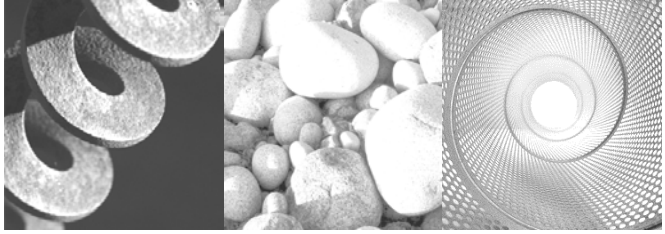

GEI Consultants

Consulting
Engineers and
Scientists

# Alternative Source Demonstration

Brayton Point Power Station
Somerset, Massachusetts

**Submitted to:**
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1650 Des Peres Road, Suite 230
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April 11, 2018 Rev. 0

Project 1800705

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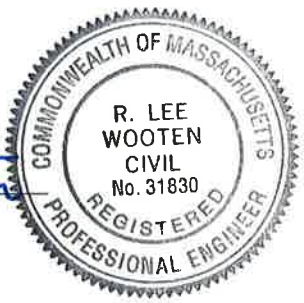
# Professional Engineer Certification

"I hereby certify that the Alternative Source Demonstration prepared for the Brayton Point Station meets requirements in federal regulation 40 CFR § 257.93 of the Standards of Coal Combustion Residuals (CCR) in Landfills and Impoundments published April 17, 2015. I am a duly licensed Professional Engineer under the laws of the Commonwealth of Massachusetts."




R. Lee Wooten, P.E.
Vice President

# 1. Introduction

Brayton Point Station (Brayton Point) was an electric generating plant located in Somerset, Massachusetts (Fig. 1). Brayton Point Energy, LLC formerly owned the plant, which burned coal, oil, and natural gas to generate electricity. Brayton Point, LLC now owns the plant. Basins A, B, and C (Basins) were polishing basins in the wet bottom ash management system and are shown on Fig. 2. Bottom ash from the boilers fell into the wet collection system at the boilers and was conveyed as bottom ash sluice water to the hydro-bins. Decant from the hydro-bins was conveyed into either Basins B or C and then to Basin A for polishing or settling out of additional bottom ash material. In accordance with the United States Environmental Protection Agency (USEPA) coal combustion residual (CCR) rule (40 CFR 257 Subpart D), Brayton Point Basins A, B and C are therefore classified as existing CCR surface impoundments.

Brayton Point ceased electricity generating operations on May 31, 2017. Following shutdown, Brayton Point began the process of closing Basins A, B, and C. Basin B received its last CCR material on May 31, 2017. Basins A and C were in service until June 1, 2017. Semi-annual monitoring and reporting for Basins A, B and C is performed in accordance with the monitoring requirements §257.90 through §257.94 during the closure process for the Basins.

In accordance with the USEPA CCR Rule, a 2017 Annual Groundwater Monitoring and Corrective Action Report (2017 Annual Report) was prepared by O'Brien and Gere Engineers, Inc (OBG) in January 2018 to document 2017 groundwater monitoring activities at Basins A, B and C to satisfy the requirements of §257.90(e). The 2017 Annual Report documents the completion of background groundwater monitoring (eight sampling events), which were completed between November 2015 and July 2017; and the first detection monitoring sampling event, which was completed in November 2017.

Following the preparation of the 2017 Annual Report, OBG performed a determination of statistically significant increases (SSIs) over background concentrations for Appendix III constituents for the wells around the Basins. On January 11, 2018 in accordance with 40 CFR Part 257, Subpart D, §257.93(h)(2) OBG documented their findings in a letter dated January 14, 2018, which was placed into the facility's operating record. SSIs documented in the letter included the following Appendix III constituents at unspecified monitoring well locations:

- Boron
- Calcium
- Chloride
- Fluoride
- Sulfate
- Total Dissolved Solids

CCR Rule regulation 40 CFR §257.94(e)(2) states the following,

> *"the owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels within 90 days from the date of determination."*

The demonstration of an alternate source is frequently referred to as an Alternative Source Demonstration (ASD). The framework for ASD was developed in 1991 USEPA Subtitle D groundwater monitoring regulations for municipal solid waste landfills in 40 CFR Part 258. The objective of this ASD is to provide sufficient evidence, after detailed data evaluation, that the SSIs identified in the 2017 Annual Groundwater Monitoring and Corrective Action Report resulted from sources other than the CCR unit.

## 1.1 Purpose

This ASD has been prepared by GEI Consultants, Inc., on behalf of Brayton Point, LLC, to address the SSIs identified for the parameters listed above and to demonstrate that the identified statistical increases are an artifact of a statistical evaluation that established upper prediction limits that did not account for the natural variability in background groundwater using a weight-of-evidence based approach.

