340i)	
595		
596	Raw Statistics	
597	Number of Valid Observations	8
598	Number of Distinct Observations	7
599	Minimum	7.635
600	Maximum	7.832
601	Mean of Raw Data	7.751
602	Standard Deviation of Raw Data	0.057
603	Khat	21056
604	Theta hat	3.6810E-4
605	Kstar	13160
606	Theta star	5.8895E-4
607	Mean of Log Transformed Data	2.048
608	Standard Deviation of Log Transformed Data	0.00737
609		
610	Normal GOF Test Results	
611		
612	Correlation Coefficient R	0.937
613	Shapiro Wilk Test Statistic	0.904
614	Shapiro Wilk Critical (0.05) Value	0.818
615	Approximate Shapiro Wilk P Value	0.197
616	Lilliefors Test Statistic	0.21
617	Lilliefors Critical (0.05) Value	0.283
618	Data appear Normal at (0.05) Significance Level	
619		
620	Gamma GOF Test Results	
621		
622	Correlation Coefficient R	0.94
623	A-D Test Statistic	0.456
624	A-D Critical (0.05) Value	0.715
625	K-S Test Statistic	0.212
626	K-S Critical(0.05) Value	0.294
627	Data appear Gamma Distributed at (0.05) Significance Level	
628		
629	Lognormal GOF Test Results	
630		
631	Correlation Coefficient R	0.936
632	Shapiro Wilk Test Statistic	0.902
633	Shapiro Wilk Critical (0.05) Value	0.818
634	Approximate Shapiro Wilk P Value	0.19
635	Lilliefors Test Statistic	0.21
636	Lilliefors Critical (0.05) Value	0.283
637	Data appear Lognormal at (0.05) Significance Level	
638		
639	LnCl (cbl - 341i)	
640		
641	Raw Statistics	
642	Number of Valid Observations	8
643	Number of Distinct Observations	8
644	Minimum	7.378
645	Maximum	7.601
646	Mean of Raw Data	7.504
647	Standard Deviation of Raw Data	0.0743
648	Khat	11622
649	Theta hat	6.4562E-4
650	Kstar	7264
651	Theta star	0.00103
652	Mean of Log Transformed Data	2.015
653	Standard Deviation of Log Transformed Data	0.00992
654		
655	Normal GOF Test Results	
656		
657	Correlation Coefficient R	0.986
658	Shapiro Wilk Test Statistic	0.967
659	Shapiro Wilk Critical (0.05) Value	0.818
660	Approximate Shapiro Wilk P Value	0.912

Lilliefors Test Statistic	0.12
Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.986
A-D Test Statistic	0.316
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.221
K-S Critical(0.05) Value	0.294

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.986
Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.908
Lilliefors Test Statistic	0.121
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

LnF (cbl - 301i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable LnF (cbl - 301i) was not processed!

LnF (cbl - 302i)

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	8	0	8	1	7	87.50%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable LnF (cbl - 302i) was not processed!

LnF (cbl - 306i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	0
Maximum	2.534
Mean of Raw Data	0.888
Standard Deviation of Raw Data	0.751

Data contains values <= 0

Data not gamma or lognormal

Normal GOF Test Results

Correlation Coefficient R	0.906
Shapiro Wilk Test Statistic	0.848

	A	B	C	D	E	F	G	H	I	J	K	L
724	Shapiro Wilk Critical (0.05) Value					0.818						
725	Approximate Shapiro Wilk P Value					0.054						
726	Lilliefors Test Statistic					0.28						
727	Lilliefors Critical (0.05) Value					0.283						
728	**Data appear Normal at (0.05) Significance Level**											
729												
730	**LnF (cbl - 308i)**											
731												
732	**Raw Statistics**											
733	Number of Valid Observations					8						
734	Number of Distinct Observations					8						
735	Minimum					0.285						
736	Maximum					2.203						
737	Mean of Raw Data					0.731						
738	Standard Deviation of Raw Data					0.617						
739	Khat					2.634						
740	Theta hat					0.278						
741	Kstar					1.73						
742	Theta star					0.423						
743	Mean of Log Transformed Data					-0.515						
744	Standard Deviation of Log Transformed Data					0.614						
745												
746	**Normal GOF Test Results**											
747												
748	Correlation Coefficient R					0.799						
749	Shapiro Wilk Test Statistic					0.666						
750	Shapiro Wilk Critical (0.05) Value					0.818						
751	Approximate Shapiro Wilk P Value					6.4279E-4						
752	Lilliefors Test Statistic					0.31						
753	Lilliefors Critical (0.05) Value					0.283						
754	**Data not Normal at (0.05) Significance Level**											
755												
756	**Gamma GOF Test Results**											
757												
758	Correlation Coefficient R					0.91						
759	A-D Test Statistic					0.717						
760	A-D Critical (0.05) Value					0.722						
761	K-S Test Statistic					0.249						
762	K-S Critical(0.05) Value					0.297						
763	**Data appear Gamma Distributed at (0.05) Significance Level**											
764												
765	**Lognormal GOF Test Results**											
766												
767	Correlation Coefficient R					0.931						
768	Shapiro Wilk Test Statistic					0.887						
769	Shapiro Wilk Critical (0.05) Value					0.818						
770	Approximate Shapiro Wilk P Value					0.15						
771	Lilliefors Test Statistic					0.204						
772	Lilliefors Critical (0.05) Value					0.283						
773	**Data appear Lognormal at (0.05) Significance Level**											
774												
775	**LnF (cbl - 340i)**											
776												
777	**Raw Statistics**											
778	Number of Valid Observations					8						
779	Number of Distinct Observations					8						
780	Minimum					-0.174						
781	Maximum					2.133						
782	Mean of Raw Data					0.354						
783	Standard Deviation of Raw Data					0.765						
784	**Data contains values <= 0**											
785	**Data not gamma or lognormal**											
786												
787	**Normal GOF Test Results**											
788												
789	Correlation Coefficient R					0.826						
790	Shapiro Wilk Test Statistic					0.701						

	A	B	C	D	E	F	G	H	I	J	K	L
791	Shapiro Wilk Critical (0.05) Value					0.818						
792	Approximate Shapiro Wilk P Value					0.00179						
793	Lilliefors Test Statistic					0.314						
794	Lilliefors Critical (0.05) Value					0.283						
795	Data not Normal at (0.05) Significance Level											
796												
797	Non-parametric GOF Test Results											
798												
799	Data do not follow a discernible distribution at (0.05) Level of Significance											
800												
801	LnF (cbl - 341i)											
802												
803					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
804	Raw Statistics				8	0	8	0	8	100.00%		
805												
806	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
807	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
808	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
809												
810	The data set for variable LnF (cbl - 341i) was not processed!											
811												
812												
813												
814	LnS (cbl - 301i)											
815												
816	Raw Statistics											
817	Number of Valid Observations					8						
818	Number of Distinct Observations					7						
819	Minimum					5.74						
820	Maximum					6.19						
821	Mean of Raw Data					5.869						
822	Standard Deviation of Raw Data					0.142						
823	Khat					2000						
824	Theta hat					0.00293						
825	Kstar					1250						
826	Theta star					0.00469						
827	Mean of Log Transformed Data					1.769						
828	Standard Deviation of Log Transformed Data					0.0238						
829												
830	Normal GOF Test Results											
831												
832	Correlation Coefficient R					0.852						
833	Shapiro Wilk Test Statistic					0.75						
834	Shapiro Wilk Critical (0.05) Value					0.818						
835	Approximate Shapiro Wilk P Value					0.00533						
836	Lilliefors Test Statistic					0.344						
837	Lilliefors Critical (0.05) Value					0.283						
838	Data not Normal at (0.05) Significance Level											
839												
840	Gamma GOF Test Results											
841												
842	Correlation Coefficient R					0.86						
843	A-D Test Statistic					0.992						
844	A-D Critical (0.05) Value					0.715						
845	K-S Test Statistic					0.355						
846	K-S Critical(0.05) Value					0.294						
847	Data not Gamma Distributed at (0.05) Significance Level											
848												
849	Lognormal GOF Test Results											
850												
851	Correlation Coefficient R					0.856						
852	Shapiro Wilk Test Statistic					0.757						
853	Shapiro Wilk Critical (0.05) Value					0.818						
854	Approximate Shapiro Wilk P Value					0.00638						
855	Lilliefors Test Statistic					0.342						

	A	B	C	D	E	F	G	H	I	J	K	L
856	Lilliefors Critical (0.05) Value					0.283						
857	Data not Lognormal at (0.05) Significance Level											
858												
859	Non-parametric GOF Test Results											
860												
861	Data do not follow a discernible distribution at (0.05) Level of Significance											
862												
863	LnS (cbl - 302i)											
864												
865					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
866	Raw Statistics				8	0	8	0	8	100.00%		
867												
868	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
869	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
870	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
871												
872	The data set for variable LnS (cbl - 302i) was not processed!											
873												
874												
875												
876	LnS (cbl - 306i)											
877												
878					Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
879	Raw Statistics				8	0	8	0	8	100.00%		
880												
881	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
882	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
883	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
884												
885	The data set for variable LnS (cbl - 306i) was not processed!											
886												
887												
888												
889	LnS (cbl - 308i)											
890												
891	Raw Statistics											
892	Number of Valid Observations					8						
893	Number of Distinct Observations					6						
894	Minimum					7.185						
895	Maximum					7.365						
896	Mean of Raw Data					7.3						
897	Standard Deviation of Raw Data					0.0587						
898	Khat					17597						
899	Theta hat					4.1484E-4						
900	Kstar					10998						
901	Theta star					6.6373E-4						
902	Mean of Log Transformed Data					1.988						
903	Standard Deviation of Log Transformed Data					0.00807						
904												
905	Normal GOF Test Results											
906												
907	Correlation Coefficient R					0.951						
908	Shapiro Wilk Test Statistic					0.908						
909	Shapiro Wilk Critical (0.05) Value					0.818						
910	Approximate Shapiro Wilk P Value					0.326						
911	Lilliefors Test Statistic					0.203						
912	Lilliefors Critical (0.05) Value					0.283						
913	Data appear Normal at (0.05) Significance Level											
914												
915	Gamma GOF Test Results											
916												
917	Correlation Coefficient R					0.951						
918	A-D Test Statistic					0.356						

	A	B	C	D	E	F	G	H	I	J	K	L
919	A-D Critical (0.05) Value					0.715						
920	K-S Test Statistic					0.174						
921	K-S Critical(0.05) Value					0.294						
922	**Data appear Gamma Distributed at (0.05) Significance Level**											
923												
924	**Lognormal GOF Test Results**											
925												
926	Correlation Coefficient R					0.95						
927	Shapiro Wilk Test Statistic					0.906						
928	Shapiro Wilk Critical (0.05) Value					0.818						
929	Approximate Shapiro Wilk P Value					0.314						
930	Lilliefors Test Statistic					0.204						
931	Lilliefors Critical (0.05) Value					0.283						
932	**Data appear Lognormal at (0.05) Significance Level**											
933												
934	**LnS (cbl - 340i)**											
935												
936	**Raw Statistics**											
937	Number of Valid Observations					8						
938	Number of Distinct Observations					8						
939	Minimum					6.347						
940	Maximum					6.572						
941	Mean of Raw Data					6.478						
942	Standard Deviation of Raw Data					0.0699						
943	Khat					9767						
944	Theta hat					6.6325E-4						
945	Kstar					6105						
946	Theta star					0.00106						
947	Mean of Log Transformed Data					1.868						
948	Standard Deviation of Log Transformed Data					0.0108						
949												
950	**Normal GOF Test Results**											
951												
952	Correlation Coefficient R					0.978						
953	Shapiro Wilk Test Statistic					0.965						
954	Shapiro Wilk Critical (0.05) Value					0.818						
955	Approximate Shapiro Wilk P Value					0.796						
956	Lilliefors Test Statistic					0.146						
957	Lilliefors Critical (0.05) Value					0.283						
958	**Data appear Normal at (0.05) Significance Level**											
959												
960	**Gamma GOF Test Results**											
961												
962	Correlation Coefficient R					0.979						
963	A-D Test Statistic					0.226						
964	A-D Critical (0.05) Value					0.715						
965	K-S Test Statistic					0.156						
966	K-S Critical(0.05) Value					0.294						
967	**Data appear Gamma Distributed at (0.05) Significance Level**											
968												
969	**Lognormal GOF Test Results**											
970												
971	Correlation Coefficient R					0.977						
972	Shapiro Wilk Test Statistic					0.963						
973	Shapiro Wilk Critical (0.05) Value					0.818						
974	Approximate Shapiro Wilk P Value					0.776						
975	Lilliefors Test Statistic					0.147						
976	Lilliefors Critical (0.05) Value					0.283						
977	**Data appear Lognormal at (0.05) Significance Level**											
978												
979	**LnS (cbl - 341i)**											
980												
981	**Raw Statistics**											
982	Number of Valid Observations					8						
983	Number of Distinct Observations					8						
984	Minimum					5.727						
985	Maximum					6.038						

	A	B	C	D	E	F	G	H	I	J	K	L
986	Mean of Raw Data					5.888						
987	Standard Deviation of Raw Data					0.0993						
988	Khat					4022						
989	Theta hat					0.00146						
990	Kstar					2514						
991	Theta star					0.00234						
992	Mean of Log Transformed Data					1.773						
993	Standard Deviation of Log Transformed Data					0.0169						
994												
995	Normal GOF Test Results											
996												
997	Correlation Coefficient R					0.986						
998	Shapiro Wilk Test Statistic					0.974						
999	Shapiro Wilk Critical (0.05) Value					0.818						
1000	Approximate Shapiro Wilk P Value					0.916						
1001	Lilliefors Test Statistic					0.159						
1002	Lilliefors Critical (0.05) Value					0.283						
1003	**Data appear Normal at (0.05) Significance Level**											
1004												
1005	Gamma GOF Test Results											
1006												
1007	Correlation Coefficient R					0.987						
1008	A-D Test Statistic					0.208						
1009	A-D Critical (0.05) Value					0.715						
1010	K-S Test Statistic					0.151						
1011	K-S Critical(0.05) Value					0.294						
1012	**Data appear Gamma Distributed at (0.05) Significance Level**											
1013												
1014	Lognormal GOF Test Results											
1015												
1016	Correlation Coefficient R					0.986						
1017	Shapiro Wilk Test Statistic					0.974						
1018	Shapiro Wilk Critical (0.05) Value					0.818						
1019	Approximate Shapiro Wilk P Value					0.917						
1020	Lilliefors Test Statistic					0.157						
1021	Lilliefors Critical (0.05) Value					0.283						
1022	**Data appear Lognormal at (0.05) Significance Level**											
1023												
1024	**LnTDS (cbl - 301i)**											
1025												
1026	Raw Statistics											
1027	Number of Valid Observations					8						
1028	Number of Distinct Observations					8						
1029	Minimum					8.364						
1030	Maximum					8.79						
1031	Mean of Raw Data					8.586						
1032	Standard Deviation of Raw Data					0.18						
1033	Khat					2607						
1034	Theta hat					0.00329						
1035	Kstar					1629						
1036	Theta star					0.00527						
1037	Mean of Log Transformed Data					2.15						
1038	Standard Deviation of Log Transformed Data					0.0209						
1039												
1040	Normal GOF Test Results											
1041												
1042	Correlation Coefficient R					0.945						
1043	Shapiro Wilk Test Statistic					0.86						
1044	Shapiro Wilk Critical (0.05) Value					0.818						
1045	Approximate Shapiro Wilk P Value					0.231						
1046	Lilliefors Test Statistic					0.242						
1047	Lilliefors Critical (0.05) Value					0.283						
1048	**Data appear Normal at (0.05) Significance Level**											
1049												
1050	Gamma GOF Test Results											
1051												
1052	Correlation Coefficient R					0.94						

1053	A-D Test Statistic	0.586
1054	A-D Critical (0.05) Value	0.715
1055	K-S Test Statistic	0.258
1056	K-S Critical(0.05) Value	0.294
1057	**Data appear Gamma Distributed at (0.05) Significance Level**	
1058		
1059	**Lognormal GOF Test Results**	
1060		
1061	Correlation Coefficient R	0.944
1062	Shapiro Wilk Test Statistic	0.86
1063	Shapiro Wilk Critical (0.05) Value	0.818
1064	Approximate Shapiro Wilk P Value	0.229
1065	Lilliefors Test Statistic	0.244
1066	Lilliefors Critical (0.05) Value	0.283
1067	**Data appear Lognormal at (0.05) Significance Level**	
1068		
1069	LnTDS (cbl - 302i)	
1070		
1071	**Raw Statistics**	
1072	Number of Valid Observations	8
1073	Number of Distinct Observations	8
1074	Minimum	8.345
1075	Maximum	8.832
1076	Mean of Raw Data	8.643
1077	Standard Deviation of Raw Data	0.157
1078	Khat	3443
1079	Theta hat	0.00251
1080	Kstar	2152
1081	Theta star	0.00402
1082	Mean of Log Transformed Data	2.157
1083	Standard Deviation of Log Transformed Data	0.0183
1084		
1085	**Normal GOF Test Results**	
1086		
1087	Correlation Coefficient R	0.968
1088	Shapiro Wilk Test Statistic	0.941
1089	Shapiro Wilk Critical (0.05) Value	0.818
1090	Approximate Shapiro Wilk P Value	0.602
1091	Lilliefors Test Statistic	0.164
1092	Lilliefors Critical (0.05) Value	0.283
1093	**Data appear Normal at (0.05) Significance Level**	
1094		
1095	**Gamma GOF Test Results**	
1096		
1097	Correlation Coefficient R	0.968
1098	A-D Test Statistic	0.274
1099	A-D Critical (0.05) Value	0.715
1100	K-S Test Statistic	0.179
1101	K-S Critical(0.05) Value	0.294
1102	**Data appear Gamma Distributed at (0.05) Significance Level**	
1103		
1104	**Lognormal GOF Test Results**	
1105		
1106	Correlation Coefficient R	0.967
1107	Shapiro Wilk Test Statistic	0.938
1108	Shapiro Wilk Critical (0.05) Value	0.818
1109	Approximate Shapiro Wilk P Value	0.569
1110	Lilliefors Test Statistic	0.164
1111	Lilliefors Critical (0.05) Value	0.283
1112	**Data appear Lognormal at (0.05) Significance Level**	
1113		
1114	LnTDS (cbl - 306i)	
1115		
1116	**Raw Statistics**	
1117	Number of Valid Observations	8
1118	Number of Distinct Observations	7
1119	Minimum	6.066

	A	B	C	D	E	F	G	H	I	J	K	L
1120	Maximum					7.286						
1121	Mean of Raw Data					6.98						
1122	Standard Deviation of Raw Data					0.417						
1123	Khat					301.4						
1124	Theta hat					0.0232						
1125	Kstar					188.4						
1126	Theta star					0.037						
1127	Mean of Log Transformed Data					1.941						
1128	Standard Deviation of Log Transformed Data					0.0626						
1129												
1130	**Normal GOF Test Results**											
1131												
1132	Correlation Coefficient R					0.857						
1133	Shapiro Wilk Test Statistic					0.745						
1134	Shapiro Wilk Critical (0.05) Value					0.818						
1135	Approximate Shapiro Wilk P Value					0.00624						
1136	Lilliefors Test Statistic					0.314						
1137	Lilliefors Critical (0.05) Value					0.283						
1138	Data not Normal at (0.05) Significance Level											
1139												
1140	**Gamma GOF Test Results**											
1141												
1142	Correlation Coefficient R					0.847						
1143	A-D Test Statistic					1.003						
1144	A-D Critical (0.05) Value					0.715						
1145	K-S Test Statistic					0.324						
1146	K-S Critical(0.05) Value					0.294						
1147	Data not Gamma Distributed at (0.05) Significance Level											
1148												
1149	**Lognormal GOF Test Results**											
1150												
1151	Correlation Coefficient R					0.848						
1152	Shapiro Wilk Test Statistic					0.732						
1153	Shapiro Wilk Critical (0.05) Value					0.818						
1154	Approximate Shapiro Wilk P Value					0.00433						
1155	Lilliefors Test Statistic					0.322						
1156	Lilliefors Critical (0.05) Value					0.283						
1157	Data not Lognormal at (0.05) Significance Level											
1158												
1159	Non-parametric GOF Test Results											
1160												
1161	Data do not follow a discernible distribution at (0.05) Level of Significance											
1162												
1163	LnTDS (cbl - 308i)											
1164												
1165	**Raw Statistics**											
1166	Number of Valid Observations					8						
1167	Number of Distinct Observations					8						
1168	Minimum					8.719						
1169	Maximum					9.23						
1170	Mean of Raw Data					8.923						
1171	Standard Deviation of Raw Data					0.188						
1172	Khat					2584						
1173	Theta hat					0.00345						
1174	Kstar					1615						
1175	Theta star					0.00552						
1176	Mean of Log Transformed Data					2.188						
1177	Standard Deviation of Log Transformed Data					0.021						
1178												
1179	**Normal GOF Test Results**											
1180												
1181	Correlation Coefficient R					0.948						
1182	Shapiro Wilk Test Statistic					0.885						
1183	Shapiro Wilk Critical (0.05) Value					0.818						
1184	Approximate Shapiro Wilk P Value					0.281						
1185	Lilliefors Test Statistic					0.194						

Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.949
A-D Test Statistic	0.51
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.212
K-S Critical(0.05) Value	0.294

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.95
Shapiro Wilk Test Statistic	0.888
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.3
Lilliefors Test Statistic	0.192
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

LnTDS (cbl - 340i)

Raw Statistics

Number of Valid Observations	8
Number of Distinct Observations	8
Minimum	8.493
Maximum	8.74
Mean of Raw Data	8.613
Standard Deviation of Raw Data	0.0919
Khat	10049
Theta hat	8.5713E-4
Kstar	6281
Theta star	0.00137
Mean of Log Transformed Data	2.153
Standard Deviation of Log Transformed Data	0.0107

Normal GOF Test Results

Correlation Coefficient R	0.973
Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.66
Lilliefors Test Statistic	0.161
Lilliefors Critical (0.05) Value	0.283

Data appear Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.971
A-D Test Statistic	0.598
A-D Critical (0.05) Value	0.715
K-S Test Statistic	0.29
K-S Critical(0.05) Value	0.294

Data appear Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.973
Shapiro Wilk Test Statistic	0.928
Shapiro Wilk Critical (0.05) Value	0.818
Approximate Shapiro Wilk P Value	0.669
Lilliefors Test Statistic	0.16
Lilliefors Critical (0.05) Value	0.283

Data appear Lognormal at (0.05) Significance Level

	A	B	C	D	E	F	G	H	I	J	K	L
1253	**LnTDS (cbl - 341i)**											
1254												
1255	**Raw Statistics**											
1256	Number of Valid Observations					8						
1257	Number of Distinct Observations					8						
1258	Minimum					8.331						
1259	Maximum					8.689						
1260	Mean of Raw Data					8.477						
1261	Standard Deviation of Raw Data					0.114						
1262	Khat					6315						
1263	Theta hat					0.00134						
1264	Kstar					3947						
1265	Theta star					0.00215						
1266	Mean of Log Transformed Data					2.137						
1267	Standard Deviation of Log Transformed Data					0.0134						
1268												
1269	**Normal GOF Test Results**											
1270												
1271	Correlation Coefficient R					0.97						
1272	Shapiro Wilk Test Statistic					0.945						
1273	Shapiro Wilk Critical (0.05) Value					0.818						
1274	Approximate Shapiro Wilk P Value					0.629						
1275	Lilliefors Test Statistic					0.17						
1276	Lilliefors Critical (0.05) Value					0.283						
1277	**Data appear Normal at (0.05) Significance Level**											
1278												
1279	**Gamma GOF Test Results**											
1280												
1281	Correlation Coefficient R					0.971						
1282	A-D Test Statistic					0.295						
1283	A-D Critical (0.05) Value					0.715						
1284	K-S Test Statistic					0.156						
1285	K-S Critical(0.05) Value					0.294						
1286	**Data appear Gamma Distributed at (0.05) Significance Level**											
1287												
1288	**Lognormal GOF Test Results**											
1289												
1290	Correlation Coefficient R					0.971						
1291	Shapiro Wilk Test Statistic					0.947						
1292	Shapiro Wilk Critical (0.05) Value					0.818						
1293	Approximate Shapiro Wilk P Value					0.648						
1294	Lilliefors Test Statistic					0.168						
1295	Lilliefors Critical (0.05) Value					0.283						
1296	**Data appear Lognormal at (0.05) Significance Level**											
1297												
1298	**LnpH (cbl - 301i)**											
1299												
1300	**Raw Statistics**											
1301	Number of Valid Observations					8						
1302	Number of Distinct Observations					6						
1303	Minimum					1.783						
1304	Maximum					1.845						
1305	Mean of Raw Data					1.818						
1306	Standard Deviation of Raw Data					0.0265						
1307	Khat					5375						
1308	Theta hat					3.3830E-4						
1309	Kstar					3359						
1310	Theta star					5.4127E-4						
1311	Mean of Log Transformed Data					0.598						
1312	Standard Deviation of Log Transformed Data					0.0146						
1313												
1314	**Normal GOF Test Results**											
1315												
1316	Correlation Coefficient R					0.917						
1317	Shapiro Wilk Test Statistic					0.814						
1318	Shapiro Wilk Critical (0.05) Value					0.818						
1319	Approximate Shapiro Wilk P Value					0.0744						

	A	B	C	D	E	F	G	H	I	J	K	L
1320	Lilliefors Test Statistic					0.286						
1321	Lilliefors Critical (0.05) Value					0.283						
1322	Data not Normal at (0.05) Significance Level											
1323												
1324	**Gamma GOF Test Results**											
1325												
1326	Correlation Coefficient R					0.913						
1327	A-D Test Statistic					0.811						
1328	A-D Critical (0.05) Value					0.715						
1329	K-S Test Statistic					0.298						
1330	K-S Critical(0.05) Value					0.294						
1331	Data not Gamma Distributed at (0.05) Significance Level											
1332												
1333	**Lognormal GOF Test Results**											
1334												
1335	Correlation Coefficient R					0.917						
1336	Shapiro Wilk Test Statistic					0.812						
1337	Shapiro Wilk Critical (0.05) Value					0.818						
1338	Approximate Shapiro Wilk P Value					0.0723						
1339	Lilliefors Test Statistic					0.288						
1340	Lilliefors Critical (0.05) Value					0.283						
1341	Data not Lognormal at (0.05) Significance Level											
1342												
1343	Non-parametric GOF Test Results											
1344												
1345	Data do not follow a discernible distribution at (0.05) Level of Significance											
1346												
1347	LnpH (cbl - 302i)											
1348												
1349	**Raw Statistics**											
1350	Number of Valid Observations					8						
1351	Number of Distinct Observations					8						
1352	Minimum					1.597						
1353	Maximum					2.048						
1354	Mean of Raw Data					1.764						
1355	Standard Deviation of Raw Data					0.145						
1356	Khat					176.2						
1357	Theta hat					0.01						
1358	Kstar					110.2						
1359	Theta star					0.016						
1360	Mean of Log Transformed Data					0.565						
1361	Standard Deviation of Log Transformed Data					0.0799						
1362												
1363	**Normal GOF Test Results**											
1364												
1365	Correlation Coefficient R					0.954						
1366	Shapiro Wilk Test Statistic					0.915						
1367	Shapiro Wilk Critical (0.05) Value					0.818						
1368	Approximate Shapiro Wilk P Value					0.364						
1369	Lilliefors Test Statistic					0.204						
1370	Lilliefors Critical (0.05) Value					0.283						
1371	Data appear Normal at (0.05) Significance Level											
1372												
1373	**Gamma GOF Test Results**											
1374												
1375	Correlation Coefficient R					0.962						
1376	A-D Test Statistic					0.337						
1377	A-D Critical (0.05) Value					0.715						
1378	K-S Test Statistic					0.214						
1379	K-S Critical(0.05) Value					0.294						
1380	Data appear Gamma Distributed at (0.05) Significance Level											
1381												
1382	**Lognormal GOF Test Results**											
1383												
1384	Correlation Coefficient R					0.963						
1385	Shapiro Wilk Test Statistic					0.931						

	A–E	F
1386	Shapiro Wilk Critical (0.05) Value	0.818
1387	Approximate Shapiro Wilk P Value	0.5
1388	Lilliefors Test Statistic	0.201
1389	Lilliefors Critical (0.05) Value	0.283
1390	Data appear Lognormal at (0.05) Significance Level	
1391		
1392	LnpH (cbl - 306i)	
1393		
1394	Raw Statistics	
1395	Number of Valid Observations	8
1396	Number of Distinct Observations	8
1397	Minimum	1.484
1398	Maximum	1.987
1399	Mean of Raw Data	1.854
1400	Standard Deviation of Raw Data	0.17
1401	Khat	124.2
1402	Theta hat	0.0149
1403	Kstar	77.68
1404	Theta star	0.0239
1405	Mean of Log Transformed Data	0.614
1406	Standard Deviation of Log Transformed Data	0.0984
1407		
1408	Normal GOF Test Results	
1409		
1410	Correlation Coefficient R	0.854
1411	Shapiro Wilk Test Statistic	0.743
1412	Shapiro Wilk Critical (0.05) Value	0.818
1413	Approximate Shapiro Wilk P Value	0.00569
1414	Lilliefors Test Statistic	0.357
1415	Lilliefors Critical (0.05) Value	0.283
1416	Data not Normal at (0.05) Significance Level	
1417		
1418	Gamma GOF Test Results	
1419		
1420	Correlation Coefficient R	0.838
1421	A-D Test Statistic	1.057
1422	A-D Critical (0.05) Value	0.715
1423	K-S Test Statistic	0.37
1424	K-S Critical(0.05) Value	0.294
1425	Data not Gamma Distributed at (0.05) Significance Level	
1426		
1427	Lognormal GOF Test Results	
1428		
1429	Correlation Coefficient R	0.841
1430	Shapiro Wilk Test Statistic	0.722
1431	Shapiro Wilk Critical (0.05) Value	0.818
1432	Approximate Shapiro Wilk P Value	0.00325
1433	Lilliefors Test Statistic	0.364
1434	Lilliefors Critical (0.05) Value	0.283
1435	Data not Lognormal at (0.05) Significance Level	
1436		
1437	Non-parametric GOF Test Results	
1438		
1439	Data do not follow a discernible distribution at (0.05) Level of Significance	
1440		
1441	LnpH (cbl - 308i)	
1442		
1443	Raw Statistics	
1444	Number of Valid Observations	8
1445	Number of Distinct Observations	6
1446	Minimum	1.712
1447	Maximum	1.921
1448	Mean of Raw Data	1.823
1449	Standard Deviation of Raw Data	0.0596
1450	Khat	1060
1451	Theta hat	0.00172

	A	B	C	D	E	F	G	H	I	J	K	L
1452					Kstar	662.8						
1453					Theta star	0.00275						
1454					Mean of Log Transformed Data	0.6						
1455					Standard Deviation of Log Transformed Data	0.0329						
1456												
1457	**Normal GOF Test Results**											
1458												
1459					Correlation Coefficient R	0.947						
1460					Shapiro Wilk Test Statistic	0.925						
1461					Shapiro Wilk Critical (0.05) Value	0.818						
1462					Approximate Shapiro Wilk P Value	0.297						
1463					Lilliefors Test Statistic	0.207						
1464					Lilliefors Critical (0.05) Value	0.283						
1465	**Data appear Normal at (0.05) Significance Level**											
1466												
1467	**Gamma GOF Test Results**											
1468												
1469					Correlation Coefficient R	0.949						
1470					A-D Test Statistic	0.448						
1471					A-D Critical (0.05) Value	0.715						
1472					K-S Test Statistic	0.216						
1473					K-S Critical(0.05) Value	0.294						
1474	**Data appear Gamma Distributed at (0.05) Significance Level**											
1475												
1476	**Lognormal GOF Test Results**											
1477												
1478					Correlation Coefficient R	0.945						
1479					Shapiro Wilk Test Statistic	0.921						
1480					Shapiro Wilk Critical (0.05) Value	0.818						
1481					Approximate Shapiro Wilk P Value	0.275						
1482					Lilliefors Test Statistic	0.212						
1483					Lilliefors Critical (0.05) Value	0.283						
1484	**Data appear Lognormal at (0.05) Significance Level**											
1485												
1486	**LnpH (cbl - 340i)**											
1487												
1488	**Raw Statistics**											
1489					Number of Valid Observations	8						
1490					Number of Distinct Observations	8						
1491					Minimum	1.697						
1492					Maximum	1.939						
1493					Mean of Raw Data	1.829						
1494					Standard Deviation of Raw Data	0.0758						
1495					Khat	657.6						
1496					Theta hat	0.00278						
1497					Kstar	411.1						
1498					Theta star	0.00445						
1499					Mean of Log Transformed Data	0.603						
1500					Standard Deviation of Log Transformed Data	0.0418						
1501												
1502	**Normal GOF Test Results**											
1503												
1504					Correlation Coefficient R	0.978						
1505					Shapiro Wilk Test Statistic	0.963						
1506					Shapiro Wilk Critical (0.05) Value	0.818						
1507					Approximate Shapiro Wilk P Value	0.79						
1508					Lilliefors Test Statistic	0.169						
1509					Lilliefors Critical (0.05) Value	0.283						
1510	**Data appear Normal at (0.05) Significance Level**											
1511												
1512	**Gamma GOF Test Results**											
1513												
1514					Correlation Coefficient R	0.977						
1515					A-D Test Statistic	0.269						
1516					A-D Critical (0.05) Value	0.715						
1517					K-S Test Statistic	0.171						
1518					K-S Critical(0.05) Value	0.294						

	A	B	C	D	E	F	G	H	I	J	K	L
1519	Data appear Gamma Distributed at (0.05) Significance Level											
1520												
1521	Lognormal GOF Test Results											
1522												
1523	Correlation Coefficient R					0.975						
1524	Shapiro Wilk Test Statistic					0.957						
1525	Shapiro Wilk Critical (0.05) Value					0.818						
1526	Approximate Shapiro Wilk P Value					0.738						
1527	Lilliefors Test Statistic					0.176						
1528	Lilliefors Critical (0.05) Value					0.283						
1529	Data appear Lognormal at (0.05) Significance Level											
1530												
1531	LnpH (cbl - 341i)											
1532												
1533	Raw Statistics											
1534	Number of Valid Observations					8						
1535	Number of Distinct Observations					8						
1536	Minimum					1.654						
1537	Maximum					1.826						
1538	Mean of Raw Data					1.758						
1539	Standard Deviation of Raw Data					0.0594						
1540	Khat					992.6						
1541	Theta hat					0.00177						
1542	Kstar					620.5						
1543	Theta star					0.00283						
1544	Mean of Log Transformed Data					0.563						
1545	Standard Deviation of Log Transformed Data					0.034						
1546												
1547	Normal GOF Test Results											
1548												
1549	Correlation Coefficient R					0.96						
1550	Shapiro Wilk Test Statistic					0.915						
1551	Shapiro Wilk Critical (0.05) Value					0.818						
1552	Approximate Shapiro Wilk P Value					0.451						
1553	Lilliefors Test Statistic					0.193						
1554	Lilliefors Critical (0.05) Value					0.283						
1555	Data appear Normal at (0.05) Significance Level											
1556												
1557	Gamma GOF Test Results											
1558												
1559	Correlation Coefficient R					0.958						
1560	A-D Test Statistic					0.393						
1561	A-D Critical (0.05) Value					0.715						
1562	K-S Test Statistic					0.194						
1563	K-S Critical(0.05) Value					0.294						
1564	Data appear Gamma Distributed at (0.05) Significance Level											
1565												
1566	Lognormal GOF Test Results											
1567												
1568	Correlation Coefficient R					0.959						
1569	Shapiro Wilk Test Statistic					0.914						
1570	Shapiro Wilk Critical (0.05) Value					0.818						
1571	Approximate Shapiro Wilk P Value					0.432						
1572	Lilliefors Test Statistic					0.187						
1573	Lilliefors Critical (0.05) Value					0.283						
1574	Data appear Lognormal at (0.05) Significance Level											

1		Goodness-of-Fit Test Statistics for Data Sets with Non-Detects
2	User Selected Options	
3	Date/Time of Computation	ProUCL 5.112/2/2017 11:09:53 AM
4	From File	DetectionMonitoring_ProUCLUpload_11272017_a.xls
5	Full Precision	OFF
6	Confidence Coefficient	0.95
7		
8		
9	TotalTDS (cbl - 301i)	
10		
11	Raw Statistics	
12	Number of Valid Observations	8
13	Number of Distinct Observations	8
14	Minimum	4290
15	Maximum	6570
16	Mean of Raw Data	5431
17	Standard Deviation of Raw Data	959
18	Khat	35.97
19	Theta hat	151
20	Kstar	22.56
21	Theta star	240.7
22	Mean of Log Transformed Data	8.586
23	Standard Deviation of Log Transformed Data	0.18
24		
25	Normal GOF Test Results	
26		
27	Correlation Coefficient R	0.946
28	Shapiro Wilk Test Statistic	0.863
29	Shapiro Wilk Critical (0.05) Value	0.818
30	Approximate Shapiro Wilk P Value	0.243
31	Lilliefors Test Statistic	0.23
32	Lilliefors Critical (0.05) Value	0.283
33	Data appear Normal at (0.05) Significance Level	
34		
35	Gamma GOF Test Results	
36		
37	Correlation Coefficient R	0.939
38	A-D Test Statistic	0.571
39	A-D Critical (0.05) Value	0.715
40	K-S Test Statistic	0.253
41	K-S Critical(0.05) Value	0.294
42	Data appear Gamma Distributed at (0.05) Significance Level	
43		
44	Lognormal GOF Test Results	
45		
46	Correlation Coefficient R	0.945
47	Shapiro Wilk Test Statistic	0.86
48	Shapiro Wilk Critical (0.05) Value	0.818
49	Approximate Shapiro Wilk P Value	0.231
50	Lilliefors Test Statistic	0.242
51	Lilliefors Critical (0.05) Value	0.283
52	Data appear Lognormal at (0.05) Significance Level	
53		
54	TotalTDS (cbl - 302i)	
55		
56	Raw Statistics	
57	Number of Valid Observations	8
58	Number of Distinct Observations	8
59	Minimum	4210
60	Maximum	6850
61	Mean of Raw Data	5728
62	Standard Deviation of Raw Data	857.3
63	Khat	48.17
64	Theta hat	118.9
65	Kstar	30.19
66	Theta star	189.7
67	Mean of Log Transformed Data	8.643

	A	B	C	D	E	F	G	H	I
68	Standard Deviation of Log Transformed Data					0.157			
69									
70	Normal GOF Test Results								
71									
72	Correlation Coefficient R					0.98			
73	Shapiro Wilk Test Statistic					0.961			
74	Shapiro Wilk Critical (0.05) Value					0.818			
75	Approximate Shapiro Wilk P Value					0.825			
76	Lilliefors Test Statistic					0.169			
77	Lilliefors Critical (0.05) Value					0.283			
78	Data appear Normal at (0.05) Significance Level								
79									
80	Gamma GOF Test Results								
81									
82	Correlation Coefficient R					0.971			
83	A-D Test Statistic					0.257			
84	A-D Critical (0.05) Value					0.715			
85	K-S Test Statistic					0.182			
86	K-S Critical(0.05) Value					0.293			
87	Data appear Gamma Distributed at (0.05) Significance Level								
88									
89	Lognormal GOF Test Results								
90									
91	Correlation Coefficient R					0.968			
92	Shapiro Wilk Test Statistic					0.941			
93	Shapiro Wilk Critical (0.05) Value					0.818			
94	Approximate Shapiro Wilk P Value					0.602			
95	Lilliefors Test Statistic					0.164			
96	Lilliefors Critical (0.05) Value					0.283			
97	Data appear Lognormal at (0.05) Significance Level								
98									
99	TotalTDS (cbl - 306i)								
100									
101	Raw Statistics								
102	Number of Valid Observations					8			
103	Number of Distinct Observations					7			
104	Minimum					431			
105	Maximum					1460			
106	Mean of Raw Data					1144			
107	Standard Deviation of Raw Data					356.4			
108	Khat					8.186			
109	Theta hat					139.7			
110	Kstar					5.2			
111	Theta star					220			
112	Mean of Log Transformed Data					6.98			
113	Standard Deviation of Log Transformed Data					0.417			
114									
115	Normal GOF Test Results								
116									
117	Correlation Coefficient R					0.909			
118	Shapiro Wilk Test Statistic					0.828			
119	Shapiro Wilk Critical (0.05) Value					0.818			
120	Approximate Shapiro Wilk P Value					0.0567			
121	Lilliefors Test Statistic					0.274			
122	Lilliefors Critical (0.05) Value					0.283			
123	Data appear Normal at (0.05) Significance Level								
124									
125	Gamma GOF Test Results								
126									
127	Correlation Coefficient R					0.845			
128	A-D Test Statistic					0.877			
129	A-D Critical (0.05) Value					0.716			
130	K-S Test Statistic					0.303			
131	K-S Critical(0.05) Value					0.295			
132	Data not Gamma Distributed at (0.05) Significance Level								
133									
134	Lognormal GOF Test Results								

	A	B	C	D	E	F	G	H	I
135									
136					Correlation Coefficient R	0.857			
137					Shapiro Wilk Test Statistic	0.745			
138					Shapiro Wilk Critical (0.05) Value	0.818			
139					Approximate Shapiro Wilk P Value	0.00624			
140					Lilliefors Test Statistic	0.314			
141					Lilliefors Critical (0.05) Value	0.283			
142	Data not Lognormal at (0.05) Significance Level								
143									
144	TotalTDS (cbl - 308i)								
145									
146	Raw Statistics								
147					Number of Valid Observations	8			
148					Number of Distinct Observations	8			
149					Minimum	6120			
150					Maximum	10200			
151					Mean of Raw Data	7623			
152					Standard Deviation of Raw Data	1517			
153					Khat	31.19			
154					Theta hat	244.4			
155					Kstar	19.58			
156					Theta star	389.4			
157					Mean of Log Transformed Data	8.923			
158					Standard Deviation of Log Transformed Data	0.188			
159									
160	Normal GOF Test Results								
161									
162					Correlation Coefficient R	0.932			
163					Shapiro Wilk Test Statistic	0.856			
164					Shapiro Wilk Critical (0.05) Value	0.818			
165					Approximate Shapiro Wilk P Value	0.146			
166					Lilliefors Test Statistic	0.219			
167					Lilliefors Critical (0.05) Value	0.283			
168	Data appear Normal at (0.05) Significance Level								
169									
170	Gamma GOF Test Results								
171									
172					Correlation Coefficient R	0.95			
173					A-D Test Statistic	0.525			
174					A-D Critical (0.05) Value	0.716			
175					K-S Test Statistic	0.209			
176					K-S Critical(0.05) Value	0.294			
177	Data appear Gamma Distributed at (0.05) Significance Level								
178									
179	Lognormal GOF Test Results								
180									
181					Correlation Coefficient R	0.948			
182					Shapiro Wilk Test Statistic	0.885			
183					Shapiro Wilk Critical (0.05) Value	0.818			
184					Approximate Shapiro Wilk P Value	0.281			
185					Lilliefors Test Statistic	0.194			
186					Lilliefors Critical (0.05) Value	0.283			
187	Data appear Lognormal at (0.05) Significance Level								
188									
189	TotalTDS (cbl - 340i)								
190									
191	Raw Statistics								
192					Number of Valid Observations	8			
193					Number of Distinct Observations	8			
194					Minimum	4880			
195					Maximum	6250			
196					Mean of Raw Data	5525			
197					Standard Deviation of Raw Data	512.4			
198					Khat	134.7			
199					Theta hat	41.03			
200					Kstar	84.24			
201					Theta star	65.59			

	A	B	C	D	E	F	G	H	I
202					Mean of Log Transformed Data	8.613			
203					Standard Deviation of Log Transformed Data	0.0919			
204									
205			Normal GOF Test Results						
206									
207					Correlation Coefficient R	0.968			
208					Shapiro Wilk Test Statistic	0.918			
209					Shapiro Wilk Critical (0.05) Value	0.818			
210					Approximate Shapiro Wilk P Value	0.57			
211					Lilliefors Test Statistic	0.166			
212					Lilliefors Critical (0.05) Value	0.283			
213	Data appear Normal at (0.05) Significance Level								
214									
215			Gamma GOF Test Results						
216									
217					Correlation Coefficient R	0.969			
218					A-D Test Statistic	0.32			
219					A-D Critical (0.05) Value	0.715			
220					K-S Test Statistic	0.177			
221					K-S Critical(0.05) Value	0.294			
222	Data appear Gamma Distributed at (0.05) Significance Level								
223									
224			Lognormal GOF Test Results						
225									
226					Correlation Coefficient R	0.973			
227					Shapiro Wilk Test Statistic	0.927			
228					Shapiro Wilk Critical (0.05) Value	0.818			
229					Approximate Shapiro Wilk P Value	0.66			
230					Lilliefors Test Statistic	0.161			
231					Lilliefors Critical (0.05) Value	0.283			
232	Data appear Lognormal at (0.05) Significance Level								
233									
234	TotalTDS (cbl - 341i)								
235									
236			Raw Statistics						
237					Number of Valid Observations	8			
238					Number of Distinct Observations	8			
239					Minimum	4150			
240					Maximum	5940			
241					Mean of Raw Data	4833			
242					Standard Deviation of Raw Data	566.6			
243					Khat	86.32			
244					Theta hat	55.98			
245					Kstar	54.03			
246					Theta star	89.43			
247					Mean of Log Transformed Data	8.477			
248					Standard Deviation of Log Transformed Data	0.114			
249									
250			Normal GOF Test Results						
251									
252					Correlation Coefficient R	0.959			
253					Shapiro Wilk Test Statistic	0.927			
254					Shapiro Wilk Critical (0.05) Value	0.818			
255					Approximate Shapiro Wilk P Value	0.442			
256					Lilliefors Test Statistic	0.187			
257					Lilliefors Critical (0.05) Value	0.283			
258	Data appear Normal at (0.05) Significance Level								
259									
260			Gamma GOF Test Results						
261									
262					Correlation Coefficient R	0.968			
263					A-D Test Statistic	0.285			
264					A-D Critical (0.05) Value	0.715			
265					K-S Test Statistic	0.163			
266					K-S Critical(0.05) Value	0.294			
267	Data appear Gamma Distributed at (0.05) Significance Level								
268									

	A	B	C	D	E	F	G	H	I
269	**Lognormal GOF Test Results**								
270									
271	Correlation Coefficient R					0.97			
272	Shapiro Wilk Test Statistic					0.945			
273	Shapiro Wilk Critical (0.05) Value					0.818			
274	Approximate Shapiro Wilk P Value					0.629			
275	Lilliefors Test Statistic					0.17			
276	Lilliefors Critical (0.05) Value					0.283			
277	**Data appear Lognormal at (0.05) Significance Level**								

Appendix E

Outlier Tests for Selected Uncensored Variables

User Selected Options

Date/Time of Computation ProUCL 5.112/2/2017 11:16:25 PM

From File DetectionMonitoring_ProUCLUploadDeTrendResiduals_11272017_a.xls

Full Precision OFF

Dixon's Outlier Test for LnB (cbl - 301i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value -2.64930970607961 is a Potential Outlier (Up

Test Statistic: 1.000

For 10% significance level, -2.64930970607961 is an outlier.