## 1.2 Geology, Hydrogeology and Hydrochemistry

The Brayton Point Station is situated on a small peninsular area in Mt. Hope Bay, near the confluence of the Taunton and Lee Rivers. Based on soil borings completed in 2015 during monitoring well installations around the Basins (monitoring wells MW802, MW803, MW804 and MW805), the Site geology in the vicinity of Basins A, B and C consists of an unconsolidated sequence of sand, silty sand, gravel and discontinuous clay interbeds with a combined thickness of approximately 50 feet. Glacial till underlies the silty sand sequence and separates the silty sand from the underlying bedrock.

The dominant sitewide groundwater flow direction is southward toward the Mt. Hope Bay and the Taunton River from upland areas to the north. A groundwater contour map for the Third Quarter 2017 groundwater monitoring event is provided as Fig. 2. Groundwater flow occurs principally in the native silty sand unit, which is defined as the uppermost aquifer at the facility as defined in 40 CFR §257.53.

Background groundwater quality for Basins A, B and C is established using monitoring wells MW801 and MW301 which are located approximately 700 feet and 1,600 feet north (upgradient) of the Basins, respectively. Monitoring well MW801 is installed at a total depth

of 28 feet, with a 10-foot long well screen, monitoring the silty sand and uppermost portion of the till unit. Background monitoring well MW301 is installed to a total depth of approximately 50 feet, with a 40-foot long well screen principally installed in the till unit.

Total Dissolved Solids (TDS) is a general measure of the overall quality of groundwater. Concentrations of TDS in background monitoring well MW801 varied between 440 and 960 mg/L during the 2015-2017 background monitoring period. Comparatively, TDS concentrations in background monitoring well MW301 varied from 60 to 100 mg/L. A statistical analysis that compared geochemistry between the two wells identified significant variance between concentrations of all Appendix III constituents except fluoride, which was not detected in either well during background monitoring. The statistically significant variance is an indication that background groundwater quality at the facility is spatially variable. This variability is discussed in detail in the following section.

# 2. Alternative Source Demonstration

The following SSIs were identified in unspecified Basin monitoring wells by OBG during the first detection monitoring event which was performed in November 2017:

- Boron
- Calcium
- Chloride
- Fluoride
- Sulfate
- Total Dissolved Solids

Our review of sampling methods and laboratory analytical protocols validated the usability of the data that was statistically evaluated in OBG's 2017 Annual Report and OBG's January 14, 2018 Determination of SSIs over Background Levels. Therefore, this ASD has addressed the methods of statistical data assessment as a possible cause of the SSIs identified at Basins A, B and C as well as the natural variability of dissolved constituents in groundwater.

## 2.1 Methods

The evaluation of statistical error in determining false SSIs was assessed for Basin A, B and C data through: 1) review of variability in background (upgradient) monitoring wells and 2) revision of the statistical application appropriate for the population. In accordance with the Statistical Analysis Plan (O'Brien and Gere, 2017), GEI resampled monitoring wells in February 2018 to confirm the presence of an SSI.

## 2.2 Statistical Analysis

The statistical evaluation of groundwater data for Basins A, B and C was performed in accordance with the Statistical Analysis Plan developed for the Site and the 2009 USEPA Unified Guidance Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities. GEI utilizes Sanitas™ software, a third-party statistical program designed specifically for statistical analysis of groundwater data and frequently used for CCR sites across the United States.

OBG's determination of SSIs in downgradient groundwater documented in the January 14, 2018 letter was based on an interwell upper prediction limit (UPL) approach to data evaluation which utilizes pooled upgradient monitoring well data against which downgradient groundwater quality is compared. With an interwell approach, exceedance of a UPL constitutes an SSI for the respective analyte. Use of the interwell UPL method assumes the hypothesis that the background data population is not spatially variable. To evaluate this hypothesis, a one-way Analysis of Variance (ANOVA) was computed for background wells utilizing an alpha value of 0.05 in accordance with the USEPA Unified Guidance and

CCR Rule. Results of the ANOVA test indicates that significant variation, or a significant difference in the median concentrations exists for boron, calcium, chloride, fluoride, sulfate and TDS in background monitoring wells MW301 and MW801. Results of the ANOVA analysis is provided in Appendix A.

Box and Whisker plots were also generated for the Appendix III parameters in background monitoring wells MW301 and MW801 to further evaluate spatial variability in background groundwater. Box and Whisker Plots, presented in Appendix B, visually summarize the upper and lower range of concentrations as well as the median and mean concentration for a given analyte in each monitoring well. The mean concentrations and concentration ranges indicate that significant spatial variability exists for boron, calcium, chloride, sulfate and TDS in background groundwater.

Based on the presence of variability in the background population of the above-described analytes and because the variability in these upgradient wells is not attributable to a release from a CCR unit, an intrawell data comparison (in contrast to an interwell data comparison) was performed in accordance with the Statistical Analysis Plan, which states that if spatial variability is not due to an existing release, intrawell comparisons in downgradient wells may be used to evaluate groundwater quality.