For 5% significance level, -2.64930970607961 is an outlier.

For 1% significance level, -2.64930970607961 is an outlier.

2. Observation Value -2.99573227355399 is a Potential Outlier (Lo

Test Statistic: NaN

For 10% significance level, -2.99573227355399 is an outlier.

For 5% significance level, -2.99573227355399 is an outlier.

For 1% significance level, -2.99573227355399 is an outlier.

Dixon's Outlier Test for LnB (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value -1.21402314017944 is a Potential Outlier (Up

Test Statistic: 0.361

For 10% significance level, -1.21402314017944 is not an outlier.

For 5% significance level, -1.21402314017944 is not an outlier.

For 1% significance level, -1.21402314017944 is not an outlier.

2. Observation Value -2.99573227355399 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is not an outlier.

For 5% significance level, -2.99573227355399 is not an outlier.

For 1% significance level, -2.99573227355399 is not an outlier.

Dixon's Outlier Test for LnB (cbl - 306i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value -2.0874737133771 is a Potential Outlier (Upp

Test Statistic: 0.239

For 10% significance level, -2.0874737133771 is not an outlier.
For 5% significance level, -2.0874737133771 is not an outlier.
For 1% significance level, -2.0874737133771 is not an outlier.

2. Observation Value -2.99573227355399 is a Potential Outlier (Lov

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is not an outlier.
For 5% significance level, -2.99573227355399 is not an outlier.
For 1% significance level, -2.99573227355399 is not an outlier.

Dixon's Outlier Test for LnB (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -0.606969484318893 is a Potential Outlier (U

Test Statistic: 0.316

For 10% significance level, -0.606969484318893 is not an outlier.
For 5% significance level, -0.606969484318893 is not an outlier.
For 1% significance level, -0.606969484318893 is not an outlier.

2. Observation Value -2.99573227355399 is a Potential Outlier (Lov

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is not an outlier.
For 5% significance level, -2.99573227355399 is not an outlier.
For 1% significance level, -2.99573227355399 is not an outlier.

Dixon's Outlier Test for LnB (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -1.74869997976761 is a Potential Outlier (Up

Test Statistic: 0.077

For 10% significance level, -1.74869997976761 is not an outlier.
For 5% significance level, -1.74869997976761 is not an outlier.
For 1% significance level, -1.74869997976761 is not an outlier.

2. Observation Value -2.99573227355399 is a Potential Outlier (Lov

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is not an outlier.
For 5% significance level, -2.99573227355399 is not an outlier.
For 1% significance level, -2.99573227355399 is not an outlier.

Dixon's Outlier Test for LnB (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -2.41239995900125 is a Potential Outlier (Up

Test Statistic: 0.503

For 10% significance level, -2.41239995900125 is an outlier.
For 5% significance level, -2.41239995900125 is not an outlier.
For 1% significance level, -2.41239995900125 is not an outlier.

2. Observation Value -2.99573227355399 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is not an outlier.
For 5% significance level, -2.99573227355399 is not an outlier.
For 1% significance level, -2.99573227355399 is not an outlier.

Dixon's Outlier Test for LnCa (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Upper Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnCa (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.00306545878646 is a Potential Outlier (Up

Test Statistic: 0.000

For 10% significance level, 7.00306545878646 is not an outlier.
For 5% significance level, 7.00306545878646 is not an outlier.
For 1% significance level, 7.00306545878646 is not an outlier.

2. Observation Value 6.9177056098353 is a Potential Outlier (Lowe

Test Statistic: 0.230

For 10% significance level, 6.9177056098353 is not an outlier.
For 5% significance level, 6.9177056098353 is not an outlier.
For 1% significance level, 6.9177056098353 is not an outlier.

Dixon's Outlier Test for LnCa (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Upper Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnCa (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.86066367144829 is a Potential Outlier (Up

Test Statistic: 0.089

For 10% significance level, 6.86066367144829 is not an outlier.
For 5% significance level, 6.86066367144829 is not an outlier.
For 1% significance level, 6.86066367144829 is not an outlier.

2. Observation Value 6.76849321164863 is a Potential Outlier (Low

Test Statistic: 0.108

For 10% significance level, 6.76849321164863 is not an outlier.
For 5% significance level, 6.76849321164863 is not an outlier.
For 1% significance level, 6.76849321164863 is not an outlier.

Dixon's Outlier Test for LnCa (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.44094654063292 is a Potential Outlier (Up

Test Statistic: 0.306

For 10% significance level, 6.44094654063292 is not an outlier.
For 5% significance level, 6.44094654063292 is not an outlier.
For 1% significance level, 6.44094654063292 is not an outlier.

2. Observation Value 6.32793678372919 is a Potential Outlier (Low

Test Statistic: 0.088

For 10% significance level, 6.32793678372919 is not an outlier.
For 5% significance level, 6.32793678372919 is not an outlier.
For 1% significance level, 6.32793678372919 is not an outlier.

Dixon's Outlier Test for LnCa (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.85646198459459 is a Potential Outlier (Up

Test Statistic: 0.418

For 10% significance level, 6.85646198459459 is not an outlier.
For 5% significance level, 6.85646198459459 is not an outlier.
For 1% significance level, 6.85646198459459 is not an outlier.

2. Observation Value 6.7202201551353 is a Potential Outlier (Lowe

Test Statistic: 0.255

For 10% significance level, 6.7202201551353 is not an outlier.
For 5% significance level, 6.7202201551353 is not an outlier.
For 1% significance level, 6.7202201551353 is not an outlier.

Dixon's Outlier Test for LnCl (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.07090608878782 is a Potential Outlier (Up

Test Statistic: 0.701

For 10% significance level, 8.07090608878782 is an outlier.
For 5% significance level, 8.07090608878782 is an outlier.
For 1% significance level, 8.07090608878782 is an outlier.

2. Observation Value 7.67786350067821 is a Potential Outlier (Low

Test Statistic: 0.279

For 10% significance level, 7.67786350067821 is not an outlier.
For 5% significance level, 7.67786350067821 is not an outlier.
For 1% significance level, 7.67786350067821 is not an outlier.

Dixon's Outlier Test for LnCl (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.70975686445416 is a Potential Outlier (Up

Test Statistic: 0.107

For 10% significance level, 7.70975686445416 is not an outlier.
For 5% significance level, 7.70975686445416 is not an outlier.
For 1% significance level, 7.70975686445416 is not an outlier.

2. Observation Value 7.62070508683826 is a Potential Outlier (Low

Test Statistic: 0.061

For 10% significance level, 7.62070508683826 is not an outlier.
For 5% significance level, 7.62070508683826 is not an outlier.
For 1% significance level, 7.62070508683826 is not an outlier.

Dixon's Outlier Test for LnCl (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Upper Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnCl (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.96206730875367 is a Potential Outlier (Up

Test Statistic: 0.310

For 10% significance level, 7.96206730875367 is not an outlier.
For 5% significance level, 7.96206730875367 is not an outlier.
For 1% significance level, 7.96206730875367 is not an outlier.

2. Observation Value 7.76641689801966 is a Potential Outlier (Low

Test Statistic: 0.444

For 10% significance level, 7.76641689801966 is not an outlier.
For 5% significance level, 7.76641689801966 is not an outlier.
For 1% significance level, 7.76641689801966 is not an outlier.

Dixon's Outlier Test for LnCl (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.83201418050547 is a Potential Outlier (Up

Test Statistic: 0.525

For 10% significance level, 7.83201418050547 is an outlier.
For 5% significance level, 7.83201418050547 is not an outlier.
For 1% significance level, 7.83201418050547 is not an outlier.

2. Observation Value 7.63530388625941 is a Potential Outlier (Low

Test Statistic: 0.629

For 10% significance level, 7.63530388625941 is an outlier.
For 5% significance level, 7.63530388625941 is an outlier.
For 1% significance level, 7.63530388625941 is not an outlier.

Dixon's Outlier Test for LnCl (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.60090245954208 is a Potential Outlier (Up

Test Statistic: 0.096

For 10% significance level, 7.60090245954208 is not an outlier.
For 5% significance level, 7.60090245954208 is not an outlier.
For 1% significance level, 7.60090245954208 is not an outlier.

2. Observation Value 7.37775890822787 is a Potential Outlier (Low

Test Statistic: 0.320

For 10% significance level, 7.37775890822787 is not an outlier.
For 5% significance level, 7.37775890822787 is not an outlier.
For 1% significance level, 7.37775890822787 is not an outlier.

Dixon's Outlier Test for LnF (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -0.693147180559945 is a Potential Outlier (U

Test Statistic: 0.000

For 10% significance level, -0.693147180559945 is not an outlier.
For 5% significance level, -0.693147180559945 is not an outlier.
For 1% significance level, -0.693147180559945 is not an outlier.

2. Observation Value -4.60517018598809 is a Potential Outlier (Lo

Test Statistic: 0.177

For 10% significance level, -4.60517018598809 is not an outlier.
For 5% significance level, -4.60517018598809 is not an outlier.
For 1% significance level, -4.60517018598809 is not an outlier.

Dixon's Outlier Test for LnF (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -0.693147180559945 is a Potential Outlier (U

Test Statistic: 0.000

For 10% significance level, -0.693147180559945 is not an outlier.
For 5% significance level, -0.693147180559945 is not an outlier.
For 1% significance level, -0.693147180559945 is not an outlier.

2. Observation Value -3.91202300542815 is a Potential Outlier (Lo

Test Statistic: 0.785

For 10% significance level, -3.91202300542815 is an outlier.
For 5% significance level, -3.91202300542815 is an outlier.
For 1% significance level, -3.91202300542815 is an outlier.

Dixon's Outlier Test for LnF (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2.53369681395743 is a Potential Outlier (Up

Test Statistic: 0.660

For 10% significance level, 2.53369681395743 is an outlier.
For 5% significance level, 2.53369681395743 is an outlier.
For 1% significance level, 2.53369681395743 is not an outlier.

2. Observation Value 0 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.295

For 10% significance level, 0 is not an outlier.
For 5% significance level, 0 is not an outlier.
For 1% significance level, 0 is not an outlier.

Dixon's Outlier Test for LnF (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2.20276475771183 is a Potential Outlier (Up

Test Statistic: 0.759

For 10% significance level, 2.20276475771183 is an outlier.
For 5% significance level, 2.20276475771183 is an outlier.
For 1% significance level, 2.20276475771183 is an outlier.

2. Observation Value 0.285178942233662 is a Potential Outlier (Lo

Test Statistic: 0.207

For 10% significance level, 0.285178942233662 is not an outlier.
For 5% significance level, 0.285178942233662 is not an outlier.
For 1% significance level, 0.285178942233662 is not an outlier.

Dixon's Outlier Test for LnF (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2.13298230860787 is a Potential Outlier (Up

Test Statistic: 0.645

For 10% significance level, 2.13298230860787 is an outlier.
For 5% significance level, 2.13298230860787 is an outlier.
For 1% significance level, 2.13298230860787 is not an outlier.

2. Observation Value -0.174353387144778 is a Potential Outlier (L

Test Statistic: 0.014

For 10% significance level, -0.174353387144778 is not an outlier.
For 5% significance level, -0.174353387144778 is not an outlier.
For 1% significance level, -0.174353387144778 is not an outlier.

Dixon's Outlier Test for LnF (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Upper Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnS (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.19031540585315 is a Potential Outlier (Up

Test Statistic: 0.614

For 10% significance level, 6.19031540585315 is an outlier.
For 5% significance level, 6.19031540585315 is an outlier.
For 1% significance level, 6.19031540585315 is not an outlier.

2. Observation Value 5.73979291217923 is a Potential Outlier (Low

Test Statistic: 0.232

For 10% significance level, 5.73979291217923 is not an outlier.
For 5% significance level, 5.73979291217923 is not an outlier.
For 1% significance level, 5.73979291217923 is not an outlier.

Dixon's Outlier Test for LnS (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Upper Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnS (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Upper Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower Tail)?

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnS (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.36518012602101 is a Potential Outlier (Up

Test Statistic: 0.168

For 10% significance level, 7.36518012602101 is not an outlier.
For 5% significance level, 7.36518012602101 is not an outlier.
For 1% significance level, 7.36518012602101 is not an outlier.

2. Observation Value 7.18538701558042 is a Potential Outlier (Low

Test Statistic: 0.411

For 10% significance level, 7.18538701558042 is not an outlier.
For 5% significance level, 7.18538701558042 is not an outlier.
For 1% significance level, 7.18538701558042 is not an outlier.

Dixon's Outlier Test for LnS (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.57228254269401 is a Potential Outlier (Up

Test Statistic: 0.288

For 10% significance level, 6.57228254269401 is not an outlier.
For 5% significance level, 6.57228254269401 is not an outlier.
For 1% significance level, 6.57228254269401 is not an outlier.

2. Observation Value 6.34738920965601 is a Potential Outlier (Low

Test Statistic: 0.417

For 10% significance level, 6.34738920965601 is not an outlier.
For 5% significance level, 6.34738920965601 is not an outlier.
For 1% significance level, 6.34738920965601 is not an outlier.

Dixon's Outlier Test for LnS (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.03787091992214 is a Potential Outlier (Up

Test Statistic: 0.165

For 10% significance level, 6.03787091992214 is not an outlier.
For 5% significance level, 6.03787091992214 is not an outlier.
For 1% significance level, 6.03787091992214 is not an outlier.

2. Observation Value 5.7268477475872 is a Potential Outlier (Lowe

Test Statistic: 0.329

For 10% significance level, 5.7268477475872 is not an outlier.
For 5% significance level, 5.7268477475872 is not an outlier.
For 1% significance level, 5.7268477475872 is not an outlier.

Dixon's Outlier Test for LnTDS (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.79026911147866 is a Potential Outlier (Up

Test Statistic: 0.053

For 10% significance level, 8.79026911147866 is not an outlier.
For 5% significance level, 8.79026911147866 is not an outlier.
For 1% significance level, 8.79026911147866 is not an outlier.

2. Observation Value 8.36404201192206 is a Potential Outlier (Low

Test Statistic: 0.051

For 10% significance level, 8.36404201192206 is not an outlier.
For 5% significance level, 8.36404201192206 is not an outlier.
For 1% significance level, 8.36404201192206 is not an outlier.

Dixon's Outlier Test for LnTDS (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.83200393125627 is a Potential Outlier (Up

Test Statistic: 0.201

For 10% significance level, 8.83200393125627 is not an outlier.
For 5% significance level, 8.83200393125627 is not an outlier.
For 1% significance level, 8.83200393125627 is not an outlier.

2. Observation Value 8.34521792667643 is a Potential Outlier (Low

Test Statistic: 0.457

For 10% significance level, 8.34521792667643 is not an outlier.
For 5% significance level, 8.34521792667643 is not an outlier.
For 1% significance level, 8.34521792667643 is not an outlier.

Dixon's Outlier Test for LnTDS (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.28619171470238 is a Potential Outlier (Up

Test Statistic: 0.022

For 10% significance level, 7.28619171470238 is not an outlier.
For 5% significance level, 7.28619171470238 is not an outlier.
For 1% significance level, 7.28619171470238 is not an outlier.

2. Observation Value 6.06610809010375 is a Potential Outlier (Low

Test Statistic: 0.502

For 10% significance level, 6.06610809010375 is an outlier.
For 5% significance level, 6.06610809010375 is not an outlier.
For 1% significance level, 6.06610809010375 is not an outlier.

Dixon's Outlier Test for LnTDS (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 9.23014299927236 is a Potential Outlier (Up

Test Statistic: 0.129

For 10% significance level, 9.23014299927236 is not an outlier.
For 5% significance level, 9.23014299927236 is not an outlier.
For 1% significance level, 9.23014299927236 is not an outlier.

2. Observation Value 8.71931737550637 is a Potential Outlier (Low

Test Statistic: 0.126

For 10% significance level, 8.71931737550637 is not an outlier.
For 5% significance level, 8.71931737550637 is not an outlier.
For 1% significance level, 8.71931737550637 is not an outlier.

Dixon's Outlier Test for LnTDS (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.74033674273045 is a Potential Outlier (Up

Test Statistic: 0.014

For 10% significance level, 8.74033674273045 is not an outlier.
For 5% significance level, 8.74033674273045 is not an outlier.
For 1% significance level, 8.74033674273045 is not an outlier.

2. Observation Value 8.49290049884719 is a Potential Outlier (Low

Test Statistic: 0.091

For 10% significance level, 8.49290049884719 is not an outlier.
For 5% significance level, 8.49290049884719 is not an outlier.
For 1% significance level, 8.49290049884719 is not an outlier.

Dixon's Outlier Test for LnTDS (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.68946441235669 is a Potential Outlier (Up

Test Statistic: 0.446

For 10% significance level, 8.68946441235669 is not an outlier.
For 5% significance level, 8.68946441235669 is not an outlier.
For 1% significance level, 8.68946441235669 is not an outlier.

2. Observation Value 8.33086361322474 is a Potential Outlier (Low

Test Statistic: 0.103

For 10% significance level, 8.33086361322474 is not an outlier.
For 5% significance level, 8.33086361322474 is not an outlier.
For 1% significance level, 8.33086361322474 is not an outlier.

Dixon's Outlier Test for LnpH (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 1.84530023615608 is a Potential Outlier (Up

Test Statistic: 0.051

For 10% significance level, 1.84530023615608 is not an outlier.
For 5% significance level, 1.84530023615608 is not an outlier.
For 1% significance level, 1.84530023615608 is not an outlier.

2. Observation Value 1.78339121955754 is a Potential Outlier (Low

Test Statistic: 0.000

For 10% significance level, 1.78339121955754 is not an outlier.
For 5% significance level, 1.78339121955754 is not an outlier.
For 1% significance level, 1.78339121955754 is not an outlier.

Dixon's Outlier Test for LnpH (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 2.04769284336526 is a Potential Outlier (Up

Test Statistic: 0.516

For 10% significance level, 2.04769284336526 is an outlier.

For 5% significance level, 2.04769284336526 is not an outlier.

For 1% significance level, 2.04769284336526 is not an outlier.

2. Observation Value 1.59736533119983 is a Potential Outlier (Low

Test Statistic: 0.188

For 10% significance level, 1.59736533119983 is not an outlier.

For 5% significance level, 1.59736533119983 is not an outlier.

For 1% significance level, 1.59736533119983 is not an outlier.

Dixon's Outlier Test for LnpH (cbl - 306i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1.98650354602057 is a Potential Outlier (Up

Test Statistic: 0.106

For 10% significance level, 1.98650354602057 is not an outlier.

For 5% significance level, 1.98650354602057 is not an outlier.

For 1% significance level, 1.98650354602057 is not an outlier.

2. Observation Value 1.48387468945875 is a Potential Outlier (Low

Test Statistic: 0.507

For 10% significance level, 1.48387468945875 is an outlier.

For 5% significance level, 1.48387468945875 is not an outlier.

For 1% significance level, 1.48387468945875 is not an outlier.

Dixon's Outlier Test for LnpH (cbl - 308i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1.9213246735827 is a Potential Outlier (Upp

Test Statistic: 0.517

For 10% significance level, 1.9213246735827 is an outlier.

For 5% significance level, 1.9213246735827 is not an outlier.

For 1% significance level, 1.9213246735827 is not an outlier.

2. Observation Value 1.71199450075919 is a Potential Outlier (Low

Test Statistic: 0.517

For 10% significance level, 1.71199450075919 is an outlier.

For 5% significance level, 1.71199450075919 is not an outlier.

For 1% significance level, 1.71199450075919 is not an outlier.

Dixon's Outlier Test for LnpH (cbl - 340i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1.9387416595767 is a Potential Outlier (Upp

Test Statistic: 0.343

For 10% significance level, 1.9387416595767 is not an outlier.

For 5% significance level, 1.9387416595767 is not an outlier.

For 1% significance level, 1.9387416595767 is not an outlier.

2. Observation Value 1.69744878975681 is a Potential Outlier (Low

Test Statistic: 0.311

For 10% significance level, 1.69744878975681 is not an outlier.

For 5% significance level, 1.69744878975681 is not an outlier.

For 1% significance level, 1.69744878975681 is not an outlier.

Dixon's Outlier Test for LnpH (cbl - 341i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1.82616089594539 is a Potential Outlier (Up

Test Statistic: 0.028

For 10% significance level, 1.82616089594539 is not an outlier.

For 5% significance level, 1.82616089594539 is not an outlier.

For 1% significance level, 1.82616089594539 is not an outlier.

2. Observation Value 1.65441127807683 is a Potential Outlier (Low

Test Statistic: 0.342

For 10% significance level, 1.65441127807683 is not an outlier.

For 5% significance level, 1.65441127807683 is not an outlier.

For 1% significance level, 1.65441127807683 is not an outlier.

Outlier Tests for Selected Uncensored Variables

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2017 2:25:04 PM
From File	DetectionMonitoring_ProUCLUploadDeTrendResiduals_11272017_a.xls
Full Precision	OFF

Dixon's Outlier Test for LnB (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -2.64930970607961 is a Pote

Test Statistic: 1.000

For 10% significance level, -2.64930970607961 is an
For 5% significance level, -2.64930970607961 is an c
For 1% significance level, -2.64930970607961 is an c

2. Observation Value -2.99573227355399 is a Pote

Test Statistic: NaN

For 10% significance level, -2.99573227355399 is an
For 5% significance level, -2.99573227355399 is an c
For 1% significance level, -2.99573227355399 is an c

Dixon's Outlier Test for LnB (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -1.21402314017944 is a Pote

Test Statistic: 0.361

For 10% significance level, -1.21402314017944 is no
For 5% significance level, -1.21402314017944 is not
For 1% significance level, -1.21402314017944 is not

2. Observation Value -2.99573227355399 is a Pote

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is no
For 5% significance level, -2.99573227355399 is not
For 1% significance level, -2.99573227355399 is not

Dixon's Outlier Test for LnB (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -2.0874737133771 is a Poter

Test Statistic: 0.239

For 10% significance level, -2.0874737133771 is not
For 5% significance level, -2.0874737133771 is not a
For 1% significance level, -2.0874737133771 is not a

2. Observation Value -2.99573227355399 is a Pote

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is no
For 5% significance level, -2.99573227355399 is not
For 1% significance level, -2.99573227355399 is not

Dixon's Outlier Test for LnB (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -0.606969484318893 is a Po

Test Statistic: 0.316

For 10% significance level, -0.606969484318893 is n
For 5% significance level, -0.606969484318893 is no
For 1% significance level, -0.606969484318893 is no

2. Observation Value -2.99573227355399 is a Pote

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is no
For 5% significance level, -2.99573227355399 is not
For 1% significance level, -2.99573227355399 is not

Dixon's Outlier Test for LnB (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -1.74869997976761 is a Pote

Test Statistic: 0.077

For 10% significance level, -1.74869997976761 is no
For 5% significance level, -1.74869997976761 is not
For 1% significance level, -1.74869997976761 is not

2. Observation Value -2.99573227355399 is a Pote

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is no
For 5% significance level, -2.99573227355399 is not
For 1% significance level, -2.99573227355399 is not

Dixon's Outlier Test for LnB (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -2.41239995900125 is a Pote

Test Statistic: 0.503

For 10% significance level, -2.41239995900125 is an
For 5% significance level, -2.41239995900125 is not
For 1% significance level, -2.41239995900125 is not

2. Observation Value -2.99573227355399 is a Pote

Test Statistic: 0.000

For 10% significance level, -2.99573227355399 is no
For 5% significance level, -2.99573227355399 is not
For 1% significance level, -2.99573227355399 is not

Dixon's Outlier Test for LnCa (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Uppe

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnCa (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.00306545878646 is a Pote

Test Statistic: 0.000

For 10% significance level, 7.00306545878646 is not
For 5% significance level, 7.00306545878646 is not
For 1% significance level, 7.00306545878646 is not

2. Observation Value 6.9177056098353 is a Potent

Test Statistic: 0.230

For 10% significance level, 6.9177056098353 is not a

For 5% significance level, 6.9177056098353 is not ar

For 1% significance level, 6.9177056098353 is not ar

Dixon's Outlier Test for LnCa (cbl - 306i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Uppe

Test Statistic: NaN

For 10% significance level, 0 is an outlier.

For 5% significance level, 0 is an outlier.

For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower

Test Statistic: NaN

For 10% significance level, 0 is an outlier.

For 5% significance level, 0 is an outlier.

For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnCa (cbl - 308i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 6.86066367144829 is a Pote

Test Statistic: 0.089

For 10% significance level, 6.86066367144829 is not

For 5% significance level, 6.86066367144829 is not a

For 1% significance level, 6.86066367144829 is not a

2. Observation Value 6.76849321164863 is a Poter

Test Statistic: 0.108

For 10% significance level, 6.76849321164863 is not

For 5% significance level, 6.76849321164863 is not a

For 1% significance level, 6.76849321164863 is not a

Dixon's Outlier Test for LnCa (cbl - 340i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 6.44094654063292 is a Pote

Test Statistic: 0.306

For 10% significance level, 6.44094654063292 is not
For 5% significance level, 6.44094654063292 is not a
For 1% significance level, 6.44094654063292 is not a

2. Observation Value 6.32793678372919 is a Pote

Test Statistic: 0.088

For 10% significance level, 6.32793678372919 is not
For 5% significance level, 6.32793678372919 is not a
For 1% significance level, 6.32793678372919 is not a

Dixon's Outlier Test for LnCa (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.85646198459459 is a Pote

Test Statistic: 0.418

For 10% significance level, 6.85646198459459 is not
For 5% significance level, 6.85646198459459 is not a
For 1% significance level, 6.85646198459459 is not a

2. Observation Value 6.7202201551353 is a Potent

Test Statistic: 0.255

For 10% significance level, 6.7202201551353 is not a
For 5% significance level, 6.7202201551353 is not a
For 1% significance level, 6.7202201551353 is not a

Dixon's Outlier Test for LnCl (cbl - 301i)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 7.82404601085629 is a Pote

Test Statistic: 0.222

For 10% significance level, 7.82404601085629 is not
For 5% significance level, 7.82404601085629 is not a
For 1% significance level, 7.82404601085629 is not a

2. Observation Value 7.67786350067821 is a Pote

Test Statistic: 0.279

For 10% significance level, 7.67786350067821 is not
For 5% significance level, 7.67786350067821 is not a
For 1% significance level, 7.67786350067821 is not a

Dixon's Outlier Test for LnCl (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 7.70975686445416 is a Pote

Test Statistic: 0.107

For 10% significance level, 7.70975686445416 is not

For 5% significance level, 7.70975686445416 is not a

For 1% significance level, 7.70975686445416 is not a

2. Observation Value 7.62070508683826 is a Poter

Test Statistic: 0.061

For 10% significance level, 7.62070508683826 is not

For 5% significance level, 7.62070508683826 is not a

For 1% significance level, 7.62070508683826 is not a

Dixon's Outlier Test for LnCl (cbl - 306i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Uppe

Test Statistic: NaN

For 10% significance level, 0 is an outlier.

For 5% significance level, 0 is an outlier.

For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower

Test Statistic: NaN

For 10% significance level, 0 is an outlier.

For 5% significance level, 0 is an outlier.

For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnCl (cbl - 308i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 7.96206730875367 is a Pote

Test Statistic: 0.310

For 10% significance level, 7.96206730875367 is not

For 5% significance level, 7.96206730875367 is not a

For 1% significance level, 7.96206730875367 is not a

2. Observation Value 7.76641689801966 is a Poter

Test Statistic: 0.444

For 10% significance level, 7.76641689801966 is not
For 5% significance level, 7.76641689801966 is not a
For 1% significance level, 7.76641689801966 is not a

Dixon's Outlier Test for LnCl (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.83201418050547 is a Pote

Test Statistic: 0.525

For 10% significance level, 7.83201418050547 is an
For 5% significance level, 7.83201418050547 is not a
For 1% significance level, 7.83201418050547 is not a

2. Observation Value 7.63530388625941 is a Poten

Test Statistic: 0.629

For 10% significance level, 7.63530388625941 is an
For 5% significance level, 7.63530388625941 is an o
For 1% significance level, 7.63530388625941 is not a

Dixon's Outlier Test for LnCl (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.60090245954208 is a Pote

Test Statistic: 0.096

For 10% significance level, 7.60090245954208 is not
For 5% significance level, 7.60090245954208 is not a
For 1% significance level, 7.60090245954208 is not a

2. Observation Value 7.37775890822787 is a Poten

Test Statistic: 0.320

For 10% significance level, 7.37775890822787 is not
For 5% significance level, 7.37775890822787 is not a
For 1% significance level, 7.37775890822787 is not a

Dixon's Outlier Test for LnF (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -0.693147180559945 is a Po

Test Statistic: 0.000

For 10% significance level, -0.693147180559945 is n
For 5% significance level, -0.693147180559945 is no
For 1% significance level, -0.693147180559945 is no

2. Observation Value -4.60517018598809 is a Pote

Test Statistic: 0.177

For 10% significance level, -4.60517018598809 is no
For 5% significance level, -4.60517018598809 is not
For 1% significance level, -4.60517018598809 is not

Dixon's Outlier Test for LnF (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value -0.693147180559945 is a Po

Test Statistic: 0.000

For 10% significance level, -0.693147180559945 is n
For 5% significance level, -0.693147180559945 is no
For 1% significance level, -0.693147180559945 is no

2. Observation Value -3.91202300542815 is a Pote

Test Statistic: 0.785

For 10% significance level, -3.91202300542815 is an
For 5% significance level, -3.91202300542815 is an
For 1% significance level, -3.91202300542815 is an

Dixon's Outlier Test for LnF (cbl - 306i)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 1.0681530811834 is a Poten

Test Statistic: 0.142

For 10% significance level, 1.0681530811834 is not
For 5% significance level, 1.0681530811834 is not ar
For 1% significance level, 1.0681530811834 is not ar

2. Observation Value 0 is a Potential Outlier (Lower

Test Statistic: 0.295

For 10% significance level, 0 is not an outlier.
For 5% significance level, 0 is not an outlier.
For 1% significance level, 0 is not an outlier.

Dixon's Outlier Test for LnF (cbl - 308i)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 0.832909122935104 is a Pot

Test Statistic: 0.349

For 10% significance level, 0.832909122935104 is no
For 5% significance level, 0.832909122935104 is not
For 1% significance level, 0.832909122935104 is not

2. Observation Value 0.285178942233662 is a Pote

Test Statistic: 0.207

For 10% significance level, 0.285178942233662 is no
For 5% significance level, 0.285178942233662 is not
For 1% significance level, 0.285178942233662 is not

Dixon's Outlier Test for LnF (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2.13298230860787 is a Pote

Test Statistic: 0.645

For 10% significance level, 2.13298230860787 is an
For 5% significance level, 2.13298230860787 is an o
For 1% significance level, 2.13298230860787 is not a

2. Observation Value -0.174353387144778 is a Pot

Test Statistic: 0.014

For 10% significance level, -0.174353387144778 is n
For 5% significance level, -0.174353387144778 is no
For 1% significance level, -0.174353387144778 is no

Dixon's Outlier Test for LnF (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Uppe

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnS (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.19031540585315 is a Pote

Test Statistic: 0.614

For 10% significance level, 6.19031540585315 is an
For 5% significance level, 6.19031540585315 is an o
For 1% significance level, 6.19031540585315 is not a

2. Observation Value 5.73979291217923 is a Poter

Test Statistic: 0.232

For 10% significance level, 5.73979291217923 is not
For 5% significance level, 5.73979291217923 is not a
For 1% significance level, 5.73979291217923 is not a

Dixon's Outlier Test for LnS (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Uppe

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnS (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0 is a Potential Outlier (Uppe

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

2. Observation Value 0 is a Potential Outlier (Lower

Test Statistic: NaN

For 10% significance level, 0 is an outlier.
For 5% significance level, 0 is an outlier.
For 1% significance level, 0 is an outlier.

Dixon's Outlier Test for LnS (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.36518012602101 is a Pote

Test Statistic: 0.168

For 10% significance level, 7.36518012602101 is not
For 5% significance level, 7.36518012602101 is not a
For 1% significance level, 7.36518012602101 is not a

2. Observation Value 7.18538701558042 is a Poter

Test Statistic: 0.411

For 10% significance level, 7.18538701558042 is not
For 5% significance level, 7.18538701558042 is not a
For 1% significance level, 7.18538701558042 is not a

Dixon's Outlier Test for LnS (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.57228254269401 is a Pote

Test Statistic: 0.288

For 10% significance level, 6.57228254269401 is not
For 5% significance level, 6.57228254269401 is not a
For 1% significance level, 6.57228254269401 is not a

2. Observation Value 6.34738920965601 is a Poter

Test Statistic: 0.417

For 10% significance level, 6.34738920965601 is not
For 5% significance level, 6.34738920965601 is not a
For 1% significance level, 6.34738920965601 is not a

Dixon's Outlier Test for LnS (cbl - 341i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 6.03787091992214 is a Pote

Test Statistic: 0.165

For 10% significance level, 6.03787091992214 is not

For 5% significance level, 6.03787091992214 is not a

For 1% significance level, 6.03787091992214 is not a

2. Observation Value 5.7268477475872 is a Potent

Test Statistic: 0.329

For 10% significance level, 5.7268477475872 is not a

For 5% significance level, 5.7268477475872 is not ar

For 1% significance level, 5.7268477475872 is not ar

Dixon's Outlier Test for LnTDS (cbl - 301i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 8.79026911147866 is a Pote

Test Statistic: 0.053

For 10% significance level, 8.79026911147866 is not

For 5% significance level, 8.79026911147866 is not a

For 1% significance level, 8.79026911147866 is not a

2. Observation Value 8.36404201192206 is a Poter

Test Statistic: 0.051

For 10% significance level, 8.36404201192206 is not

For 5% significance level, 8.36404201192206 is not a

For 1% significance level, 8.36404201192206 is not a

Dixon's Outlier Test for LnTDS (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 8.83200393125627 is a Pote

Test Statistic: 0.201

For 10% significance level, 8.83200393125627 is not

For 5% significance level, 8.83200393125627 is not a

For 1% significance level, 8.83200393125627 is not a

2. Observation Value 8.34521792667643 is a Poter

Test Statistic: 0.457

For 10% significance level, 8.34521792667643 is not
For 5% significance level, 8.34521792667643 is not a
For 1% significance level, 8.34521792667643 is not a

Dixon's Outlier Test for LnTDS (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 7.28619171470238 is a Pote

Test Statistic: 0.022

For 10% significance level, 7.28619171470238 is not
For 5% significance level, 7.28619171470238 is not a
For 1% significance level, 7.28619171470238 is not a

2. Observation Value 6.06610809010375 is a Poter

Test Statistic: 0.502

For 10% significance level, 6.06610809010375 is an
For 5% significance level, 6.06610809010375 is not a
For 1% significance level, 6.06610809010375 is not a

Dixon's Outlier Test for LnTDS (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 9.23014299927236 is a Pote

Test Statistic: 0.129

For 10% significance level, 9.23014299927236 is not
For 5% significance level, 9.23014299927236 is not a
For 1% significance level, 9.23014299927236 is not a

2. Observation Value 8.71931737550637 is a Poter

Test Statistic: 0.126

For 10% significance level, 8.71931737550637 is not
For 5% significance level, 8.71931737550637 is not a
For 1% significance level, 8.71931737550637 is not a

Dixon's Outlier Test for LnTDS (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.74033674273045 is a Pote

Test Statistic: 0.014

For 10% significance level, 8.74033674273045 is not
For 5% significance level, 8.74033674273045 is not a
For 1% significance level, 8.74033674273045 is not a

2. Observation Value 8.49290049884719 is a Poter

Test Statistic: 0.091

For 10% significance level, 8.49290049884719 is not
For 5% significance level, 8.49290049884719 is not a
For 1% significance level, 8.49290049884719 is not a

Dixon's Outlier Test for LnTDS (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.68946441235669 is a Pote

Test Statistic: 0.446

For 10% significance level, 8.68946441235669 is not
For 5% significance level, 8.68946441235669 is not a
For 1% significance level, 8.68946441235669 is not a

2. Observation Value 8.33086361322474 is a Poter

Test Statistic: 0.103

For 10% significance level, 8.33086361322474 is not
For 5% significance level, 8.33086361322474 is not a
For 1% significance level, 8.33086361322474 is not a

Dixon's Outlier Test for LnpH (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 1.84530023615608 is a Pote

Test Statistic: 0.051

For 10% significance level, 1.84530023615608 is not
For 5% significance level, 1.84530023615608 is not a
For 1% significance level, 1.84530023615608 is not a

2. Observation Value 1.78339121955754 is a Poter

Test Statistic: 0.000

For 10% significance level, 1.78339121955754 is not
For 5% significance level, 1.78339121955754 is not a
For 1% significance level, 1.78339121955754 is not a

Dixon's Outlier Test for LnpH (cbl - 302i)

	A	B	C	D	E	F	G	H	I	J	K	L
897												
898	Number of Observations = 8											
899	10% critical value: 0.479											
900	5% critical value: 0.554											
901	1% critical value: 0.683											
902												
903	**1. Observation Value 2.04769284336526 is a Pote**											
904												
905	Test Statistic: 0.516											
906												
907	For 10% significance level, 2.04769284336526 is an											
908	For 5% significance level, 2.04769284336526 is not a											
909	For 1% significance level, 2.04769284336526 is not a											
910												
911	**2. Observation Value 1.59736533119983 is a Poter**											
912												
913	Test Statistic: 0.188											
914												
915	For 10% significance level, 1.59736533119983 is not											
916	For 5% significance level, 1.59736533119983 is not a											
917	For 1% significance level, 1.59736533119983 is not a											
918												
919												
920	**Dixon's Outlier Test for LnpH (cbl - 306i)**											
921												
922	Number of Observations = 8											
923	10% critical value: 0.479											
924	5% critical value: 0.554											
925	1% critical value: 0.683											
926												
927	**1. Observation Value 1.98650354602057 is a Pote**											
928												
929	Test Statistic: 0.106											
930												
931	For 10% significance level, 1.98650354602057 is not											
932	For 5% significance level, 1.98650354602057 is not a											
933	For 1% significance level, 1.98650354602057 is not a											
934												
935	**2. Observation Value 1.48387468945875 is a Poter**											
936												
937	Test Statistic: 0.507											
938												
939	For 10% significance level, 1.48387468945875 is an											
940	For 5% significance level, 1.48387468945875 is not a											
941	For 1% significance level, 1.48387468945875 is not a											
942												
943												
944	**Dixon's Outlier Test for LnpH (cbl - 308i)**											
945												
946	Number of Observations = 8											
947	10% critical value: 0.479											
948	5% critical value: 0.554											
949	1% critical value: 0.683											
950												
951	**1. Observation Value 1.9213246735827 is a Poten**											
952												
953	Test Statistic: 0.517											
954												
955	For 10% significance level, 1.9213246735827 is an o											
956	For 5% significance level, 1.9213246735827 is not ar											
957	For 1% significance level, 1.9213246735827 is not ar											
958												
959	**2. Observation Value 1.71199450075919 is a Poter**											
960												

Test Statistic: 0.517

For 10% significance level, 1.71199450075919 is an

For 5% significance level, 1.71199450075919 is not a

For 1% significance level, 1.71199450075919 is not a

Dixon's Outlier Test for LnpH (cbl - 340i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1.9387416595767 is a Poten

Test Statistic: 0.343

For 10% significance level, 1.9387416595767 is not a

For 5% significance level, 1.9387416595767 is not an

For 1% significance level, 1.9387416595767 is not an

2. Observation Value 1.69744878975681 is a Poter

Test Statistic: 0.311

For 10% significance level, 1.69744878975681 is not

For 5% significance level, 1.69744878975681 is not a

For 1% significance level, 1.69744878975681 is not a

Dixon's Outlier Test for LnpH (cbl - 341i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1.82616089594539 is a Pote

Test Statistic: 0.028

For 10% significance level, 1.82616089594539 is not

For 5% significance level, 1.82616089594539 is not a

For 1% significance level, 1.82616089594539 is not a

2. Observation Value 1.65441127807683 is a Poter

Test Statistic: 0.342

For 10% significance level, 1.65441127807683 is not

For 5% significance level, 1.65441127807683 is not a

For 1% significance level, 1.65441127807683 is not a

Outlier Tests for Selected Uncensored Variables

User Selected Options

Date/Time of Computation ProUCL 5.112/2/2017 10:44:18 PM

From File DetectionMonitoring_ProUCLUploadDeTrendResiduals_11272017_a.xls

Full Precision OFF

Dixon's Outlier Test for TotalBoron (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.0707 is a Potential Outlier (

Test Statistic: 1.000

For 10% significance level, 0.0707 is an outlier.
For 5% significance level, 0.0707 is an outlier.
For 1% significance level, 0.0707 is an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: NaN

For 10% significance level, 0.05 is an outlier.
For 5% significance level, 0.05 is an outlier.
For 1% significance level, 0.05 is an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.297 is a Potential Outlier (U

Test Statistic: 0.571

For 10% significance level, 0.297 is an outlier.
For 5% significance level, 0.297 is an outlier.
For 1% significance level, 0.297 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.
For 5% significance level, 0.05 is not an outlier.
For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.124 is a Potential Outlier (U

Test Statistic: 0.327

For 10% significance level, 0.124 is not an outlier.
For 5% significance level, 0.124 is not an outlier.
For 1% significance level, 0.124 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.
For 5% significance level, 0.05 is not an outlier.
For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.545 is a Potential Outlier (U

Test Statistic: 0.584

For 10% significance level, 0.545 is an outlier.
For 5% significance level, 0.545 is an outlier.
For 1% significance level, 0.545 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.
For 5% significance level, 0.05 is not an outlier.
For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.174 is a Potential Outlier (U

Test Statistic: 0.129

For 10% significance level, 0.174 is not an outlier.
For 5% significance level, 0.174 is not an outlier.
For 1% significance level, 0.174 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.
For 5% significance level, 0.05 is not an outlier.
For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 341i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 0.0896 is a Potential Outlier (

Test Statistic: 0.576

For 10% significance level, 0.0896 is an outlier.

For 5% significance level, 0.0896 is an outlier.

For 1% significance level, 0.0896 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.

For 5% significance level, 0.05 is not an outlier.

For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 301i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 47 is a Potential Outlier (Upp

Test Statistic: 0.245

For 10% significance level, 47 is not an outlier.

For 5% significance level, 47 is not an outlier.

For 1% significance level, 47 is not an outlier.

2. Observation Value -65.93 is a Potential Outlier (L

Test Statistic: 0.397

For 10% significance level, -65.93 is not an outlier.

For 5% significance level, -65.93 is not an outlier.

For 1% significance level, -65.93 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1100 is a Potential Outlier (U

Test Statistic: 0.000

For 10% significance level, 1100 is not an outlier.

For 5% significance level, 1100 is not an outlier.

For 1% significance level, 1100 is not an outlier.

2. Observation Value 1010 is a Potential Outlier (Lo

Test Statistic: 0.222

For 10% significance level, 1010 is not an outlier.
For 5% significance level, 1010 is not an outlier.
For 1% significance level, 1010 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 52.22 is a Potential Outlier (U

Test Statistic: 0.141

For 10% significance level, 52.22 is not an outlier.
For 5% significance level, 52.22 is not an outlier.
For 1% significance level, 52.22 is not an outlier.

2. Observation Value -64.78 is a Potential Outlier (L

Test Statistic: 0.342

For 10% significance level, -64.78 is not an outlier.
For 5% significance level, -64.78 is not an outlier.
For 1% significance level, -64.78 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 954 is a Potential Outlier (Up

Test Statistic: 0.092

For 10% significance level, 954 is not an outlier.
For 5% significance level, 954 is not an outlier.
For 1% significance level, 954 is not an outlier.

2. Observation Value 870 is a Potential Outlier (Low

Test Statistic: 0.104

For 10% significance level, 870 is not an outlier.
For 5% significance level, 870 is not an outlier.
For 1% significance level, 870 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 627 is a Potential Outlier (Up

Test Statistic: 0.317

For 10% significance level, 627 is not an outlier.
For 5% significance level, 627 is not an outlier.
For 1% significance level, 627 is not an outlier.

2. Observation Value 560 is a Potential Outlier (Low

Test Statistic: 0.085

For 10% significance level, 560 is not an outlier.
For 5% significance level, 560 is not an outlier.
For 1% significance level, 560 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 950 is a Potential Outlier (Up

Test Statistic: 0.431

For 10% significance level, 950 is not an outlier.
For 5% significance level, 950 is not an outlier.
For 1% significance level, 950 is not an outlier.

2. Observation Value 829 is a Potential Outlier (Low

Test Statistic: 0.247

For 10% significance level, 829 is not an outlier.
For 5% significance level, 829 is not an outlier.
For 1% significance level, 829 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 3200 is a Potential Outlier (U

Test Statistic: 0.737

For 10% significance level, 3200 is an outlier.
For 5% significance level, 3200 is an outlier.
For 1% significance level, 3200 is an outlier.

2. Observation Value 2160 is a Potential Outlier (Lo

Test Statistic: 0.265

For 10% significance level, 2160 is not an outlier.
For 5% significance level, 2160 is not an outlier.
For 1% significance level, 2160 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2230 is a Potential Outlier (U

Test Statistic: 0.111

For 10% significance level, 2230 is not an outlier.
For 5% significance level, 2230 is not an outlier.
For 1% significance level, 2230 is not an outlier.

2. Observation Value 2040 is a Potential Outlier (Lo

Test Statistic: 0.059

For 10% significance level, 2040 is not an outlier.
For 5% significance level, 2040 is not an outlier.
For 1% significance level, 2040 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 129 is a Potential Outlier (Up

Test Statistic: 0.304

For 10% significance level, 129 is not an outlier.
For 5% significance level, 129 is not an outlier.
For 1% significance level, 129 is not an outlier.

2. Observation Value -105.2 is a Potential Outlier (L

Test Statistic: 0.319

For 10% significance level, -105.2 is not an outlier.
For 5% significance level, -105.2 is not an outlier.
For 1% significance level, -105.2 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2870 is a Potential Outlier (U

Test Statistic: 0.324

For 10% significance level, 2870 is not an outlier.
For 5% significance level, 2870 is not an outlier.
For 1% significance level, 2870 is not an outlier.

2. Observation Value 2360 is a Potential Outlier (Lo

Test Statistic: 0.425

For 10% significance level, 2360 is not an outlier.
For 5% significance level, 2360 is not an outlier.
For 1% significance level, 2360 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2520 is a Potential Outlier (U

Test Statistic: 0.538

For 10% significance level, 2520 is an outlier.
For 5% significance level, 2520 is not an outlier.
For 1% significance level, 2520 is not an outlier.

2. Observation Value 2070 is a Potential Outlier (Lo

Test Statistic: 0.613

For 10% significance level, 2070 is an outlier.
For 5% significance level, 2070 is an outlier.
For 1% significance level, 2070 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2000 is a Potential Outlier (U

Test Statistic: 0.103

For 10% significance level, 2000 is not an outlier.
For 5% significance level, 2000 is not an outlier.
For 1% significance level, 2000 is not an outlier.

2. Observation Value 1600 is a Potential Outlier (Lo

Test Statistic: 0.297

For 10% significance level, 1600 is not an outlier.
For 5% significance level, 1600 is not an outlier.
For 1% significance level, 1600 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.5 is a Potential Outlier (Upp

Test Statistic: 0.000

For 10% significance level, 0.5 is not an outlier.
For 5% significance level, 0.5 is not an outlier.
For 1% significance level, 0.5 is not an outlier.

2. Observation Value 0.01 is a Potential Outlier (Lo

Test Statistic: 0.020

For 10% significance level, 0.01 is not an outlier.
For 5% significance level, 0.01 is not an outlier.
For 1% significance level, 0.01 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.5 is a Potential Outlier (Upp

Test Statistic: 0.000

For 10% significance level, 0.5 is not an outlier.
For 5% significance level, 0.5 is not an outlier.
For 1% significance level, 0.5 is not an outlier.

2. Observation Value 0.02 is a Potential Outlier (Lo

Test Statistic: 0.479

For 10% significance level, 0.02 is an outlier.
For 5% significance level, 0.02 is not an outlier.
For 1% significance level, 0.02 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 12.6 is a Potential Outlier (Up

Test Statistic: 0.863

For 10% significance level, 12.6 is an outlier.
For 5% significance level, 12.6 is an outlier.
For 1% significance level, 12.6 is an outlier.

2. Observation Value 1 is a Potential Outlier (Lower

Test Statistic: 0.194

For 10% significance level, 1 is not an outlier.
For 5% significance level, 1 is not an outlier.
For 1% significance level, 1 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 9.05 is a Potential Outlier (Up

Test Statistic: 0.893

For 10% significance level, 9.05 is an outlier.
For 5% significance level, 9.05 is an outlier.
For 1% significance level, 9.05 is an outlier.

2. Observation Value 1.33 is a Potential Outlier (Lo

Test Statistic: 0.165

For 10% significance level, 1.33 is not an outlier.
For 5% significance level, 1.33 is not an outlier.
For 1% significance level, 1.33 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 8.44 is a Potential Outlier (Up

Test Statistic: 0.859

For 10% significance level, 8.44 is an outlier.
For 5% significance level, 8.44 is an outlier.
For 1% significance level, 8.44 is an outlier.

2. Observation Value 0.84 is a Potential Outlier (Lo

Test Statistic: 0.009

For 10% significance level, 0.84 is not an outlier.
For 5% significance level, 0.84 is not an outlier.
For 1% significance level, 0.84 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.133 is a Potential Outlier (U

Test Statistic: 0.210

For 10% significance level, 0.133 is not an outlier.
For 5% significance level, 0.133 is not an outlier.
For 1% significance level, 0.133 is not an outlier.

2. Observation Value -0.244 is a Potential Outlier (L

Test Statistic: 0.618

For 10% significance level, -0.244 is an outlier.

For 5% significance level, -0.244 is an outlier.

For 1% significance level, -0.244 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 301i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 488 is a Potential Outlier (Up

Test Statistic: 0.660

For 10% significance level, 488 is an outlier.

For 5% significance level, 488 is an outlier.

For 1% significance level, 488 is not an outlier.

2. Observation Value 311 is a Potential Outlier (Low

Test Statistic: 0.214

For 10% significance level, 311 is not an outlier.

For 5% significance level, 311 is not an outlier.

For 1% significance level, 311 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 67.9 is a Potential Outlier (Up

Test Statistic: 0.212

For 10% significance level, 67.9 is not an outlier.

For 5% significance level, 67.9 is not an outlier.

For 1% significance level, 67.9 is not an outlier.

2. Observation Value -56.17 is a Potential Outlier (L

Test Statistic: 0.099

For 10% significance level, -56.17 is not an outlier.

For 5% significance level, -56.17 is not an outlier.

For 1% significance level, -56.17 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 306i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 145.8 is a Potential Outlier (U

Test Statistic: 0.003

For 10% significance level, 145.8 is not an outlier.
For 5% significance level, 145.8 is not an outlier.
For 1% significance level, 145.8 is not an outlier.

2. Observation Value -153.3 is a Potential Outlier (L

Test Statistic: 0.200

For 10% significance level, -153.3 is not an outlier.
For 5% significance level, -153.3 is not an outlier.
For 1% significance level, -153.3 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 1580 is a Potential Outlier (U

Test Statistic: 0.176

For 10% significance level, 1580 is not an outlier.
For 5% significance level, 1580 is not an outlier.
For 1% significance level, 1580 is not an outlier.

2. Observation Value 1320 is a Potential Outlier (Lo

Test Statistic: 0.391

For 10% significance level, 1320 is not an outlier.
For 5% significance level, 1320 is not an outlier.
For 1% significance level, 1320 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 715 is a Potential Outlier (Up

Test Statistic: 0.303

For 10% significance level, 715 is not an outlier.
For 5% significance level, 715 is not an outlier.
For 1% significance level, 715 is not an outlier.

2. Observation Value 571 is a Potential Outlier (Low

Test Statistic: 0.395

For 10% significance level, 571 is not an outlier.
For 5% significance level, 571 is not an outlier.
For 1% significance level, 571 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 419 is a Potential Outlier (Up

Test Statistic: 0.181

For 10% significance level, 419 is not an outlier.
For 5% significance level, 419 is not an outlier.
For 1% significance level, 419 is not an outlier.

2. Observation Value 307 is a Potential Outlier (Low

Test Statistic: 0.299

For 10% significance level, 307 is not an outlier.
For 5% significance level, 307 is not an outlier.
For 1% significance level, 307 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6570 is a Potential Outlier (U

Test Statistic: 0.064

For 10% significance level, 6570 is not an outlier.
For 5% significance level, 6570 is not an outlier.
For 1% significance level, 6570 is not an outlier.

2. Observation Value 4290 is a Potential Outlier (Lo

Test Statistic: 0.042

For 10% significance level, 4290 is not an outlier.
For 5% significance level, 4290 is not an outlier.
For 1% significance level, 4290 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6850 is a Potential Outlier (U

Test Statistic: 0.225

For 10% significance level, 6850 is not an outlier.
For 5% significance level, 6850 is not an outlier.
For 1% significance level, 6850 is not an outlier.

2. Observation Value 4210 is a Potential Outlier (Lo

Test Statistic: 0.404

For 10% significance level, 4210 is not an outlier.
For 5% significance level, 4210 is not an outlier.
For 1% significance level, 4210 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 1460 is a Potential Outlier (U

Test Statistic: 0.030

For 10% significance level, 1460 is not an outlier.
For 5% significance level, 1460 is not an outlier.
For 1% significance level, 1460 is not an outlier.

2. Observation Value 431 is a Potential Outlier (Low

Test Statistic: 0.356

For 10% significance level, 431 is not an outlier.
For 5% significance level, 431 is not an outlier.
For 1% significance level, 431 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 10200 is a Potential Outlier (

Test Statistic: 0.156

For 10% significance level, 10200 is not an outlier.
For 5% significance level, 10200 is not an outlier.
For 1% significance level, 10200 is not an outlier.

2. Observation Value 6120 is a Potential Outlier (Lo

Test Statistic: 0.103

For 10% significance level, 6120 is not an outlier.
For 5% significance level, 6120 is not an outlier.
For 1% significance level, 6120 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6250 is a Potential Outlier (U

Test Statistic: 0.016

For 10% significance level, 6250 is not an outlier.
For 5% significance level, 6250 is not an outlier.
For 1% significance level, 6250 is not an outlier.

2. Observation Value 4880 is a Potential Outlier (Lo

Test Statistic: 0.081

For 10% significance level, 4880 is not an outlier.
For 5% significance level, 4880 is not an outlier.
For 1% significance level, 4880 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 5940 is a Potential Outlier (U

Test Statistic: 0.488

For 10% significance level, 5940 is an outlier.
For 5% significance level, 5940 is not an outlier.
For 1% significance level, 5940 is not an outlier.

2. Observation Value 4150 is a Potential Outlier (Lo

Test Statistic: 0.094

For 10% significance level, 4150 is not an outlier.
For 5% significance level, 4150 is not an outlier.
For 1% significance level, 4150 is not an outlier.

Dixon's Outlier Test for pH (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.33 is a Potential Outlier (Up

Test Statistic: 0.053

For 10% significance level, 6.33 is not an outlier.
For 5% significance level, 6.33 is not an outlier.
For 1% significance level, 6.33 is not an outlier.

2. Observation Value 5.95 is a Potential Outlier (Lov

Test Statistic: 0.000

For 10% significance level, 5.95 is not an outlier.
For 5% significance level, 5.95 is not an outlier.
For 1% significance level, 5.95 is not an outlier.

Dixon's Outlier Test for pH (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 7.75 is a Potential Outlier (Up

Test Statistic: 0.566

For 10% significance level, 7.75 is an outlier.

For 5% significance level, 7.75 is an outlier.

For 1% significance level, 7.75 is not an outlier.

2. Observation Value 4.94 is a Potential Outlier (Lo

Test Statistic: 0.170

For 10% significance level, 4.94 is not an outlier.

For 5% significance level, 4.94 is not an outlier.

For 1% significance level, 4.94 is not an outlier.

Dixon's Outlier Test for pH (cbl - 306i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 7.29 is a Potential Outlier (Up

Test Statistic: 0.119

For 10% significance level, 7.29 is not an outlier.

For 5% significance level, 7.29 is not an outlier.

For 1% significance level, 7.29 is not an outlier.

2. Observation Value 4.41 is a Potential Outlier (Lo

Test Statistic: 0.448

For 10% significance level, 4.41 is not an outlier.

For 5% significance level, 4.41 is not an outlier.

For 1% significance level, 4.41 is not an outlier.

Dixon's Outlier Test for pH (cbl - 308i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 6.83 is a Potential Outlier (Up

Test Statistic: 0.534

For 10% significance level, 6.83 is an outlier.

For 5% significance level, 6.83 is not an outlier.

For 1% significance level, 6.83 is not an outlier.

2. Observation Value 5.54 is a Potential Outlier (Lo

Test Statistic: 0.500

For 10% significance level, 5.54 is an outlier.
For 5% significance level, 5.54 is not an outlier.
For 1% significance level, 5.54 is not an outlier.

Dixon's Outlier Test for pH (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.95 is a Potential Outlier (Up

Test Statistic: 0.364

For 10% significance level, 6.95 is not an outlier.
For 5% significance level, 6.95 is not an outlier.
For 1% significance level, 6.95 is not an outlier.

2. Observation Value 5.46 is a Potential Outlier (Lo

Test Statistic: 0.292

For 10% significance level, 5.46 is not an outlier.
For 5% significance level, 5.46 is not an outlier.
For 1% significance level, 5.46 is not an outlier.

Dixon's Outlier Test for pH (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.21 is a Potential Outlier (Up

Test Statistic: 0.030

For 10% significance level, 6.21 is not an outlier.
For 5% significance level, 6.21 is not an outlier.
For 1% significance level, 6.21 is not an outlier.

2. Observation Value 5.23 is a Potential Outlier (Lo

Test Statistic: 0.323

For 10% significance level, 5.23 is not an outlier.
For 5% significance level, 5.23 is not an outlier.
For 1% significance level, 5.23 is not an outlier.

Outlier Tests for Selected Uncensored Variables

User Selected Options

Date/Time of Computation	ProUCL 5.112/3/2017 2:20:41 PM
From File	DetectionMonitoring_ProUCLUploadDeTrendResiduals_11272017_a.xls
Full Precision	OFF

Dixon's Outlier Test for TotalBoron (cbl - 301i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 0.0707 is a Potential Outlier (

Test Statistic: 1.000

For 10% significance level, 0.0707 is an outlier.

For 5% significance level, 0.0707 is an outlier.

For 1% significance level, 0.0707 is an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: NaN

For 10% significance level, 0.05 is an outlier.

For 5% significance level, 0.05 is an outlier.

For 1% significance level, 0.05 is an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 0.297 is a Potential Outlier (U

Test Statistic: 0.571

For 10% significance level, 0.297 is an outlier.

For 5% significance level, 0.297 is an outlier.

For 1% significance level, 0.297 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.

For 5% significance level, 0.05 is not an outlier.

For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 306i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 0.124 is a Potential Outlier (U

Test Statistic: 0.327

For 10% significance level, 0.124 is not an outlier.
For 5% significance level, 0.124 is not an outlier.
For 1% significance level, 0.124 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.
For 5% significance level, 0.05 is not an outlier.
For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.545 is a Potential Outlier (U

Test Statistic: 0.584

For 10% significance level, 0.545 is an outlier.
For 5% significance level, 0.545 is an outlier.
For 1% significance level, 0.545 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.
For 5% significance level, 0.05 is not an outlier.
For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.174 is a Potential Outlier (U

Test Statistic: 0.129

For 10% significance level, 0.174 is not an outlier.
For 5% significance level, 0.174 is not an outlier.
For 1% significance level, 0.174 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.
For 5% significance level, 0.05 is not an outlier.
For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalBoron (cbl - 341i)

Number of Observations = 7

10% critical value: 0.434

5% critical value: 0.507

1% critical value: 0.637

1. Observation Value 0.0668 is a Potential Outlier (

Test Statistic: 0.482

For 10% significance level, 0.0668 is an outlier.

For 5% significance level, 0.0668 is not an outlier.

For 1% significance level, 0.0668 is not an outlier.

2. Observation Value 0.05 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 0.05 is not an outlier.

For 5% significance level, 0.05 is not an outlier.

For 1% significance level, 0.05 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 301i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 47 is a Potential Outlier (Upp

Test Statistic: 0.245

For 10% significance level, 47 is not an outlier.

For 5% significance level, 47 is not an outlier.

For 1% significance level, 47 is not an outlier.

2. Observation Value -65.93 is a Potential Outlier (L

Test Statistic: 0.397

For 10% significance level, -65.93 is not an outlier.

For 5% significance level, -65.93 is not an outlier.

For 1% significance level, -65.93 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 1100 is a Potential Outlier (U

Test Statistic: 0.000

For 10% significance level, 1100 is not an outlier.

For 5% significance level, 1100 is not an outlier.

For 1% significance level, 1100 is not an outlier.

2. Observation Value 1010 is a Potential Outlier (Lo

Test Statistic: 0.222

For 10% significance level, 1010 is not an outlier.
For 5% significance level, 1010 is not an outlier.
For 1% significance level, 1010 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 52.22 is a Potential Outlier (U

Test Statistic: 0.141

For 10% significance level, 52.22 is not an outlier.
For 5% significance level, 52.22 is not an outlier.
For 1% significance level, 52.22 is not an outlier.

2. Observation Value -64.78 is a Potential Outlier (L

Test Statistic: 0.342

For 10% significance level, -64.78 is not an outlier.
For 5% significance level, -64.78 is not an outlier.
For 1% significance level, -64.78 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 954 is a Potential Outlier (Up

Test Statistic: 0.092

For 10% significance level, 954 is not an outlier.
For 5% significance level, 954 is not an outlier.
For 1% significance level, 954 is not an outlier.

2. Observation Value 870 is a Potential Outlier (Low

Test Statistic: 0.104

For 10% significance level, 870 is not an outlier.
For 5% significance level, 870 is not an outlier.
For 1% significance level, 870 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 627 is a Potential Outlier (Up

Test Statistic: 0.317

For 10% significance level, 627 is not an outlier.
For 5% significance level, 627 is not an outlier.
For 1% significance level, 627 is not an outlier.

2. Observation Value 560 is a Potential Outlier (Low

Test Statistic: 0.085

For 10% significance level, 560 is not an outlier.
For 5% significance level, 560 is not an outlier.
For 1% significance level, 560 is not an outlier.

Dixon's Outlier Test for TotalCalcium (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 950 is a Potential Outlier (Up

Test Statistic: 0.431

For 10% significance level, 950 is not an outlier.
For 5% significance level, 950 is not an outlier.
For 1% significance level, 950 is not an outlier.

2. Observation Value 829 is a Potential Outlier (Low

Test Statistic: 0.247

For 10% significance level, 829 is not an outlier.
For 5% significance level, 829 is not an outlier.
For 1% significance level, 829 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 3200 is a Potential Outlier (U

Test Statistic: 0.737

For 10% significance level, 3200 is an outlier.
For 5% significance level, 3200 is an outlier.
For 1% significance level, 3200 is an outlier.

2. Observation Value 2160 is a Potential Outlier (Lo

Test Statistic: 0.265

For 10% significance level, 2160 is not an outlier.
For 5% significance level, 2160 is not an outlier.
For 1% significance level, 2160 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2230 is a Potential Outlier (U

Test Statistic: 0.111

For 10% significance level, 2230 is not an outlier.
For 5% significance level, 2230 is not an outlier.
For 1% significance level, 2230 is not an outlier.

2. Observation Value 2040 is a Potential Outlier (Lo

Test Statistic: 0.059

For 10% significance level, 2040 is not an outlier.
For 5% significance level, 2040 is not an outlier.
For 1% significance level, 2040 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 129 is a Potential Outlier (Up

Test Statistic: 0.304

For 10% significance level, 129 is not an outlier.
For 5% significance level, 129 is not an outlier.
For 1% significance level, 129 is not an outlier.

2. Observation Value -105.2 is a Potential Outlier (L

Test Statistic: 0.319

For 10% significance level, -105.2 is not an outlier.
For 5% significance level, -105.2 is not an outlier.
For 1% significance level, -105.2 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2870 is a Potential Outlier (U

Test Statistic: 0.324

For 10% significance level, 2870 is not an outlier.
For 5% significance level, 2870 is not an outlier.
For 1% significance level, 2870 is not an outlier.

2. Observation Value 2360 is a Potential Outlier (Lo

Test Statistic: 0.425

For 10% significance level, 2360 is not an outlier.
For 5% significance level, 2360 is not an outlier.
For 1% significance level, 2360 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 340i)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 2520 is a Potential Outlier (U

Test Statistic: 0.538

For 10% significance level, 2520 is an outlier.
For 5% significance level, 2520 is an outlier.
For 1% significance level, 2520 is not an outlier.

2. Observation Value 2260 is a Potential Outlier (Lo

Test Statistic: 0.077

For 10% significance level, 2260 is not an outlier.
For 5% significance level, 2260 is not an outlier.
For 1% significance level, 2260 is not an outlier.

Dixon's Outlier Test for Chloride (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 2000 is a Potential Outlier (U

Test Statistic: 0.103

For 10% significance level, 2000 is not an outlier.
For 5% significance level, 2000 is not an outlier.
For 1% significance level, 2000 is not an outlier.

2. Observation Value 1600 is a Potential Outlier (Lo

Test Statistic: 0.297

For 10% significance level, 1600 is not an outlier.
For 5% significance level, 1600 is not an outlier.
For 1% significance level, 1600 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.5 is a Potential Outlier (Upp

Test Statistic: 0.000

For 10% significance level, 0.5 is not an outlier.
For 5% significance level, 0.5 is not an outlier.
For 1% significance level, 0.5 is not an outlier.

2. Observation Value 0.01 is a Potential Outlier (Lo

Test Statistic: 0.020

For 10% significance level, 0.01 is not an outlier.
For 5% significance level, 0.01 is not an outlier.
For 1% significance level, 0.01 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 0.5 is a Potential Outlier (Up

Test Statistic: 0.000

For 10% significance level, 0.5 is not an outlier.
For 5% significance level, 0.5 is not an outlier.
For 1% significance level, 0.5 is not an outlier.

2. Observation Value 0.02 is a Potential Outlier (Lo

Test Statistic: 0.479

For 10% significance level, 0.02 is an outlier.
For 5% significance level, 0.02 is not an outlier.
For 1% significance level, 0.02 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 12.6 is a Potential Outlier (U

Test Statistic: 0.863

For 10% significance level, 12.6 is an outlier.
For 5% significance level, 12.6 is an outlier.
For 1% significance level, 12.6 is an outlier.

2. Observation Value 1 is a Potential Outlier (Lower

Test Statistic: 0.194

For 10% significance level, 1 is not an outlier.
For 5% significance level, 1 is not an outlier.
For 1% significance level, 1 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 308i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 9.05 is a Potential Outlier (Up

Test Statistic: 0.893

For 10% significance level, 9.05 is an outlier.

For 5% significance level, 9.05 is an outlier.

For 1% significance level, 9.05 is an outlier.

2. Observation Value 1.33 is a Potential Outlier (Lo

Test Statistic: 0.165

For 10% significance level, 1.33 is not an outlier.

For 5% significance level, 1.33 is not an outlier.

For 1% significance level, 1.33 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 340i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 8.44 is a Potential Outlier (Up

Test Statistic: 0.859

For 10% significance level, 8.44 is an outlier.

For 5% significance level, 8.44 is an outlier.

For 1% significance level, 8.44 is an outlier.

2. Observation Value 0.84 is a Potential Outlier (Lo

Test Statistic: 0.009

For 10% significance level, 0.84 is not an outlier.

For 5% significance level, 0.84 is not an outlier.

For 1% significance level, 0.84 is not an outlier.

Dixon's Outlier Test for Fluoride (cbl - 341i)

Number of Observations = 7

10% critical value: 0.434

5% critical value: 0.507

1% critical value: 0.637

1. Observation Value 0.133 is a Potential Outlier (U

Test Statistic: 0.210

For 10% significance level, 0.133 is not an outlier.

For 5% significance level, 0.133 is not an outlier.

For 1% significance level, 0.133 is not an outlier.

2. Observation Value -0.0325 is a Potential Outlier (

Test Statistic: 0.085

For 10% significance level, -0.0325 is not an outlier.
For 5% significance level, -0.0325 is not an outlier.
For 1% significance level, -0.0325 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 301i)

Number of Observations = 7
10% critical value: 0.434
5% critical value: 0.507
1% critical value: 0.637

1. Observation Value 381 is a Potential Outlier (Up

Test Statistic: 0.557

For 10% significance level, 381 is an outlier.
For 5% significance level, 381 is an outlier.
For 1% significance level, 381 is not an outlier.

2. Observation Value 311 is a Potential Outlier (Low

Test Statistic: 0.214

For 10% significance level, 311 is not an outlier.
For 5% significance level, 311 is not an outlier.
For 1% significance level, 311 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 67.9 is a Potential Outlier (Up

Test Statistic: 0.212

For 10% significance level, 67.9 is not an outlier.
For 5% significance level, 67.9 is not an outlier.
For 1% significance level, 67.9 is not an outlier.

2. Observation Value -56.17 is a Potential Outlier (L

Test Statistic: 0.099

For 10% significance level, -56.17 is not an outlier.
For 5% significance level, -56.17 is not an outlier.
For 1% significance level, -56.17 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 145.8 is a Potential Outlier (U

Test Statistic: 0.003

For 10% significance level, 145.8 is not an outlier.
For 5% significance level, 145.8 is not an outlier.
For 1% significance level, 145.8 is not an outlier.

2. Observation Value -153.3 is a Potential Outlier (L

Test Statistic: 0.200

For 10% significance level, -153.3 is not an outlier.
For 5% significance level, -153.3 is not an outlier.
For 1% significance level, -153.3 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 1580 is a Potential Outlier (U

Test Statistic: 0.176

For 10% significance level, 1580 is not an outlier.
For 5% significance level, 1580 is not an outlier.
For 1% significance level, 1580 is not an outlier.

2. Observation Value 1320 is a Potential Outlier (Lo

Test Statistic: 0.391

For 10% significance level, 1320 is not an outlier.
For 5% significance level, 1320 is not an outlier.
For 1% significance level, 1320 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 715 is a Potential Outlier (Up

Test Statistic: 0.303

For 10% significance level, 715 is not an outlier.
For 5% significance level, 715 is not an outlier.
For 1% significance level, 715 is not an outlier.

2. Observation Value 571 is a Potential Outlier (Low

Test Statistic: 0.395

For 10% significance level, 571 is not an outlier.
For 5% significance level, 571 is not an outlier.
For 1% significance level, 571 is not an outlier.

Dixon's Outlier Test for Sulfate (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 419 is a Potential Outlier (Up

Test Statistic: 0.181

For 10% significance level, 419 is not an outlier.
For 5% significance level, 419 is not an outlier.
For 1% significance level, 419 is not an outlier.

2. Observation Value 307 is a Potential Outlier (Low

Test Statistic: 0.299

For 10% significance level, 307 is not an outlier.
For 5% significance level, 307 is not an outlier.
For 1% significance level, 307 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6570 is a Potential Outlier (U

Test Statistic: 0.064

For 10% significance level, 6570 is not an outlier.
For 5% significance level, 6570 is not an outlier.
For 1% significance level, 6570 is not an outlier.

2. Observation Value 4290 is a Potential Outlier (Lo

Test Statistic: 0.042

For 10% significance level, 4290 is not an outlier.
For 5% significance level, 4290 is not an outlier.
For 1% significance level, 4290 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 302i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6850 is a Potential Outlier (U

Test Statistic: 0.225

For 10% significance level, 6850 is not an outlier.
For 5% significance level, 6850 is not an outlier.
For 1% significance level, 6850 is not an outlier.

2. Observation Value 4210 is a Potential Outlier (Lo

Test Statistic: 0.404

For 10% significance level, 4210 is not an outlier.
For 5% significance level, 4210 is not an outlier.
For 1% significance level, 4210 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 306i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 1460 is a Potential Outlier (U

Test Statistic: 0.030

For 10% significance level, 1460 is not an outlier.
For 5% significance level, 1460 is not an outlier.
For 1% significance level, 1460 is not an outlier.

2. Observation Value 431 is a Potential Outlier (Low

Test Statistic: 0.356

For 10% significance level, 431 is not an outlier.
For 5% significance level, 431 is not an outlier.
For 1% significance level, 431 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 308i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 10200 is a Potential Outlier (

Test Statistic: 0.156

For 10% significance level, 10200 is not an outlier.
For 5% significance level, 10200 is not an outlier.
For 1% significance level, 10200 is not an outlier.

2. Observation Value 6120 is a Potential Outlier (Lo

Test Statistic: 0.103

For 10% significance level, 6120 is not an outlier.
For 5% significance level, 6120 is not an outlier.
For 1% significance level, 6120 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 340i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6250 is a Potential Outlier (U

Test Statistic: 0.016

For 10% significance level, 6250 is not an outlier.
For 5% significance level, 6250 is not an outlier.
For 1% significance level, 6250 is not an outlier.

2. Observation Value 4880 is a Potential Outlier (Lo

Test Statistic: 0.081

For 10% significance level, 4880 is not an outlier.
For 5% significance level, 4880 is not an outlier.
For 1% significance level, 4880 is not an outlier.

Dixon's Outlier Test for TotalTDS (cbl - 341i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 5940 is a Potential Outlier (U

Test Statistic: 0.488

For 10% significance level, 5940 is an outlier.
For 5% significance level, 5940 is not an outlier.
For 1% significance level, 5940 is not an outlier.

2. Observation Value 4150 is a Potential Outlier (Lo

Test Statistic: 0.094

For 10% significance level, 4150 is not an outlier.
For 5% significance level, 4150 is not an outlier.
For 1% significance level, 4150 is not an outlier.

Dixon's Outlier Test for pH (cbl - 301i)

Number of Observations = 8
10% critical value: 0.479
5% critical value: 0.554
1% critical value: 0.683

1. Observation Value 6.33 is a Potential Outlier (Up

Test Statistic: 0.053

For 10% significance level, 6.33 is not an outlier.
For 5% significance level, 6.33 is not an outlier.
For 1% significance level, 6.33 is not an outlier.

2. Observation Value 5.95 is a Potential Outlier (Lo

Test Statistic: 0.000

For 10% significance level, 5.95 is not an outlier.
For 5% significance level, 5.95 is not an outlier.
For 1% significance level, 5.95 is not an outlier.

Dixon's Outlier Test for pH (cbl - 302i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 7.75 is a Potential Outlier (Up

Test Statistic: 0.566

For 10% significance level, 7.75 is an outlier.

For 5% significance level, 7.75 is an outlier.

For 1% significance level, 7.75 is not an outlier.

2. Observation Value 4.94 is a Potential Outlier (Lo

Test Statistic: 0.170

For 10% significance level, 4.94 is not an outlier.

For 5% significance level, 4.94 is not an outlier.

For 1% significance level, 4.94 is not an outlier.

Dixon's Outlier Test for pH (cbl - 306i)

Number of Observations = 7

10% critical value: 0.434

5% critical value: 0.507

1% critical value: 0.637

1. Observation Value 7.29 is a Potential Outlier (Up

Test Statistic: 0.119

For 10% significance level, 7.29 is not an outlier.

For 5% significance level, 7.29 is not an outlier.

For 1% significance level, 7.29 is not an outlier.

2. Observation Value 5.61 is a Potential Outlier (Lo

Test Statistic: 0.643

For 10% significance level, 5.61 is an outlier.

For 5% significance level, 5.61 is an outlier.

For 1% significance level, 5.61 is an outlier.

Dixon's Outlier Test for pH (cbl - 308i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 6.83 is a Potential Outlier (Up

Test Statistic: 0.534

For 10% significance level, 6.83 is an outlier.

For 5% significance level, 6.83 is not an outlier.

For 1% significance level, 6.83 is not an outlier.

2. Observation Value 5.54 is a Potential Outlier (Lo

Test Statistic: 0.500

For 10% significance level, 5.54 is an outlier.

For 5% significance level, 5.54 is not an outlier.

For 1% significance level, 5.54 is not an outlier.

Dixon's Outlier Test for pH (cbl - 340i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 6.95 is a Potential Outlier (Up

Test Statistic: 0.364

For 10% significance level, 6.95 is not an outlier.

For 5% significance level, 6.95 is not an outlier.

For 1% significance level, 6.95 is not an outlier.

2. Observation Value 5.46 is a Potential Outlier (Lo

Test Statistic: 0.292

For 10% significance level, 5.46 is not an outlier.

For 5% significance level, 5.46 is not an outlier.

For 1% significance level, 5.46 is not an outlier.

Dixon's Outlier Test for pH (cbl - 341i)

Number of Observations = 8

10% critical value: 0.479

5% critical value: 0.554

1% critical value: 0.683

1. Observation Value 6.21 is a Potential Outlier (Up

Test Statistic: 0.030

For 10% significance level, 6.21 is not an outlier.

For 5% significance level, 6.21 is not an outlier.

For 1% significance level, 6.21 is not an outlier.

2. Observation Value 5.23 is a Potential Outlier (Lo

Test Statistic: 0.323

For 10% significance level, 5.23 is not an outlier.

For 5% significance level, 5.23 is not an outlier.

For 1% significance level, 5.23 is not an outlier.

APPENDIX C

Groundwater Monitoring System Certification of Alternate Source Demonstration, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018

GROUNDWATER MONITORING SYSTEM
CERTIFICATION OF ALTERNATE SOURCE DEMONSTRATION
LOWER COLORADO RIVER AUTHORITY
COAL COMBUSTION RESIDUALS UNIT: COMBUSTION BYPRODUCTS LANDFILL
FAYETTE POWER PROJECT
La Grange, Texas

AMEC FOSTER WHEELER (Consultant) was retained by the Lower Colorado River Authority (LCRA) to perform an alternate source demonstration (ASD) in response to the January 2018 identification of a statistically significant increase (SSI) in certain constituents detected in the groundwater monitoring system for the Combustion Byproducts Landfill, a coal combustion residuals (CCR) unit, at the Fayette Power Project in La Grange, Texas. The ASD was performed in accordance with 40 C.F.R. § 257.94(e)(2). The ASD indicates that, based on major anion-cation concentrations in the monitored groundwater unit, the Intermediate Sand, a minimum of two groundwater types (hydro-geochemical facies) are monitored by the wells in the groundwater monitoring system for the CCR unit. Additional discussion regarding the findings of the ASD, and the Professional Engineer's (P.E.'s) certification verifying the accuracy of the information used in making the ASD, are provided herein.

1.0 BACKGROUND

Groundwater monitoring data from eight (8) detection monitoring sampling events were evaluated using the tolerance or prediction limit statistical methodology as certified by the P.E. in October 2017. Preliminary analysis of the groundwater data in January 2018 identified an SSI for certain of the constituents listed in Appendix III to 40 C.F.R. Part 257. The SSI triggered the implementation of the ASD.

In the process of conducting the ASD, existing geochemical data were evaluated; a statistical method-allowed resampling event of each well in the CCR unit's groundwater monitoring system was conducted; additional samples were collected for broader geochemical characterization; and other potential sources were considered. In addition, a new well was installed in an attempt to locate an upgradient Intermediate Sand well, however a saturated Intermediate Sand was not encountered. Furthermore, an upgradient well installed in 2011 was evaluated as a potential upgradient Intermediate Sand well but was determined to be unusable.

Based on the findings of the ASD, it was determined that natural groundwater geochemistry within the area monitored by the CCR unit's groundwater monitoring system is of a heterogeneous nature, with at least two different groundwater types identified by analysis of the calculated milliequivalents of the major cations (sodium, potassium, calcium, and magnesium) and major anions (chloride, bicarbonate-carbonate, and sulfate). These groundwater types, referred to as hydro-geochemical facies, are (1) sodium chloride-type groundwater (for background monitoring well CBL-340I, and monitoring wells CBL-308I, and CBL-306I), and (2) calcium chloride-type groundwater (for monitoring wells CBL-301I, CBL-302I, and CBL-341I). These major cations and anions are naturally present in soils at the Fayette Power Project facility, commonly in calcium carbonate and sulfide-sulfate minerals. Given the heterogeneity of the groundwater beneath, and lateral to, the CCR unit, the SSI identified using interwell analysis was determined to be invalid (i.e., the SSI resulted from an inappropriate analysis and/or statistical evaluation on account of natural spatial variation present in groundwater quality). Accordingly, going forward, the facility will use prediction limit intrawell analysis when making SSI determinations. The intrawell analysis will utilize data from the ninth groundwater sampling event (the resampling event described above) in comparison to each monitoring well's prediction limits developed utilizing the initial eight samples. Existing background monitoring well CBL-340I will no longer be a part of the unit's groundwater monitoring system for geochemical comparisons, as it does not appear to be representative of background groundwater quality for all groundwater flowing beneath the CCR unit.

Based on the above findings regarding aquifer heterogeneity, the SSI identified in January 2018 using interwell analysis is determined to have been invalid, and the prediction limit intrawell analysis discussed above will be used for SSI determinations going forward.

2.0 LIMITATIONS

The Consultant's signature on this document represents that, to the best of the Consultant's knowledge, information, and professional judgment, the aforementioned information is accurate as of the signature date. The Consultant's opinions and decisions are made on the basis of the Consultant's experience, qualifications, and professional judgment, and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions (or other estimates) are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

3.0 CERTIFICATION

I, **Seth Green,** being a Registered P.E. with the State of Texas, do hereby certify to the best of my knowledge, information, and belief, that the information used in the ASD is accurate, and that the SSI identified in the January 2018 analysis may not be a result of a release from the monitored unit, but instead may be a result of natural variability of groundwater present in the uppermost aquifer beneath the unit. As such, per 40 C.F.R. § 257.94(e)(2), the Detection Monitoring Program shall continue, utilizing the prediction limit intrawell analysis for identification of an SSI.

SETH EDWARD GREEN
109563

4/13/18

SIGNATURE ____________ DATE 4/13/18

I, Craig C. Macon, being a Professional Geoscientist the State of Texas, do hereby certify to the best of my knowledge, information, and belief, that information used in the ASD is accurate, and that the SSI identified in the January 2018 analysis may not be a result of a release from the monitored unit, but instead may be a result of natural variability of groundwater present in the uppermost aquifer beneath the unit. As such, per 40 C.F.R. § 257.94(e)(2), the Detection Monitoring Program shall continue, utilizing the prediction limit intrawell analysis for identification of an SSI.

CRAIG C. MACON
Geology
1301

4/13/18

SIGNATURE ____________ DATE 4/13/18

APPENDIX D

Groundwater Geotechnical Evaluation at the Lower Colorado River Authority, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018

Technical Memorandum

To:	Craig C. Macon, P.G.
From:	Bruce Wielinga, PhD
Project:	6706180017
Date:	April 13, 2018
Subject:	**Groundwater Geochemical Evaluation at the Lower Colorado River Authority, Fayette Power Project, - La Grange, Texas**

INTRODUCTION

On April 17, 2015, the U.S. Environmental Protection Agency (EPA) published its final rule governing the disposal of coal combustion residuals (CCR) from electric utilities, as codified in 40 CFR Parts 257 and 261 [80 Fed. Reg. 21,301 (April 17, 2015)] (the "CCR Rule"). The CCR Rule established nationally applicable minimum criteria for the safe disposal of CCR in landfills and surface impoundments.

The Fayette Power Project (FPP) is a coal-fired power plant located east of La Grange in Fayette County, Texas. CCR generated at the facility are disposed in the Combustion Byproducts Landfill (CBL) located south of the power plant and north of the railroad that borders the FPP site. The existing CBL consists of Cell 1 and Sub-Cell 2D (Figure 1, attached). At final buildout, the CBL may consist of up to three cells, Cells 1 to 3 (Figure 1). Cell 1 was constructed in 1988 and Sub-Cell 2D was constructed in 2015; therefore, both active landfill cells are considered existing units under the CCR Rule. The northern slope of Cell 1 was closed with a final cover system in 1992.

As codified in 40 CFR § 257.91(a), a CCR landfill groundwater monitoring system must consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer beneath the CCR unit that:

- accurately represent the quality of background groundwater, unaffected by leakage from a CCR unit; and
- accurately represent the quality of groundwater passing the waste boundary of the CCR unit.

The CCR Rule also specifies a minimum of one well upgradient of the CCR unit, and three wells downgradient of the CCR unit. *See* 40 CFR § 257.91(c)(1). The rule allows for variances; for example, an alternative "background" location may be utilized if site conditions do not permit a well to be placed hydrologically upgradient of the CCR unit. *See* 40 CFR § 257.91(a)(1)(i).