Consistent with the USEPA Unified Guidance, the use of intrawell UPLs evaluates background data from a single monitoring well and evaluates compliance monitoring results against only data from that well. Utilizing this method, the presence of spatial variability in background is eliminated and the presence of trending data is evaluated within a single well. Therefore, intrawell UPLs were constructed utilizing the background and detection monitoring data in each monitoring well and are presented in Appendix C. Utilizing the intrawell UPL approach to the data evaluation, the following SSIs were determined for the Basin A, B and C monitoring network.

- MW802- Calcium, TDS
- MW804- Chloride

These SSIs were further evaluated by comparing the concentrations of each constituent exhibiting an SSI with concentrations in the upgradient monitoring network. Time-concentration trend plots (Appendix D) were prepared which compare upgradient groundwater concentrations of the above-listed parameters with the concentration trend in each downgradient well exhibiting the SSI. The following table summarizes the observed SSI concentrations and the respective upgradient concentrations for each parameter during the February 2018 sampling event.

| Appendix III Parameter Exhibiting SSI | Downgradient SSI Concentration (mg/L) and Location | Upgradient Concentration (mg/L) and Location |
|---|---|---|
| **Calcium** | 124 (MW802) | 127 (MW801) |
| **Chloride** | 56.7 (MW804) | 164 (MW801) |
| **TDS** | 730 (MW802) | 960 (MW801) |

As shown in Appendix D and the summary table above, Appendix III parameters which exhibit SSIs in Basin monitoring wells were detected at higher concentrations in background (upgradient) groundwater. The time-series concentration plots also visually highlight the variability in both concentrations and trends of these parameters in background groundwater. The concentration trends for calcium, chloride and TDS were further evaluated for each background monitoring well utilizing the Mann-Kendall/ Sen's Estimate of Slope analysis. Mann-Kendall/ Sen's Slope plots are provided in Appendix E.

The following table summarizes the background (upgradient) concentration trends of Appendix III parameters exhibiting SSIs.

| Background Well ID | Concentration Trend* | | |
|---|---|---|---|
| | **Calcium** | **Chloride** | **TDS** |
| **MW301** | Decreasing | Stable | Increasing |
| **MW801** | Increasing | Increasing | Increasing |

*based on value of Sen's Slope

Appendix III parameters which exhibit SSIs in Basins A, B and C monitoring wells are present in background groundwater at higher concentrations and also exhibit increasing concentration trends in at least one background monitoring well (MW801). These concentrations and concentration trends indicate that downgradient groundwater quality is likely influenced by elevated concentrations in upgradient groundwater and not attributable to a release from Basins A, B and C.

# 3. Conclusion

GEI evaluated the potential for statistical error and natural variability in determining an alternative source of SSIs at Basins A, B and C in accordance with 40 CFR 257.94(e)(2). Natural variability in upgradient groundwater quality documented through ANOVA and Box and Whisker plots indicates non-homogenous (variable) background data and suggests that an intrawell comparison, rather than interwell comparison, of downgradient groundwater quality is appropriate for the evaluation of data. SSIs which were subsequently identified utilizing the intrawell comparison method include calcium (MW802), chloride (MW804) and TDS (MW802). However, further data evaluation identified higher concentrations of these constituents in upgradient monitoring well MW801. Furthermore, increasing concentration trends were also identified for each of these constituents in the upgradient well using a Mann-Kendall Sen's Slope analysis.

GEI has concluded that a release from Basins A, B and C has not occurred and that upgradient groundwater quality has influenced groundwater quality in the vicinity of the Basins. Therefore, no further action (i.e., assessment monitoring) is warranted and Basins A, B and C will remain in detection monitoring as the closure process proceeds.

# 4. References

GEI Consultants, Inc., 2017, Sampling and Analysis Plan, Brayton Point Ash Basin A, Ash Basin B, Ash Basin C, Brayton Point Power Station, Somerset, Massachusetts, Project 1508760, Revision 0, October 17, 2017.

Natural Resource Technology, an OBG Company, 2017, Statistical Analysis Plan, Brayton Point Power Station, Brayton Point Energy, LLC, October 17, 2017.

US Environmental Protection Agency, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities; Unified Guidance. EPA 530/R-09-007.

US Environmental Protection Agency, May 2009. National Primary Drinking Water Regulations. EPA 816-F-09-004.

WQStat Plus by Sanitas Technologies User Manual v.9.4.41, 2014.

# Figures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Alternative Source Demonstration

Brayton Point, LLC
Somerset, Massachusetts

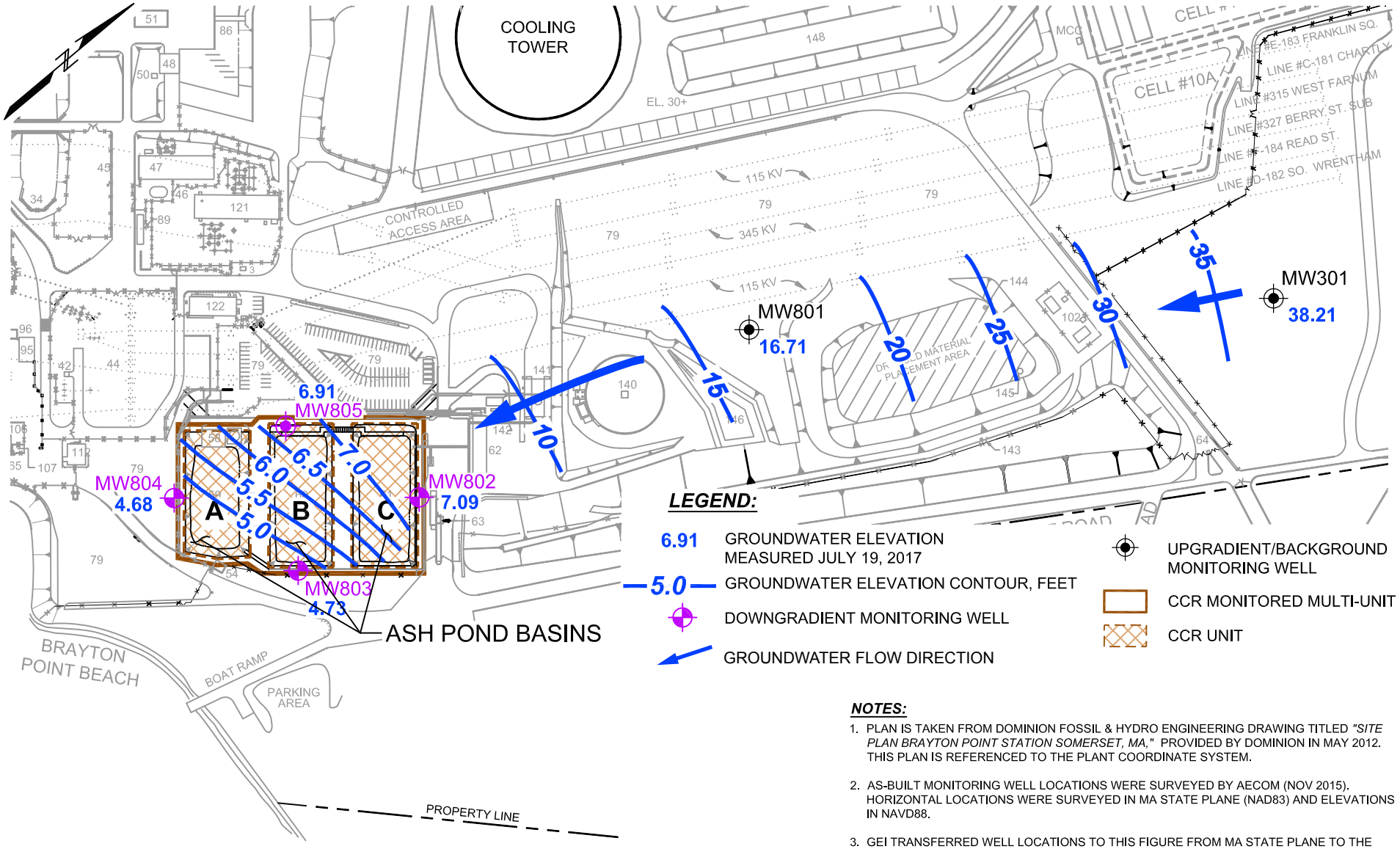
GEI Consultants

SITE LOCATION MAP

Project 1800705

April 2018

Figure 1




**NOTES:**

1. PLAN IS TAKEN FROM DOMINION FOSSIL & HYDRO ENGINEERING DRAWING TITLED *"SITE PLAN BRAYTON POINT STATION SOMERSET, MA,"* PROVIDED BY DOMINION IN MAY 2012. THIS PLAN IS REFERENCED TO THE PLANT COORDINATE SYSTEM.
2. AS-BUILT MONITORING WELL LOCATIONS WERE SURVEYED BY AECOM (NOV 2015). HORIZONTAL LOCATIONS WERE SURVEYED IN MA STATE PLANE (NAD83) AND ELEVATIONS IN NAVD88.
3. GEI TRANSFERRED WELL LOCATIONS TO THIS FIGURE FROM MA STATE PLANE TO THE PLANT COORDINATE SYSTEM USING KNOWN REFERENCE POINTS.