The current system consists of the following monitoring wells (as shown on Figure 1):

- **CBL-340I** – As a saturated intermediate sand groundwater bearing unit is not present north (upgradient) of the CBL, CBL-340I (west of the CBL) was intended to serve as the background well for the CBL. This well is used to evaluate groundwater geochemical conditions at a location unaffected by CBL operations. Although CBL-340I can technically be considered "side-gradient" to Cell 1 of the CBL, it is located 750 feet west of Cell 1, and intermediate sand potentiometric surface data indicates groundwater flow in the area of Cell 1 is due south.
- **CBL-308I** – CBL-308I is within the disposal footprint of the CBL and is positioned to evaluate groundwater conditions immediately downgradient of Sub-Cell 2D (west of the naturally occurring clay partition that splits the Intermediate Sand). This well will eventually be replaced as the waste placement progresses south.
- **CBL-302I** – CBL-302I is within the disposal footprint of the CBL and is positioned to evaluate groundwater conditions downgradient of CBL Cell 1 and Sub-Cell 2A. This well will eventually be replaced as the waste placement progresses south.
- **CBL-341I** – CBL-341I is within the disposal footprint of the CBL and is positioned to evaluate groundwater conditions downgradient of CBL Cell 1 and Sub-Cell 2C. This well will eventually be replaced as the waste placement progresses south.
- **CBL-306I** – CBL-306I is positioned to evaluate groundwater conditions downgradient of the entire CBL, including the permitted stormwater run-off management pond for the CBL.
- **CBL-301I** – CBL-301I is also positioned to evaluate groundwater conditions downgradient of the entire CBL.

In summary, the CBL groundwater monitoring well system meets the requirements of the CCR Rule regarding placement of groundwater monitoring wells and was certified on October 16, 2017, in accordance with the CCR Rule. Specifically, the system is designed to accurately represent the quality of groundwater unaffected by leakage from the CBL, as well as groundwater passing the waste boundary. The design conservatively incorporates the planned southernly expansion of the CBL, with three monitoring wells currently installed inside the landfill's disposal footprint.

GROUNDWATER GEOCHEMISTRY

The above-referenced CBL groundwater monitoring wells were sampled in February 2018 to evaluate the geochemistry of the monitored groundwater. The groundwater samples were sent to an analytical laboratory for analysis of major ion chemistry, alkalinity, calcium (Ca), chloride (Cl), magnesium (Mg), potassium (K), nitrite and nitrate, sodium (Na), and sulfate.

Initial chemical analyses focused on the major ion chemistry, consisting of major cations Ca, K, Mg, and Na, and major anions Cl, bicarbonate and carbonate (HCO_3 and CO_3), and sulfate (SO_4). These major ions can make up more than 90% of the total dissolved solids in a groundwater sample. As groundwater flows through an aquifer it develops a diagnostic chemical signature as a result of interaction with the lithological framework. The term hydro-geochemical facies is used to describe the groundwater types in an aquifer that differ in chemical composition. Several graphical techniques can be used to compare differences or similarities in groundwater types at sites using the major ion chemistry, including Stiff diagrams, and Piper and Durov diagrams.

Stiff diagrams are a visual way of identifying different groundwater types across the site. Stiff diagrams plot the milliequivalent concentrations of four cations (generally Mg, Ca, Na, and K) and three anions (generally HCO_3+CO_3, SO_4, and Cl) about a central vertical axis as shown in **Figure 2**. The points are connected to form a figure, and the shape of the figure quickly highlights the dominant cation and anion combinations.

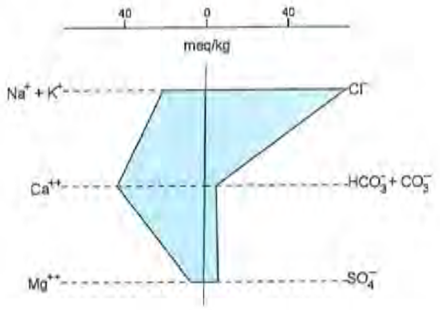


Figure 2. Example of a Stiff Diagram to illustrate major ion chemistry.

Piper (1944) diagrams are another commonly used graphical tool to evaluate the composition of groundwater with respect to major ion chemistry. The Piper diagram employs two trilinear plots that show the percentage composition of three ions or groups of ions relative to one another. By grouping Na and K together, the major cations can be grouped on one trilinear diagram, and likewise grouping HCO_3 and CO_3 together allows the major anions to be grouped on a second trilinear diagram. The diamond shape between them can be used to make a tentative conclusion as to the origin of the water represented by the analysis and to characterize different water types. An example Piper diagram is shown on **Figure 3**. On **Figure 3**, this groundwater sample plots toward the lower left portion of the trilinear plot for the cations (e.g., the Ca corner) and toward the lower right portion of the trilinear plot for the anions (e.g., the Cl corner) and would be classified as a calcium-chloride type water (Ca-Cl).

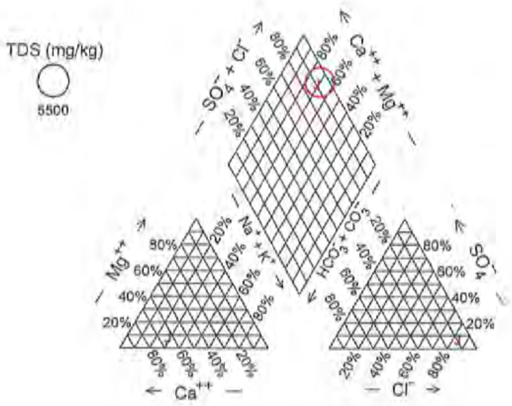


Figure 3. Example of a Piper Diagram

Durov (1948) introduced another graphical method that provides more information on the hydro-geochemical facies by helping to identify the water types. The Durov diagram can display some possible geochemical processes that could help in understanding and evaluating groundwater quality. The Durov diagram is a composite plot consisting of two trilinear plots like the Piper diagram. The cations of interest are plotted versus the anions of interest, and the sides form a binary plot of total cation versus total anion concentrations. The Durov diagram expands on the Piper diagram by including two rectangles for total dissolved solids (TDS) and pH as shown on **Figure 4**.

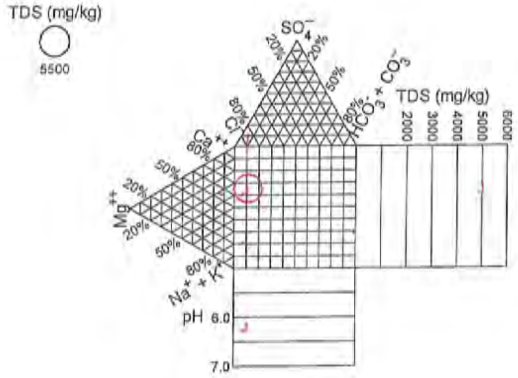


Figure 4. Example of a Durov Diagram

The initial evaluation of groundwater samples collected at FPP in February 2018 focused on the major ion chemistry and identification of major hydrogeochemical facies. Data was entered into the geochemical modeling software Geochemist's Workbench® version 11, from Aqueous Solutions, LLC. **Figure 5** shows the 2018 FPP data plotted on a Piper diagram.

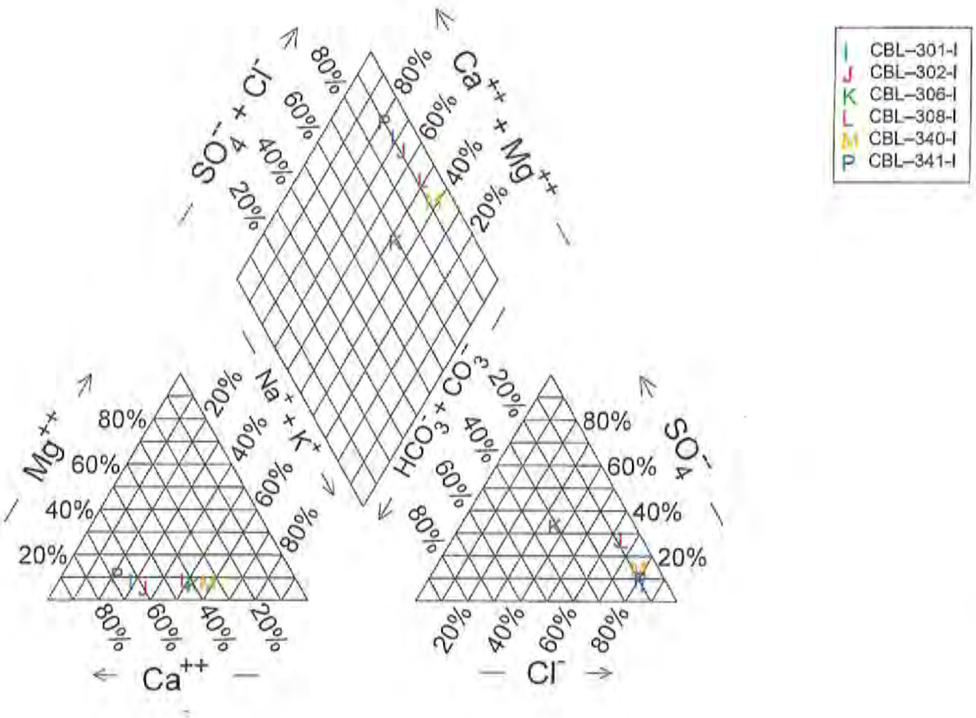


Figure 5. Major Ion Chemistry for Groundwater Samples Collected at FPP CBL in February 2018 Shown on a Piper Diagram.

The cations in groundwater from wells CBL-301I, CBL-302I, and CBL-341I are grouped and plot toward the calcium portion of the left trilinear plot, while groundwater from wells CBL-306I, CBL-308I, and CBL-340I are grouped toward the sodium-potassium portion of the trilinear plot. On the anion trilinear plot, groundwater from all wells except CBL-306I plot toward the chloride portion of the plot, while water from CBL-306I plots near the center of the plot. Geochemist's Workbench® calculates the water type for each sample. Groundwater from wells CBL-301I, CBL-302I, and CBL-341I are classified as Ca-Cl type water, and groundwater from wells CBL-306I, CBL-308I, and CBL-340I are classified as Na-Cl type water.

The groundwater data were also plotted on a Durov diagram as shown on **Figure 6**. As discussed above, the Durov diagram adds the dimensions of pH and TDS in rectangles at the bottom and right sides, respectively. The pH of the groundwater at all wells except CBL-306I ranges from pH 6.0 to 6.5, while the pH at well CBL-306I is greater than 6.5.

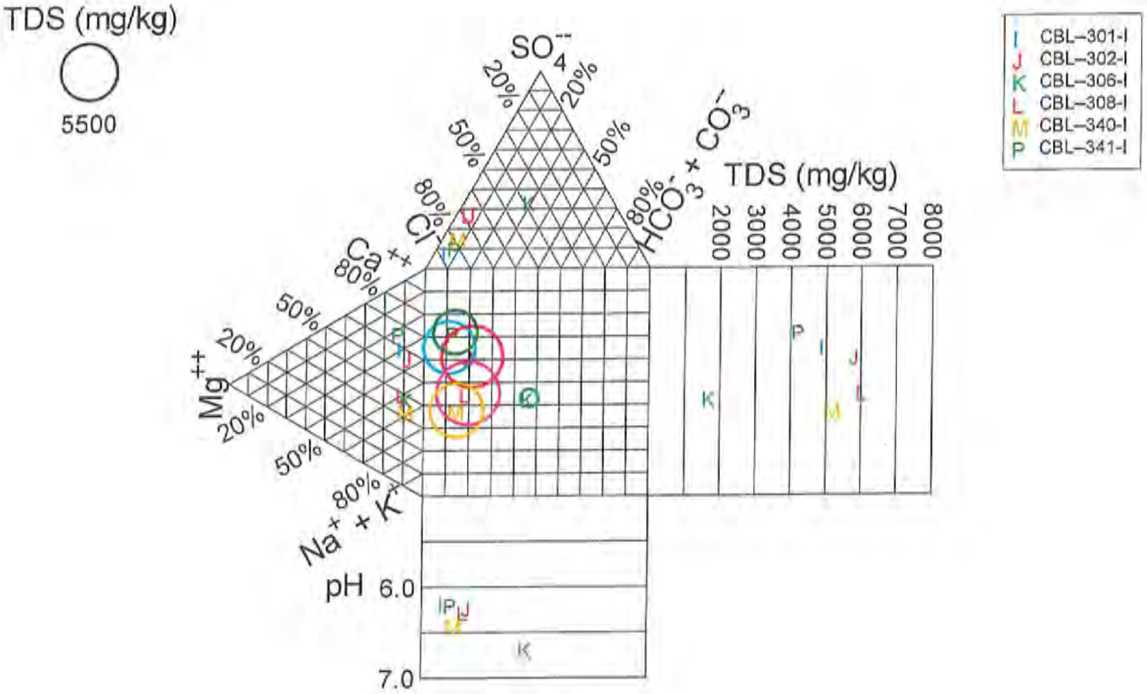


Figure 6. Major Ion Chemistry for Groundwater Samples Collected at FPP CBL in February 2018 Shown on a Durov Diagram.

Groundwater at CBL-306I also has the lowest TDS (<2,000 mg/L), while TDS at the other wells ranges from around 4,000 mg/L to slightly greater than 6,000 mg/L, with wells CBL-302I and CBL-308I having the highest TDS.

Figure 7 shows the major ion chemistry plotted on a Stiff diagram. Looking at the shapes of the plots for these data, the dominance of the chloride ion at all wells except CBL-306I is apparent. The similarity in water chemistry between CBL-301I, CBL-302I, and CBL-341I is also apparent, with the greater TDS observed at CBL-302I being primarily a function of the greater sulfate contribution as seen in the Stiff diagram (**Figure 7**). The similarity in water chemistry between CBL-308I and CBL-340I is also apparent, with greater concentrations of sulfate and calcium contributing to the higher TDS observed at CBL-308I. CBL-306I appears to be somewhat of an outlier, with much lower TDS, showing much lower concentrations of all major ions. The depth of CBL-306I is shallow compared to the other wells, and the intermediate sand is shallower at this location; therefore, chemical dilution resulting from infiltrating meteoric water might possibly explain the lower concentrations of all major ions observed at this location.

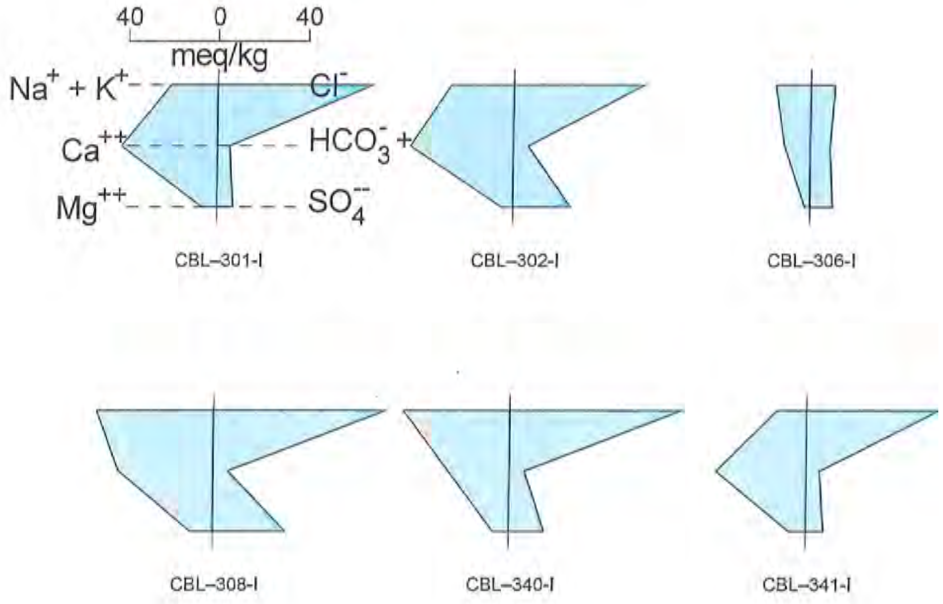


Figure 7. Major Ion Chemistry for Groundwater Samples Collected at FPP CBL in February 2018 Shown on a Stiff Diagrams.

DISCUSSION

Analysis of groundwater geochemical data collected from monitoring wells at FPP in February of 2018 indicate the presence of potentially two groundwater populations. One population with groundwater derived from CBL-306I, CBL-308I, and CBL-340I wells represents a Na-Cl hydrogeochemical facies, and the other with water derived from wells CBL-301I, CBL-302I and CBL-341I represents a Ca-Cl hydrogeochemical facies.

Groundwater at all locations, except CBL-306I, have a prominent chloride signature, with chloride concentrations ranging from 2,080 mg/L at CBL-302I to 2,750 mg/l at CBL-308I. The source of the chloride is unknown, but could be related to past oilfield activities at locations west and north of the CBL area with potential ponds and an injection well upgradient of the CBL area.

The concentration of chloride at CBL-340I (2,730 mg/L), a well cross-gradient to Cell 1 of the CBL, provides evidence that the elevated chloride observed in the wells is not sourced from CBL operations.

The concentrations of sodium appear elevated in wells CBL-308I and CBL-340I compared with the other site wells. Concentrations in CBL-308I and CBL-340I are 1,210 mg/L and 1,100 mg/L, respectively. Elevated concentrations observed at the cross-gradient well CBL-340I suggest that the elevated concentrations observed at these wells is also unrelated to CBL operations and represents natural variability in localized sodium concentrations. Evaporative concentration of soil pore water, which can lead to elevated concentrations of soluble salts, such as NaCl, could also help to explain the current observations.

The geology and geochemistry of this area has been previously described by others (Radian Corporation, 1995; Roy F. Weston, Inc., 2000). These investigators reported the presence of pyrite (FeS_2), calcite ($CaCO_3$), and gypsum ($CaSO_4$) present in the near-surface geologic material at the FPP site and surrounding areas. The oxidation of pyrite produces dissolve iron, sulfate, and proton acidity (H^+) that is released to the soil pore-water and groundwater. Proton acidity produced by pyrite oxidation would be consumed by the dissolution of $CaCO_3$ with the release of HCO_3^- and Ca^{2+}. In addition, the dissolution of gypsum is also expected to contribute Ca^{2+} and SO_4^{2-} to soil pore water and groundwater.

Groundwater at wells CBL-301I, CBL-302I, and CBL-341I represents a Ca-Cl type water. As discussed above, reactions occurring in native geologic material at the site could result in the elevated concentrations of Ca and SO_4 observed at these locations and the elevated Cl possibly from past oilfield activities as discussed above. These same constituents are also commonly associated with coal combustion byproducts, making delineation of the source of these constituents challenging. The variability in groundwater chemistry as demonstrated by the major ion chemistry, due to potential anthropogenic inputs non-related to CCR management, and weathering of near-surface geologic material, precludes identification of a representative background well location.

REFERENCES

Durov, S. A. (1948), "Klassifikacija prirodynych vod i grafices-koje izobrazenie ich sostava." Doklady Ak. Nauk SSSR 59(1): 87-90.

Piper, A. M. (1944), "A graphic procedure in the geochemical interpretation of water analysis." Am. Geoph. Union Trans. 25: 914-923.

Radian Corporation (1995), "Results of Investigation, Lower Colorado River Authority, Fayette Power Project" December 4, 1995.

Roy F. Weston Inc. (2000), "Groundwater Assessment Report, Phase I, Fayette Power Project.," October 2000.

APPENDIX E

Groundwater Monitoring System Addendum Certification, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018

GROUNDWATER MONITORING SYSTEM ADDENDUM CERTIFICATION
LOWER COLORADO RIVER AUTHORITY
COAL COMBUSTION RESIDUALS UNIT: COMBUSTION BYPRODUCTS LANDFILL
FAYETTE POWER PROJECT
La Grange, Texas

AMEC FOSTER WHEELER (Consultant) was retained by the Lower Colorado River Authority (LCRA) to perform an alternate source demonstration (ASD) in response to the January 2018 identification of a statistically significant increase (SSI) in certain constituents detected in the groundwater monitoring system for the Combustion Byproducts Landfill, a coal combustion residuals (CCR) unit, at the Fayette Power Project in La Grange, Texas. The ASD was performed in accordance with 40 C.F.R. § 257.94(e)(2). The ASD indicates that, based on major anion-cation concentrations in the monitored groundwater, a minimum of two groundwater types (hydro-geochemical facies) are monitored by the wells in the groundwater monitoring system for the CCR unit. Accordingly, the existing groundwater monitoring system for the CCR unit, and the interwell statistical methodology originally utilized for groundwater analysis, must be modified due to significantly heterogeneous natural groundwater geochemistry present in the monitored groundwater bearing unit, the Intermediate Sand. Additional information regarding the modified groundwater monitoring system, the statistical methodology to be used going forward, and the Professional Engineer's (P.E.'s) certification of the modified system, is provided herein.

1.0 BACKGROUND

Groundwater monitoring data from eight (8) detection monitoring sampling events were evaluated using the tolerance or prediction limit statistical methodology as certified by the P.E. in October 2017. Preliminary analysis of the groundwater data in January 2018 identified an SSI for certain of the constituents listed in Appendix III to 40 C.F.R. Part 257. The SSI triggered implementation of the ASD.

In the process of conducting the ASD, existing geochemical data were evaluated; a statistical method-allowed resampling event of each well in the CCR unit's groundwater monitoring system was conducted; additional samples were collected for broader geochemical characterization; and other potential sources were considered. In addition, a new well was installed in an attempt to locate an upgradient Intermediate Sand well, however a saturated Intermediate Sand was not encountered. Furthermore, an upgradient well installed in 2011 was evaluated as a potential upgradient Intermediate Sand well but was determined to be unusable.

Based on the findings of the ASD, it was determined that natural groundwater geochemistry within the area monitored by the CCR unit's groundwater monitoring system is of a heterogeneous nature, with at least two different groundwater types identified. Consequently, it was also determined that the monitoring well CBL-340I, identified as the background well in the existing groundwater monitoring system, cannot be reliably used to characterize the background geochemistry of the groundwater flowing beneath the CCR unit. Furthermore, attempts to locate a new upgradient well failed. Accordingly, interwell analysis (i.e., comparing groundwater data from monitoring wells downgradient of the CCR unit to data from the existing background well) will no longer be utilized. Instead, intrawell analysis will be utilized, which negates the need to use groundwater data from monitoring well CBL-340I. Well CBL-340I will remain in the groundwater monitoring system for the CCR unit, but data from the well will not be included in the intrawell analysis that will be used going forward.

2.0 LIMITATIONS

The Consultant's signature on this document represents that to the best of the Consultant's knowledge, information, and professional judgment, the aforementioned information is accurate as of the signature date. The Consultant's opinions and decisions are made on the basis of the Consultant's experience, qualifications, and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions (or other estimates) are based on available data, and actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

3.0 CERTIFICATION

I, **Seth Green,** being a Registered P.E. with the State of Texas, do hereby certify to the best of my knowledge, information, and belief, that the groundwater monitoring system for the CCR unit (Combustion Byproducts Landfill), as herein revised, has been designed and constructed to meet the requirements of 40 C.F.R. § 257.91,in accordance with recognized and generally accepted good engineering and scientific practices.

SETH EDWARD GREEN
109563

4/13/18

SIGNATURE ______________________ DATE 4/13/18

I, **Craig C. Macon,** being a Professional Geoscientist in the State of Texas, do hereby certify to the best of my knowledge, information, and belief, that the Groundwater Monitoring System for the CCR Unit: Combustion Byproducts Landfill, herein revised, has been designed and constructed to meet the requirements of 40 C.F.R. § 257.91 in accordance with recognized and generally accepted good scientific practices.

CRAIG C MACON
Geology
1301

4/13/18

SIGNATURE Craig C. M DATE 4/13/18

APPENDIX F

Statistical Analysis Updates of Detection Monitoring Appendix III Constituent Data, AMEC Foster Wheeler Environmental and Infrastructure, Inc. – April 13, 2018

Technical Memorandum

To: Craig C. Macon, P.G.
From: Carla Landrum, PhD
Tel: 916-717-6552 Project: 6706170053
Date: April 13, 2018

Subject: STATISTICAL ANALYSIS UPDATES OF DETECTION MONITORING APPENDIX III CONSTITUENT DATA
Fayette Power Project – La Grange, Texas

This Technical Memorandum (Memo) summarizes the methods and findings of an updated statistical analysis of groundwater constituent data, conducted by Lower Colorado River Authority (LCRA) for the Combustion Byproducts Landfill (CBL) at LCRA's Fayette Power Project (FPP) facility. This updated analysis followed from the findings of an alternative source demonstration (ASD), which substantiated natural spatial heterogeneity in groundwater quality at the CBL. The ASD supports the determination that an observed statistically significant increase (SSI) over background identified in a January 14, 2018 Technical Memorandum (AMECFW, 2018) was invalid because the background well used to perform this interwell prediction limit statistical analysis is non-representative of the spatial variation in groundwater quality beneath and downgradient of the CBL.

This Memo summarizes the results of an intrawell statistical analysis of the groundwater constituent data using the initial eight groundwater samples collected prior to October 2017, and using the subsequent ninth groundwater sample collected in February 2018 to reassess detection monitoring compliance. Sample data collected in five downgradient CBL wells (CBL-301I, CBL-302I, CBL-306I, CBL-308I, and CBL-341I) were used for this intrawell statistical analysis.

This Memo details salient points related to the updated statistical analysis. Additional information regarding data inputs, sampling frequencies, exploratory data analysis (EDA) procedures, and streamlined statistical workflow are provided in the January 14, 2018 Memo. The methods and findings detailed herein are in accordance with 40 CFR § 257.93.

METHODS

Intrawell prediction limit statistical methods are appropriate when natural spatial variation in groundwater conditions prevents a representative background well designation or designations for groundwater conditions downgradient of the site. Intrawell analysis establishes background concentrations at a downgradient groundwater well location using a subset of sample data that reflects a baseline groundwater condition; in this specific case, samples collected between January 2016 and September 2017. Future sample data collected from the groundwater well are then compared to its respective baseline groundwater condition to assess if there is an SSI at that location.

Intrawell statistical evaluations assume that: (1) current groundwater conditions (e.g., baseline conditions) at the site are void of constituents leaking from a CCR unit and (2) baseline conditions are representative of natural temporal variations in groundwater quality. At this time, there is no substantial geologic, site operation, or hydro-geologic evidence to suggest these assumptions are invalid with respect to FPP. However, two years of sampling are likely inadequate to reliably characterize natural seasonal variations and regional temporal trends in groundwater quality. As such, baseline conditions will need updating as sufficient data become available.

Intrawell baseline conditions were established using the eight initial groundwater samples from each downgradient monitoring well for each constituent in 40 CFR Part 257, Appendix III. Figure 1 summarizes the prediction limit statistical methods and their basic data-driven selection criteria.

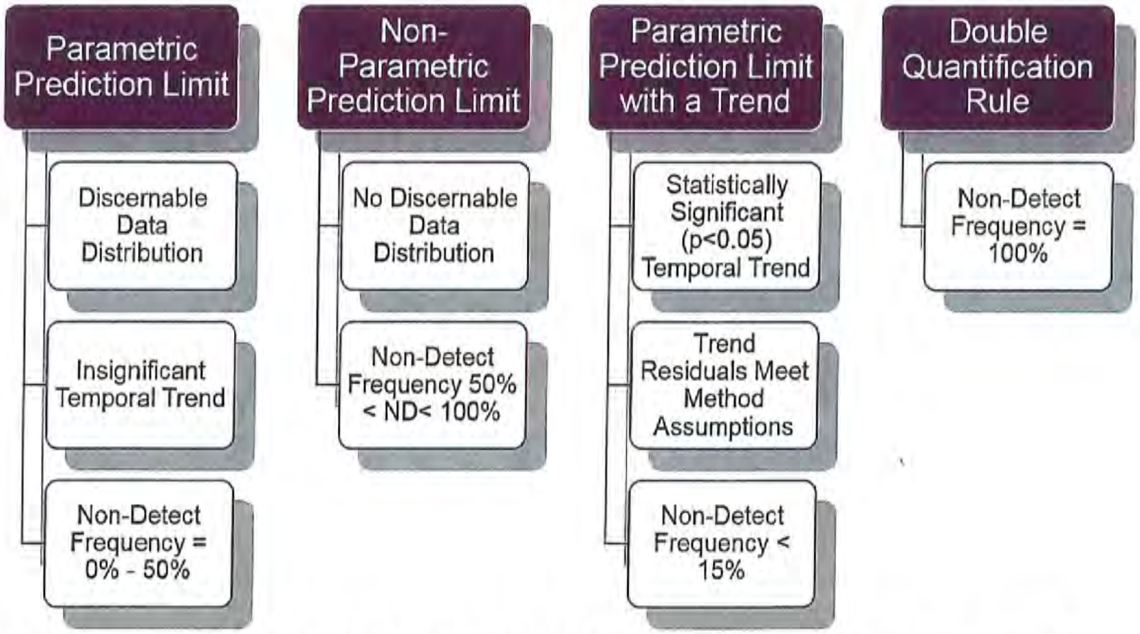


Figure 1: Basic prediction limit method selection criteria. Censored estimation techniques were applied for datasets with <50% non-detect frequency.

Prediction limits were calculated with a declared site-wide false positive rate (α) equal to 0.1. A 1 of 2 resampling strategy is in place to reduce the overall false positive occurrence (falsely identifying an SSI) while maintaining adequate statistical power. However, there are too few sample data (n=8) to establish adequate statistical power for non-parametric methods for this evaluation. Please refer to the January 14, 2018 Technical Memorandum for further details regarding the prediction limit resampling strategy.

Parametric intrawell prediction limit calculations (without a trend) follow Equation 19.13 in the Unified Guidance (U.S. EPA, 2009). Table 19-10 within the Unified Guidance (U.S. EPA, 2009) was used to establish an k-multiplier with "good" or "adequate" statistical power. The value of the k-multiplier for each constituent in each well are shown in the accompanying Practitioner's Notes. If the dataset exhibited a statistically significant trend, the prediction limits were calculated around the trend using Equation 10-13 in the ProUCL Technical Guide (U.S. EPA, 2013). Non-parametric prediction limits consist of the maximum ordered detectable sample value.

Prediction limit methods are inadequate for baseline datasets containing 100% non-detectable concentrations; in such case the Double Quantification Rule is applicable. Pursuant to the Unified Guidance, the Double Quantification Rule states that a confirmed exceedance is registered if the compliance sample dataset exhibits quantified measurements at or above the reporting limit for two consecutive future observations.

The February 2018 sample, constituting the ninth sample in each respective constituent-well sample dataset, was compared to its respective prediction limit to assess detection monitoring compliance.

RESULTS & CONCLUSIONS

The results from this statistical evaluation indicate the February 2018 sample concentrations are within their respective predicted baseline limits, meaning there are no initial exceedances to declare at this time, as detailed below:

- Prediction limits were established for each Appendix III constituent in each well using the initial eight samples collected; prediction limit calculations reflect a 1 of 2 resampling strategy to minimize false positive SSIs.

- The ninth sample for each Appendix III constituent within each well was compared to the well's respective prediction limit to assess detection monitoring compliance.

- No initial exceedances, which would trigger the resampling strategy, are present in the February 2018 sample dataset.

- Trend significance ($p<0.05$) shifted for some Appendix III constituents in some wells when incorporating the ninth sample. In general, this is expected since the trends are characterized by relatively few samples. Trend definition and significance will improve as sample datasets build over time.

Based on these findings, it is recommended that trend testing transpire at least annually to determine if the prediction limit calculations herein maintain relevance. If the trend significance shifts over time, the prediction limits will need recalculation to better honor the sample data. In cases where the prediction limit was calculated around the trend and the future compliance sample does not exceed the calculated prediction limit, it is recommended to incorporate the compliance sample into the baseline prediction limit calculation to help ensure the temporal trend is honored when comparing the next future sample; in this specific case, the tenth future sample. This will require that the trend prediction limits be recalculated iteratively for each statistical comparison, assuming the temporal trend remains statistically significant over time and the dataset meet the method assumptions.

REFERENCES

AMECFW, 2018. Technical Memorandum – Client Copy. Statistical Analysis of Initial Detection Monitoring Appendix III Constituent Data. Fayette Power Project – La Grange, Texas.

U.S. Environmental Protection Agency (U.S. EPA), 2013. ProUCL (Version 5.0.00) User Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA/600/R-07/041. Washington D.C. September.

U.S. Environmental Protection Agency (U.S. EPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance. EPA 530/R-09-007. Environmental Protection Agency Office of Resource Conservation and Recovery.

APPENDIX G

CCR Groundwater Detection Monitoring Evaluation of Third Quarter 2018 Data Collected form the CBL, Wood Environmental and Infrastructure Solutions, Inc., November, 5, 2018

Technical Memorandum

To:	Nancy Overesch, PG	**File No:**	6706180078
From:	Carla Landrum, PhD and Charlie Macon, PG	**cc:**	File
Date:	November 5, 2018		

Subject: **CCR GROUNDWATER DETECTION MONITORING**
EVALUATION OF THIRD QUARTER 2018 DATA COLLECTED FROM THE CBL
Fayette Power Project – La Grange, Texas

1.0 INTRODUCTION

This Technical Memorandum (Tech Memo) documents an evaluation of detection monitoring data collected in the third quarter of 2018 (3Q 2018) from the Combustion Byproducts Landfill (CBL) located at the Lower Colorado River Authority's (LRCA) Fayette Power Project (FPP) facility. The evaluation consists of comparing CBL compliance (i.e., downgradient) sample data to Appendix III baseline threshold values (BTVs) using the intrawell prediction limit statistical method declared in the *Statistical Analysis Updates of Detection Monitoring Appendix III Constituent Data* (2018 Tech Memo) (AMECFW, 2018b). The 2018 Tech Memo is in support of the initial detection monitoring assessment results documented for the CBL (AMECFW, 2008a). This Tech Memo as well as the 2018 Tech Memo were prepared pursuant to 40 CFR § 257.93. For the reasons discussed in this Tech Memo, there is insufficient evidence at this time to declare that a statistically significant increase for any Appendix 3 constituent in any monitoring well has occurred in accordance with 40 CFR 357.93.

2.0 EVALUATION

Table 1 presents the sample concentrations of Appendix III constituents collected from CBL compliance monitoring wells 301I, 302I, 306I and 308I on July 27, 2018 and monitoring well 341I on August 24, 2018. The 3Q 2018 sampling event constitutes the tenth sampling round for the detection monitoring program for the CBL. Applicable BTVs are presented in Table 1 for this third quarter 2018 statistical comparison.

2.1 Updates to Temporal Trends and Background Threshold Values

The BTVs presented in Table 1 reflect those previously declared in the 2018 Tech Memo for the CBL with the following exceptions: calcium for monitoring well 306I; chloride for monitoring well 306I; and sulfate for monitoring wells 302I and 306I. Pursuant to the 2018 Tech Memo, the prediction limits calculated around a statistically significant trend were updated to include the ninth sampling event, which constitutes the first quarter 2018 (1Q 2018) detection monitoring sampling event (AMECFW, 2018b), on the basis these events were below their respective BTVs. A discussion of updates to temporal trend significance and BTVs (by constituent) follows.

To provide context regarding the consistency of temporal trends over time, the initial detection monitoring trends (AMECFW, 2018a) and 1Q 2018 temporal trends are referenced below.

Temporal Trends. The premise of intrawell comparisons is to evaluate if constituent concentrations at a geographic location downgradient of the CBL are, in part, changing over time respective to a baseline concentration calculated for that specific geographic location. On this basis, intrawell statistical comparisons should consider the presence of statistically significant ($p<0.05$) temporal trends to interpret if there is a release from the CBL, particularly if the trend is: 1) increasing, 2) incongruent with the conceptual site model as it relates to alternative source demonstration(s) and/or 3) inconsistent with past trend analyses. The most recent sampling event (3Q 2018) introduces the presence of statistically significant ($p<0.05$) temporal trends in the following monitoring wells (constituent/trend direction/trend significance): 302I (chloride/decreasing/p=0.030) and 306I (fluoride/increasing/p=0.037; TDS/increasing/p=0.012). Recommendations follow to help manage changes in trend significance over time. Reference to the conceptual site model and professional judgement/interpretation are necessary to confirm if the temporal trends in the downgradient monitoring wells indicate there is a release from the CBL.

The most recent sampling event (3Q 2018) maintains the presence of existing statistically significant ($p<0.05$) temporal trends for the following constituents:

Calcium. Monitoring well 306I exhibits an increasing trend ($p<0.05$) for calcium. The trend significance and direction maintain consistency during the 1Q 2018 and the 3Q 2018 sampling events. The approximate p-values for the Mann-Kendall trend test, range among 0.0047, 0.0024 and 0.00060 (all well below $p < 0.05$) for the initial 8 detection monitoring sampling events and subsequent inclusion of the 1Q 2018 and 3Q 2018 detection monitoring sampling events, respectively. The upper prediction limit in Table 1 for calcium in monitoring well 306I reflects the trend for the ninth sampling event (Table 1). The tenth sampling event is subsequently compared to this time-dependent upper prediction limit to complete this statistical evaluation. The UPL calculation honors a 1 of 2 resampling strategy and Equation 10-13 in the ProUCL Technical Guide (U.S. EPA, 2013).

Chloride. Monitoring well 306I exhibits an increasing trend ($p<0.05$) for chloride. The trend significance and direction maintain consistency for the 1Q 2018 and 3Q 2018 sampling events. The approximate p-values for the Mann-Kendall trend test range among 0.018, 0.0046 and 0.010 (all below $p<0.05$) for the initial 8 detection monitoring sampling events and subsequent inclusion of the 1Q 2018 and 3Q 2018 detection monitoring sampling events, respectively. The upper prediction limit in Table 1 for chloride in monitoring well 306I reflects the trend for the ninth sampling event (Table 1). The tenth sampling event is subsequently compared to this time-dependent upper prediction limit to complete this statistical evaluation. The UPL calculation honors a 1 of 2 resampling strategy and Equation 10-13 in the ProUCL Technical Guide (U.S. EPA, 2013).

Sulfate. Monitoring wells 302I and 306I exhibit increasing trends for sulfate. The trend significance and direction maintain consistency for the 1Q 2018 and 3Q 2018 sampling events. For monitoring well 302I, the approximate p-values for the Mann-Kendall trend test range among 0.023, 0.0059 and 0.0015 (all below $p<0.05$) for the initial eight detection monitoring sampling events and subsequent inclusion of the 1Q 2018 and 3Q 2018 detection monitoring sampling events, respectively. For monitoring well 306I, the approximate p-values for the Mann-Kendall trend test, range among 0.018, 0.0082 and 0.016 for the initial 8 detection monitoring sampling events and subsequent inclusion of the 1Q 2018 and 3Q 2018 detection monitoring sampling events, respectively. The upper prediction limit in Table 1 for chloride in monitoring wells 302I and 306I reflect the trend for the ninth sampling event. The tenth sampling event is for each well subsequently compared to its respective time-dependent upper prediction limit to complete this statistical evaluation. The UPL calculation honors a 1 of 2 resampling strategy and Equation 10-13 in the ProUCL Technical Guide (U.S. EPA, 2013).

Fluoride. Monitoring well 341I exhibits a statistically significant ($p<0.05$) decreasing trend for fluoride. The trend significance and direction maintain consistency for the 1Q 2018 and 3Q 2018 sampling events. The fluoride prediction limit for monitoring well 341I is not calculated around this decreasing trend because the data distribution is identified as non-parametric. Therefore, the BTV in Table 1 reflects the non-parametric upper prediction limit.

2.2 Exceedance Assessment

As indicated in Table 1, there is insufficient evidence at this time to declare an initial exceedance for boron, calcium, chloride, fluoride, pH, sulfate, or total dissolved solids because the 3Q 2018 sample concentrations are less than their respective BTVs.

3.0 RECOMMENDATIONS

For the majority of monitoring well/constituent pairs, the initial detection monitoring sample events (AMECFW, 2018b) represent non-trending (i.e. stationary) BTVs that remain constant for each subsequent statistical comparison test. A sample size equal to eight is relatively small and likely underrepresents long-term temporal variability in constituent concentrations beneath the CBL. Wood recommends updating the intrawell BTVs in Table 1 for the 3Q 2019 sampling event, which will incorporate sampling events between 1Q 2018 and 1Q 2019 into the intrawell BTV calculations. This recommendation is conditional upon the absence of initial exceedances in constituent concentrations above their respective BTVs. Updating BTVs to reflect larger sample sizes over time will improve the overall power of future statistical tests.

For a few monitoring well/constituent pairs the temporal trend is inconsistent over time. In general, this is expected since the trends are characterized by relatively few samples and a few of the trends border on the threshold of being statistically significant. Trend definition and significance will improve as sample datasets build over time. Wood recommends testing the significance of temporal trends after each sampling event (e.g. semiannually).

Certain constituent/monitoring well pairs show statistically significant trends for recent sampling events (e.g. 1Q 2018 and/or 3Q 2018), but did not show a significant temporal trend during the initial detection monitoring statistical evaluation (AMECFW, 2018a). If the trends continue, further evaluation with respect to the conceptual site model may be warranted to determine if the trends indicate a potential release from the CBL. If the trends remain consistent and are justifiable through the conceptual site model, then the recommended prediction limit updates in 3Q 2019 should account for these temporal trends.

Wood maintains the recommendation put forth in the 2018 Tech Memo declaring the reiterative calculation of the prediction limit around a temporal trend for each statistical evaluation, assuming the temporal trend remains statistically significant over time and the dataset meet the method assumptions (AMECFW, 2018b).

4.0 REFERENCES

Amec Foster Wheeler (AMECFW), 2018a. Technical Memorandum – Client Draft. Statistical Analysis of Initial Detection Monitoring Appendix III Constituent Data. Fayette Power Project – La Grange, Texas. Technical Memorandum dated January 14, 2018.

Amec Foster Wheeler (AMECFW), 2018b. Technical Memorandum – Client Draft. Statistical Analysis Updates of Detection Monitoring Appendix III Constituent Data. Fayette Power Project – La Grange, Texas. Technical Memorandum dated April 13, 2018.

U.S. Environmental Protection Agency (U.S. EPA), 2013. ProUCL (Version 5.0.00) User Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. EPA/600/R-07/041. Washington D.C. September.

U.S. Environmental Protection Agency (U.S. EPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance. EPA 530/R-09-007. Environmental Protection Agency Office of Resource Conservation and Recovery.

TABLE 1
Statistical Results Summary - LCRA Combustion Byproducts Landfill
Appendix III Statistical Comparison

	301I						
Appendix III Constituent	**Boron (mg/L)**	**Calcium (mg/L)**	**Chloride (mg/L)**	**Fluoride (mg/L)**	**pH (S.U.)***	**Sulfate (mg/L)**	**TDS (mg/L)**
Intrawell Statistical Test	NP-UPL	P-UPLT	P-UPL	NP-UPL	NP-UPL/NP-LPL	P-UPLT	P-UPL
BTV	0.07	1135	2676	0.3	6.33/5.95	410	7905
Third Quarter 2018 Compliance Sample Value	<0.0500	993	1330	<0.2	6.04	196[a]	5390
	302I						
Appendix III Constituent	**Boron (mg/L)**	**Calcium (mg/L)**	**Chloride (mg/L)**	**Fluoride (mg/L)**	**pH (S.U.)**	**Sulfate (mg/L)**	**TDS (mg/L)**
Intrawell Statistical Test	NP-UPL	P-UPL	P-UPL	P-UPL	P-UPL/P-LPL	P-UPLT	P-UPL
BTV	0.3	1154	2328	0.3	8.21/3.57	1487	7940
Third Quarter 2018 Compliance Sample Value	<0.0500	995	1980	<0.2[a]	5.77	1390	5510
	306I						
Appendix III Constituent	**Boron (mg/L)**	**Calcium (mg/L)**	**Chloride (mg/L)**	**Fluoride (mg/L)**	**pH (S.U.)**	**Sulfate (mg/L)**	**TDS (mg/L)**
Intrawell Statistical Test	P-UPL	P-UPLT	P-UPLT	P-UPL	P-UPL/P-LPL	P-UPLT	P-UPL
BTV	0.2	454	774	4	7.29/4.41	1093	2064
Third Quarter 2018 Compliance Sample Value	<0.0500	275	283	2.95	6.86	406	1450
	308I						
Appendix III Constituent	**Boron (mg/L)**	**Calcium (mg/L)**	**Chloride (mg/L)**	**Fluoride (mg/L)**	**pH (S.U.)**	**Sulfate (mg/L)**	**TDS (mg/L)**
Intrawell Statistical Test	P-UCL	P-UPL	P-UPL	P-UPL	P-UPL/P-LPL	P-UPL	P-UPL
BTV	0.7	995	3079	3	7.15/5.26	1702	12186
Third Quarter 2018 Compliance Sample Value	<0.0500	863	2680	2.1	6.07	1540	6320
	341I						
Appendix III Constituent	Boron (mg/L)	Calcium (mg/L)	Chloride (mg/L)	Fluoride (mg/L)	pH (S.U.)	Sulfate (mg/L)	TDS (mg/L)
Intrawell Statistical Test	P-UPL	P-UPL	P-UPL	NP-UPL	P-UPL/N-LPL	P-UPL	P-UPL
BTV	0.09	981	2661	0.53	6.69/4.93	466	6295
Third Quarter 2018 Compliance Sample Value	<0.0500	824	1910	0.114	5.82	376	4800

Footnotes:

aThe reporting limit for fluoride is in exceedance of the prediction limit, however, it has been confirmed the fluoride concentration is below the Method Detection Limit of 0.2 mg/L.

Legend

NP-LPL: Non-Parametric Lower Prediction Limit

NP-UPL: Non-Parametric Upper Prediction Limit

P-UPL: Parametric Upper Prediction Limit

P-LPL: Parametric Lower Prediction Limit

P-UPLT: Parametric Upper Prediction Limit with a Trend

APPENDIX H

Analytical Data for Calendar Year 2018

Environmental
Laboratory
Services
The Solution Lab

LCRA Environmental Laboratory Services
3505 Montopolis Drive
Austin, TX 78744
Phone: (512)356-6022
Fax: (512)356-6021

February 16, 2018

BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

RE: Final Analytical Report
ELS Workorder Q1804933

Attn: BECKIE LOEVE

Enclosed are the analytical results for sample(s) received by LCRA Environmental Laboratory Services. Results reported herein conform to the most current NELAP standards, where applicable, unless otherwise narrated in the body of the report. This final report provides results related only to the sample(s) as received for the above referenced work order.

Thank you for selecting ELS for your analytical needs. If you have any questions regarding this report, please contact us at (512) 356-6022. We look forward to assisting you again.

Authorized for release by:

Ariana Dean
Project Manager
ariana.dean@lcra.org

Enclosures

SAMPLE SUMMARY

Workorder: Q1804933

Lab ID	Sample ID	Matrix	Date Collected	Date Received
Q1804933001	CBL-340I	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804933002	CBL-340I - 0.45 micron filter	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804933003	CBL-301I	Aqueous	2/7/2018 10:52	2/8/2018 07:45
Q1804933004	CBL-301I - 0.45 micron filter	Aqueous	2/7/2018 10:52	2/8/2018 07:45
Q1804933005	CBL-302I	Aqueous	2/7/2018 12:32	2/8/2018 07:45
Q1804933006	CBL-302I - 0.45 micron filter	Aqueous	2/7/2018 12:32	2/8/2018 07:45
Q1804933007	CBL-306I	Aqueous	2/7/2018 14:16	2/8/2018 07:45
Q1804933008	CBL-306I - 0.45 micron filter	Aqueous	2/7/2018 14:16	2/8/2018 07:45
Q1804933009	CBL-308I	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804933010	CBL-308I - 0.45 micron filter	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804933011	CBL-341I	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804933012	CBL-341I - 0.45 micron filter	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804933013	CBL-641I	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804933014	CBL-641I - 0.45 micron filter	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804933015	Field Blank 1	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804933016	Field Blank 2	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804933017	EQB Pump	Aqueous	2/7/2018 11:30	2/8/2018 07:45
Q1804933018	EQB - 0.45 micron filter	Aqueous	2/7/2018 16:00	2/8/2018 07:45

Report Definitions

LOD	Limit of Detection
LOQ	Limit of Quantitation
ML	Maximum Limit - Client Specified
DF	Dilution Factor
Qual	Qualifiers

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933001**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-340I**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2730	mg/L	50.0	20.0		50	02/09/18 01:21	ML	02/09/18 01:21	ML	
Fluoride	1.00	mg/L	0.500	0.200		50	02/09/18 01:21	ML	02/09/18 01:21	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/09/18 01:39	ML	02/09/18 01:39	ML	
Nitrate (as N)	6.39	mg/L	0.100	0.0400		10	02/09/18 01:39	ML	02/09/18 01:39	ML	
Sulfate	752	mg/L	50.0	20.0		50	02/09/18 01:21	ML	02/09/18 01:21	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	334	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	334	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Calcium Total	555	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:02	FO	
Magnesium Total	87.5	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 18:56	FO	
Potassium Total	3.96	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 18:56	FO	
Sodium Total	1100	mg/L	3.00	1.00		10	02/14/18 18:02	BS	02/15/18 19:02	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933002**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-340I - 0.45 micron filter**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	2620	mg/L	50.0	20.0		50	02/09/18 01:57	ML	02/09/18 01:57	ML	
Fluoride	1.08	mg/L	0.500	0.200		50	02/09/18 01:57	ML	02/09/18 01:57	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/09/18 02:16	ML	02/09/18 02:16	ML	
Nitrate (as N)	6.24	mg/L	0.100	0.0400		10	02/09/18 02:16	ML	02/09/18 02:16	ML	
Sulfate	724	mg/L	50.0	20.0		50	02/09/18 01:57	ML	02/09/18 01:57	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity	Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity										
Bicarbonate Alkalinity	335	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	335	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES										
Calcium Dissolved	547	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:33	FO	
Magnesium Dissolved	86.4	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/15/18 20:27	FO	
Potassium Dissolved	6.01	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/15/18 20:27	FO	
Sodium Dissolved	1060	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:33	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933003**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-301I**	Date Collected:	2/7/2018 10:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	2480	mg/L	50.0	20.0		50	02/08/18 16:17	ML	02/08/18 16:17	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 16:35	ML	02/08/18 16:35	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 16:35	ML	02/08/18 16:35	ML	
Nitrate (as N)	0.283	mg/L	0.100	0.0400		10	02/08/18 16:35	ML	02/08/18 16:35	ML	
Sulfate	344	mg/L	50.0	20.0		50	02/08/18 16:17	ML	02/08/18 16:17	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity	Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity										
Bicarbonate Alkalinity	274	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	274	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Calcium Total	873	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:13	FO	
Magnesium Total	82.7	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:07	FO	
Potassium Total	30.5	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:07	FO	
Sodium Total	473	mg/L	3.00	1.00		10	02/14/18 18:02	BS	02/15/18 19:13	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933004**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-301I - 0.45 micron filter**	Date Collected:	2/7/2018 10:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2560	mg/L	50.0	20.0		50	02/08/18 16:53	ML	02/08/18 16:53	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 17:11	ML	02/08/18 17:11	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 17:11	ML	02/08/18 17:11	ML	
Nitrate (as N)	0.294	mg/L	0.100	0.0400		10	02/08/18 17:11	ML	02/08/18 17:11	ML	
Sulfate	359	mg/L	50.0	20.0		50	02/08/18 16:53	ML	02/08/18 16:53	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	281	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	281	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Calcium Dissolved	917	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:44	FO	
Magnesium Dissolved	99.5	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/15/18 20:38	FO	
Potassium Dissolved	9.90	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/15/18 20:38	FO	
Sodium Dissolved	428	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:44	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933005**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-302I**	Date Collected:	2/7/2018 12:32	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2080	mg/L	50.0	20.0		50	02/08/18 20:13	ML	02/08/18 20:13	ML	
Fluoride	0.112	mg/L	0.100	0.0400		10	02/08/18 20:31	ML	02/08/18 20:31	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 20:31	ML	02/08/18 20:31	ML	
Nitrate (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 20:31	ML	02/08/18 20:31	ML	
Sulfate	1240	mg/L	50.0	20.0		50	02/08/18 20:13	ML	02/08/18 20:13	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	319	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	319	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Calcium Total	934	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:24	FO	
Magnesium Total	62.7	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:18	FO	
Potassium Total	2.23	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:18	FO	
Sodium Total	652	mg/L	3.00	1.00		10	02/14/18 18:02	BS	02/15/18 19:24	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933006**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-302I - 0.45 micron filter**	Date Collected:	2/7/2018 12:32	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	1980	mg/L	50.0	20.0		50	02/08/18 20:49	ML	02/08/18 20:49	ML	
Fluoride	0.103	mg/L	0.100	0.0400		10	02/08/18 21:07	ML	02/08/18 21:07	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 21:07	ML	02/08/18 21:07	ML	
Nitrate (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 21:07	ML	02/08/18 21:07	ML	
Sulfate	1180	mg/L	50.0	20.0		50	02/08/18 20:49	ML	02/08/18 20:49	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	319	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	319	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Calcium Dissolved	924	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:56	FO	
Magnesium Dissolved	63.2	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/15/18 20:50	FO	
Potassium Dissolved	1.82	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/13/18 16:31	FO	
Sodium Dissolved	637	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:56	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933007**	Date Received: 2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-306I**	Date Collected: 2/7/2018 14:16	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**			

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	385 mg/L	25.0	10.0		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
Fluoride	2.81 mg/L	0.250	0.100		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
Nitrite (as N)	<0.250 mg/L	0.250	0.100		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
Nitrate (as N)	<0.250 mg/L	0.250	0.100		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
Sulfate	493 mg/L	25.0	10.0		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
ALKALINITY										
Analysis Desc: SM2320B, Alkalinity	Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity									
Bicarbonate Alkalinity	439 mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00 mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	439 mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Calcium Total	230 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:30	FO	
Magnesium Total	28.0 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:30	FO	
Potassium Total	1.09 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:30	FO	
Sodium Total	357 mg/L	0.300	0.100		1	02/14/18 18:02	BS	02/15/18 19:30	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933008**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-306I - 0.45 micron filter**	Date Collected:	2/7/2018 14:16	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	398	mg/L	25.0	10.0		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
Fluoride	2.88	mg/L	0.250	0.100		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
Nitrite (as N)	<0.250	mg/L	0.250	0.100		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
Nitrate (as N)	<0.250	mg/L	0.250	0.100		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
Sulfate	518	mg/L	25.0	10.0		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	432	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	432	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Calcium Dissolved	229	mg/L	0.100			1	02/12/18 15:20	FO	02/15/18 21:12	FO	
Magnesium Dissolved	29.1	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/15/18 21:12	FO	
Potassium Dissolved	1.05	mg/L	0.100	0.0400		1	02/12/18 15:20	FO	02/15/18 21:12	FO	
Sodium Dissolved	364	mg/L	0.100			1	02/12/18 15:20	FO	02/15/18 21:12	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933009**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-308I**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2750	mg/L	50.0	20.0		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
Fluoride	1.76	mg/L	0.500	0.200		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
Nitrite (as N)	<0.500	mg/L	0.500	0.200		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
Nitrate (as N)	0.835	mg/L	0.500	0.200		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
Sulfate	1570	mg/L	50.0	20.0		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	327	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	327	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Calcium Total	859	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:47	FO	
Magnesium Total	123	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:41	FO	
Potassium Total	6.63	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:41	FO	
Sodium Total	1210	mg/L	3.00	1.00		10	02/14/18 18:02	BS	02/15/18 19:47	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933010**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-308I - 0.45 micron filter**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions		Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	3110 mg/L	50.0	20.0		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
Fluoride	1.81 mg/L	0.500	0.200		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
Nitrite (as N)	<0.500 mg/L	0.500	0.200		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
Nitrate (as N)	0.940 mg/L	0.500	0.200		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
Sulfate	1800 mg/L	50.0	20.0		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
ALKALINITY										
Analysis Desc: SM2320B, Alkalinity		Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	326 mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00 mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	326 mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES		Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Calcium Dissolved	818 mg/L	1.00			10	02/12/18 15:22	FO	02/15/18 21:29	FO	
Magnesium Dissolved	121 mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/15/18 21:23	FO	
Potassium Dissolved	6.67 mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/15/18 21:23	FO	
Sodium Dissolved	1140 mg/L	1.00			10	02/12/18 15:22	FO	02/15/18 21:29	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933011**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-341I**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions									
	Analytical Method: E300.0, Anions									
Chloride	2110 mg/L	50.0	20.0		50	02/08/18 13:03	ML	02/08/18 13:03	ML	
Fluoride	0.106 mg/L	0.100	0.0400		10	02/08/18 12:26	ML	02/08/18 12:26	ML	
Nitrite (as N)	<0.100 mg/L	0.100	0.0400		10	02/08/18 12:26	ML	02/08/18 12:26	ML	
Nitrate (as N)	0.173 mg/L	0.100	0.0400		10	02/08/18 12:26	ML	02/08/18 12:26	ML	
Sulfate	383 mg/L	10.0	4.00		10	02/08/18 12:26	ML	02/08/18 12:26	ML	
ALKALINITY										
Analysis Desc: SM2320B, Alkalinity	Preparation Method: SM2320B, Alkalinity									
	Analytical Method: SM2320B, Alkalinity									
Bicarbonate Alkalinity	297 mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00 mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	297 mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep									
	Analytical Method: SW6010B ICP-AES									
Calcium Total	810 mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 20:10	FO	
Magnesium Total	90.8 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 20:04	FO	
Potassium Total	5.80 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 20:04	FO	
Sodium Total	302 mg/L	0.300	0.100		1	02/14/18 18:02	BS	02/15/18 20:04	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933012**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-341I - 0.45 micron filter**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	1880	mg/L	50.0	20.0		50	02/08/18 12:15	ML	02/08/18 12:15	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 12:51	ML	02/08/18 12:51	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 12:51	ML	02/08/18 12:51	ML	
Nitrate (as N)	0.158	mg/L	0.100	0.0400		10	02/08/18 12:51	ML	02/08/18 12:51	ML	
Sulfate	360	mg/L	50.0	20.0		50	02/08/18 12:15	ML	02/08/18 12:15	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	300	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	300	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Calcium Dissolved	788	mg/L	1.00			10	02/12/18 15:22	FO	02/15/18 21:41	FO	
Magnesium Dissolved	89.1	mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/15/18 21:34	FO	
Potassium Dissolved	5.84	mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/15/18 21:34	FO	
Sodium Dissolved	288	mg/L	0.100			1	02/12/18 15:22	FO	02/15/18 21:34	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID: **Q1804933013**
Sample ID: **CBL-641I**
Project ID: **FPP GWMP CCR**

Date Received: 2/8/2018 07:45
Date Collected: 2/6/2018 13:00

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	1710	mg/L	50.0	20.0		50	02/08/18 11:57	ML	02/08/18 11:57	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 12:34	ML	02/08/18 12:34	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 12:34	ML	02/08/18 12:34	ML	
Nitrate (as N)	0.180	mg/L	0.100	0.0400		10	02/08/18 12:34	ML	02/08/18 12:34	ML	
Sulfate	409	mg/L	50.0	20.0		50	02/08/18 11:57	ML	02/08/18 11:57	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	298	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	298	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Calcium Total	806	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 20:21	FO	
Magnesium Total	90.8	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 20:15	FO	
Potassium Total	5.96	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 20:15	FO	
Sodium Total	301	mg/L	0.300	0.100		1	02/14/18 18:02	BS	02/15/18 20:15	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933014**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-641I - 0.45 micron filter**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	1720	mg/L	50.0	20.0		50	02/08/18 11:53	ML	02/08/18 11:53	ML	
Fluoride	0.116	mg/L	0.100	0.0400		10	02/08/18 12:30	ML	02/08/18 12:30	ML	
Nitrite (as N)	<0.100	mg/L	0.100	0.0400		10	02/08/18 12:30	ML	02/08/18 12:30	ML	
Nitrate (as N)	0.156	mg/L	0.100	0.0400		10	02/08/18 12:30	ML	02/08/18 12:30	ML	
Sulfate	333	mg/L	50.0	20.0		50	02/08/18 11:53	ML	02/08/18 11:53	ML	
ALKALINITY											
Analysis Desc: SM2320B, Alkalinity			Preparation Method: SM2320B, Alkalinity Analytical Method: SM2320B, Alkalinity								
Bicarbonate Alkalinity	302	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Carbonate Alkalinity	0.00	mg/L	0.00	0.00		1	02/14/18	ADG	02/14/18	ADG	N
Total Alkalinity (CaCO3)	302	mg/L	20.0	20.0		1	02/14/18	ADG	02/14/18	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Calcium Dissolved	767	mg/L	1.00			10	02/12/18 15:22	FO	02/15/18 21:52	FO	
Magnesium Dissolved	87.3	mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/15/18 21:46	FO	
Potassium Dissolved	5.69	mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/15/18 21:46	FO	
Sodium Dissolved	289	mg/L	0.100			1	02/12/18 15:22	FO	02/15/18 21:46	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933015**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**Field Blank 1**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

INORGANICS

Analysis Desc: SW6010B ICP-AES

Preparation Method: SW3010A, Metals Prep

Analytical Method: SW6010B ICP-AES

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
Calcium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:39	FO	
Magnesium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:39	FO	
Potassium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:39	FO	
Sodium Total	<0.300	mg/L	0.300	0.100		1	02/14/18 18:02	BS	02/14/18 19:39	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933016**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**Field Blank 2**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Calcium Total	<0.200 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:46	FO	
Magnesium Total	<0.200 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:46	FO	
Potassium Total	<0.200 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:46	FO	
Sodium Total	<0.300 mg/L	0.300	0.100		1	02/14/18 18:02	BS	02/14/18 19:46	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933017**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**EQB Pump**	Date Collected:	2/7/2018 11:30	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Calcium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:52	FO	
Magnesium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:52	FO	
Potassium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:52	FO	
Sodium Total	<0.300	mg/L	0.300	0.100		1	02/14/18 18:02	BS	02/14/18 19:52	FO	

ANALYTICAL RESULTS

Workorder: Q1804933

Lab ID:	**Q1804933018**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**EQB - 0.45 micron filter**	Date Collected:	2/7/2018 16:00	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES									
Calcium Dissolved	<0.100 mg/L	0.100			1	02/12/18 15:22	FO	02/13/18 20:45	FO	
Magnesium Dissolved	<0.100 mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/13/18 20:45	FO	
Potassium Dissolved	<0.100 mg/L	0.100	0.0400		1	02/12/18 15:22	FO	02/13/18 20:45	FO	
Sodium Dissolved	<0.100 mg/L	0.100			1	02/12/18 15:22	FO	02/13/18 20:45	FO	

ANALYTICAL RESULTS QUALIFIERS

Workorder: Q1804933

PARAMETER QUALIFIERS

Lab ID: Q1804933001

N Not Accredited

Lab ID: Q1804933002

N Not Accredited

Lab ID: Q1804933003

N Not Accredited

Lab ID: Q1804933004

N Not Accredited

Lab ID: Q1804933005

N Not Accredited

Lab ID: Q1804933006

N Not Accredited

Lab ID: Q1804933009

N Not Accredited

Lab ID: Q1804933010

N Not Accredited

Lab ID: Q1804933011

N Not Accredited

Lab ID: Q1804933012

N Not Accredited

Lab ID: Q1804933013

N Not Accredited

Lab ID: Q1804933014

N Not Accredited

QUALITY CONTROL DATA

Workorder: Q1804933

QC Batch: WET/16576 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1804933014

METHOD BLANK: 1017900

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Nitrate (as N)	mg/L	<0.0100	0.0100	
Nitrite (as N)	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1017903

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	28.5	95	90 - 110	
Fluoride	mg/L	1	.99	99	90 - 110	
Nitrate (as N)	mg/L	1	.97	97.4	90 - 110	
Nitrite (as N)	mg/L	1	.94	93.8	90 - 110	
Sulfate	mg/L	30	28.5	95.1	90 - 110	

MATRIX SPIKE: 1017905 DUPLICATE: 1017906 ORIGINAL: Q1804911026

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	1720	1000	2690	2690	97.3	97.2	80 - 120	0	20	
Fluoride	mg/L	.12	50	48.8	48.8	97.4	97.3	80 - 120	0	20	
Nitrate (as N)	mg/L	.21	50	48.9	48.9	97.8	97.8	80 - 120	0	20	
Nitrite (as N)	mg/L	0	50	48.1	47.2	96.2	94.4	80 - 120	1.89	20	
Sulfate	mg/L	333	1000	1330	1330	99.9	100	80 - 120	0	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

SAMPLE DUPLICATE: 1018110 ORIGINAL: Q1803992007

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Nitrate (as N)	mg/L	10.7	10.7			0		

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

QC Batch: WET/16586 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1804933010, Q1804933012, Q1804933013

METHOD BLANK: 1018319

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Nitrate (as N)	mg/L	<0.0100	0.0100	
Nitrite (as N)	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1018322

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	28.5	95.1	90 - 110	
Fluoride	mg/L	1	1	100	90 - 110	
Nitrate (as N)	mg/L	1	.99	98.9	90 - 110	
Nitrite (as N)	mg/L	1	.99	99	90 - 110	
Sulfate	mg/L	30	28.6	95.5	90 - 110	

MATRIX SPIKE: 1018324 DUPLICATE: 1018325 ORIGINAL: Q1804911025

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	1710	1000	2810	2760	110	104	80 - 120	1.8	20	
Fluoride	mg/L	.05	50	52.3	51.2	105	102	80 - 120	2.13	20	
Nitrate (as N)	mg/L	.19	50	52.2	50.8	104	102	80 - 120	2.72	20	
Nitrite (as N)	mg/L	0	50	52.7	51	105	102	80 - 120	3.28	20	
Sulfate	mg/L	409	1000	1510	1470	110	106	80 - 120	2.68	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

Environmental
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LCRA Environmental Laboratory Services
3505 Montopolis Drive
Austin, TX 78744
Phone: (512)356-6022
Fax: (512)356-6021

QUALITY CONTROL DATA

Workorder: Q1804933

QC Batch: WET/16588 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1804933001, Q1804933002, Q1804933003, Q1804933004, Q1804933005, Q1804933006, Q1804933007, Q1804933008, Q1804933009, Q1804933011

METHOD BLANK: 1018432

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Nitrate (as N)	mg/L	<0.0100	0.0100	
Nitrite (as N)	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1018435

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	29.6	98.5	90 - 110	
Fluoride	mg/L	1	.98	97.9	90 - 110	
Nitrate (as N)	mg/L	1	.96	95.8	90 - 110	
Nitrite (as N)	mg/L	1	.92	92.1	90 - 110	
Sulfate	mg/L	30	27.3	91	90 - 110	

MATRIX SPIKE: 1018437 DUPLICATE: 1018438 ORIGINAL: Q1804911024

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	1820	1000	2700	2700	87.4	87.2	80 - 120	0	20	
Fluoride	mg/L	.13	50	48.5	48.4	96.7	96.6	80 - 120	.206	20	
Nitrate (as N)	mg/L	.22	50	47.8	47.8	95.6	95.5	80 - 120	0	20	
Nitrite (as N)	mg/L	0	50	49.2	49.2	98.4	98.5	80 - 120	0	20	
Sulfate	mg/L	344	1000	1290	1290	94.9	94.9	80 - 120	0	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

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Fax: (512)356-6021

QUALITY CONTROL DATA

Workorder: Q1804933

METHOD BLANK: 1018442

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Nitrate (as N)	mg/L	<0.0100	0.0100	
Nitrite (as N)	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1018443

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	32.1	107	90 - 110	
Fluoride	mg/L	1	1.03	103	90 - 110	
Nitrate (as N)	mg/L	1	1	100	90 - 110	
Nitrite (as N)	mg/L	1	.98	98.4	90 - 110	
Sulfate	mg/L	30	27.5	91.8	90 - 110	

MATRIX SPIKE: 1018439 DUPLICATE: 1018440 ORIGINAL: Q1804911007

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	***mg/L***	***2620***	***200***	***1780***	***1790***	***-424***	***-419***	***80 - 120***	***.56***	***20***	***S***
Fluoride	mg/L	.08	10	9.54	9.64	95.4	96.4	80 - 120	1.04	20	
Nitrate (as N)	mg/L	.27	10	9.94	10	96.7	97.4	80 - 120	.602	20	
Nitrite (as N)	mg/L	0	10	11.1	11.2	111	112	80 - 120	.897	20	
Sulfate	mg/L	370	200	540	533	84.6	81.4	80 - 120	1.3	20	

MATRIX SPIKE: 1018444 DUPLICATE: 1018445 ORIGINAL: Q1804911012

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	***mg/L***	***2030***	***200***	***1580***	***1620***	***-227***	***-209***	***80 - 120***	***2.5***	***20***	***S***
Fluoride	mg/L	.13	10	9.43	9.74	93.1	96.2	80 - 120	3.23	20	
Nitrate (as N)	mg/L	.02	10	9.4	9.73	94	97.3	80 - 120	3.45	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

MATRIX SPIKE: 1018444 DUPLICATE: 1018445 ORIGINAL: Q1804911012

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Nitrite (as N)	mg/L	0	10	10.5	10.8	105	108	80 - 120	2.82	20	
Sulfate	***mg/L***	***1240***	***200***	***1220***	***1240***	***-11.4***	***-1.65***	***80 - 120***	***1.63***	***20***	***S***

METHOD BLANK: 1018447

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Nitrate (as N)	mg/L	<0.0100	0.0100	
Nitrite (as N)	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1018448

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	29.6	98.5	90 - 110	
Fluoride	mg/L	1	.98	98	90 - 110	
Nitrate (as N)	mg/L	1	.97	97.2	90 - 110	
Nitrite (as N)	mg/L	1	.92	92.2	90 - 110	
Sulfate	mg/L	30	27	90.1	90 - 110	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

QC Batch: MEP/7991 **Analysis Method:** SW6010B ICP-AES
QC Batch Method: SW6010B ICP-AES
Associated Lab Samples: Q1804933002, Q1804933004, Q1804933006, Q1804933008, Q1804933012

METHOD BLANK: 1019542

Parameter	Units	Blank Result	Reporting Limit	Qual
Calcium Dissolved	mg/L	<0.100	0.100	
Magnesium Dissolved	mg/L	<0.100	0.100	
Potassium Dissolved	mg/L	<0.100	0.100	
Sodium Dissolved	mg/L	<0.100	0.100	

LABORATORY CONTROL SAMPLE: 1019543

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Calcium Dissolved	mg/L	10	10.2	10.2	102	102	80 - 120	0	20	
Magnesium Dissolved	mg/L	10	10.1	10	101	100	80 - 120	.995	20	
Potassium Dissolved	mg/L	10	9.85	9.72	98.5	97.2	80 - 120	1.33	20	
Sodium Dissolved	mg/L	10	10	9.98	100	99.8	80 - 120	.2	20	

MATRIX SPIKE: 1019547 DUPLICATE: 1019548 ORIGINAL: Q1804911023

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Calcium Dissolved	***mg/L***	***854***	***10***	***808***	***796***	***-463***	***-580***	***75 - 125***	***1.5***	***20***	***S***
Magnesium Dissolved	mg/L	89.6	10	100	99.2	104	95.5	75 - 125	.803	20	
Potassium Dissolved	mg/L	6.36	10	17.8	17.5	115	112	75 - 125	1.7	20	
Sodium Dissolved	***mg/L***	***307***	***10***	***319***	***316***	***126***	***94.3***	***75 - 125***	***.945***	***20***	***S***

Qualifiers

S - Spike Recovery Outside Recovery Limits
R - RPD Outside Recovery Limits
B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

QC Batch: MEP/7992 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW6010B ICP-AES

Associated Lab Samples: Q1804933010, Q1804933014, Q1804933018

METHOD BLANK: 1019549

Parameter	Units	Blank Result	Reporting Limit	Qual
Calcium Dissolved	mg/L	<0.100	0.100	
Magnesium Dissolved	mg/L	<0.100	0.100	
Potassium Dissolved	mg/L	<0.100	0.100	
Sodium Dissolved	mg/L	<0.100	0.100	

LABORATORY CONTROL SAMPLE: 1019550

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Calcium Dissolved	mg/L	10	9.9	10	99	100	80 - 120	1.01	20	
Magnesium Dissolved	mg/L	10	9.62	9.76	96.2	97.6	80 - 120	1.44	20	
Potassium Dissolved	mg/L	10	9.65	9.7	96.5	97	80 - 120	.517	20	
Sodium Dissolved	mg/L	10	9.9	10	99	100	80 - 120	1.01	20	

MATRIX SPIKE: 1019552 DUPLICATE: 1019553 ORIGINAL: Q1804933010

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Calcium Dissolved	***mg/L***	***818***	***10***	***796***	***804***	***-220***	***-144***	***75 - 125***	***1***	***20***	***S***
Magnesium Dissolved	***mg/L***	***121***	***10***	***127***	***128***	***60.7***	***69.6***	***75 - 125***	***.784***	***20***	***S***
Potassium Dissolved	mg/L	6.67	10	17	17.3	103	106	75 - 125	1.75	20	

MATRIX SPIKE: 1019554 DUPLICATE: 1019555 ORIGINAL: Q1805209015

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Calcium Dissolved	mg/L	0	10	10.2	9.96	102	99.6	75 - 125	2.38	20	
Magnesium Dissolved	mg/L	0	10	9.93	9.72	99.3	97.2	75 - 125	2.14	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

MATRIX SPIKE: 1019554 DUPLICATE: 1019555 ORIGINAL: Q1805209015

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Potassium Dissolved	mg/L	0	10	10.1	9.79	101	97.9	75 - 125	3.12	20	
Sodium Dissolved	mg/L	0	10	10.3	9.95	103	99.5	75 - 125	3.46	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

QC Batch: MEP/8006 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW3010A, Metals Prep

Associated Lab Samples: Q1804933001, Q1804933003, Q1804933005, Q1804933007, Q1804933009, Q1804933011, Q1804933013, Q1804933015, Q1804933016, Q1804933017

LABORATORY CONTROL SAMPLE: 1021152

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Calcium Total	mg/L	10	10.4	10.4	104	104	80 - 120	0	20	
Magnesium Total	mg/L	10	9.84	9.89	98.4	98.9	80 - 120	.507	20	
Potassium Total	mg/L	10	9.5	9.65	95	96.5	80 - 120	1.57	20	
Sodium Total	mg/L	10	10	10.2	100	102	80 - 120	1.98	20	

METHOD BLANK: 1021154

Parameter	Units	Blank Result	Reporting Limit	Qual
Calcium Total	mg/L	<0.200	0.200	
Magnesium Total	mg/L	<0.200	0.200	
Potassium Total	mg/L	<0.200	0.200	
Sodium Total	mg/L	<0.300	0.300	

MATRIX SPIKE: 1021157 DUPLICATE: 1021158 ORIGINAL: Q1804933001

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Calcium Total	***mg/L***	***555***	***10***	***541***	***551***	***-134***	***-35.1***	***75 - 125***	***1.83***	***20***	***S***
Magnesium Total	***mg/L***	***87.5***	***10***	***92.4***	***94.2***	***48.5***	***66.8***	***75 - 125***	***1.93***	***20***	***S***
Potassium Total	mg/L	3.96	10	15.1	15.3	111	113	75 - 125	1.32	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804933

QC Batch: WET/16639 **Analysis Method:** SM2320B, Alkalinity

QC Batch Method: SM2320B, Alkalinity

Associated Lab Samples: Q1804933001, Q1804933002, Q1804933003, Q1804933004, Q1804933005, Q1804933006, Q1804933007, Q1804933008, Q1804933009, Q1804933010, Q1804933011, Q1804933012, Q1804933013, Q1804933014

SAMPLE DUPLICATE: 1021559 ORIGINAL: Q1804933001

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Alkalinity (CaCO3)	mg/L	334	333			.3	20	

MATRIX SPIKE SAMPLE: 1021560 ORIGINAL: Q1804933001

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Alkalinity (CaCO3)	***mg/L***	***334***	***100***	***398***	***64.5***	***70 - 130***	***S***

LABORATORY CONTROL SAMPLE: 1021561

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Alkalinity (CaCO3)	mg/L	100	98.4	98.4	90 - 110	

METHOD BLANK: 1021562

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Alkalinity (CaCO3)	mg/L	<20.0	20.0	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1804933

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1804933014	CBL-641I - 0.45 micron filter			E300.0, Anions	WET/16576
Q1804933010	CBL-308I - 0.45 micron filter			E300.0, Anions	WET/16586
Q1804933012	CBL-341I - 0.45 micron filter			E300.0, Anions	WET/16586
Q1804933013	CBL-641I			E300.0, Anions	WET/16586
Q1804933001	CBL-340I			E300.0, Anions	WET/16588
Q1804933002	CBL-340I - 0.45 micron filter			E300.0, Anions	WET/16588
Q1804933003	CBL-301I			E300.0, Anions	WET/16588
Q1804933004	CBL-301I - 0.45 micron filter			E300.0, Anions	WET/16588
Q1804933005	CBL-302I			E300.0, Anions	WET/16588
Q1804933006	CBL-302I - 0.45 micron filter			E300.0, Anions	WET/16588
Q1804933009	CBL-308I			E300.0, Anions	WET/16588
Q1804933011	CBL-341I			E300.0, Anions	WET/16588
Q1804933006	CBL-302I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804933002	CBL-340I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804933004	CBL-301I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804933006	CBL-302I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804933012	CBL-341I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804933018	EQB - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6191
Q1804933010	CBL-308I - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6207
Q1804933014	CBL-641I - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6207
Q1804933015	Field Blank 1	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804933016	Field Blank 2	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804933017	EQB Pump	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804933001	CBL-340I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804933003	CBL-301I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804933005	CBL-302I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804933009	CBL-308I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804933011	CBL-341I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1804933

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1804933013	CBL-641I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804933001	CBL-340I			SM2320B, Alkalinity	WET/16639
Q1804933002	CBL-340I - 0.45 micron filter			SM2320B, Alkalinity	WET/16639
Q1804933003	CBL-301I			SM2320B, Alkalinity	WET/16639
Q1804933004	CBL-301I - 0.45 micron filter			SM2320B, Alkalinity	WET/16639
Q1804933005	CBL-302I			SM2320B, Alkalinity	WET/16639
Q1804933006	CBL-302I - 0.45 micron filter			SM2320B, Alkalinity	WET/16639
Q1804933009	CBL-308I			SM2320B, Alkalinity	WET/16639
Q1804933010	CBL-308I - 0.45 micron filter			SM2320B, Alkalinity	WET/16639
Q1804933011	CBL-341I			SM2320B, Alkalinity	WET/16639
Q1804933012	CBL-341I - 0.45 micron filter			SM2320B, Alkalinity	WET/16639
Q1804933013	CBL-641I			SM2320B, Alkalinity	WET/16639
Q1804933014	CBL-641I - 0.45 micron filter			SM2320B, Alkalinity	WET/16639

Q1804933

Environmental Laboratory Services
The Solution Lab

LCRA Environmental Laboratory Services
Request for Analysis Chain-of-Custody Record

LCRA - Environmental Lab
3505 Montopolis Dr.
Austin, TX 78744

Phone: (512) 356-6022 or 1-800-776-5272
Fax: (512) 356-6021
https://els.lcra.org

Project:	FPP - CCR Wells - Ionic Species	**Client:**	LCRA
Collector:	Jason Woods	**Contact:**	
Event#:	1393475 / 5420	**Phone:**	

Report To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

Lab ID#:

Client PO:

Invoice To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

Matrix*: AQ = Aqueous, S = Solid, T = Tissue, DW = Drinking Water

	LAB USE ONLY	Sample ID *	Collected *		Matrix*	Container(s) Type/Preservative/Number *				Requested Analysis *			
			Date*	Time * HH:MM		COMPOSITE Y/N	FILTERED Y/N	1LPU	250PHNO3	300.0AM-48	6010-AM	2320-AM	6010-AMF
1	1	CBL-340I	2/7/18	1540	AQ	N	N	1	1	X	X	X	
2	2	CBL-340I - 0.45 micron filter	2/7/18	1540	AQ	N	Y	1	1	X		X	X
13	3	CBL-301I	2/7/18	1052	AQ	N	N	1	1	X	X	X	
14	4	CBL-301I - 0.45 micron filter	2/7/18	1052	AQ	N	Y	1	1	X		X	X
15	5	CBL-302I	2/7/18	1232	AQ	N	N	1	1	X	X	X	
6	6	CBL-302I - 0.45 micron filter	2/7/18	1232	AQ	N	Y	1	1	X		X	X
7	7	CBL-306I	2/7/18	1416	AQ	N	N	1	1	X	X	X	
8	8	CBL-306I - 0.45 micron filter	2/7/18	1416	AQ	N	Y	1	1	X		X	X
9	9	CBL-308I	2/6/18	1452	AQ	N	N	1	1	X	X	X	
0	10	CBL-308I - 0.45 micron filter	2/6/18	1452	AQ	N	Y	1	1	X		X	X

Transfers	Relinquished By	Date/Time	Received By	Date/Time
1		2/8/18 745		2/8/18 745
2				
3				

Cooler Temp:			
#	T#	Obs.	Corr.
1	6	0.7°C	0.7°C
2			

Client Special Instructions:

Lab Use Only:

01804933 314499

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Environmental Laboratory Services
The Solution Lab

LCRA Environmental Laboratory Services
Request for Analysis Chain-of-Custody Record

LCRA - Environmental Lab
3505 Montopolis Dr.
Austin, TX 78744

Phone: (512) 356-6022 or 1-800-776-5272
Fax: (512) 356-6021
https://els.lcra.org

Lab ID#:
Client PO:

Project: FPP - CCR Wells - Ionic Species
Collector: Jason Woods
Event#: 1393475 / 5420
Client: LCRA
Contact:
Phone:

Report To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

Invoice To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

	LAB USE ONLY	Sample ID *	Collected * Date*	Collected * Time * HH:MM	Matrix* AQ = Aqueous S = Solid T = Tissue DW =Drinking Water	COMPOSITE Y/N	FILTERED Y/N	1LPU	250PHNO3	300.0AM-48	6010-AM	2320-AM	6010-AMF
11	11	CBL-341I	2/6/18	1300	AQ			1	1	X	X	X	
12	12	CBL-341I - 0.45 micron filter	2/6/18	1300	AQ			1	1	X		X	X
13	13	CBL-641I	2/6/18	1300	AQ			1	1	X	X	X	
14	14	CBL-641I - 0.45 micron filter	2/6/18	1300	AQ			1	1	X		X	X
15	15	Field Blank 1	2/6/18	1452	AQ	N	N		1		X		
16	16	Field Blank 2	2/7/18	1540	AQ				1		X		
17	17	EQB Pump	2/7/18	1130	AQ	N	N		1		X		
18	18	EQB - 0.45 micron filter	2/7/18	1600	AQ				1				X

Transfers	Relinquished By	Date/Time	Received By	Date/Time
1		2/8/18 745		2/8/18 745
2				
3				

Cooler Temp:

#	T#	Obs.	Corr.
1	6	0.7C	0.7C
2			

Client Special Instructions:

Lab Use Only:

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Environmental
Laboratory
Services
The Solution Lab

LCRA Environmental Laboratory Services
3505 Montopolis Drive
Austin, TX 78744
Phone: (512)356-6022
Fax: (512)356-6021

February 21, 2018

BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

RE: Final Analytical Report
ELS Workorder Q1804911

Attn: BECKIE LOEVE

Enclosed are the analytical results for sample(s) received by LCRA Environmental Laboratory Services. Results reported herein conform to the most current NELAP standards, where applicable, unless otherwise narrated in the body of the report. This final report provides results related only to the sample(s) as received for the above referenced work order.

Thank you for selecting ELS for your analytical needs. If you have any questions regarding this report, please contact us at (512) 356-6022. We look forward to assisting you again.

Authorized for release by:

Jason Woods
Project Manager
jason.woods@lcra.org

NELAP ACCREDITED TNI LABORATORY

Enclosures

SAMPLE SUMMARY

Workorder: Q1804911

Lab ID	Sample ID	Matrix	Date Collected	Date Received
Q1804911001	CBL-340I	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804911002	CBL-340I - 0.45 micron filter	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804911003	CBL-340I - 10 micron filter	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804911004	CBL-340I settled	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804911005	CBL-301I	Aqueous	2/7/2018 10:52	2/8/2018 07:45
Q1804911006	CBL-301I - 0.45 micron filter	Aqueous	2/7/2018 10:52	2/8/2018 07:45
Q1804911007	CBL-301I - 10 micron filter	Aqueous	2/7/2018 10:52	2/8/2018 07:45
Q1804911008	CBL-301I settled	Aqueous	2/7/2018 10:52	2/8/2018 07:45
Q1804911009	CBL-302I	Aqueous	2/7/2018 12:32	2/8/2018 07:45
Q1804911010	CBL-302I - 0.45 micron filter	Aqueous	2/7/2018 12:32	2/8/2018 07:45
Q1804911011	CBL-302I - 10 micron filter	Aqueous	2/7/2018 12:32	2/8/2018 07:45
Q1804911012	CBL-302I settled	Aqueous	2/7/2018 12:32	2/8/2018 07:45
Q1804911013	CBL-306I	Aqueous	2/7/2018 14:16	2/8/2018 07:45
Q1804911014	CBL-306I - 0.45 micron filter	Aqueous	2/7/2018 14:16	2/8/2018 07:45
Q1804911015	CBL-306I - 10 micron filter	Aqueous	2/7/2018 14:16	2/8/2018 07:45
Q1804911016	CBL-306I settled	Aqueous	2/7/2018 14:16	2/8/2018 07:45
Q1804911017	CBL-308I	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804911018	CBL-308I - 0.45 micron filter	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804911019	CBL-308I - 10 micron filter	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804911020	CBL-308I settled	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804911021	CBL-341I	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911022	CBL-341I - 0.45 micron filter	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911023	CBL-341I - 10 micron filter	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911024	CBL-341I settled	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911025	CBL-641I	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911026	CBL-641I - 0.45 micron filter	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911027	CBL-641I - 10 micron filter	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911028	CBL-641I settled	Aqueous	2/6/2018 13:00	2/8/2018 07:45
Q1804911029	Field Blank 1	Aqueous	2/6/2018 14:52	2/8/2018 07:45
Q1804911030	Field Blank 2	Aqueous	2/7/2018 15:40	2/8/2018 07:45
Q1804911031	EQB Pump	Aqueous	2/7/2018 11:30	2/8/2018 07:45
Q1804911032	EQB - 0.45 micron filter	Aqueous	2/7/2018 16:00	2/8/2018 07:45
Q1804911033	EQB - 10 micron filter	Aqueous	2/7/2018 16:10	2/8/2018 07:45

SAMPLE SUMMARY

Workorder: Q1804911

Lab ID	Sample ID	Matrix	Date Collected	Date Received

Report Definitions

LOD	Limit of Detection
LOQ	Limit of Quantitation
ML	Maximum Limit - Client Specified
DF	Dilution Factor
Qual	Qualifiers

PROJECT SUMMARY

Workorder: Q1804911

Workorder Comments

The settled samples were collected in a four liter cubitainer at the monitoring well. The sample was placed on ice and allowed to settled overnight in the laboratory refridgerator. The samples were carefully transfered to individual sample containers the following morning for analysis without mixing the sample in the cubitainer.