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Alternative Source Demonstration

Brayton Point, LLC
Somerset, Massachusetts

GEI Consultants

SITE LAYOUT AND GROUNDWATER CONTOUR MAP

Project 1800705 | April 2018 | Figure 2

# Appendix A

## Background ANOVA Summary

# Parametric ANOVA

Constituent: Boron, total  Analysis Run 4/4/2018 2:59 PM
Brayton Point  Client: GEI  Data: Brayton Point CCR Database

For observations made between 11/23/2015 and 2/26/2018 the parametric analysis of variance test indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 14.58

Tabulated F statistic = 2.904 with 3 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Squares | F |
|---|---|---|---|---|
| Between Groups | 9.426 | 3 | 3.142 | 10.72 |
| Error Within Groups | 9.084 | 31 | 0.293 | |
| Total | 18.51 | 34 | | |

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.05, calculated = 0.9651, critical = 0.935. Levene's Equality of Variance test passed. Calculated = 0.8191, tabulated = 2.904.

# Non-Parametric ANOVA

Constituent: Calcium, total  Analysis Run 4/4/2018 2:59 PM
Brayton Point  Client: GEI  Data: Brayton Point CCR Database

For observations made between 11/23/2015 and 2/26/2018, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 19.69

Tabulated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.

There were 1 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 19.69
Adjusted Kruskal-Wallis statistic (H') = 19.69

# Non-Parametric ANOVA

Constituent: Chloride  Analysis Run 4/4/2018 2:59 PM
Brayton Point  Client: GEI  Data: Brayton Point CCR Database

For observations made between 11/23/2015 and 2/26/2018, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 27.71

Tabulated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.

There were 0 groups of ties in the data, so no adjustment to the Kruskal-Wallis statistic (H) was necessary.

# Non-Parametric ANOVA

Constituent: Fluoride  Analysis Run 4/4/2018 2:59 PM
Brayton Point  Client: GEI  Data: Brayton Point CCR Database

For observations made between 11/23/2015 and 2/26/2018, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 8.059

Tabulated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.

There were 7 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 8.032
Adjusted Kruskal-Wallis statistic (H') = 8.059

# Parametric ANOVA

Constituent: pH [field] Analysis Run 4/4/2018 2:59 PM
Brayton Point Client: GEI Data: Brayton Point CCR Database

For observations made between 11/23/2015 and 11/14/2017 the parametric analysis of variance test indicates NO VARIATION at the 5% significance level. Because the calculated F statistic is less than or equal to the tabulated F statistic, the hypothesis of a single homogeneous population is accepted.

Calculated F statistic = 1.809

Tabulated F statistic = 2.904 with 3 and 32 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Squares | F |
|---|---|---|---|---|
| Between Groups | 9.426 | 3 | 3.142 | 10.72 |
| Error Within Groups | 9.084 | 31 | 0.293 | |
| Total | 18.51 | 34 | | |

The Shapiro Wilk normality test on the residuals passed on the raw data. Alpha = 0.05, calculated = 0.9863, critical = 0.935. Levene's Equality of Variance test passed. Calculated = 0.3913, tabulated = 2.904.

# Parametric ANOVA

Constituent: Sulfate  Analysis Run 4/4/2018 2:59 PM
Brayton Point  Client: GEI  Data: Brayton Point CCR Database

For observations made between 11/23/2015 and 2/26/2018 the parametric analysis of variance test (after cube root transformation) indicates VARIATION at the 5% significance level. Because the calculated F statistic is greater than the tabulated F statistic, the hypothesis of a single homogeneous population is rejected.

Calculated F statistic = 10.72

Tabulated F statistic = 2.912 with 3 and 31 degrees of freedom at the 5% significance level.

ONE-WAY PARAMETRIC ANOVA TABLE

| Source of Variation | Sum of Squares | Degrees of Freedom | Mean Squares | F |
|---|---|---|---|---|
| Between Groups | 9.426 | 3 | 3.142 | 10.72 |
| Error Within Groups | 9.084 | 31 | 0.293 | |
| Total | 18.51 | 34 | | |

The Shapiro Wilk normality test on the residuals passed after cube root transformation. Alpha = 0.05, calculated = 0.936, critical = 0.934. Levene's Equality of Variance test passed. Calculated = 2.555, tabulated = 2.912.

# Non-Parametric ANOVA

Constituent: Total Dissolved Solids  Analysis Run 4/4/2018 2:59 PM
Brayton Point  Client: GEI  Data: Brayton Point CCR Database

For observations made between 11/23/2015 and 11/15/2017, the non-parametric analysis of variance test indicates a DIFFERENCE between the medians of the groups tested at the 5% significance level. Because the calculated Kruskal-Wallis statistic is greater than the Chi-squared value, we conclude that at least one group has a significantly different median concentration of this constituent when compared to another group.

Calculated Kruskal-Wallis statistic = 21.87

Tabulated Chi-Squared value = 7.815 with 3 degrees of freedom at the 5% significance level.