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911001**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-340I**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	2730 mg/L	50.0	20.0		50	02/09/18 01:21	ML	02/09/18 01:21	ML	
Fluoride	1.00 mg/L	0.500	0.200		50	02/09/18 01:21	ML	02/09/18 01:21	ML	
Sulfate	752 mg/L	50.0	20.0		50	02/09/18 01:21	ML	02/09/18 01:21	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	5290 mg/L	250	250		100	02/13/18 12:12	ADG	02/13/18 12:12	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	0.0638 mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 18:32	FO	
Calcium Total	555 mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:02	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	21.61 C				1	02/07/18 15:40	JBW	02/07/18 15:40	JBW	N
pH	6.41 pH				1	02/07/18 15:40	JBW	02/07/18 15:40	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911002**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-340I - 0.45 micron filter**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	2620	mg/L	50.0	20.0		50	02/09/18 01:57	ML	02/09/18 01:57	ML	
Fluoride	1.08	mg/L	0.500	0.200		50	02/09/18 01:57	ML	02/09/18 01:57	ML	
Sulfate	724	mg/L	50.0	20.0		50	02/09/18 01:57	ML	02/09/18 01:57	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS										
Total Dissolved Solids(TDS)	5490	mg/L	250	250		100	02/13/18 12:17	ADG	02/13/18 12:17	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES										
Boron Dissolved	0.0886	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 15:46	FO	
Calcium Dissolved	547	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:33	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1										
Temperature	18.26	C				1	02/07/18 15:40	JBW	02/07/18 15:40	JBW	N
pH	6.68	pH				1	02/07/18 15:40	JBW	02/07/18 15:40	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911003**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-340I - 10 micron filter**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	2520	mg/L	50.0	20.0		50	02/09/18 02:34	ML	02/09/18 02:34	ML	
Fluoride	1.10	mg/L	0.500	0.200		50	02/09/18 02:34	ML	02/09/18 02:34	ML	
Sulfate	690	mg/L	50.0	20.0		50	02/09/18 02:34	ML	02/09/18 02:34	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS										
Total Dissolved Solids(TDS)	5270	mg/L	250	250		100	02/13/18 12:17	ADG	02/13/18 12:17	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES										
Boron Dissolved	0.0950	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 16:08	FO	
Calcium Dissolved	549	mg/L	1.00			10	02/12/18 15:20	FO	02/14/18 12:24	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1										
Temperature	18.10	C				1	02/07/18 15:40	JBW	02/07/18 15:40	JBW	N
pH	6.54	pH				1	02/07/18 15:40	JBW	02/07/18 15:40	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911004**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-340I settled**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2530	mg/L	50.0	20.0		50	02/09/18 03:02	ML	02/09/18 03:02	ML	
Fluoride	0.960	mg/L	0.500	0.200		50	02/09/18 03:02	ML	02/09/18 03:02	ML	
Sulfate	724	mg/L	50.0	20.0		50	02/09/18 03:02	ML	02/09/18 03:02	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	5220	mg/L	250	250		100	02/13/18 12:17	ADG	02/13/18 12:17	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Boron Total	0.0583	mg/L	0.0500	0.0200		1	02/14/18 18:03	BS	02/14/18 20:32	FO	
Calcium Total	554	mg/L	2.00	0.700		10	02/14/18 18:03	BS	02/15/18 01:03	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
pH	6.56	pH				1	02/07/18 15:40	JBW	02/07/18 15:40	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911005**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-301I**	Date Collected:	2/7/2018 10:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	2480	mg/L	50.0	20.0		50	02/08/18 16:17	ML	02/08/18 16:17	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 16:35	ML	02/08/18 16:35	ML	
Sulfate	344	mg/L	50.0	20.0		50	02/08/18 16:17	ML	02/08/18 16:17	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS										
Total Dissolved Solids(TDS)	5120	mg/L	250	250		100	02/13/18 12:17	ADG	02/13/18 12:17	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 18:54	FO	
Calcium Total	873	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:13	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1										
Temperature	23.37	C				1	02/07/18 10:52	JBW	02/07/18 10:52	JBW	N
pH	6.17	pH				1	02/07/18 10:52	JBW	02/07/18 10:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911006**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-301I - 0.45 micron filter**	Date Collected:	2/7/2018 10:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2560	mg/L	50.0	20.0		50	02/08/18 16:53	ML	02/08/18 16:53	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 17:11	ML	02/08/18 17:11	ML	
Sulfate	359	mg/L	50.0	20.0		50	02/08/18 16:53	ML	02/08/18 16:53	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4730	mg/L	250	250		100	02/13/18 12:17	ADG	02/13/18 12:17	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	<0.0500	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 16:15	FO	
Calcium Dissolved	917	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:44	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	20.40	C				1	02/07/18 10:52	JBW	02/07/18 10:52	JBW	N
pH	6.26	pH				1	02/07/18 10:52	JBW	02/07/18 10:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911007**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-301I - 10 micron filter**	Date Collected:	2/7/2018 10:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2620	mg/L	50.0	20.0		50	02/08/18 17:29	ML	02/08/18 17:29	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 19:18	ML	02/08/18 19:18	ML	
Sulfate	370	mg/L	10.0	4.00		10	02/08/18 19:18	ML	02/08/18 19:18	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4570	mg/L	250	250		100	02/13/18 12:17	ADG	02/13/18 12:17	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	<0.0500	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 16:23	FO	
Calcium Dissolved	937	mg/L	1.00			10	02/12/18 15:20	FO	02/14/18 12:37	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	20.08	C				1	02/07/18 10:52	JBW	02/07/18 10:52	JBW	N
pH	6.28	pH				1	02/07/18 10:52	JBW	02/07/18 10:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911008**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-301I settled**	Date Collected:	2/7/2018 10:52	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	2390	mg/L	50.0	20.0		50	02/08/18 19:36	ML	02/08/18 19:36	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 19:54	ML	02/08/18 19:54	ML	
Sulfate	330	mg/L	50.0	20.0		50	02/08/18 19:36	ML	02/08/18 19:36	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS										
Total Dissolved Solids(TDS)	5590	mg/L	250	250		100	02/13/18 12:17	ADG	02/13/18 12:17	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:03	BS	02/14/18 20:54	FO	
Calcium Total	923	mg/L	2.00	0.700		10	02/14/18 18:03	BS	02/15/18 01:10	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1										
pH	6.33	pH				1	02/07/18 10:52	JBW	02/07/18 10:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID: **Q1804911009**
Sample ID: **CBL-302I**
Project ID: **FPP GWMP CCR**

Date Received: 2/8/2018 07:45
Date Collected: 2/7/2018 12:32

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2080	mg/L	50.0	20.0		50	02/08/18 20:13	ML	02/08/18 20:13	ML	
Fluoride	0.112	mg/L	0.100	0.0400		10	02/08/18 20:31	ML	02/08/18 20:31	ML	
Sulfate	1240	mg/L	50.0	20.0		50	02/08/18 20:13	ML	02/08/18 20:13	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	6010	mg/L	250	250		100	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:02	FO	
Calcium Total	934	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:24	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	20.47	C				1	02/07/18 12:32	JBW	02/07/18 12:32	JBW	N
pH	6.21	pH				1	02/07/18 12:32	JBW	02/07/18 12:32	JBW	N

Environmental
Laboratory
Services
The Solution Lab

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ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911010**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-302I - 0.45 micron filter**	Date Collected:	2/7/2018 12:32	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	1980 mg/L	50.0	20.0		50	02/08/18 20:49	ML	02/08/18 20:49	ML	
Fluoride	0.103 mg/L	0.100	0.0400		10	02/08/18 21:07	ML	02/08/18 21:07	ML	
Sulfate	1180 mg/L	50.0	20.0		50	02/08/18 20:49	ML	02/08/18 20:49	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	5780 mg/L	250	250		100	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES									
Boron Dissolved	<0.0500 mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 16:31	FO	
Calcium Dissolved	924 mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 20:56	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	17.26 C				1	02/07/18 12:32	JBW	02/07/18 12:32	JBW	N
pH	6.37 pH				1	02/07/18 12:32	JBW	02/07/18 12:32	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911011**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-302I - 10 micron filter**	Date Collected:	2/7/2018 12:32	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2040	mg/L	50.0	20.0		50	02/08/18 21:25	ML	02/08/18 21:25	ML	
Fluoride	0.131	mg/L	0.100	0.0400		10	02/08/18 21:43	ML	02/08/18 21:43	ML	
Sulfate	1220	mg/L	50.0	20.0		50	02/08/18 21:25	ML	02/08/18 21:25	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	6050	mg/L	250	250		100	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	<0.0500	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 16:38	FO	
Calcium Dissolved	957	mg/L	1.00			10	02/12/18 15:20	FO	02/14/18 12:50	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	17.41	C				1	02/07/18 12:32	JBW	02/07/18 12:32	JBW	N
pH	6.40	pH				1	02/07/18 12:32	JBW	02/07/18 12:32	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911012**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-302I settled**	Date Collected:	2/7/2018 12:32	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	2030 mg/L	50.0	20.0		50	02/08/18 22:01	ML	02/08/18 22:01	ML	
Fluoride	0.125 mg/L	0.100	0.0400		10	02/08/18 23:50	ML	02/08/18 23:50	ML	
Sulfate	1240 mg/L	50.0	20.0		50	02/08/18 22:01	ML	02/08/18 22:01	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	6070 mg/L	250	250		100	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	02/14/18 18:03	BS	02/14/18 21:02	FO	
Calcium Total	969 mg/L	2.00	0.700		10	02/14/18 18:03	BS	02/15/18 01:16	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
pH	6.24 pH				1	02/07/18 12:32	JBW	02/07/18 12:32	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911013**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-306I**	Date Collected:	2/7/2018 14:16	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	385 mg/L	25.0	10.0		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
Fluoride	2.81 mg/L	0.250	0.100		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
Sulfate	493 mg/L	25.0	10.0		25	02/09/18 00:09	ML	02/09/18 00:09	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	1760 mg/L	125	125		50	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:09	FO	
Calcium Total	230 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/15/18 19:30	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	19.32 C				1	02/07/18 14:16	JBW	02/07/18 14:16	JBW	N
pH	6.67 pH				1	02/07/18 14:16	JBW	02/07/18 14:16	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911014**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-306I - 0.45 micron filter**	Date Collected:	2/7/2018 14:16	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	398	mg/L	25.0	10.0		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
Fluoride	2.88	mg/L	0.250	0.100		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
Sulfate	518	mg/L	25.0	10.0		25	02/09/18 00:27	ML	02/09/18 00:27	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	1740	mg/L	125	125		50	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	<0.0500	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 16:46	FO	
Calcium Dissolved	229	mg/L	0.100			1	02/12/18 15:20	FO	02/15/18 21:12	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	14.88	C				1	02/07/18 14:16	JBW	02/07/18 14:16	JBW	N
pH	7.01	pH				1	02/07/18 14:16	JBW	02/07/18 14:16	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911015**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-306I - 10 micron filter**	Date Collected:	2/7/2018 14:16	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	384	mg/L	25.0	10.0		25	02/09/18 00:45	ML	02/09/18 00:45	ML	
Fluoride	2.85	mg/L	0.250	0.100		25	02/09/18 00:45	ML	02/09/18 00:45	ML	
Sulfate	488	mg/L	25.0	10.0		25	02/09/18 00:45	ML	02/09/18 00:45	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS										
Total Dissolved Solids(TDS)	1640	mg/L	125	125		50	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES										
Boron Dissolved	<0.0500	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 16:53	FO	
Calcium Dissolved	221	mg/L	0.100			1	02/12/18 15:20	FO	02/13/18 16:53	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1										
Temperature	15.53	C				1	02/07/18 14:16	JBW	02/07/18 14:16	JBW	N
pH	7.03	pH				1	02/07/18 14:16	JBW	02/07/18 14:16	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911016**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-306I settled**	Date Collected:	2/7/2018 14:16	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	380	mg/L	25.0	10.0		25	02/09/18 01:03	ML	02/09/18 01:03	ML	
Fluoride	3.13	mg/L	0.250	0.100		25	02/09/18 01:03	ML	02/09/18 01:03	ML	
Sulfate	483	mg/L	25.0	10.0		25	02/09/18 01:03	ML	02/09/18 01:03	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	1610	mg/L	125	125		50	02/13/18 14:19	ADG	02/13/18 14:19	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:03	BS	02/14/18 21:09	FO	
Calcium Total	227	mg/L	0.200	0.0700		1	02/14/18 18:03	BS	02/14/18 21:09	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
pH	6.79	pH				1	02/07/18 14:16	JBW	02/07/18 14:16	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911017**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-308I**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2750	mg/L	50.0	20.0		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
Fluoride	1.76	mg/L	0.500	0.200		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
Sulfate	1570	mg/L	50.0	20.0		50	02/08/18 13:21	ML	02/08/18 13:21	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	6200	mg/L	500	500		200	02/12/18 16:39	ADG	02/12/18 16:39	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:16	FO	
Calcium Total	859	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 19:47	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	21.73	C				1	02/06/18 14:52	JBW	02/06/18 14:52	JBW	N
pH	6.26	pH				1	02/06/18 14:52	JBW	02/06/18 14:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911018**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-308I - 0.45 micron filter**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	3110 mg/L	50.0	20.0		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
Fluoride	1.81 mg/L	0.500	0.200		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
Sulfate	1800 mg/L	50.0	20.0		50	02/08/18 13:07	ML	02/08/18 13:07	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	6720 mg/L	500	500		200	02/12/18 16:39	ADG	02/12/18 16:39	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES									
Boron Dissolved	0.0629 mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 18:38	FO	
Calcium Dissolved	818 mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 21:29	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	21.42 C				1	02/06/18 14:52	JBW	02/06/18 14:52	JBW	N
pH	6.38 pH				1	02/06/18 14:52	JBW	02/06/18 14:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911019**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-308I - 10 micron filter**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2740	mg/L	50.0	20.0		50	02/08/18 13:06	ML	02/08/18 13:06	ML	
Fluoride	1.72	mg/L	0.500	0.200		50	02/08/18 13:06	ML	02/08/18 13:06	ML	
Sulfate	1600	mg/L	50.0	20.0		50	02/08/18 13:06	ML	02/08/18 13:06	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	6460	mg/L	250	250		100	02/12/18 16:39	ADG	02/12/18 16:39	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	0.0616	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 17:00	FO	
Calcium Dissolved	539	mg/L	1.00			10	02/12/18 15:20	FO	02/14/18 12:57	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	21.01	C				1	02/06/18 14:52	JBW	02/06/18 14:52	JBW	N
pH	6.38	pH				1	02/06/18 14:52	JBW	02/06/18 14:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911020**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-308I settled**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	2800 mg/L	50.0	20.0		50	02/08/18 13:04	ML	02/08/18 13:04	ML	
Fluoride	1.96 mg/L	0.500	0.200		50	02/08/18 13:04	ML	02/08/18 13:04	ML	
Sulfate	1600 mg/L	50.0	20.0		50	02/08/18 13:04	ML	02/08/18 13:04	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	6680 mg/L	500	500		200	02/12/18 16:39	ADG	02/12/18 16:39	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	02/14/18 18:03	BS	02/14/18 21:16	FO	
Calcium Total	892 mg/L	2.00	0.700		10	02/14/18 18:03	BS	02/15/18 01:30	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
pH	6.26 pH				1	02/06/18 14:52	JBW	02/06/18 14:52	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911021**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-341I**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions		Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2110 mg/L	50.0	20.0		50	02/08/18 13:03	ML	02/08/18 13:03	ML	
Fluoride	0.106 mg/L	0.100	0.0400		10	02/08/18 12:26	ML	02/08/18 12:26	ML	
Sulfate	383 mg/L	10.0	4.00		10	02/08/18 12:26	ML	02/08/18 12:26	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS		Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4320 mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES		Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:24	FO	
Calcium Total	810 mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 20:10	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1		Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	21.52 C				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N
pH	6.18 pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911022**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-341I - 0.45 micron filter**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	1880 mg/L	50.0	20.0		50	02/08/18 12:15	ML	02/08/18 12:15	ML	
Fluoride	<0.100 mg/L	0.100	0.0400		10	02/08/18 12:51	ML	02/08/18 12:51	ML	
Sulfate	360 mg/L	50.0	20.0		50	02/08/18 12:15	ML	02/08/18 12:15	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	3810 mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES									
Boron Dissolved	<0.0500 mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 17:21	FO	
Calcium Dissolved	788 mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 21:41	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	20.21 C				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N
pH	6.29 pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911023**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-341I - 10 micron filter**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions		Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2040 mg/L	50.0	20.0		50	02/08/18 12:12	ML	02/08/18 12:12	ML	
Fluoride	0.160 mg/L	0.100	0.0400		10	02/08/18 12:49	ML	02/08/18 12:49	ML	
Sulfate	397 mg/L	50.0	20.0		50	02/08/18 12:12	ML	02/08/18 12:12	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS		Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4800 mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES		Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	0.0627 mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 17:43	FO	
Calcium Dissolved	854 mg/L	1.00			10	02/12/18 15:20	FO	02/14/18 13:03	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1		Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	20.36 C				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N
pH	6.37 pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911024**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-341I settled**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	1820	mg/L	50.0	20.0		50	02/08/18 12:03	ML	02/08/18 12:03	ML	
Fluoride	0.134	mg/L	0.100	0.0400		10	02/08/18 12:45	ML	02/08/18 12:45	ML	
Sulfate	344	mg/L	50.0	20.0		50	02/08/18 12:03	ML	02/08/18 12:03	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4400	mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:03	BS	02/14/18 21:24	FO	
Calcium Total	842	mg/L	2.00	0.700		10	02/14/18 18:03	BS	02/15/18 01:36	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
pH	6.27	pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911025**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-641I**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	1710	mg/L	50.0	20.0		50	02/08/18 11:57	ML	02/08/18 11:57	ML	
Fluoride	<0.100	mg/L	0.100	0.0400		10	02/08/18 12:34	ML	02/08/18 12:34	ML	
Sulfate	409	mg/L	50.0	20.0		50	02/08/18 11:57	ML	02/08/18 11:57	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4070	mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES								
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:31	FO	
Calcium Total	806	mg/L	2.00	0.700		10	02/14/18 18:02	BS	02/15/18 20:21	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	21.52	C				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N
pH	6.18	pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911026**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-641I - 0.45 micron filter**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	1720	mg/L	50.0	20.0		50	02/08/18 11:53	ML	02/08/18 11:53	ML	
Fluoride	0.116	mg/L	0.100	0.0400		10	02/08/18 12:30	ML	02/08/18 12:30	ML	
Sulfate	333	mg/L	50.0	20.0		50	02/08/18 11:53	ML	02/08/18 11:53	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4730	mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	0.0644	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 20:37	FO	
Calcium Dissolved	767	mg/L	1.00			10	02/12/18 15:20	FO	02/15/18 21:52	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	20.21	C				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N
pH	6.29	pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911027**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-641I - 10 micron filter**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions			Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions								
Chloride	2000	mg/L	50.0	20.0		50	02/08/18 15:29	ML	02/08/18 15:29	ML	
Fluoride	0.261	mg/L	0.100	0.0400		10	02/08/18 12:23	ML	02/08/18 12:23	ML	
Sulfate	380	mg/L	10.0	4.00		10	02/08/18 12:23	ML	02/08/18 12:23	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS			Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS								
Total Dissolved Solids(TDS)	4540	mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES			Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES								
Boron Dissolved	0.0644	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 17:51	FO	
Calcium Dissolved	823	mg/L	1.00			10	02/12/18 15:20	FO	02/14/18 13:10	FO	
Field Parameters											
Analysis Desc: TCEQ SOP V1			Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1								
Temperature	20.36	C				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N
pH	6.37	pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911028**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**CBL-641I settled**	Date Collected:	2/6/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	1890 mg/L	50.0	20.0		50	02/08/18 12:02	ML	02/08/18 12:02	ML	
Fluoride	0.290 mg/L	0.100	0.0400		10	02/08/18 12:42	ML	02/08/18 12:42	ML	
Sulfate	352 mg/L	50.0	20.0		50	02/08/18 12:02	ML	02/08/18 12:02	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	4120 mg/L	250	250		100	02/13/18 11:53	ADG	02/13/18 11:53	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	02/14/18 18:03	BS	02/14/18 21:32	FO	
Calcium Total	823 mg/L	2.00	0.700		10	02/14/18 18:03	BS	02/15/18 01:43	FO	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
pH	6.27 pH				1	02/06/18 13:00	JBW	02/06/18 13:00	JBW	N

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911029**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**Field Blank 1**	Date Collected:	2/6/2018 14:52	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:39	FO	
Calcium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:39	FO	

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911030**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**Field Blank 2**	Date Collected:	2/7/2018 15:40	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:46	FO	
Calcium Total	<0.200 mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:46	FO	

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911031**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**EQB Pump**	Date Collected:	2/7/2018 11:30	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	02/14/18 18:02	BS	02/14/18 19:52	FO	
Calcium Total	<0.200	mg/L	0.200	0.0700		1	02/14/18 18:02	BS	02/14/18 19:52	FO	

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID:	**Q1804911032**	Date Received:	2/8/2018 07:45	Matrix:	Aqueous
Sample ID:	**EQB - 0.45 micron filter**	Date Collected:	2/7/2018 16:00	Sample Type:	SAMPLE
Project ID:	FPP GWMP CCR				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES									
Boron Dissolved	<0.0500 mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 20:45	FO	
Calcium Dissolved	<0.100 mg/L	0.100			1	02/12/18 15:20	FO	02/13/18 20:45	FO	

ANALYTICAL RESULTS

Workorder: Q1804911

Lab ID: **Q1804911033**
Sample ID: **EQB - 10 micron filter**
Project ID: **FPP GWMP CCR**

Date Received: 2/8/2018 07:45
Date Collected: 2/7/2018 16:10

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW6010B ICP-AES Analytical Method: SW6010B ICP-AES										
Boron Dissolved	<0.0500	mg/L	0.0500	0.0200		1	02/12/18 15:20	FO	02/13/18 17:59	FO	
Calcium Dissolved	<0.100	mg/L	0.100			1	02/12/18 15:20	FO	02/13/18 17:59	FO	

ANALYTICAL RESULTS QUALIFIERS

Workorder: Q1804911

PARAMETER QUALIFIERS

Lab ID: Q1804911001

N	Not Accredited

Lab ID: Q1804911002

N	Not Accredited

Lab ID: Q1804911003

N	Not Accredited

Lab ID: Q1804911004

N	Not Accredited

Lab ID: Q1804911005

N	Not Accredited

Lab ID: Q1804911006

N	Not Accredited

Lab ID: Q1804911007

N	Not Accredited

Lab ID: Q1804911008

N	Not Accredited

Lab ID: Q1804911009

N	Not Accredited

Lab ID: Q1804911010

N	Not Accredited

Lab ID: Q1804911011

N	Not Accredited

Lab ID: Q1804911012

N	Not Accredited

Lab ID: Q1804911013

N	Not Accredited

Lab ID: Q1804911014

N	Not Accredited

Lab ID: Q1804911015

N	Not Accredited

Lab ID: Q1804911016

ANALYTICAL RESULTS QUALIFIERS

Workorder: Q1804911

N Not Accredited

Lab ID: Q1804911017

N Not Accredited

Lab ID: Q1804911018

N Not Accredited

Lab ID: Q1804911019

N Not Accredited

Lab ID: Q1804911020

N Not Accredited

Lab ID: Q1804911021

N Not Accredited

Lab ID: Q1804911022

N Not Accredited

Lab ID: Q1804911023

N Not Accredited

Lab ID: Q1804911024

N Not Accredited

Lab ID: Q1804911025

N Not Accredited

Lab ID: Q1804911026

N Not Accredited

Lab ID: Q1804911027

N Not Accredited

Lab ID: Q1804911028

N Not Accredited

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16576 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1804911004, Q1804911019, Q1804911023, Q1804911026

METHOD BLANK: 1017900

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1017903

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	28.5	95	90 - 110	
Fluoride	mg/L	1	.99	99	90 - 110	
Sulfate	mg/L	30	28.5	95.1	90 - 110	

MATRIX SPIKE: 1017905 DUPLICATE: 1017906 ORIGINAL: Q1804911026

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	1720	1000	2690	2690	97.3	97.2	80 - 120	0	20	
Fluoride	mg/L	.12	50	48.8	48.8	97.4	97.3	80 - 120	0	20	
Sulfate	mg/L	333	1000	1330	1330	99.9	100	80 - 120	0	20	

METHOD BLANK: 1018119

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

LABORATORY CONTROL SAMPLE: 1018120

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	28.6	95.4	90 - 110	
Fluoride	mg/L	1	1.06	106	90 - 110	
Sulfate	mg/L	30	28.6	95.3	90 - 110	

MATRIX SPIKE: 1018121 DUPLICATE: 1018122 ORIGINAL: Q1805000002

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	5.4	20	25.9	26	103	103	80 - 120	.385	20	
Fluoride	mg/L	.34	1	1.25	1.25	90.5	90.2	80 - 120	0	20	
Sulfate	mg/L	19.1	20	39.7	39.6	103	102	80 - 120	.252	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16585 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1804911020, Q1804911027, Q1804911028

METHOD BLANK: 1018305

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1018308

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	31	103	90 - 110	
Fluoride	mg/L	1	1.05	105	90 - 110	
Sulfate	mg/L	30	30.5	102	90 - 110	

MATRIX SPIKE: 1018310 DUPLICATE: 1018311 ORIGINAL: Q1804911028

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	1890	1000	2850	2840	96.4	95.1	80 - 120	.351	20	
Fluoride	mg/L	.29	50	50.3	50.2	100	99.9	80 - 120	.199	20	
Sulfate	mg/L	352	1000	1390	1390	104	103	80 - 120	0	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16586 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1804911018, Q1804911022, Q1804911025

METHOD BLANK: 1018319

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1018322

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	28.5	95.1	90 - 110	
Fluoride	mg/L	1	1	100	90 - 110	
Sulfate	mg/L	30	28.6	95.5	90 - 110	

MATRIX SPIKE: 1018324 DUPLICATE: 1018325 ORIGINAL: Q1804911025

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	1710	1000	2810	2760	110	104	80 - 120	1.8	20	
Fluoride	mg/L	.05	50	52.3	51.2	105	102	80 - 120	2.13	20	
Sulfate	mg/L	409	1000	1510	1470	110	106	80 - 120	2.68	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16588 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1804911001, Q1804911002, Q1804911003, Q1804911005, Q1804911006, Q1804911007, Q1804911008, Q1804911009, Q1804911010, Q1804911011, Q1804911012, Q1804911013, Q1804911014, Q1804911015, Q1804911016, Q1804911017, Q1804911021, Q1804911024

METHOD BLANK: 1018432

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1018435

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	29.6	98.5	90 - 110	
Fluoride	mg/L	1	.98	97.9	90 - 110	
Sulfate	mg/L	30	27.3	91	90 - 110	

MATRIX SPIKE: 1018437 DUPLICATE: 1018438 ORIGINAL: Q1804911024

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	1820	1000	2700	2700	87.4	87.2	80 - 120	0	20	
Fluoride	mg/L	.13	50	48.5	48.4	96.7	96.6	80 - 120	.206	20	
Sulfate	mg/L	344	1000	1290	1290	94.9	94.9	80 - 120	0	20	

METHOD BLANK: 1018442

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

LABORATORY CONTROL SAMPLE: 1018443

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	32.1	107	90 - 110	
Fluoride	mg/L	1	1.03	103	90 - 110	
Sulfate	mg/L	30	27.5	91.8	90 - 110	

MATRIX SPIKE: 1018439 DUPLICATE: 1018440 ORIGINAL: Q1804911007

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	***mg/L***	***2620***	***200***	***1780***	***1790***	***-424***	***-419***	***80 - 120***	***.56***	***20***	***S***
Fluoride	mg/L	.08	10	9.54	9.64	95.4	96.4	80 - 120	1.04	20	
Sulfate	mg/L	370	200	540	533	84.6	81.4	80 - 120	1.3	20	

MATRIX SPIKE: 1018444 DUPLICATE: 1018445 ORIGINAL: Q1804911012

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	***mg/L***	***2030***	***200***	***1580***	***1620***	***-227***	***-209***	***80 - 120***	***2.5***	***20***	***S***
Fluoride	mg/L	.13	10	9.43	9.74	93.1	96.2	80 - 120	3.23	20	
Sulfate	***mg/L***	***1240***	***200***	***1220***	***1240***	***-11.4***	***-1.65***	***80 - 120***	***1.63***	***20***	***S***

METHOD BLANK: 1018447

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

LABORATORY CONTROL SAMPLE: 1018448

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	29.6	98.5	90 - 110	
Fluoride	mg/L	1	.98	98	90 - 110	
Sulfate	mg/L	30	27	90.1	90 - 110	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: MEP/7991 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW6010B ICP-AES

Associated Lab Samples: Q1804911002, Q1804911003, Q1804911006, Q1804911007, Q1804911010, Q1804911011, Q1804911014, Q1804911015, Q1804911019, Q1804911022, Q1804911023, Q1804911027, Q1804911033

METHOD BLANK: 1019542

Parameter	Units	Blank Result	Reporting Limit	Qual
Boron Dissolved	mg/L	<0.0500	0.0500	
Calcium Dissolved	mg/L	<0.100	0.100	

LABORATORY CONTROL SAMPLE: 1019543

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Boron Dissolved	mg/L	1	1.01	1.02	101	102	80 - 120	.985	20	
Calcium Dissolved	mg/L	10	10.2	10.2	102	102	80 - 120	0	20	

MATRIX SPIKE: 1019545 DUPLICATE: 1019546 ORIGINAL: Q1804911002

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Dissolved	mg/L	.09	1	.99	1.02	89.9	93.1	75 - 125	3.29	20	
Calcium Dissolved	***mg/L***	***547***	***10***	***560***	***561***	***129***	***140***	***75 - 125***	***.178***	***20***	***S***

MATRIX SPIKE: 1019547 DUPLICATE: 1019548 ORIGINAL: Q1804911023

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Dissolved	mg/L	.06	1	1.06	1.04	100	98.1	75 - 125	1.9	20	
Calcium Dissolved	***mg/L***	***854***	***10***	***808***	***796***	***-463***	***-580***	***75 - 125***	***1.5***	***20***	***S***

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: MEP/7992 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW6010B ICP-AES

Associated Lab Samples: Q1804911018, Q1804911026, Q1804911032

METHOD BLANK: 1019549

Parameter	Units	Blank Result	Reporting Limit	Qual
Boron Dissolved	mg/L	<0.0500	0.0500	
Calcium Dissolved	mg/L	<0.100	0.100	

LABORATORY CONTROL SAMPLE: 1019550

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Boron Dissolved	mg/L	1	1	1.02	100	102	80 - 120	1.98	20	
Calcium Dissolved	mg/L	10	9.9	10	99	100	80 - 120	1.01	20	

MATRIX SPIKE: 1019554 DUPLICATE: 1019555 ORIGINAL: Q1805209015

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Dissolved	mg/L	.01	1	1.07	1.07	107	107	75 - 125	0	20	
Calcium Dissolved	mg/L	0	10	10.2	9.96	102	99.6	75 - 125	2.38	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16608 **Analysis Method:** SM2540C, TDS

QC Batch Method: SM2540C, TDS

Associated Lab Samples: Q1804911017, Q1804911018, Q1804911019, Q1804911020

METHOD BLANK: 1019622

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Dissolved Solids(TDS)	mg/L	<25.0	25.0	

LABORATORY CONTROL SAMPLE: 1019623

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	400	364	91	80 - 120	

SAMPLE DUPLICATE: 1019624 ORIGINAL: Q1804749001

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Dissolved Solids(TDS)	mg/L	512	503			1.77	20	

MATRIX SPIKE SAMPLE: 1019625 ORIGINAL: Q1804749001

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	512	400	894	95.5	70 - 130	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16611 **Analysis Method:** SM2540C, TDS

QC Batch Method: SM2540C, TDS

Associated Lab Samples: Q1804911021, Q1804911022, Q1804911023, Q1804911024, Q1804911025, Q1804911026, Q1804911027, Q1804911028

METHOD BLANK: 1019776

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Dissolved Solids(TDS)	mg/L	<25.0	25.0	

LABORATORY CONTROL SAMPLE: 1019777

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	400	354	88.5	80 - 120	

SAMPLE DUPLICATE: 1019778 ORIGINAL: Q1804973011

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Dissolved Solids(TDS)	mg/L	620	616			.647	20	

MATRIX SPIKE SAMPLE: 1019779 ORIGINAL: Q1804973011

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	620	400	962	85.5	70 - 130	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16612 **Analysis Method:** SM2540C, TDS

QC Batch Method: SM2540C, TDS

Associated Lab Samples: Q1804911001, Q1804911002, Q1804911003, Q1804911004, Q1804911005, Q1804911006, Q1804911007, Q1804911008

METHOD BLANK: 1019780

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Dissolved Solids(TDS)	mg/L	<25.0	25.0	

LABORATORY CONTROL SAMPLE: 1019781

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	400	427	107	80 - 120	

SAMPLE DUPLICATE: 1019782 ORIGINAL: Q1805508002

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Dissolved Solids(TDS)	mg/L	82	90			9.3	20	

MATRIX SPIKE SAMPLE: 1019783 ORIGINAL: Q1805508002

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	82	400	450	92	70 - 130	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: WET/16618 **Analysis Method:** SM2540C, TDS

QC Batch Method: SM2540C, TDS

Associated Lab Samples: Q1804911009, Q1804911010, Q1804911011, Q1804911012, Q1804911013, Q1804911014, Q1804911015, Q1804911016

METHOD BLANK: 1020157

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Dissolved Solids(TDS)	mg/L	<25.0	25.0	

LABORATORY CONTROL SAMPLE: 1020158

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	400	376	94	80 - 120	

SAMPLE DUPLICATE: 1020159 ORIGINAL: Q1804997002

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Dissolved Solids(TDS)	mg/L	436	471			7.72	20	

MATRIX SPIKE SAMPLE: 1020160 ORIGINAL: Q1804997002

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	436	400	888	113	70 - 130	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: MEP/8006 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW3010A, Metals Prep

Associated Lab Samples: Q1804911001, Q1804911005, Q1804911009, Q1804911013, Q1804911017, Q1804911021, Q1804911025, Q1804911029, Q1804911030, Q1804911031

LABORATORY CONTROL SAMPLE: 1021152

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Boron Total	mg/L	1	.94	.97	94.4	96.5	80 - 120	2.2	20	
Calcium Total	mg/L	10	10.4	10.4	104	104	80 - 120	0	20	

METHOD BLANK: 1021154

Parameter	Units	Blank Result	Reporting Limit	Qual
Boron Total	mg/L	<0.0500	0.0500	
Calcium Total	mg/L	<0.200	0.200	

MATRIX SPIKE: 1021155 DUPLICATE: 1021156 ORIGINAL: Q1804911001

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Total	mg/L	.06	1	.94	.98	88	91.3	75 - 125	3.44	20	
Calcium Total	***mg/L***	***555***	***10***	***541***	***551***	***-134***	***-35.1***	***75 - 125***	***1.83***	***20***	***S***

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1804911

QC Batch: MEP/8007 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW3010A, Metals Prep

Associated Lab Samples: Q1804911004, Q1804911008, Q1804911012, Q1804911016, Q1804911020, Q1804911024, Q1804911028

LABORATORY CONTROL SAMPLE: 1021159

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Boron Total	mg/L	1	.97	1	96.7	99.7	80 - 120	3.05	20	
Calcium Total	mg/L	10	10.2	10.4	102	104	80 - 120	1.94	20	

METHOD BLANK: 1021161

Parameter	Units	Blank Result	Reporting Limit	Qual
Boron Total	mg/L	<0.0500	0.0500	
Calcium Total	mg/L	<0.200	0.200	

MATRIX SPIKE: 1021162 DUPLICATE: 1021163 ORIGINAL: Q1804911004

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Total	mg/L	.06	1	.97	.99	91.6	93.5	75 - 125	1.93	20	
Calcium Total	***mg/L***	***554***	***10***	***543***	***558***	***-106***	***41.3***	***75 - 125***	***2.72***	***20***	***S***

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1804911

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1804911004	CBL-340I settled			E300.0, Anions	WET/16576
Q1804911019	CBL-308I - 10 micron filter			E300.0, Anions	WET/16576
Q1804911023	CBL-341I - 10 micron filter			E300.0, Anions	WET/16576
Q1804911026	CBL-641I - 0.45 micron filter			E300.0, Anions	WET/16576
Q1804911020	CBL-308I settled			E300.0, Anions	WET/16585
Q1804911027	CBL-641I - 10 micron filter			E300.0, Anions	WET/16585
Q1804911028	CBL-641I settled			E300.0, Anions	WET/16585
Q1804911018	CBL-308I - 0.45 micron filter			E300.0, Anions	WET/16586
Q1804911022	CBL-341I - 0.45 micron filter			E300.0, Anions	WET/16586
Q1804911025	CBL-641I			E300.0, Anions	WET/16586
Q1804911001	CBL-340I			E300.0, Anions	WET/16588
Q1804911002	CBL-340I - 0.45 micron filter			E300.0, Anions	WET/16588
Q1804911003	CBL-340I - 10 micron filter			E300.0, Anions	WET/16588
Q1804911005	CBL-301I			E300.0, Anions	WET/16588
Q1804911006	CBL-301I - 0.45 micron filter			E300.0, Anions	WET/16588
Q1804911007	CBL-301I - 10 micron filter			E300.0, Anions	WET/16588
Q1804911008	CBL-301I settled			E300.0, Anions	WET/16588
Q1804911009	CBL-302I			E300.0, Anions	WET/16588
Q1804911010	CBL-302I - 0.45 micron filter			E300.0, Anions	WET/16588
Q1804911011	CBL-302I - 10 micron filter			E300.0, Anions	WET/16588
Q1804911012	CBL-302I settled			E300.0, Anions	WET/16588
Q1804911013	CBL-306I			E300.0, Anions	WET/16588
Q1804911014	CBL-306I - 0.45 micron filter			E300.0, Anions	WET/16588
Q1804911015	CBL-306I - 10 micron filter			E300.0, Anions	WET/16588
Q1804911016	CBL-306I settled			E300.0, Anions	WET/16588
Q1804911017	CBL-308I			E300.0, Anions	WET/16588
Q1804911021	CBL-341I			E300.0, Anions	WET/16588
Q1804911024	CBL-341I settled			E300.0, Anions	WET/16588
Q1804911002	CBL-340I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1804911

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1804911003	CBL-340I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911006	CBL-301I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911007	CBL-301I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911010	CBL-302I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911011	CBL-302I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911014	CBL-306I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911015	CBL-306I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911019	CBL-308I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911022	CBL-341I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911023	CBL-341I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911027	CBL-641I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911033	EQB - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6191
Q1804911003	CBL-340I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6197
Q1804911007	CBL-301I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6197
Q1804911011	CBL-302I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6197
Q1804911019	CBL-308I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6197
Q1804911023	CBL-341I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6197
Q1804911027	CBL-641I - 10 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6197
Q1804911002	CBL-340I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804911006	CBL-301I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804911010	CBL-302I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804911014	CBL-306I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804911022	CBL-341I - 0.45 micron filter	SW6010B ICP-AES	MEP/7991	SW6010B ICP-AES	MET/6207
Q1804911018	CBL-308I - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6191
Q1804911026	CBL-641I - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6191
Q1804911032	EQB - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6191
Q1804911018	CBL-308I - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6207
Q1804911026	CBL-641I - 0.45 micron filter	SW6010B ICP-AES	MEP/7992	SW6010B ICP-AES	MET/6207
Q1804911017	CBL-308I			SM2540C, TDS	WET/16608
Q1804911018	CBL-308I - 0.45 micron filter			SM2540C, TDS	WET/16608
Q1804911019	CBL-308I - 10 micron filter			SM2540C, TDS	WET/16608
Q1804911020	CBL-308I settled			SM2540C, TDS	WET/16608

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1804911

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1804911021	CBL-341I			SM2540C, TDS	WET/16611
Q1804911022	CBL-341I - 0.45 micron filter			SM2540C, TDS	WET/16611
Q1804911023	CBL-341I - 10 micron filter			SM2540C, TDS	WET/16611
Q1804911024	CBL-341I settled			SM2540C, TDS	WET/16611
Q1804911025	CBL-641I			SM2540C, TDS	WET/16611
Q1804911026	CBL-641I - 0.45 micron filter			SM2540C, TDS	WET/16611
Q1804911027	CBL-641I - 10 micron filter			SM2540C, TDS	WET/16611
Q1804911028	CBL-641I settled			SM2540C, TDS	WET/16611
Q1804911001	CBL-340I			SM2540C, TDS	WET/16612
Q1804911002	CBL-340I - 0.45 micron filter			SM2540C, TDS	WET/16612
Q1804911003	CBL-340I - 10 micron filter			SM2540C, TDS	WET/16612
Q1804911004	CBL-340I settled			SM2540C, TDS	WET/16612
Q1804911005	CBL-301I			SM2540C, TDS	WET/16612
Q1804911006	CBL-301I - 0.45 micron filter			SM2540C, TDS	WET/16612
Q1804911007	CBL-301I - 10 micron filter			SM2540C, TDS	WET/16612
Q1804911008	CBL-301I settled			SM2540C, TDS	WET/16612
Q1804911009	CBL-302I			SM2540C, TDS	WET/16618
Q1804911010	CBL-302I - 0.45 micron filter			SM2540C, TDS	WET/16618
Q1804911011	CBL-302I - 10 micron filter			SM2540C, TDS	WET/16618
Q1804911012	CBL-302I settled			SM2540C, TDS	WET/16618
Q1804911013	CBL-306I			SM2540C, TDS	WET/16618
Q1804911014	CBL-306I - 0.45 micron filter			SM2540C, TDS	WET/16618
Q1804911015	CBL-306I - 10 micron filter			SM2540C, TDS	WET/16618
Q1804911016	CBL-306I settled			SM2540C, TDS	WET/16618
Q1804911001	CBL-340I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911005	CBL-301I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911009	CBL-302I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911013	CBL-306I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911017	CBL-308I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911021	CBL-341I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911025	CBL-641I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1804911

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1804911029	Field Blank 1	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911030	Field Blank 2	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911031	EQB Pump	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6200
Q1804911001	CBL-340I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804911005	CBL-301I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804911009	CBL-302I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804911013	CBL-306I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804911017	CBL-308I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804911021	CBL-341I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804911025	CBL-641I	SW3010A, Metals Prep	MEP/8006	SW6010B ICP-AES	MET/6207
Q1804911004	CBL-340I settled	SW3010A, Metals Prep	MEP/8007	SW6010B ICP-AES	MET/6200
Q1804911008	CBL-301I settled	SW3010A, Metals Prep	MEP/8007	SW6010B ICP-AES	MET/6200
Q1804911012	CBL-302I settled	SW3010A, Metals Prep	MEP/8007	SW6010B ICP-AES	MET/6200
Q1804911016	CBL-306I settled	SW3010A, Metals Prep	MEP/8007	SW6010B ICP-AES	MET/6200
Q1804911020	CBL-308I settled	SW3010A, Metals Prep	MEP/8007	SW6010B ICP-AES	MET/6200
Q1804911024	CBL-341I settled	SW3010A, Metals Prep	MEP/8007	SW6010B ICP-AES	MET/6200
Q1804911028	CBL-641I settled	SW3010A, Metals Prep	MEP/8007	SW6010B ICP-AES	MET/6200

Q1804911

Environmental Laboratory Services
The Solution Lab

LCRA Environmental Laboratory Services
Request for Analysis Chain-of-Custody Record

LCRA - Environmental Lab
3505 Montopolis Dr.
Austin, TX 78744

Phone: (512) 356-6022 or 1-800-776-5272
Fax: (512) 356-6021
https://els.lcra.org

Lab ID#:

Client PO:

Project:	FPP - CCR Wells - Appendix 3	**Client:**	LCRA
Collector:	Jason Woods	**Contact:**	
Event#:	1393474 / 5422	**Phone:**	

Report To: BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

Invoice To: BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

	LAB USE ONLY	Sample ID *	Collected *		Matrix* AQ = Aqueous S = Solid T = Tissue DW =Drinking Water	Container(s) Type/Preservative/Number *										Requested Analysis *											
			Date*	Time * HH:MM		COMPOSITE Y/N	FILTERED Y/N	1LPU	250PHNO3							6010-AM	Fld_FP	2540-AMTDS	300.0AM-48	6010-AMF							
01	1	CBL-340I	2/7/18	1540	AQ	N	N	1	1							X	X	X	X								
02	2	CBL-340I - 0.45 micron filter	2/7/18	1540	AQ	N	Y	1	1								X	X	X	X							
03	3	CBL-340I - 10 micron filter	2/7/18	1540	AQ	N	Y	1	1								X	X	X	X							
04	4	CBL-340I settled	2/7/18	1540	AQ	N	N	1	1							X	X	X	X								
05	5	CBL-301I	2/7/18	1052	AQ	N	N	1	1							X	X	X	X								
06	6	CBL-301I - 0.45 micron filter	2/7/18	1052	AQ	N	Y	1	1								X	X	X	X							
07	7	CBL-301I - 10 micron filter	2/7/18	1052	AQ	N	Y	1	1								X	X	X	X							
08	8	CBL-301I settled	2/7/18	1052	AQ	N	N	1	1							X	X	X	X								
09	9	CBL-302I	2/7/18	1232	AQ	N	N	1	1							X	X	X	X								
10	10	CBL-302I - 0.45 micron filter	2/7/18	1232	AQ	N	Y	1	1								X	X	X	X							

Transfers	Relinquished By	Date/Time	Received By	Date/Time
1		2/8/18 745		2/8/18 745
2				
3				