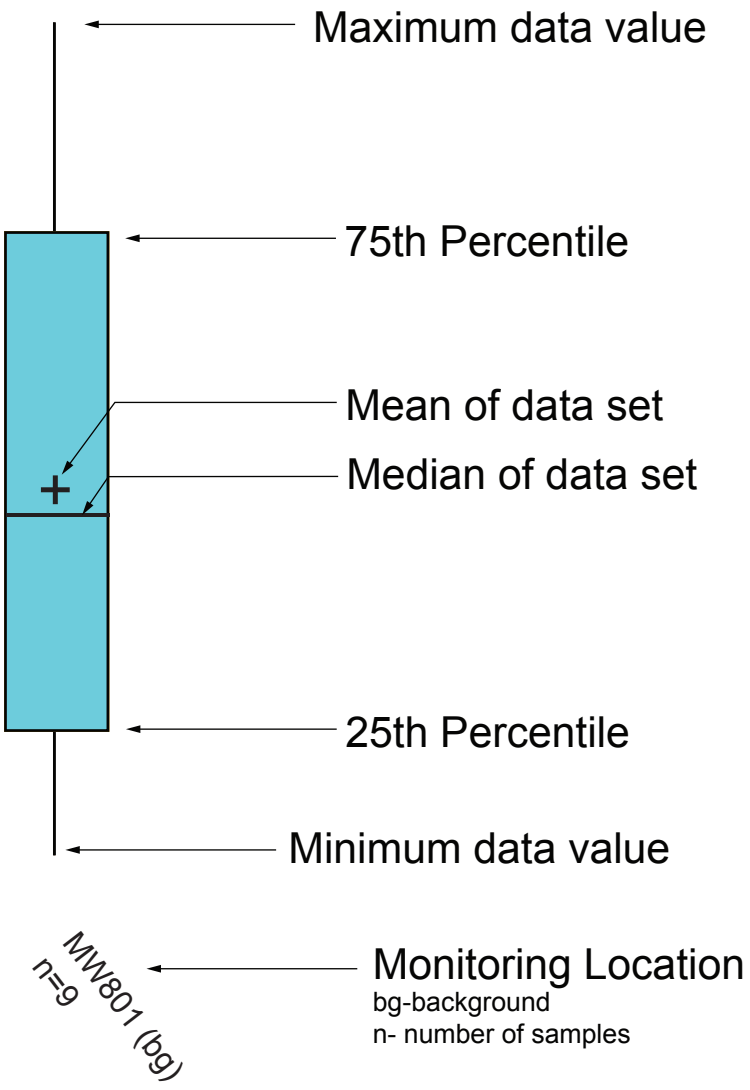
There were 9 groups of ties in the data, consequently the Kruskal-Wallis statistic (H) was adjusted. The adjusted statistic (H') was utilized to determine if the medians were equal.
Kruskal-Wallis statistic (H) = 21.8
Adjusted Kruskal-Wallis statistic (H') = 21.87

# Appendix B

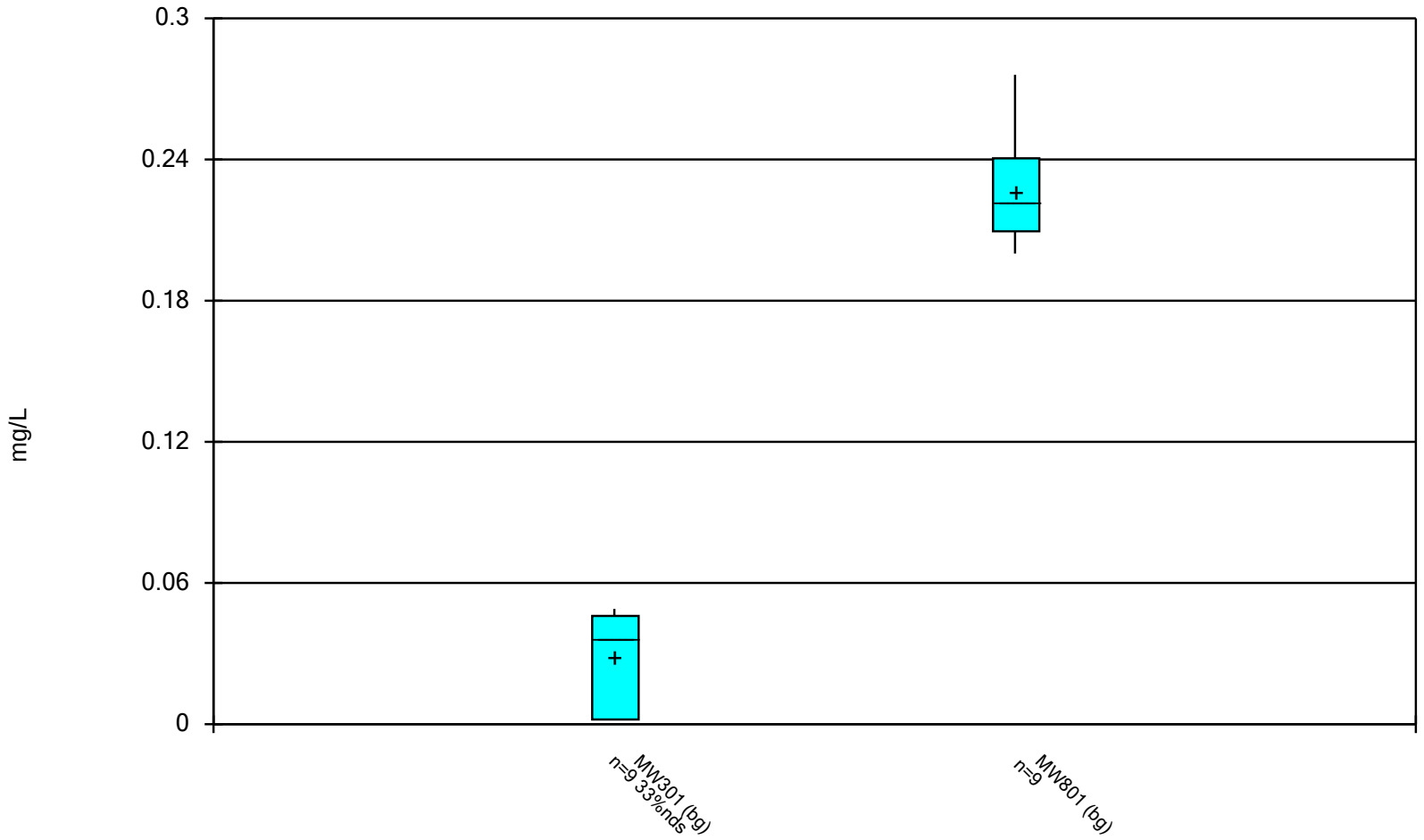
## Background Box and Whisker Plots

# Background Box and Whisker Plots

## LEGEND



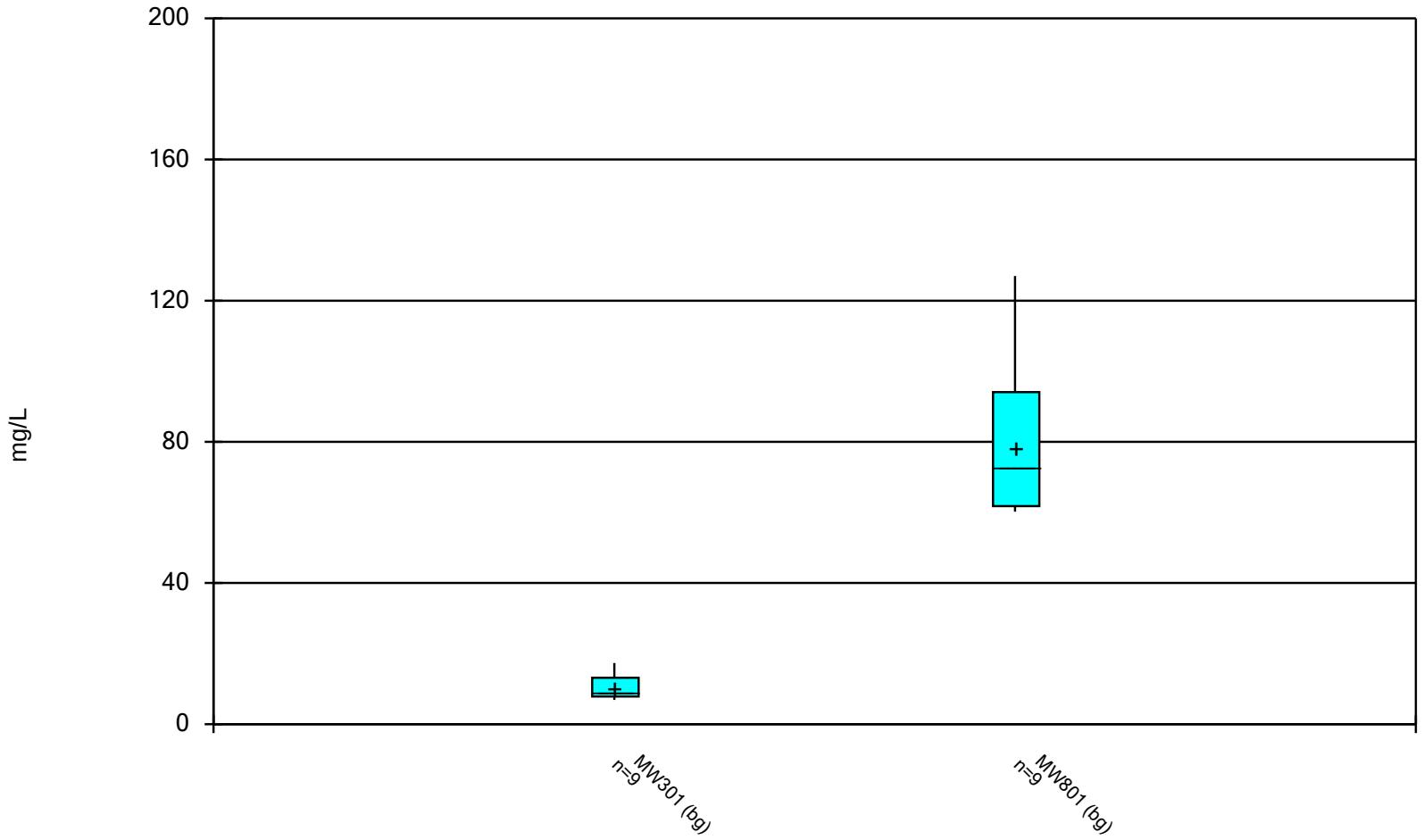
# Box & Whiskers Plot




Constituent: Boron, total  Analysis Run 