Cooler Temp:			
#	T#	Obs.	Corr.
1	6	0.7°	0.7°C
2			

Client Special Instructions:

Lab Use

Q1804911 314477

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Environmental Laboratory Services
The Solution Lab

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LCRA - Environmental Lab
3505 Montopolis Dr.
Austin, TX 78744

Phone: (512) 356-6022 or 1-800-776-5272
Fax: (512) 356-6021
https://els.lcra.org

Lab ID#:	
Client PO:	
Invoice To:	BECKIE LOEVE FAYETTE POWER PLANT 6549 POWER PLANT RD MAIL STOP FPP LA GRANGE, TX 78945

Project:	FPP - CCR Wells - Appendix 3	Client:	LCRA
Collector:	Jason Woods	Contact:	
Event#:	1393474 / 5422	Phone:	

Report To: BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

Matrix*: AQ = Aqueous, S = Solid, T = Tissue, DW = Drinking Water

	LAB USE ONLY	Sample ID *	Collected * Date*	Time * HH:MM	Matrix*	COMPOSITE Y/N	FILTERED Y/N	1LPU	250PHNO3							6010-AM	Fld_FP	2540-AMTDS	300.0AM-48	6010-AMF							
11	11	CBL-302I - 10 micron filter	2/7/18	1232	AQ	N	Y	1	1								X	X	X	X							
12	12	CBL-302I settled	2/7/18	1232	AQ	N	N	1	1							X	X	X	X								
13	13	CBL-306I	2/7/18	1416	AQ	N	N	1	1							X	X	X	X								
14	14	CBL-306I - 0.45 micron filter	2/7/18	1416	AQ	N	Y	1	1								X	X	X	X							
15	15	CBL-306I - 10 micron filter	2/7/18	1416	AQ	N	Y	1	1								X	X	X	X							
16	16	CBL-306I settled	2/7/18	1416	AQ	N	N	1	1							X	X	X	X								
17	17	CBL-308I	2/6/18	1452	AQ	N	N	1	1							X	X	X	X								
18	18	CBL-308I - 0.45 micron filter	2/6/18	1452	AQ	N	Y	1	1								X	X	X	X							
19	19	CBL-308I - 10 micron filter	2/6/18	1452	AQ	N	Y	1	1								X	X	X	X							
20	20	CBL-308I settled	2/6/18	1452	AQ	N	N	1	1							X	X	X	X								

Transfers	Relinquished By	Date/Time	Received By	Date/Time
1		2/8/18 745		2/8/18 745
2				
3				

Cooler Temp:

#	T#	Obs.	Corr.
1	6	0.7C	0.7°C
2			

Client Special Instructions:

Lab Use Only:

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Environmental Laboratory Services
The Solution Lab

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LCRA - Environmental Lab
3505 Montopolis Dr.
Austin, TX 78744

Phone: (512) 356-6022 or 1-800-776-5272
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https://els.lcra.org

Lab ID#:

Client PO:

Project:	FPP - CCR Wells - Appendix 3	**Client:**	LCRA
Collector:	Jason Woods	**Contact:**	
Event#:	1393474 / 5422	**Phone:**	

Report To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

Invoice To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

	LAB USE ONLY	Sample ID *	Collected *		Matrix* AQ = Aqueous S = Solid T = Tissue DW =Drinking Water	Container(s) Type/Preservative/Number *										Requested Analysis *												
			Date*	Time * HH:MM		COMPOSITE Y/N	FILTERED Y/N	1LPU	250PHNO3							6010-AM	Fld_FP	2540-AMTDS	300.0AM-48	6010-AMF								
21	21	CBL-341I	2/6/18	1300	AQ	N	N	1	1							X	X	X	X									
22	22	CBL-341I - 0.45 micron filter	2/6/18	1300	AQ	N	Y	1	1								X	X	X	X								
23	23	CBL-341I - 10 micron filter	2/6/18	1300	AQ	N	Y	1	1								X	X	X	X								
24	24	CBL-341I settled	2/6/18	1300	AQ	N	N	1	1							X	X	X	X									
125	25	CBL-641I	2/6/18	1300	AQ	N	N	1	1							X	X	X	X									
26	26	CBL-641I - 0.45 micron filter	2/6/18	1300	AQ	N	Y	1	1								X	X	X	X								
27	27	CBL-641I - 10 micron filter	2/6/18	1300	AQ	N	Y	1	1								X	X	X	X								
128	28	CBL-641I settled	2/6/18	1300	AQ	N	N	1	1							X	X	X	X									
129	29	Field Blank 1	2/6/18	1452	AQ	N	N		1							X												
130	30	Field Blank 2	2/7/18	1540	AQ	N	N		1							X												

Transfers	Relinquished By	Date/Time	Received By	Date/Time
1		2/8/18 745		2/8/18 745
2				
3				

Cooler Temp:

#	T#	Obs.	Corr.
1	6	0.7°C	0.7°C
2			

Client Special Instructions:

Lab Use Only:

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Environmental Laboratory Services
The Solution Lab

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LCRA - Environmental Lab
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https://els.lcra.org

Lab ID#:
Client PO:

Project:	FPP - CCR Wells - Appendix 3	**Client:**	LCRA
Collector:	Jason Woods	**Contact:**	
Event#:	1393474 / 5422	**Phone:**	

Report To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

Invoice To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
LA GRANGE, TX 78945

	LAB USE ONLY	Sample ID *	Collected *		Matrix* AQ = Aqueous S = Solid T = Tissue DW = Drinking Water	Container(s) Type/Preservative/Number *										Requested Analysis *											
			Date*	Time * HH:MM		COMPOSITE Y/N	FILTERED Y/N	1LPU	250PHNO3							6010-AM	Fld_FP	2540-AMTDS	300.0AM-48	6010-AMF							
31	31	EQB Pump	2/7/18	1130	AQ	N	N		1							X											
32	32	EQB - 0.45 micron filter	2/7/18	1600	AQ	N	Y		1											X							
33	33	EQB - 10 micron filter	2/7/18	1610	AQ	N	Y		1											X							

Transfers	Relinquished By	Date/Time	Received By	Date/Time
1		2/8/18 745		2/8/18 745
2				
3				

Cooler Temp:			
#	T#	Obs.	Corr.
1	6	0.7°C	0.7°C
2			

Client Special Instructions:

Lab Use Only:

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

FPP - Groundwater - CCR Wells - February 2018

Date M/D/Y	Time HH:MM:SS	Temp C	DO mg/L	DOsat %	pH	SpCond uS	Orp mV	Monitoring Well
2/6/2018	12:13:08	21.21	10.86	124.6	6.86	5970	250.5	CBL-341I
2/6/2018	12:13:25	21.40	4.41	50.8	6.79	5969	251.9	CBL-341I
2/6/2018	12:13:53	21.59	3.84	44.4	6.70	5976	253.8	CBL-341I
2/6/2018	12:16:53	21.87	2.92	34.0	6.47	6016	261.1	CBL-341I
2/6/2018	12:19:53	21.83	2.92	33.9	6.38	6011	263.5	CBL-341I
2/6/2018	12:22:53	21.76	2.75	31.9	6.34	6004	266.2	CBL-341I
2/6/2018	12:25:53	21.70	2.71	31.4	6.30	6004	267.4	CBL-341I
2/6/2018	12:28:53	21.65	2.78	32.2	6.28	6003	269.7	CBL-341I
2/6/2018	12:31:53	21.61	2.85	32.9	6.25	6045	272.1	CBL-341I
2/6/2018	12:34:53	21.58	2.95	34.1	6.23	6070	274.0	CBL-341I
2/6/2018	12:37:53	21.58	3.00	34.7	6.22	6087	275.5	CBL-341I
2/6/2018	12:40:53	21.56	3.11	36.0	6.21	6094	276.7	CBL-341I
2/6/2018	12:43:53	21.56	3.16	36.5	6.20	6103	277.7	CBL-341I
2/6/2018	12:46:53	21.57	3.25	37.6	6.20	6107	278.8	CBL-341I
2/6/2018	12:49:53	21.55	3.12	36.1	6.19	6106	280.0	CBL-341I
2/6/2018	12:52:53	21.55	3.15	36.4	6.19	6105	281.2	CBL-341I
2/6/2018	12:55:53	21.53	3.14	36.3	6.18	6099	282.3	CBL-341I
2/6/2018	12:58:53	21.52	3.21	37.1	6.18	6096	283.6	CBL-341I
2/6/2018	13:01:53	21.53	3.25	37.6	6.18	6095	284.3	CBL-341I
2/6/2018	13:04:53	21.52	3.29	38.0	6.18	6096	284.8	CBL-341I
2/6/2018	14:17:15	19.99	4.09	46.4	6.48	9594	280.3	CBL-308I
2/6/2018	14:17:25	20.28	3.88	44.3	6.47	9590	280.0	CBL-308I
2/6/2018	14:17:41	20.54	3.52	40.4	6.46	9609	279.9	CBL-308I
2/6/2018	14:18:01	20.62	3.16	36.3	6.45	9646	279.7	CBL-308I
2/6/2018	14:21:01	21.56	2.52	29.6	6.39	9756	280.0	CBL-308I
2/6/2018	14:24:01	21.75	2.47	29.0	6.35	9771	281.4	CBL-308I
2/6/2018	14:27:01	21.75	2.65	31.1	6.33	9736	280.9	CBL-308I
2/6/2018	14:30:01	21.74	2.57	30.2	6.31	9703	278.8	CBL-308I
2/6/2018	14:33:01	21.80	2.34	27.5	6.30	9688	279.8	CBL-308I
2/6/2018	14:36:01	21.77	2.47	29.0	6.29	9656	280.8	CBL-308I
2/6/2018	14:39:01	21.78	2.45	28.8	6.28	9660	281.4	CBL-308I
2/6/2018	14:42:01	21.71	2.40	28.1	6.27	9633	281.6	CBL-308I
2/6/2018	14:46:38	21.76	2.35	27.6	6.26	9601	282.3	CBL-308I
2/6/2018	14:49:38	21.76	2.44	28.6	6.26	9589	282.0	CBL-308I
2/6/2018	14:52:38	21.73	2.45	28.8	6.26	9577	281.7	CBL-308I
2/7/2018	10:28:09	18.78	5.62	61.7	6.26	7103	247.1	CBL - 301I
2/7/2018	10:28:30	20.60	3.10	35.4	6.10	7365	224.2	CBL - 301I
2/7/2018	10:28:59	21.02	1.66	19.1	6.03	7374	210.5	CBL - 301I
2/7/2018	10:31:59	20.80	0.84	9.6	6.08	7421	156.6	CBL - 301I
2/7/2018	10:34:59	22.29	0.98	11.5	6.11	7413	115.8	CBL - 301I

2/7/2018	10:37:59	22.99	0.77	9.2	6.14	7448	115.2	CBL - 301I
2/7/2018	10:40:59	23.20	0.75	9.0	6.15	7445	117.0	CBL - 301I
2/7/2018	10:43:59	23.29	0.66	7.9	6.16	7448	121.8	CBL - 301I
2/7/2018	10:46:18	23.34	0.64	7.7	6.17	7438	123.6	CBL - 301I
2/7/2018	10:49:02	23.34	0.65	7.9	6.17	7433	124.0	CBL - 301I
2/7/2018	10:52:02	23.37	0.64	7.7	6.17	7436	122.0	CBL - 301I

2/7/2018	11:52:28	16.78	4.41	46.5	6.36	7529	281.4	CBL-302I
2/7/2018	11:52:37	17.22	4.12	43.9	6.36	7485	292.0	CBL-302I
2/7/2018	11:52:45	17.57	3.97	42.6	6.36	7458	305.9	CBL-302I
2/7/2018	11:53:24	18.13	3.35	36.3	6.34	7474	354.1	CBL-302I
2/7/2018	11:56:24	19.12	2.51	27.8	6.30	7483	509.4	CBL-302I
2/7/2018	11:59:24	19.49	2.18	24.4	6.29	7478	538.8	CBL-302I
2/7/2018	12:02:24	19.51	2.04	22.7	6.27	7475	544.5	CBL-302I
2/7/2018	12:05:24	19.36	1.96	21.8	6.26	7489	541.9	CBL-302I
2/7/2018	12:08:24	19.26	1.97	21.9	6.25	7477	543.5	CBL-302I
2/7/2018	12:11:24	19.08	1.96	21.7	6.24	7490	540.2	CBL-302I
2/7/2018	12:14:24	18.57	2.04	22.4	6.23	7503	537.3	CBL-302I
2/7/2018	12:17:24	18.05	2.12	23.0	6.23	7495	533.9	CBL-302I
2/7/2018	12:20:24	19.28	1.81	20.1	6.22	7409	535.4	CBL-302I
2/7/2018	12:23:24	20.12	1.35	15.2	6.22	7459	536.3	CBL-302I
2/7/2018	12:26:24	20.31	1.21	13.8	6.22	7477	532.6	CBL-302I
2/7/2018	12:29:24	20.45	1.12	12.8	6.22	7472	527.5	CBL-302I
2/7/2018	12:32:24	20.47	1.09	12.4	6.21	7477	522.5	CBL-302I

2/7/2018	13:57:54	17.62	6.64	70.2	6.77	2716	317.6	CBL-306I
2/7/2018	13:57:59	17.61	6.45	68.2	6.77	2720	317.5	CBL-306I
2/7/2018	13:58:03	17.66	6.49	68.6	6.78	2721	317.5	CBL-306I
2/7/2018	13:58:24	18.05	6.14	65.5	6.78	2708	318.6	CBL-306I
2/7/2018	14:01:24	18.80	5.82	63.1	6.79	2729	342.8	CBL-306I
2/7/2018	14:04:24	18.83	5.57	60.4	6.77	2662	354.3	CBL-306I
2/7/2018	14:07:24	18.82	4.85	52.5	6.72	2551	361.0	CBL-306I
2/7/2018	14:10:24	18.92	3.19	34.6	6.68	2528	375.3	CBL-306I
2/7/2018	14:13:24	19.13	2.76	30.0	6.67	2595	373.3	CBL-306I
2/7/2018	14:16:24	19.32	3.02	33.1	6.67	2672	369.9	CBL-306I

2/7/2018	15:09:44	19.35	5.02	55.8	6.82	7332	234.1	CBL-340I
2/7/2018	15:10:02	19.88	4.97	55.9	6.77	7342	234.0	CBL-340I
2/7/2018	15:10:24	20.40	4.39	49.9	6.74	7493	234.8	CBL-340I
2/7/2018	15:11:03	20.67	4.18	47.8	6.69	7546	238.1	CBL-340I
2/7/2018	15:14:03	21.32	3.59	41.6	6.58	8057	245.5	CBL-340I
2/7/2018	15:17:03	21.47	3.31	38.5	6.53	8136	250.1	CBL-340I
2/7/2018	15:20:03	21.53	3.19	37.1	6.49	8186	253.7	CBL-340I
2/7/2018	15:23:03	21.52	3.11	36.2	6.47	8220	257.0	CBL-340I
2/7/2018	15:26:03	21.54	3.05	35.6	6.45	8254	259.0	CBL-340I
2/7/2018	15:29:03	21.54	2.98	34.7	6.44	8270	260.5	CBL-340I
2/7/2018	15:32:03	21.59	2.96	34.4	6.43	8279	261.1	CBL-340I

2/7/2018	15:35:03	21.57	2.92	34.1	6.42	8283	261.2	CBL-340I
2/7/2018	15:38:03	21.53	2.92	34.0	6.41	8306	262.1	CBL-340I
2/7/2018	15:41:03	21.61	2.90	33.9	6.41	8303	262.5	CBL-340I

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Field Information Form

Sample Date: 2/6/2018 6
Sample Time: 1300
Sample ID: CBL3411

PURGING INFORMATION

180206		V= 4.9	14.7	8
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] I N I   Sampling Equipment .... Dedicated [✓ Y] I N I

Purging Device B
Sampling Device B
A-Submersible Pump, B-Perisataltic Pump, C-Bladder Pump, D-Gas Litf Pump, E-Venturi Pump, F-Dipper/Bottle, G-Bailer, H-Scoop/Shovel, I-Piston Pump
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

Purging Material F
Sampling Material F
A-Teflon, B-Stainless Steel, C-Polypropylene, D-PVC, E-Polyethylene
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F
A-Teflon, B-Tygon, C-Rope X- NA (Specify), D-Polypropylene, E-Polyethylene, F-Silicon, G-Combination teflon/Polypropylene
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ____ (ft/msl)
Land Surface Elevation ____ (ft/msl)
Depth to water From top of well casing =D_w 16.32 (ft)
Depth to water From land surface ____ (ft)
Groundwater Elevation ____
Groundwater Elevation ____ (ft/msl)
Well Depth = D 46.40 (ft)
Pump Placement 25 (ft)
PH 6.18 (STD)
Specific Conductivity 6096 uS/cm
Sample Temp. 21.52 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
p	250ml	HNO_3	Total Metals	No
p	2x 250ml	HNO_3	Dissolved metals - 0.45 and 10 micron filter	Yes
p	1L	ICE	Anions + TDS - collected anions w/out filtering and w/ 0.45 micron and 10 micron Filter	
p	4L	ICE	Collected a 4 liter cube and allowed to settle for overnight. Settled turbidity = 0.26ntu	
p	1L	ICE		

Sample Appearance: Clear Odor: none Color: Clear Turbidity: Sample = 0.56ntu 10 micron = 0.24ntu 0.45 micron = 0.19ntu
Weather Conditions: Cloudy, Overcast, Calm
Other: Purge water is clear w/ no odor, collected samples after field parameters stabilized Collected a duplicate sample for total and dissolved metals - Sample ID: 6411 CBL

WELL VOLUME CALCULATION

$V=(D-D_w)\ (A)\ (7.48\ \text{galtft}^3)$ where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross sectional area
2" dia. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ____
If No, Explain ____

Procedure: ELS-Groundwater SOP 5-7D
Date: 2/6/2018
Sampler: Jason Woods
Employer: LCRA

0.45 micron filter Lot #85092C
10 micron filter Lot # 88711A

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③

Field Information Form

Sample Date: 2/6/2018

Sample Time: 1452

Sample ID: CBL3081

PURGING INFORMATION

180206		V= 1.7	5	5
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] / N

Sampling Equipment .... Dedicated [✓ Y] / N

Purging Device: B
Sampling Device: B
A-Submersible Pump; B-Perisataltic Pump; C-Bladder Pump; D-Gas Liff Pump; E-Venturi Pump; F-Dipper/Bottle; G-Bailer; H-Scoop/Shovel; I-Piston Pump
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Purging Material: F
Sampling Material: F
A-Teflon; B-Stainless Steel; C-Polypropylene; D-PVC; E-Polyethylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Tubing-Purging: F
Tubing-Sampling: F
A-Teflon; B-Tygon; C-Rope X- NA (Specify); D-Polypropylene; E-Polyethylene; F-Silicon; G-Combination teflon/Polypropylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ______ (ft/msl)

Depth to water From top of well casing =Dw 24.90 (ft)

Groundwater Elevation ______

Well Depth = D 35.25 (ft)

Land Surface Elevation ______ (ft/msl)

Depth to water From land surface ______ (ft)

Groundwater Elevation ______ (ft/msl)

Pump Placement 28 (ft)

PH 6.26 (STD)

Specific Conductivity 9577 uS/cm

Sample Temp. 21.73 (°C)

Bottle Type	Bottle Size	Bottle Preservative	Analysis	Field Filt. Y/N
P	250ml	HNO3	Total Metals	NO
P	2x250ml	HNO3	Dissolved Metals - Field Filtered - 0.45 + 10 micron Filter	Yes
P	1L	ICE	Anions + TDS - Collected nonfiltered and filtered	Y/N
P	250ml	HNO3	Field Blank / collected @ 1452	

Sample w/ 0.45 + 10 micron filter -

Sample Appearance: Clear Odor: none Color: Clear Turbidity: Sample = 0.21ntu 10 micron = 0.29 0.45 micron = 0.20 ntu settled = 0.26 ntu

Weather Conditions: Overcast, Cloudy, Calm

Other: Purge water is clear w/ no odor, collected saples after field parameters stabilized.

WELL VOLUME CALCULATION

=(D-Dw) (A) (7.48 galtft³) where
= volume of standing water in well
= depth to bottom of well below measuring point
=depth to water below measuring point
cross sectional area
ı. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: ELS-Groundwater SOP 5-70

Date: 2/6/18

Sampler: Jason Woods

Employer: LCRA

0.45 micron filter Lot # 85092C
10 micron filter Lot # 88711A

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Field Information Form

Sample Date: 2/7/2018 (3)
Sample Time: 1052
Sample ID: 0BL3011 i

PURGING INFORMATION

180207		V= 2.9	8.6	4
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated I Y I [✓ N]
Sampling Equipment .... Dedicated I Y I [✓ N]

Purging Device A
Sampling Device A
A-Submersible Pump
B-Perisataltic Pump
C-Bladder Pump
D-Gas Liitf Pump
E-Venturi Pump
F-Dipper/Bottle
G-Bailer
H-Scoop/Shovel
I-Piston Pump
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Purging Material E
Sampling Material E
A-Teflon
B-Stainless Steel
C-Polypropylene
D-PVC
E-Polyethylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Tubing-Purging E
Tubing-Sampling E
A-Teflon
B-Tygon
D-Polypropylene
E-Polyethylene
F-Silicon
G-Combination teflon/Polypropylene
C-Rope X- NA (Specify)
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ______ (ft/msl)
Depth to water From top of well casing =D_w 36.48 (ft)
Groundwater Elevation ______
Well Depth = D 54.10 (ft)
Land Surface Elevation ______ (ft/msl)
Depth to water From land surface ______ (ft)
Groundwater Elevation ______ (ft/msl)
Pump Placement 50 (ft)

PH 6.17 (STD)
Specific Conductivity 7436 uS/cm
Sample Temp. 23.37 (°C)

Bottle			Analysis	Field Filt.Y/N
Type	Size	Preservative		
P	250ml	HNO3	Metals	N
P	2x250ml	HNO3	Dissolved metals - 0.45 + 10 micron filter	Yes
P	1Lx3	ICE	Anions + TDS - collected w/out filtering and 0.45 + 10 micron filter	Yes / No
P	4L	ICE	collected a 4 Liter cube + Allowed to settle overnight.	

P 2x250ml HNO3 - EQB Pump Collected @ 1130

Sample Appearance: Cloudy
Odor: none
Color: Cloudy
Turbidity: Sample = 168ntu 0.45 micron = 0.24ntu 10 micron = 35.8ntu
Weather Conditions: Cloudy, Overcast, 40
Other: Purge is cloudy white, slightly cleared up after 2 gallons, Sample was still cloudy and turbid white sampling. Turbidity of settled sample is 13.7ntu

WELL VOLUME CALCULATION

$V=(D-D_w)$ (A) (7.48 galtft^3) where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross sectional area
[✓ 2" dia. A= 0.0218] 4" dia. A = 0.0872

0.45 micron filter Lot #85092C
10 micron filter Lot #88711A

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: ELS - Groundwater SOP 5-7D
Date: 2/7/2018
Sampler: Jason Woods
Employer: LCRA

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(4

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Field Information Form

Sample Date: 2/7/2018
Sample Time: 1232
Sample ID: CBL3021

PURGING INFORMATION

180207		V= 2.6	7.8	5
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] N
Sampling Equipment .... Dedicated [✓ Y] N

Purging Device B
Sampling Device B

A-Submersible Pump
B-Perisataltic Pump
C-Bladder Pump
D-Gas Litf Pump
E-Venturi Pump
F-Dipper/Bottle
G-Bailer
H-Scoop/Shovel
I-Piston Pump

X- ________ Purging Other (Specify)
X- ________ Sampling Other (Specify)

Purging Material F
Sampling Material F

A-Teflon
B-Stainless Steel
C-Polypropylene
D-PVC
E-Polyethylene

X- ________ Purging Other (Specify)
X- ________ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F

A-Teflon
B-Tygon
C-Rope X- ________ (Specify)
D-Polypropylene
E-Polyethylene
F-Silicon
G-Combination teflon/Polypropylene

X- ________ Purging Other (Specify)
X- ________ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ________ (ft/msl)
Land Surface Elevation ________ (ft/msl)

Depth to water From top of well casing =D_w 11.09 (ft)
Depth to water From land surface ________ (ft)

Groundwater Elevation ________
Groundwater Elevation ________ (ft/msl)

Well Depth = D 27.11 (ft)
Pump Placement 20 (ft)

6.21 (STD) PH
7477 uS/cm Specific Conductivity
Sample Temp. 20.47 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250mL	HNO3	Metals	No
P	2x250	HNO3	Dissolved Metals - 0.45 + 10 micron filter/Field	Yes
P	3x1L	ICE	Anions + TDS - Collected unfiltered and 0.45 + 10 micron	Y/N
P	4L	Cube/ice	Collected a few liter cube and allowed to settle Filter	N

Sample Appearance: Clear
Odor: none
Color: Clear
Turbidity: overnight Sample = 0.06 ntu
10 micron = 0.35 ntu
0.45 micron = 0.29 ntu
Settled = 0.48 ntu
Weather Conditions: Overcast, 15 mph N wind, 40°
Other: Purge water is clear w/ no odor, collected samples after field parameters Stabilized.

WELL VOLUME CALCULATION

V=(D-D_w) (A) (7.48 galtft^3) where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross sectional area
2" dia. A= 0.0218 4" dia. A = 0.0872

0.45 micron filter Lot#85092C
10 micron filter lot#88711A

Well Appearance Normal: Yes X No ________
If No, Explain ________

Procedure: ELS-Groundwater SOP 5-7D
Date: 2/7/2018
Sampler: Jason Woods
Employer: LCRA.

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Field Information Form

Sample Date: 2/7/18 ⑤
Sample Time: 1416
Sample ID: CBL3061

PURGING INFORMATION

180207		V= 0.9	2.8	3
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] / N I Sampling Equipment .... Dedicated [✓ Y] / N I

Purging Device B
Sampling Device B
A-Submersible Pump B-Perisataltic Pump C-Bladder Pump D-Gas Litf Pump E-Venturi Pump F-Dipper/Bottle G-Bailer H-Scoop/Shovel I-Piston Pump
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Purging Material F
Sampling Material F
A-Teflon B-Stainless Steel C-Polypropylene D-PVC E-Polyethylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F
A-Teflon B-Tygon C-Rope X- NA. (Specify) D-Polypropylene E-Polyethylene F-Silicon G-Combination teflon/Polypropylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ______ (ft/msl)
Land Surface Elevation ______ (ft/msl)
Depth to water From top of well casing =Dw 9.11 (ft)
Depth to water From land surface ______ (ft)
Groundwater Elevation ______
Groundwater Elevation ______ (ft/msl)
Well Depth = D 14.80 (ft)
Pump Placement 14 (ft)

6.69 (STD) PH
2672 uS/cm Specific Conductivity
Sample Temp. 19.32 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250ml	HNO_3	Metals	NO
P	2x250ml	HNO_3	Dissolved metals - Field Filtered 0.45 micron + 10 micron	Yes
P	3x1L	ICE	Anions+TDS - Collected an unfiltered, 0.45+10 micron	NO/YES
P	4L Cube	ICE	Collected a 4 Liter cube and allowed to settle	NO

Sample Appearance: clear Odor: none Color: clear Turbidity: Sample = 12.8 ntu 10 micron = 3.79 ntu 0.45 micron = 0.36 ntu Settled = 3.98 ntu
Weather Conditions: Overcast, 10mph N wind, 40°
Other: Purge water is clear w/ no odor, collected samples after field parameters stabilized.

WELL VOLUME CALCULATION

$V=(D-D_w)(A)(7.48 \text{ galtft}^3)$ where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross sectional area
2" dia. A= 0.0218 4" dia. A = 0.0872

0.45 micron filter lot #85092C
10 micron filter lot #88711A

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: EES-Groundwater SOP 5-10
Date: 2/7/2018
Sampler: LCRA - Jason Woods
Employer: LCRA

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Field Information Form

Sample Date: 2/7/2018 6
Sample Time: 1540
Sample ID: CBL3401

PURGING INFORMATION

180207		V= 2.6	7.9	5
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] I N I   Sampling Equipment .... Dedicated [✓ Y] I N I

Purging Device B   Sampling Device B
A-Submersible Pump, B-Perisatal tic Pump, C-Bladder Pump, D-Gas Litf Pump, E-Venturi Pump, F-Dipper/Bottle, G-Bailer, H-Scoop/Shovel, I-Piston Pump
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Purging Material F   Sampling Material F
A-Teflon, B-Stainless Steel, C-Polypropylene, D-PVC, E-Polyethylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Tubing-Purging F   Tubing-Sampling F
A-Teflon, B-Tygon, C-Rope X- NA (Specify), D-Polypropylene, E-Polyethylene, F-Silicon, G-Combination teflon/Polypropylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ______ (ft/msl)   Land Surface Elevation ______ (ft/msl)
Depth to water From top of well casing =Dw 23.98 (ft)   Depth to water From land surface ______ (ft)
Groundwater Elevation ______   Groundwater Elevation ______ (ft/msl)
Well Depth = D 40.14 (ft)   Pump Placement 28 (ft)
PH 6.41 (STD)   Specific Conductivity 8303 uS/cm   Sample Temp. 21.61 (°C)

Bottle			Analysis	Field Filt.Y/N
Type	Size	Preservative		
P	250ml	HNO3	Metals	NO
P	2x250ml	HNO3	Dissolved metals - Field Filtered 0.45+10 micron	Yes
P	3x1L ml	ICE	Anions+TDS - Unfiltered, 0.45+10 micron filtered	NO/Yes
P	4L	ICE	Collected a 4 liter cube and allowed to settle.	
P	250ml	HNO3	Field Blank 2 collected @ 1540	

Sample Appearance: Clear Odor: none Color: clear Turbidity: Sample = 1.24 ntu
0.45 micron = 0.22 n
10 micron = 0.52 nt
Settled = 0.52 ntu
Weather Conditions: Overcast, 10 mph N wind, 40°
Other: Purge water is clear w/ no odor, collected samples after field parameters Stab
EQB on the 0.45 micron filter and tubing collected @ 1600
EQB on 10 micron filter and tubing collected @ 1610

WELL VOLUME CALCULATION

V=(D-Dw) (A) (7.48 galtft³) where
V= volume of standing water in well
D= depth to bottom of well below measuring point
Dw=depth to water below measuring point
A= cross-sectional area
2" dia. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: ELS - Groundwater SOP 5-70
Date: 2/7/2018
Sampler: Jason Woods
Employer: LCRA

0.45 micron filter Lot# 85092C
10 micron filter Lot# 88711A

Environmental
Laboratory
Services
The Solution Lab

LCRA Environmental Laboratory Services
3505 Montopolis Drive
Austin, TX 78744
Phone: (512)730-6022
Fax: (512)730-6021

August 17, 2018

BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
La Grange, TX 78945

RE: Final Analytical Report
ELS Workorder Q1829938

Attn: BECKIE LOEVE

Enclosed are the analytical results for sample(s) received by LCRA Environmental Laboratory Services. Results reported herein conform to the most current NELAP standards, where applicable, unless otherwise narrated in the body of the report. This final report provides results related only to the sample(s) as received for the above referenced work order.

Thank you for selecting ELS for your analytical needs. If you have any questions regarding this report, please contact us at (512) 356-6022. We look forward to assisting you again.

Authorized for release by:

Jason Woods
Project Manager
jason.woods@lcra.org

Enclosures

SAMPLE SUMMARY

Workorder: Q1829938

Lab ID	Sample ID	Matrix	Date Collected	Date Received
Q1829938001	CBL - 301I	Aqueous	7/25/2018 13:05	7/27/2018 14:50
Q1829938002	CBL - 301I DISS	Aqueous	7/25/2018 13:05	7/27/2018 14:50
Q1829938003	CBL - 302I	Aqueous	7/27/2018 13:13	7/27/2018 14:50
Q1829938004	CBL - 306I	Aqueous	7/27/2018 10:13	7/27/2018 14:50
Q1829938005	CBL - 308I	Aqueous	7/25/2018 12:06	7/27/2018 14:50
Q1829938006	CBL - 340I	Aqueous	7/27/2018 11:41	7/27/2018 14:50
Q1829938007	CBL - 602I	Aqueous	7/27/2018 13:13	7/27/2018 14:50
Q1829938008	Field Blank	Aqueous	7/25/2018 13:00	7/27/2018 14:50
Q1829938009	EQ Blank	Aqueous	7/27/2018 11:45	7/27/2018 14:50

Report Definitions

LOD	Limit of Detection
LOQ	Limit of Quantitation
ML	Maximum Limit - Client Specified
DF	Dilution Factor
Qual	Qualifiers

ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID: **Q1829938001**
Sample ID: **CBL - 301I**
Project ID: **FPP GWMP CCR**

Date Received: 7/27/2018 14:50
Date Collected: 7/25/2018 13:05

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	1330 mg/L	50.0	20.0		50	07/28/18 01:29	ML	07/28/18 01:29	ML	
Fluoride	<0.500 mg/L	0.500	0.200		50	07/28/18 01:29	ML	07/28/18 01:29	ML	
Sulfate	196 mg/L	50.0	20.0		50	07/28/18 01:29	ML	07/28/18 01:29	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	5390 mg/L	250	250		100	07/30/18 11:30	ADG	07/30/18 11:30	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 10:27	FM	
Calcium Total	993 mg/L	1.00	0.350		5	08/13/18 08:35	MM	08/15/18 11:53	FM	
Lithium Total	0.0971 mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 10:27	FM	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	24.46 C				1	07/25/18 13:05	CCP	07/25/18 13:05	CCP	N
pH	6.04 pH				1	07/25/18 13:05	CCP	07/25/18 13:05	CCP	N
Specific Conductance	7446 us/cm				1	07/25/18 13:05	CCP	07/25/18 13:05	CCP	N

ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID:	**Q1829938002**	Date Received:	7/27/2018 14:50	Matrix:	Aqueous
Sample ID:	**CBL - 301I DISS**	Date Collected:	7/25/2018 13:05	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

INORGANICS

Analysis Desc: SW6010B ICP-AES Preparation Method: SW6010B ICP-AES

Analytical Method: SW6010B ICP-AES

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
Boron Dissolved	<0.0500	mg/L	0.0500	0.0200		1	08/09/18 15:34	MM	08/13/18 10:01	FM	
Calcium Dissolved	929	mg/L	0.500			5	08/09/18 15:34	MM	08/13/18 10:06	FM	
Lithium Dissolved	0.0926	mg/L	0.0100	0.00400		1	08/09/18 15:34	MM	08/13/18 10:01	FM	

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ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID: **Q1829938003**
Sample ID: **CBL - 302I**
Project ID: **FPP GWMP CCR**

Date Received: 7/27/2018 14:50
Date Collected: 7/27/2018 13:13

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	1980 mg/L	50.0	20.0		50	07/28/18 00:22	ML	07/28/18 00:22	ML	
Fluoride	<0.500 mg/L	0.500	0.200		50	07/28/18 00:22	ML	07/28/18 00:22	ML	
Sulfate	1390 mg/L	50.0	20.0		50	07/28/18 00:22	ML	07/28/18 00:22	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	5510 mg/L	250	250		100	08/01/18 13:58	ADG	08/01/18 13:58	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 10:34	FM	
Calcium Total	995 mg/L	1.00	0.350		5	08/13/18 08:35	MM	08/15/18 12:00	FM	
Lithium Total	0.0489 mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 10:34	FM	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	22.20 C				1	07/27/18 13:13	CCP	07/27/18 13:13	CCP	N
pH	5.77 pH				1	07/27/18 13:13	CCP	07/27/18 13:13	CCP	N
Specific Conductance	7259 us/cm				1	07/27/18 13:13	CCP	07/27/18 13:13	CCP	N

ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID:	**Q1829938004**	Date Received:	7/27/2018 14:50	Matrix:	Aqueous
Sample ID:	**CBL - 306I**	Date Collected:	7/27/2018 10:13	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	283 mg/L	10.0	4.00		10	07/28/18 00:56	ML	07/28/18 00:56	ML	
Fluoride	2.95 mg/L	0.100	0.0400		10	07/28/18 00:56	ML	07/28/18 00:56	ML	
Sulfate	406 mg/L	10.0	4.00		10	07/28/18 00:56	ML	07/28/18 00:56	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	1450 mg/L	25.0	25.0		10	08/01/18 13:58	ADG	08/01/18 13:58	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 10:42	FM	
Calcium Total	275 mg/L	0.200	0.0700		1	08/13/18 08:35	MM	08/15/18 10:42	FM	
Lithium Total	0.0298 mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 10:42	FM	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	24.05 C				1	07/27/18 10:13	CCP	07/27/18 10:13	CCP	N
pH	6.86 pH				1	07/27/18 10:13	CCP	07/27/18 10:13	CCP	N
Specific Conductance	1996 us/cm				1	07/27/18 10:13	CCP	07/27/18 10:13	CCP	N

ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID:	**Q1829938005**	Date Received:	7/27/2018 14:50	Matrix:	Aqueous
Sample ID:	**CBL - 308I**	Date Collected:	7/25/2018 12:06	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	2680 mg/L	50.0	20.0		50	07/28/18 01:12	ML	07/28/18 01:12	ML	
Fluoride	2.10 mg/L	0.500	0.200		50	07/28/18 01:12	ML	07/28/18 01:12	ML	
Sulfate	1540 mg/L	50.0	20.0		50	07/28/18 01:12	ML	07/28/18 01:12	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	6320 mg/L	500	500		200	07/30/18 11:30	ADG	07/30/18 11:30	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 10:49	FM	
Calcium Total	863 mg/L	1.00	0.350		5	08/13/18 08:35	MM	08/15/18 12:06	FM	
Lithium Total	0.109 mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 10:49	FM	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	23.43 C				1	07/25/18 12:06	CCP	07/25/18 12:06	CCP	N
pH	6.07 pH				1	07/25/18 12:06	CCP	07/25/18 12:06	CCP	N
Specific Conductance	9313 us/cm				1	07/25/18 12:06	CCP	07/25/18 12:06	CCP	N

ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID:	**Q1829938006**	Date Received:	7/27/2018 14:50	Matrix:	Aqueous
Sample ID:	**CBL - 340I**	Date Collected:	7/27/2018 11:41	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS										
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions									
Chloride	2450 mg/L	50.0	20.0		50	07/28/18 00:39	ML	07/28/18 00:39	ML	
Fluoride	1.30 mg/L	0.500	0.200		50	07/28/18 00:39	ML	07/28/18 00:39	ML	
Sulfate	711 mg/L	50.0	20.0		50	07/28/18 00:39	ML	07/28/18 00:39	ML	
TOTAL DISSOLVED SOLIDS										
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS									
Total Dissolved Solids(TDS)	5100 mg/L	250	250		100	08/01/18 13:58	ADG	08/01/18 13:58	ADG	
INORGANICS										
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES									
Boron Total	<0.0500 mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 10:56	FM	
Calcium Total	544 mg/L	0.400	0.140		2	08/13/18 08:35	MM	08/15/18 12:14	FM	
Lithium Total	0.0968 mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 10:56	FM	
Field Parameters										
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1									
Temperature	23.20 C				1	07/27/18 11:41	CCP	07/27/18 11:41	CCP	N
pH	6.25 pH				1	07/27/18 11:41	CCP	07/27/18 11:41	CCP	N
Specific Conductance	8131 us/cm				1	07/27/18 11:41	CCP	07/27/18 11:41	CCP	N

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ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID: **Q1829938007**
Sample ID: **CBL - 602I**
Project ID: **FPP GWMP CCR**

Date Received: 7/27/2018 14:50
Date Collected: 7/27/2018 13:13

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 11:03	FM	
Calcium Total	958	mg/L	1.00	0.350		5	08/13/18 08:35	MM	08/15/18 12:21	FM	
Lithium Total	0.0526	mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 11:03	FM	

ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID:	**Q1829938008**	Date Received:	7/27/2018 14:50	Matrix:	Aqueous
Sample ID:	**Field Blank**	Date Collected:	7/25/2018 13:00	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

INORGANICS

Analysis Desc: SW6010B ICP-AES — Preparation Method: SW3010A, Metals Prep

Analytical Method: SW6010B ICP-AES

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 11:10	FM	
Calcium Total	<0.200	mg/L	0.200	0.0700		1	08/13/18 08:35	MM	08/15/18 11:10	FM	
Lithium Total	<0.0100	mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 11:10	FM	

ANALYTICAL RESULTS

Workorder: Q1829938

Lab ID:	**Q1829938009**	Date Received:	7/27/2018 14:50	Matrix:	Aqueous
Sample ID:	**EQ Blank**	Date Collected:	7/27/2018 11:45	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

INORGANICS

Analysis Desc: SW6010B ICP-AES   Preparation Method: SW3010A, Metals Prep

Analytical Method: SW6010B ICP-AES

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	08/13/18 08:35	MM	08/15/18 11:16	FM	
Calcium Total	<0.200	mg/L	0.200	0.0700		1	08/13/18 08:35	MM	08/15/18 11:16	FM	
Lithium Total	<0.0100	mg/L	0.0100	0.00400		1	08/13/18 08:35	MM	08/15/18 11:16	FM	

ANALYTICAL RESULTS QUALIFIERS

Workorder: Q1829938

PARAMETER QUALIFIERS

Lab ID: Q1829938001

N	Not Accredited

Lab ID: Q1829938003

N	Not Accredited

Lab ID: Q1829938004

N	Not Accredited

Lab ID: Q1829938005

N	Not Accredited

Lab ID: Q1829938006

N	Not Accredited

QUALITY CONTROL DATA

Workorder: Q1829938

QC Batch: WET/17963 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1829938001, Q1829938003, Q1829938004, Q1829938005, Q1829938006

METHOD BLANK: 1103776

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1103777

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	30.3	101	90 - 110	
Fluoride	mg/L	1	1.02	102	90 - 110	
Sulfate	mg/L	30	30.7	102	90 - 110	

MATRIX SPIKE: 1103778 DUPLICATE: 1103779 ORIGINAL: Q1829938004

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	283	200	470	470	94	94	80 - 120	0	20	
Fluoride	mg/L	2.95	10	12.8	12.8	98.4	98.2	80 - 120	0	20	
Sulfate	mg/L	406	200	584	584	88.8	88.9	80 - 120	0	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1829938

QC Batch: WET/17966 **Analysis Method:** SM2540C, TDS

QC Batch Method: SM2540C, TDS

Associated Lab Samples: Q1829938001, Q1829938005

METHOD BLANK: 1103840

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Dissolved Solids(TDS)	mg/L	<25.0	25.0	

LABORATORY CONTROL SAMPLE: 1103841

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	400	368	92	80 - 120	

SAMPLE DUPLICATE: 1103842 ORIGINAL: Q1829894002

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Dissolved Solids(TDS)	mg/L	579	604			4.23	20	

MATRIX SPIKE SAMPLE: 1103843 ORIGINAL: Q1829894002

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	579	400	978	99.8	70 - 130	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1829938

QC Batch: WET/17985 **Analysis Method:** SM2540C, TDS

QC Batch Method: SM2540C, TDS

Associated Lab Samples: Q1829938003, Q1829938004, Q1829938006

METHOD BLANK: 1105031

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Dissolved Solids(TDS)	mg/L	<25.0	25.0	

LABORATORY CONTROL SAMPLE: 1105032

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	400	387	96.8	80 - 120	

SAMPLE DUPLICATE: 1105033 ORIGINAL: Q1829974002

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Dissolved Solids(TDS)	mg/L	616	620			.647	20	

MATRIX SPIKE SAMPLE: 1105034 ORIGINAL: Q1829974002

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	616	400	1050	108	70 - 130	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1829938

QC Batch: MEP/8535 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW3010A, Metals Prep

Associated Lab Samples: Q1829938001, Q1829938003, Q1829938004, Q1829938005, Q1829938006, Q1829938007, Q1829938008, Q1829938009

LABORATORY CONTROL SAMPLE: 1110156

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Boron Total	mg/L	1	1.15	1.15	115	115	80 - 120	0	20	
Calcium Total	mg/L	10	10.8	10.8	108	108	80 - 120	0	20	
Lithium Total	mg/L	1	1.13	1.15	113	115	80 - 120	1.75	20	

METHOD BLANK: 1110158

Parameter	Units	Blank Result	Reporting Limit	Qual
Boron Total	mg/L	<0.0500	0.0500	
Calcium Total	mg/L	<0.200	0.200	
Lithium Total	mg/L	<0.0100	0.0100	

MATRIX SPIKE: 1110170 DUPLICATE: 1110171 ORIGINAL: Q1829938001

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Total	***mg/L***	***.02***	***1***	***1.26***	***1.26***	***126***	***126***	***75 - 125***	***0***	***20***	***S***
Calcium Total	***mg/L***	***993***	***10***	***980***	***990***	***-130***	***-35.4***	***75 - 125***	***1.02***	***20***	***S***
Lithium Total	***mg/L***	***.1***	***1***	***1.37***	***1.35***	***128***	***125***	***75 - 125***	***1.47***	***20***	***S***

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1829938

QC Batch: MEP/8536 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW6010B ICP-AES

Associated Lab Samples: Q1829938002

METHOD BLANK: 1110181

Parameter	Units	Blank Result	Reporting Limit	Qual
Boron Dissolved	mg/L	<0.0500	0.0500	
Calcium Dissolved	mg/L	<0.100	0.100	
Lithium Dissolved	mg/L	<0.0100	0.0100	

LABORATORY CONTROL SAMPLE: 1110182

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Boron Dissolved	mg/L	1	.87	.88	86.5	88.2	80 - 120	1.95	20	
Calcium Dissolved	mg/L	10	9.84	9.79	98.4	97.9	80 - 120	.509	20	
Lithium Dissolved	mg/L	1	.99	.98	99.4	98.2	80 - 120	1.21	20	

MATRIX SPIKE: 1110184 DUPLICATE: 1110185 ORIGINAL: Q1829938002

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Dissolved	***mg/L***	***0***	***1***	***.14***	***.15***	***13.5***	***14.7***	***75 - 125***	***8.51***	***20***	***S***
Calcium Dissolved	***mg/L***	***929***	***10***	***992***	***1040***	***630***	***1130***	***75 - 125***	***4.72***	***20***	***S***
Lithium Dissolved	mg/L	.09	1	1.21	1.16	112	106	75 - 125	4.22	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1829938

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1829938001	CBL - 301I			E300.0, Anions	WET/17963
Q1829938003	CBL - 302I			E300.0, Anions	WET/17963
Q1829938004	CBL - 306I			E300.0, Anions	WET/17963
Q1829938005	CBL - 308I			E300.0, Anions	WET/17963
Q1829938006	CBL - 340I			E300.0, Anions	WET/17963
Q1829938001	CBL - 301I			SM2540C, TDS	WET/17966
Q1829938005	CBL - 308I			SM2540C, TDS	WET/17966
Q1829938003	CBL - 302I			SM2540C, TDS	WET/17985
Q1829938004	CBL - 306I			SM2540C, TDS	WET/17985
Q1829938006	CBL - 340I			SM2540C, TDS	WET/17985
Q1829938001	CBL - 301I	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938003	CBL - 302I	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938004	CBL - 306I	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938005	CBL - 308I	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938006	CBL - 340I	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938007	CBL - 602I	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938008	Field Blank	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938009	EQ Blank	SW3010A, Metals Prep	MEP/8535	SW6010B ICP-AES	MET/6611
Q1829938002	CBL - 301I DISS	SW6010B ICP-AES	MEP/8536	SW6010B ICP-AES	MET/6610

Q1829938

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Lab ID#:

Client PO:

Project: FPP - CCR Wells

Collector:

Event#: 1412479 / 6633

Client: LCRA

Contact:

Phone:

Report To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
La Grange, TX 78945

Invoice To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
La Grange, TX 78945

LAB USE ONLY		Sample ID *	Collected *		Matrix* AQ = Aqueous S = Solid T = Tissue DW =Drinking Water	Container(s) Type/Preservative/Number *										Requested Analysis *											
			Date*	Time * HH:MM		COMPOSITE Y/N	FILTERED Y/N	500PU	250PHNO3	250mlHNO3						2540-AMTDS	6010-AM	300.0AM-48	Fld_FP	dis Metals							
001 002	1	CBL - 301I	7/25/18	1305	AQ	N	N	1	1	1						X	X	X	X	X							
003	2	CBL - 302I	7/27/18	1313	AQ			1	1							X	X	X	X								
004	3	CBL - 306I	7/27/18	1013	AQ			1	1							X	X	X	X								
005	4	CBL - 308I	7/25/18	1206	AQ			1	1							X	X	X	X								
006	5	CBL - 340I	7/27/18	1141	AQ			1	1							X	X	X	X								
007	6	CBL - ~~840I~~ 602I CP 7/27/18	7/27/18	1313	AQ				1								X										
008	7	Field Blank	7/25/18	1300	AQ				1								X										
009	8	EQ Blank	7/27/18	1145	AQ				1								X										

Transfers	Relinquished By	Date/Time	Received By	Date/Time	Cooler Temp:			
					#	T#	Obs.	Corr
1		7/27/18 1450		7/27/18 1450	1	6	4.6°C	4.6°C
2					2			
3								

Client Special Instructions:

Lab Use Only

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Q1829938 339504

FPP - Groundwater Purge Data - CCR Wells - July 2018

Date M/D/Y	Time HH:MM:SS	Temp C	DO mg/L	DOsat %	pH	SpCond uS	Orp mV	Monitoring Well
7/25/2018	10:45:26	26.00	9.36	116.1	7.15	2349	145.6	CBL 306I
7/25/2018	10:48:26	23.68	3.80	45.0	6.59	1253	170.7	CBL 306I
7/25/2018	10:51:26	23.41	3.42	40.3	6.49	1278	193.5	CBL 306I
7/25/2018	10:54:26	23.19	3.40	40.0	6.40	1583	216.2	CBL 306I
7/25/2018	10:57:26	22.87	3.44	40.2	6.30	2054	242.2	CBL 306I
7/25/2018	11:00:26	23.63	6.66	79.2	6.38	2649	173.8	CBL 306I
7/25/2018	11:03:26	22.65	2.86	33.4	6.27	2847	160.6	CBL 306I
7/25/2018	11:36:15	29.23	6.24	83.9	6.90	9571	272.6	CBL 308I
7/25/2018	11:39:15	23.95	3.88	47.5	6.24	9809	258.7	CBL 308I
7/25/2018	11:42:15	23.42	3.84	46.6	6.11	9790	248.1	CBL 308I
7/25/2018	11:45:15	23.37	4.44	53.8	6.05	9714	248.2	CBL 308I
7/25/2018	11:48:15	23.56	5.41	65.8	6.01	9612	252.7	CBL 308I
7/25/2018	11:51:15	23.62	2.24	27.3	6.02	9585	283.9	CBL 308I
7/25/2018	11:54:15	23.59	3.60	43.8	6.05	9509	296.9	CBL 308I
7/25/2018	11:57:17	23.47	3.72	45.1	6.05	9490	254.0	CBL 308I
7/25/2018	12:00:17	23.44	3.57	43.2	6.04	9455	271.4	CBL 308I
7/25/2018	12:03:17	23.37	4.17	50.5	6.04	9447	277.8	CBL 308I
7/25/2018	12:06:16	23.43	3.25	39.4	6.07	9313	265.4	CBL 308I
7/25/2018	12:29:42	26.50	4.65	59.2	6.44	7415	172.0	CBL 301I
7/25/2018	12:32:42	23.87	0.93	11.3	6.05	7494	113.7	CBL 301I
7/25/2018	12:35:42	23.66	0.83	10.0	5.97	7463	127.8	CBL 301I
7/25/2018	12:38:42	23.72	0.77	9.3	5.93	7465	152.5	CBL 301I
7/25/2018	12:41:42	23.91	0.71	8.6	5.95	7459	159.7	CBL 301I
7/25/2018	12:44:42	23.99	0.63	7.7	5.99	7466	150.7	CBL 301I
7/25/2018	12:47:42	24.06	0.60	7.4	6.02	7465	157.4	CBL 301I
7/25/2018	12:50:42	24.36	0.62	7.6	6.02	7466	162.7	CBL 301I
7/25/2018	12:53:42	24.38	0.64	7.8	6.02	7448	168.1	CBL 301I
7/25/2018	12:56:42	24.55	0.59	7.2	6.03	7452	169.6	CBL 301I
7/25/2018	12:59:49	24.58	0.63	7.7	6.03	7440	169.7	CBL 301I
7/25/2018	13:02:49	24.45	0.59	7.3	6.03	7443	169.9	CBL 301I
7/25/2018	13:05:49	24.46	0.57	6.9	6.04	7446	169.3	CBL 301I
7/27/2018	10:35:31	25.37	6.22	77.8	6.73	8470	292.6	CBL 340I
7/27/2018	10:38:31	23.27	4.41	53.1	6.50	8390	320.1	CBL 340I
7/27/2018	10:41:31	23.05	3.80	45.5	6.44	8376	334.9	CBL 340I
7/27/2018	10:44:31	23.01	3.55	42.4	6.42	7681	345.6	CBL 340I
7/27/2018	10:47:31	22.98	3.33	39.9	6.39	8375	354.6	CBL 340I
7/27/2018	10:50:31	23.04	3.22	38.6	6.39	8355	362.4	CBL 340I
7/27/2018	10:53:31	23.06	3.16	37.8	6.36	7673	369.1	CBL 340I
7/27/2018	10:56:31	23.07	3.12	37.3	6.35	7687	375.0	CBL 340I

7/27/2018	10:59:31	23.02	3.09	37.0	6.34	8318	380.3	CBL 340I
7/27/2018	11:02:31	23.09	3.07	36.7	6.34	7667	385.4	CBL 340I
7/27/2018	11:05:31	23.08	3.05	36.6	6.33	8293	389.7	CBL 340I
7/27/2018	11:08:31	23.08	3.00	36.0	6.33	8288	393.7	CBL 340I
7/27/2018	11:11:31	23.02	3.00	35.9	6.33	8282	397.5	CBL 340I
7/27/2018	11:14:31	23.14	3.01	36.0	6.32	7701	400.9	CBL 340I
7/27/2018	11:17:31	23.15	2.93	35.2	6.32	8244	404.1	CBL 340I
7/27/2018	11:20:31	23.10	2.96	35.5	6.31	8226	407.1	CBL 340I
7/27/2018	11:23:31	23.13	2.95	35.4	6.30	7761	409.7	CBL 340I
7/27/2018	11:26:31	23.06	2.96	35.4	6.30	7715	412.7	CBL 340I
7/27/2018	11:29:31	23.12	3.00	35.9	6.31	8190	357.3	CBL 340I
7/27/2018	11:32:31	23.13	2.94	35.2	6.29	8184	382.0	CBL 340I
7/27/2018	11:35:31	23.21	2.91	34.9	6.27	8168	394.7	CBL 340I
7/27/2018	11:38:31	23.21	2.93	35.2	6.26	8141	404.4	CBL 340I
7/27/2018	11:41:31	23.20	2.92	35.1	6.25	8131	412.3	CBL 340I

7/27/2018	12:45:23	22.15	1.05	12.3	5.96	7254	425.5	CBL 302I
7/27/2018	12:45:59	22.17	1.01	11.8	5.96	7250	426.1	CBL 302I
7/27/2018	12:48:59	22.17	1.03	12.1	5.94	7259	429.8	CBL 302I
7/27/2018	12:51:59	22.17	1.01	11.9	5.92	7252	433.1	CBL 302I
7/27/2018	12:54:59	22.18	1.00	11.8	5.90	7249	436.0	CBL 302I
7/27/2018	12:57:59	22.17	1.03	12.1	5.89	7133	438.9	CBL 302I
7/27/2018	13:00:59	22.19	1.07	12.6	5.88	7262	441.3	CBL 302I
7/27/2018	13:03:59	22.20	1.00	11.8	5.86	7253	443.9	CBL 302I
7/27/2018	13:06:59	22.20	1.03	12.2	5.83	7248	446.8	CBL 302I
7/27/2018	13:09:59	22.18	1.07	12.6	5.81	7256	449.2	CBL 302I
7/27/2018	13:12:59	22.20	1.03	12.1	5.77	7259	452.3	CBL 302I

ENERGY • WATER • COMMUNITY SERVICES

Field Information Form

③

Sample Date: 7/27/18
Sample Time: 1313
Sample ID: CBL302I

PURGING INFORMATION

180727	1205	V= 25	7.6	8
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] | N |
Sampling Equipment .... Dedicated [✓ Y] | N |

Purging Device B
Sampling Device B
A-Submersible Pump, B-Perisataltic Pump, C-Bladder Pump, D-Gas Litf Pump, E-Venturi Pump, F-Dipper/Bottle, G-Bailer, H-Scoop/Shovel, I-Piston Pump
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

Purging Material F
Sampling Material F
A-Teflon, B-Stainless Steel, C-Polypropylene, D-PVC, E-Polyethylene
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F
A-Teflon, B-Tygon, C-Rope X- ____ (Specify), D-Polypropylene, E-Polyethylene, F-Silicon, G-Combination teflon/Polypropylene
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ____ (ft/msl)
Depth to water From top of well casing =D_w 11.50 (ft)
Groundwater Elevation ____
Well Depth = D 27.11 (ft)
5.77 (STD) PH
72~~2~~9 5 CP 7/27/18 uS/cm Specific Conductivity

Land Surface Elevation ____ (ft/msl)
Depth to water From land surface ____ (ft)
Groundwater Elevation ____ (ft/msl)
Pump Placement ____ (ft)
Sample Temp. 22.20 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250mL	Metals	HNO$_3$	
P	250mL	Metals	HNO$_3$	N
P	500mL	ICE	CP 7/27/18 Anions	N
				N

Sample Appearance: Clear Odor: none Color: Clear Turbidity: 3.37
Weather Conditions: Clear calm 95°
Other: Purge water is clear with no odor.

WELL VOLUME CALCULATION

/=$(D-D_w)$ (A) (7.48 galtft^3) where
'= volume of standing water in well
)= depth to bottom of well below measuring point
$_w$=depth to water below measuring point
= cross-sectional area
dia. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ____
If No, Explain ____

Procedure: ELS Ground water SOP 5-70
Date: 7/27/18
Sampler: CP
Employer: LCRA

Rev. 1 (08/2009)

②

LCRA
ENERGY • WATER • COMMUNITY SERVICES

Field Information Form

Sample Date: 7/27/18
Sample Time: 1141
Sample ID: CBL340I

PURGING INFORMATION

180727	1033	V= 2.7	8	7
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment ....Dedicated [✓ Y] I N I
Sampling Equipment ....Dedicated [✓ Y] I N I

Purging Device B
Sampling Device B
A-Submersible Pump
B-Perisataltic Pump
C-Bladder Pump
D-Gas Lift Pump
E-Venturi Pump
F-Dipper/Bottle
G-Bailer
H-Scoop/Shovel
I-Piston Pump
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

Purging Material F
Sampling Material F
A-Teflon
B-Stainless Steel
C-Polypropylene
D-PVC
E-Polyethylene
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F
A-Teflon
B-Tygon
C-Rope X- ____ (Specify)
D-Polypropylene
E-Polyethylene
F-Silicon
G-Combination teflon/Polypropylene
X- ____ Purging Other (Specify)
X- ____ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ____ (ft/msl)
Depth to water From top of well casing =D_w 23.79 (ft)
Groundwater Elevation ____
Well Depth = D 40.14 (ft)
Land Surface Elevation ____ (ft/msl)
Depth to water From land surface ____ (ft)
Groundwater Elevation ____ (ft/msl)
Pump Placement 36 (ft)
PH 6.25 (STD)
Specific Conductivity 8131 uS/cm
Sample Temp. 23.20 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250mL	HNO_3	Metals	N
P	500mL	ICE	Anions	N
P	250mL	HNO_3	Metals EQ Blank	N

Sample Appearance: Clear
Odor: none
Color: Clear
Turbidity: 1.68
Weather Conditions: clear Calm 85°
Other: Purge water is Clear with no odor

WELL VOLUME CALCULATION

$V=(D-D_w)$ (A) (7.48 galtft^3) where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross-sectional area
[✓ 2" dia. A= 0.0218] 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ____
If No, Explain ____

Procedure: ELS Groundwater SOP 5-7D
Date: 7/27/18
Sampler: CP
Employer: LCRA

Rev. 1 (08/2009)

⑩

LCRA
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Field Information Form

Sample Date: 7/25/18
Sample Time: 1305
Sample ID: CBL301T

PURGING INFORMATION

180725	1230	V= 3	9	8
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment ....Dedicated Y [✓ N]
Sampling Equipment ....Dedicated Y [✓ N]

Purging Device A
Sampling Device A
A-Submersible Pump
B-Perisataltic Pump
C-Bladder Pump
D-Gas Liff Pump
E-Venturi Pump
F-Dipper/Bottle
G-Bailer
H-Scoop/Shovel
I-Piston Pump
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Purging Material E
Sampling Material E
A-Teflon
B-Stainless Steel
C-Polypropylene
D-PVC
E-Polyethylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Tubing-Purging E
Tubing-Sampling E
A-Teflon
B-Tygon
C-Rope X- ______ (Specify)
D-Polypropylene
E-Polyethylene
F-Silicon
G-Combination teflon/Polypropylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ______ (ft/msl)
Depth to water From top of well casing =Dw 35.88 (ft)
Groundwater Elevation ______
Well Depth = D 54.10 (ft)
Land Surface Elevation ______ (ft/msl)
Depth to water From land surface ______ (ft)
Groundwater Elevation ______ (ft/msl)
Pump Placement 49 (ft)
6.04 (STD) PH
7446 uS/cm Specific Conductivity
Sample Temp. 24.46 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250mL	HNO_3	Metals	N
P	250mL	HNO_3	Metals	N
P	250mL	ICE	Anions	N
P	500mL	ICE	Anions	N
P	250mL	HNO_3	Dissolved metals	
P	250mL	HNO_3	Field Blank	

Sample Appearance: Clear Odor: none Color: Clear Turbidity: 6.50 dissolved 2.06
Weather Conditions: Partly Cloudy South wind 5mph 100°
Other: Purge water is cloudy milkly white to gray

WELL VOLUME CALCULATION

V=(D-Dw) (A) (7.48 galtft³) where
/= volume of standing water in well
)= depth to bottom of well below measuring point
)w=depth to water below measuring point
\= cross sectional area
" dia. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: ELS Groundwater SOP 5-7D
Date: 7/25/18
Sampler: CP/ES
Employer: LCRA

ENERGY • WATER • COMMUNITY SERVICES

Field Information Form

⑧

Sample Date: 7/25/18

Sample Time: 1206

Sample ID: CBL308I

PURGING INFORMATION

18 ~~04~~ 0725	1110	V= 1.7	5.1	7
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] I N I Sampling Equipment .... Dedicated [✓ Y] I N I

Purging Device B
Sampling Device B

A-Submersible Pump; B-Perisataltic Pump; C-Bladder Pump; D-Gas Liff Pump; E-Venturi Pump; F-Dipper/Bottle; G-Bailer; H-Scoop/Shovel; I-Piston Pump

X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Purging Material F
Sampling Material F

A-Teflon; B-Stainless Steel; C-Polypropylene; D-PVC; E-Polyethylene

X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F

A-Teflon; B-Tygon; C-Rope X- ______ (Specify); D-Polypropylene; E-Polyethylene; F-Silicon; G-Combination teflon/Polypropylene

X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ______ (ft/msl)

Depth to water From top of well casing =D_w 24.87 (ft)

Groundwater Elevation ______

Well Depth = D 35.25 (ft)

Land Surface Elevation ______ (ft/msl)

Depth to water From land surface ______ (ft)

Groundwater Elevation ______ (ft/msl)

Pump Placement 30 (ft)

PH 6.07 (STD)

Specific Conductivity 9313 uS/cm

Sample Temp. 23.43 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250ml	HNO_3	Metals,	N
P	250mL	HNO_3	Metals	N
P	250mL	ICE	Anion	N
P	500ml	ICE	Anions	N

Sample Appearance: Clear Odor: none Color: clear Turbidity: 21.8

Weather Conditions: Clear Calm 98°

Other: Purge water is clear with no odor

WELL VOLUME CALCULATION

V=(D-D_w) (A) (7.48 galtft^3) where
/= volume of standing water in well
)= depth to bottom of well below measuring point
)$_w$=depth to water below measuring point
.= cross sectional area
" dia. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: ELS Ground water SOP 5-7D

Date: 7/25/18

Sampler: CP/ES

Employer: LCRA

Rev. 1 (08/2009)

⑧

LCRA
ENERGY • WATER • COMMUNITY SERVICES

Field Information Form

Sample Date: 7/27/18
Sample Time: 1013
Sample ID: CBL306I

PURGING INFORMATION

18072~~7~~5	1045	V= 0.7	2.2	1
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] N
Sampling Equipment .... Dedicated [✓ Y] N

Purging Device B
Sampling Device B
A-Submersible Pump B-Perisataltic Pump C-Bladder Pump D-Gas Litf Pump E-Venturi Pump F-Dipper/Bottle G-Bailer H-Scoop/Shovel I-Piston Pump
X- ________ Purging Other (Specify)
X- ________ Sampling Other (Specify)

Purging Material F
Sampling Material F
A-Teflon B-Stainless Steel C-Polypropylene D-PVC E-Polyethylene
X- ________ Purging Other (Specify)
X- ________ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F
A-Teflon B-Tygon C-Rope X- ________ (Specify) D-Polypropylene E-Polyethylene F-Silicon G-Combination teflon/Polypropylene
X- ________ Purging Other (Specify)
X- ________ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ________ (ft/msl)
Depth to water From top of well casing =D_w 10.29 (ft)
Groundwater Elevation ________
Well Depth = D 14.80 (ft)
Land Surface Elevation ________ (ft/msl)
Depth to water From land surface ________ (ft)
Groundwater Elevation ________ (ft/msl)
Pump Placement 12 (ft)

6.86 (STD) PH
1996 uS/cm Specific Conductivity
Sample Temp. 24.05 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250mL	HNO3	Metals	
P	250m	HNO3	Metals	N
P	250m	ICE	Anions	N
P	500m	ICE	Anions	N
				N

Sample Appearance: Clear Odor: none Color: Clear Turbidity: 2.77
Weather Conditions: Clear Calm 90°
Other: Purge water is clear with no odor Well went Dry after 1 gallon

WELL VOLUME CALCULATION

$V=(D-D_w)\ (A)\ (7.48\ galtft^3)$ where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross sectional area
2" dia. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ________
If No, Explain ________

Procedure: ELS Groundwater SOP 5-70
Date: 7/25/18
Sampler: CP/ES
Employer: LCRA

Environmental
Laboratory
Services
The Solution Lab

LCRA Environmental Laboratory Services
3505 Montopolis Drive
Austin, TX 78744
Phone: (512)730-6022
Fax: (512)730-6021

September 7, 2018

BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
La Grange, TX 78945

RE: Final Analytical Report
ELS Workorder Q1834079

Attn: BECKIE LOEVE

Enclosed are the analytical results for sample(s) received by LCRA Environmental Laboratory Services. Results reported herein conform to the most current NELAP standards, where applicable, unless otherwise narrated in the body of the report. This final report provides results related only to the sample(s) as received for the above referenced work order.

Thank you for selecting ELS for your analytical needs. If you have any questions regarding this report, please contact us at (512) 356-6022. We look forward to assisting you again.

Authorized for release by:

Jason Woods
Project Manager
jason.woods@lcra.org

Enclosures

SAMPLE SUMMARY

Workorder: Q1834079

Lab ID	Sample ID	Matrix	Date Collected	Date Received
Q1834079001	CBL - 341I	Aqueous	8/24/2018 13:45	8/24/2018 15:20
Q1834079002	CBL - 308I	Aqueous	8/24/2018 12:22	8/24/2018 15:20
Q1834079003	CBL - 308I Dissolved 0.45	Aqueous	8/24/2018 12:22	8/24/2018 15:20
Q1834079004	Field Blank	Aqueous	8/24/2018 13:43	8/24/2018 15:20

Report Definitions

LOD	Limit of Detection
LOQ	Limit of Quantitation
ML	Maximum Limit - Client Specified
DF	Dilution Factor
Qual	Qualifiers

PROJECT SUMMARY

Workorder: Q1834079

Workorder Comments

WORKORDER COMMENTS: CBL-341I was sampled on August 24th, 2018 due to a scheduling error by the ELS field staff. The remaining CCR groundwater monitoring wells were scheduled and collected on a semi-annual frequency July 25th - July 27th, 2018.

ANALYTICAL RESULTS

Workorder: Q1834079

Lab ID:	**Q1834079001**	Date Received:	8/24/2018 15:20	Matrix:	Aqueous
Sample ID:	**CBL - 341I**	Date Collected:	8/24/2018 13:45	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Chloride	1910	mg/L	50.0	20.0		50	08/24/18 23:25	ML	08/24/18 23:25	ML	
Fluoride	0.114	mg/L	0.100	0.0400		10	08/27/18 12:50	ML	08/27/18 12:50	ML	
Sulfate	376	mg/L	50.0	20.0		50	08/24/18 23:25	ML	08/24/18 23:25	ML	
TOTAL DISSOLVED SOLIDS											
Analysis Desc: SM2540C, TDS	Preparation Method: SM2540C, TDS Analytical Method: SM2540C, TDS										
Total Dissolved Solids(TDS)	4800	mg/L	250	250		100	08/29/18 15:29	ADG	08/29/18 15:29	ADG	
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	09/05/18 16:54	MM	09/06/18 13:37	FM	
Calcium Total	824	mg/L	1.00	0.350		5	09/05/18 16:54	MM	09/06/18 13:47	FM	
Field Parameters											
Analysis Desc: TCEQ SOP V1	Preparation Method: TCEQ SOP V1 Analytical Method: TCEQ SOP V1										
Temperature	23.85	C				1	08/24/18 13:45	CCP	08/24/18 13:45	CCP	N
pH	5.82	pH				1	08/24/18 13:45	CCP	08/24/18 13:45	CCP	N
Specific Conductance	6076	us/cm				1	08/24/18 13:45	CCP	08/24/18 13:45	CCP	N

ANALYTICAL RESULTS

Workorder: Q1834079

Lab ID: **Q1834079002**
Sample ID: **CBL - 308I**
Project ID: **FPP GWMP CCR**

Date Received: 8/24/2018 15:20
Date Collected: 8/24/2018 12:22

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Fluoride	2.33	mg/L	0.500	0.200		50	08/24/18 23:42	ML	08/24/18 23:42	ML	

LCRA Environmental Laboratory Services
3505 Montopolis Drive
Austin, TX 78744
Phone: (512)730-6022
Fax: (512)730-6021

ANALYTICAL RESULTS

Workorder: Q1834079

Lab ID:	**Q1834079003**	Date Received:	8/24/2018 15:20	Matrix:	Aqueous
Sample ID:	**CBL - 308I Dissolved 0.45**	Date Collected:	8/24/2018 12:22	Sample Type:	SAMPLE
Project ID:	**FPP GWMP CCR**				

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: E300.0, Anions	Preparation Method: E300.0, Anions Analytical Method: E300.0, Anions										
Fluoride Dissolved	1.83	mg/L	0.500	0.200		50	08/25/18	ML	08/25/18	ML	

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Austin, TX 78744
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ANALYTICAL RESULTS

Workorder: Q1834079

Lab ID: **Q1834079004**
Sample ID: **Field Blank**
Project ID: **FPP GWMP CCR**

Date Received: 8/24/2018 15:20
Date Collected: 8/24/2018 13:43

Matrix: Aqueous
Sample Type: SAMPLE

Parameters	Results	Units	LOQ	LOD	ML	DF	Prepared	By	Analyzed	By	Qual
INORGANICS											
Analysis Desc: SW6010B ICP-AES	Preparation Method: SW3010A, Metals Prep Analytical Method: SW6010B ICP-AES										
Boron Total	<0.0500	mg/L	0.0500	0.0200		1	09/05/18 16:54	MM	09/06/18 13:43	FM	
Calcium Total	0.220	mg/L	0.200	0.0700		1	09/05/18 16:54	MM	09/06/18 13:43	FM	

ANALYTICAL RESULTS QUALIFIERS

Workorder: Q1834079

PARAMETER QUALIFIERS

Lab ID: Q1834079001

N	Not Accredited

QUALITY CONTROL DATA

Workorder: Q1834079

QC Batch: WET/18133 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1834079001, Q1834079002, Q1834079003

METHOD BLANK: 1118266

Parameter	Units	Blank Result	Reporting Limit	Qual
Chloride	mg/L	<1.00	1.00	
Fluoride	mg/L	<0.0100	0.0100	
Fluoride Dissolved	mg/L	<0.0100	0.0100	
Sulfate	mg/L	<1.00	1.00	

LABORATORY CONTROL SAMPLE: 1118267

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Chloride	mg/L	30	30.1	100	90 - 110	
Fluoride	mg/L	1	1	99.8	90 - 110	
Fluoride Dissolved	mg/L	1	1	99.8	90 - 110	
Sulfate	mg/L	30	30	100	90 - 110	

MATRIX SPIKE: 1118268 DUPLICATE: 1118269 ORIGINAL: Q1833961001

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Chloride	mg/L	9.84	20	29.3	29.3	97.3	97.4	80 - 120	0	20	
Fluoride	mg/L	.2	1	1.11	1.13	91.7	93.3	80 - 120	1.79	20	
Fluoride Dissolved	mg/L	.2	1	1.11	1.13	91.7	93.3	80 - 120	1.79	20	
Sulfate	mg/L	25.6	20	46	45.8	102	101	80 - 120	.436	20	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1834079

QC Batch: WET/18143 **Analysis Method:** E300.0, Anions

QC Batch Method: E300.0, Anions

Associated Lab Samples: Q1834079001

METHOD BLANK: 1118564

Parameter	Units	Blank Result	Reporting Limit	Qual
Fluoride	mg/L	<0.0100	0.0100	

LABORATORY CONTROL SAMPLE: 1118567

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Fluoride	mg/L	1	1.04	104	90 - 110	

MATRIX SPIKE: 1118569 DUPLICATE: 1118570 ORIGINAL: Q1833913003

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Fluoride	mg/L	3.01	1	3.98	4	97.2	98.4	80 - 120	.501	20	

<u>Qualifiers</u>

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1834079

QC Batch: WET/18163 **Analysis Method:** SM2540C, TDS

QC Batch Method: SM2540C, TDS

Associated Lab Samples: Q1834079001

METHOD BLANK: 1119966

Parameter	Units	Blank Result	Reporting Limit	Qual
Total Dissolved Solids(TDS)	mg/L	<25.0	25.0	

LABORATORY CONTROL SAMPLE: 1119967

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	400	391	97.8	80 - 120	

SAMPLE DUPLICATE: 1119968 ORIGINAL: Q1834140004

Parameter	Units	Original Result	DUP Result	% Rec	% Rec Limit	RPD	Max	Qual
Total Dissolved Solids(TDS)	mg/L	253	259			2.34	20	

MATRIX SPIKE SAMPLE: 1119969 ORIGINAL: Q1834140004

Parameter	Units	Original Result	Spike Conc.	MS Result	MS % Rec	% Rec Limit	Qual
Total Dissolved Solids(TDS)	mg/L	253	400	638	96.2	70 - 130	

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

QUALITY CONTROL DATA

Workorder: Q1834079

QC Batch: MEP/8614 **Analysis Method:** SW6010B ICP-AES

QC Batch Method: SW3010A, Metals Prep

Associated Lab Samples: Q1834079001, Q1834079004

LABORATORY CONTROL SAMPLE: 1123338

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limit	RPD	Max	Qual
Boron Total	mg/L	1	.89	.91	88.8	90.5	80 - 120	1.9	20	
Calcium Total	mg/L	10	9.17	9.29	91.7	92.9	80 - 120	1.3	20	

METHOD BLANK: 1123340

Parameter	Units	Blank Result	Reporting Limit	Qual
Boron Total	mg/L	<0.0500	0.0500	
Calcium Total	mg/L	<0.200	0.200	

MATRIX SPIKE: 1123341 DUPLICATE: 1123342 ORIGINAL: Q1834079001

Parameter	Units	Original Result	Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limit	RPD	Max RPD	Qual
Boron Total	*mg/L*	*.01*	*1*	*1.29*	*1.36*	*129*	*136*	*75 - 125*	*5.28*	*20*	*S*
Calcium Total	*mg/L*	*824*	*10*	*765*	*802*	*-593*	*-219*	*75 - 125*	*4.72*	*20*	*S*

Qualifiers

S - Spike Recovery Outside Recovery Limits

R - RPD Outside Recovery Limits

B - Analyte Detected in Method Blank

LCRA Environmental Laboratory Services
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Austin, TX 78744
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Fax: (512)730-6021

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Workorder: Q1834079

Lab ID	Sample ID	Prep Method	Prep Batch	Analysis Method	Analysis Batch
Q1834079001	CBL - 341I			E300.0, Anions	WET/18133
Q1834079002	CBL - 308I			E300.0, Anions	WET/18133
Q1834079003	CBL - 308I Dissolved 0.45			E300.0, Anions	WET/18133
Q1834079001	CBL - 341I			E300.0, Anions	WET/18143
Q1834079001	CBL - 341I			SM2540C, TDS	WET/18163
Q1834079001	CBL - 341I	SW3010A, Metals Prep	MEP/8614	SW6010B ICP-AES	MET/6667
Q1834079004	Field Blank	SW3010A, Metals Prep	MEP/8614	SW6010B ICP-AES	MET/6667

Q1834079

Environmental
Laboratory
Services
The Solution Lab

LCRA Environmental Laboratory Services
Request for Analysis Chain-of-Custody Record

LCRA - Environmental Lab
3505 Montopolis Dr.
Austin, TX 78744

Phone: (512) 356-6022 or 1-800-776-5272
Fax: (512) 356-6021
https://els.lcra.org

Lab ID#:
Client PO:

Project:	FPP CCR Wells	**Client:**	LCRA
Collector:	CalPetri	**Contact:**	
Event#:	1415326 / 6848	**Phone:**	

Report To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
La Grange, TX 78945

Invoice To:
BECKIE LOEVE
FAYETTE POWER PLANT
6549 POWER PLANT RD
MAIL STOP FPP
La Grange, TX 78945

	LAB USE ONLY	Sample ID *	Collected *		Matrix* AQ = Aqueous S = Solid T = Tissue DW =Drinking Water	Container(s) Type/Preservative/Number *										Requested Analysis *											
			Date*	Time * HH:MM		COMPOSITE Y/N	FILTERED Y/N	250PHNO3	500PU	250PU						2540-AMTDS	6010-AM	Fld_FP	300.0AM-28								
001	1	CBL - 341I	8/24/18	1345	AQ	V	N	1	1							X	X	X	X								
002	2	CBL - 308I	8/24/18	1222	AQ	V	N			1									X								
003	3	CBL - 308I - Dissolved 0.45	8/24/18	1222	AQ	N	Y			1									X								
004	4	Field Blank	8/24/18	1343	AQ	V	N	1									X										
	5																										
	6																										
	7																										

Transfers	Relinquished By	Date/Time	Received By	Date/Time	Cooler Temp: #	T#	Obs	Corr.
1	CalPetri	8/24/18 1520		8/24/18 1520	1	8	2.1	2.1°C
2					2			
3								

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Client Special Instructions:

Lab Use Only

Q1834079 343645

FPP - Groundwater - CCR Wells - Purge Data

Date M/D/Y	Time HH:MM:SS	Temp C	DO mg/L	DOsat %	pH	SpCond uS	Orp mV	Monitoring Well
8/24/2018	11:31:31	25.62	5.53	69.9	6.48	10229	231.7	CBL 308I
8/24/2018	11:34:31	23.87	5.28	64.7	6.34	10308	244.3	CBL 308I
8/24/2018	11:37:31	23.36	5.18	62.8	6.25	10307	273.1	CBL 308I
8/24/2018	11:40:31	23.32	5.10	61.9	6.18	10223	300.8	CBL 308I
8/24/2018	11:43:31	23.18	5.03	60.8	6.12	10179	330.4	CBL 308I
8/24/2018	11:46:31	23.18	4.81	58.1	6.10	10101	352.7	CBL 308I
8/24/2018	11:49:31	23.27	4.75	57.5	6.07	9994	368.2	CBL 308I
8/24/2018	11:52:31	23.29	4.55	55.1	6.02	9905	384.1	CBL 308I
8/24/2018	11:55:31	23.38	4.43	53.7	5.96	9847	399.4	CBL 308I
8/24/2018	11:58:31	23.35	4.45	53.9	5.92	9824	412.0	CBL 308I
8/24/2018	12:01:31	23.33	4.27	51.7	5.87	9784	420.5	CBL 308I
8/24/2018	12:04:31	23.34	4.13	50.0	5.83	9744	428.9	CBL 308I
8/24/2018	12:07:31	23.47	4.05	49.2	5.84	9707	434.7	CBL 308I
8/24/2018	12:10:31	23.41	4.09	49.6	5.81	9695	439.0	CBL 308I
8/24/2018	12:13:31	23.49	3.99	48.4	5.78	9683	444.2	CBL 308I
8/24/2018	12:16:31	23.53	3.94	47.9	5.76	9675	448.4	CBL 308I
8/24/2018	12:19:31	23.47	3.86	46.8	5.76	9685	452.0	CBL 308I
8/24/2018	12:22:31	23.49	3.82	46.4	5.77	9655	454.4	CBL 308I
8/24/2018	12:49:27	28.79	8.83	116.7	6.66	6617	266.7	CBL 341I
8/24/2018	12:52:27	23.84	5.05	60.9	6.13	6155	340.1	CBL 341I
8/24/2018	12:55:27	23.53	4.10	49.2	5.99	6088	378.7	CBL 341I
8/24/2018	12:58:27	23.54	3.86	46.3	5.96	6056	406.2	CBL 341I
8/24/2018	13:01:27	23.52	4.21	50.5	5.95	6053	424.4	CBL 341I
8/24/2018	13:04:27	23.57	4.11	49.4	5.92	6041	437.5	CBL 341I
8/24/2018	13:07:27	23.57	4.09	49.1	5.90	6049	446.2	CBL 341I
8/24/2018	13:10:27	23.71	3.96	47.7	5.88	6048	452.6	CBL 341I
8/24/2018	13:13:27	23.78	3.97	47.9	5.86	6055	456.8	CBL 341I
8/24/2018	13:16:27	23.79	3.89	46.9	5.85	6057	460.5	CBL 341I
8/24/2018	13:19:27	23.65	3.95	47.5	5.84	6073	464.0	CBL 341I
8/24/2018	13:22:27	23.79	3.81	46.0	5.81	6060	467.8	CBL 341I
8/24/2018	13:25:27	23.80	3.85	46.4	5.80	6064	470.8	CBL 341I
8/24/2018	13:28:27	23.82	3.82	46.1	5.80	6066	472.8	CBL 341I
8/24/2018	13:31:27	23.83	3.81	46.0	5.82	6071	473.0	CBL 341I
8/24/2018	13:34:27	23.87	3.79	45.8	5.84	6068	472.5	CBL 341I
8/24/2018	13:36:02	23.86	3.82	46.1	5.88	6064	388.8	CBL 341I
8/24/2018	13:39:02	23.86	3.79	45.8	5.84	6072	447.2	CBL 341I
8/24/2018	13:42:02	23.87	3.65	44.1	5.82	6070	463.4	CBL 341I
8/24/2018	13:45:29	23.85	3.64	43.9	5.82	6076	398.5	CBL 341I

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Field Information Form

Sample Date: 8/24/18
Sample Time: 1345
Sample ID: CBL3411I

PURGING INFORMATION

180824	1253	V= 4.9	14.7	8
PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 X WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)

PURGING AND SAMPLING EQUIPMENT

Purging Equipment ....Dedicated [✓ Y] I N I
Sampling Equipment ....Dedicated I[✓ Y] I N I

Purging Device Sampling Device	B B	A-Submersible Pump B-Perisataltic Pump C-Bladder Pump	D-Gas Litf Pump E-Venturi Pump F-Dipper/Bottle	G-Bailer H-Scoop/Shovel I-Piston Pump	X- ______ Purging Other (Specify) X- ______ Sampling Other (Specify)
Purging Material Sampling Material	F F	A-Teflon B-Stainless Steel	C-Polypropylene D-PVC	E-Polyethylene	X- ______ Purging Other (Specify) X- ______ Sampling Other (Specify)
Tubing-Purging Tubing-Sampling	F F	A-Teflon B-Tygon C-Rope X- ______ (Specify)	D-Polypropylene E-Polyethylene	F-Silicon G-Combination teflon/Polypropylene	X- ______ Purging Other (Specify) X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation		(ft/msl)	Land Surface Elevation		(ft/msl)
Depth to water From top of well casing =D_w	16.47	(ft)	Depth to water From land surface		(ft)
Groundwater Elevation			Groundwater Elevation		(ft/msl)
Well Depth = D	46.43	(ft)	Pump Placement	39	(ft)

5.82 (STD)
PH

6076 uS/cm
Specific Conductivity

Sample Temp. 23.85 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250m	HNO3	Metals	N
P	500 m	ICE	Anions	N
P	250m	HNO3	Metals Field Blank	N

Sample Appearance: Clear Odor: none Color: Clear Turbidity: 4,54
Weather Conditions: Clear Calm 103°
Other: Purge water is clear with no odor. Small amount of air bubbles in Tubing while purging well.

WELL VOLUME CALCULATION

$V=(D-D_w)$ (A) (7.48 galtft^3) where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross sectional area
[✓ 2" dia. A= 0.0218] 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: ELS Groundwater SOPS-7D

Date: 8/24/18
Sampler: CP
Employer: LCRA

Rev. 1 (08/2009)

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Field Information Form

Sample Date: 8/24/18
Sample Time: 1222
Sample ID: CBL308T

PURGING INFORMATION

PURGE DATE (YY MM DD)	START PURGE (2400 Hr. Clock)	WATER VOL IN CASING (Gallons)	3 x WELL VOL. IN (Gallons)	ACTUAL VOLUME PURGED (Gallons)
180824	1138	V= 1.17	5.1	6

PURGING AND SAMPLING EQUIPMENT

Purging Equipment .... Dedicated [✓ Y] N
Sampling Equipment .... Dedicated [✓ Y] N

Purging Device B
Sampling Device B
A-Submersible Pump, B-Perisataltic Pump, C-Bladder Pump, D-Gas Liff Pump, E-Venturi Pump, F-Dipper/Bottle, G-Bailer, H-Scoop/Shovel, I-Piston Pump
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Purging Material F
Sampling Material F
A-Teflon, B-Stainless Steel, C-Polypropylene, D-PVC, E-Polyethylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

Tubing-Purging F
Tubing-Sampling F
A-Teflon, B-Tygon, C-Rope X- ______ (Specify), D-Polypropylene, E-Polyethylene, F-Silicon, G-Combination teflon/Polypropylene
X- ______ Purging Other (Specify)
X- ______ Sampling Other (Specify)

FIELD MEASUREMENTS

Well Elevation ______ (ft/msl)
Depth to water From top of well casing =D_w 24.87 (ft)
Groundwater Elevation ______
Well Depth = D 35.25 (ft)
Land Surface Elevation ______ (ft/msl)
Depth to water From land surface ______ (ft)
Groundwater Elevation ______ (ft/msl)
Pump Placement 30 (ft)

PH 5.77 (STD)
Specific Conductivity 9655 uS/cm
Sample Temp. 23.49 (°C)

Bottle			Analysis	Field Filt. Y/N
Type	Size	Preservative		
P	250	ICE	Anions	N
P	250	ICE	Anions .45micron Filters	Y

Sample Appearance: Clear Odor: none Color: Clear Turbidity: 0.78 Filtered = 0.52
Weather Conditions: Clear, Calm 101°
Other: Purge water is clear with no odor. large amount of air pumping up in Tubing

WELL VOLUME CALCULATION

$V=(D-D_w)\ (A)\ (7.48\ galtft^3)$ where
V= volume of standing water in well
D= depth to bottom of well below measuring point
D_w=depth to water below measuring point
A= cross sectional area
2" dia. A= 0.0218 4" dia. A = 0.0872

Well Appearance Normal: Yes X No ______
If No, Explain ______

Procedure: ECS Groundwater SOP 5-7D
Date: 8/24/18
Sampler: CP
Employer: LCRA

Rev. 1 (08/2009)