4/4/2018 3:01 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

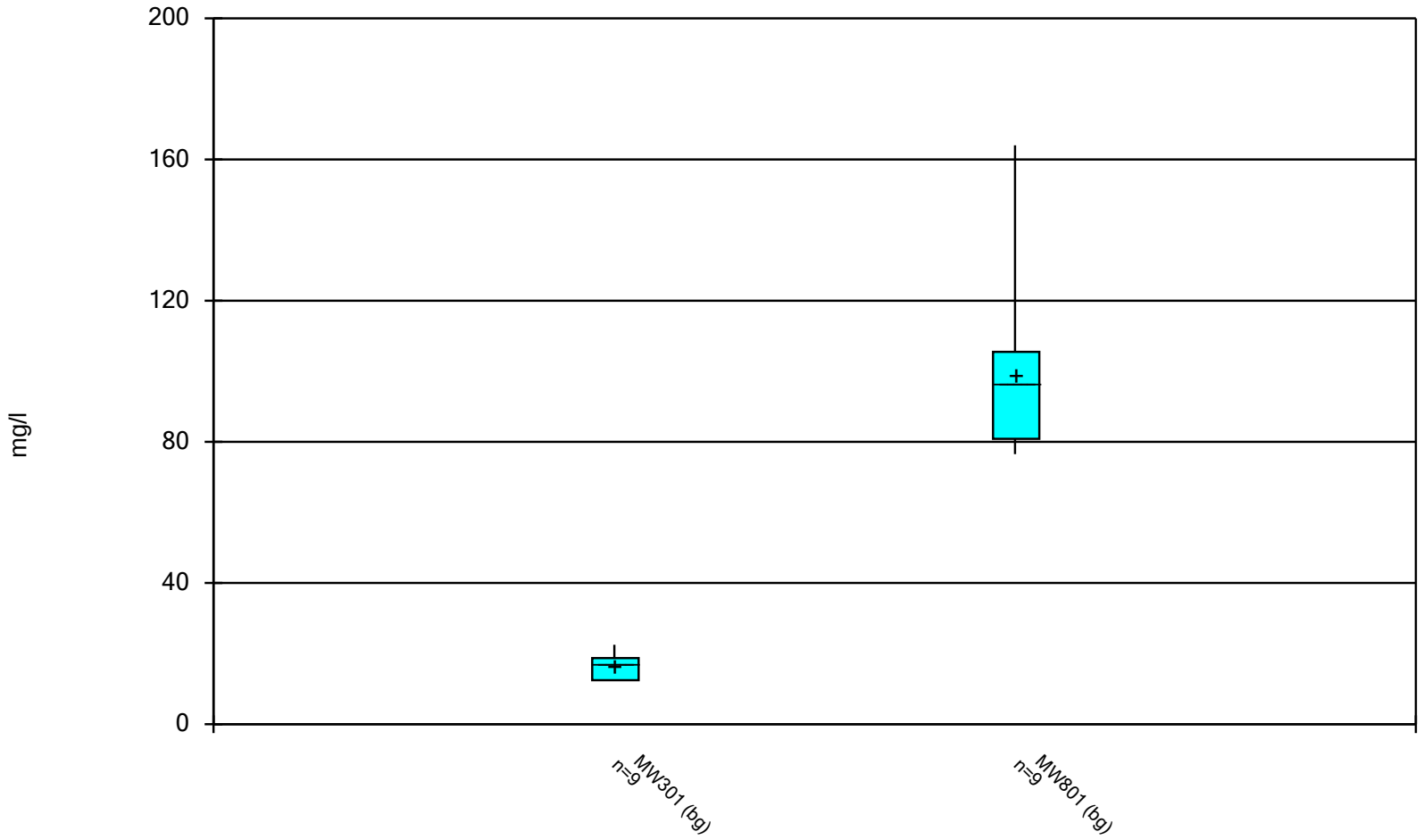
# Box & Whiskers Plot




Constituent: Calcium, total  Analysis Run 4/4/2018 3:01 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

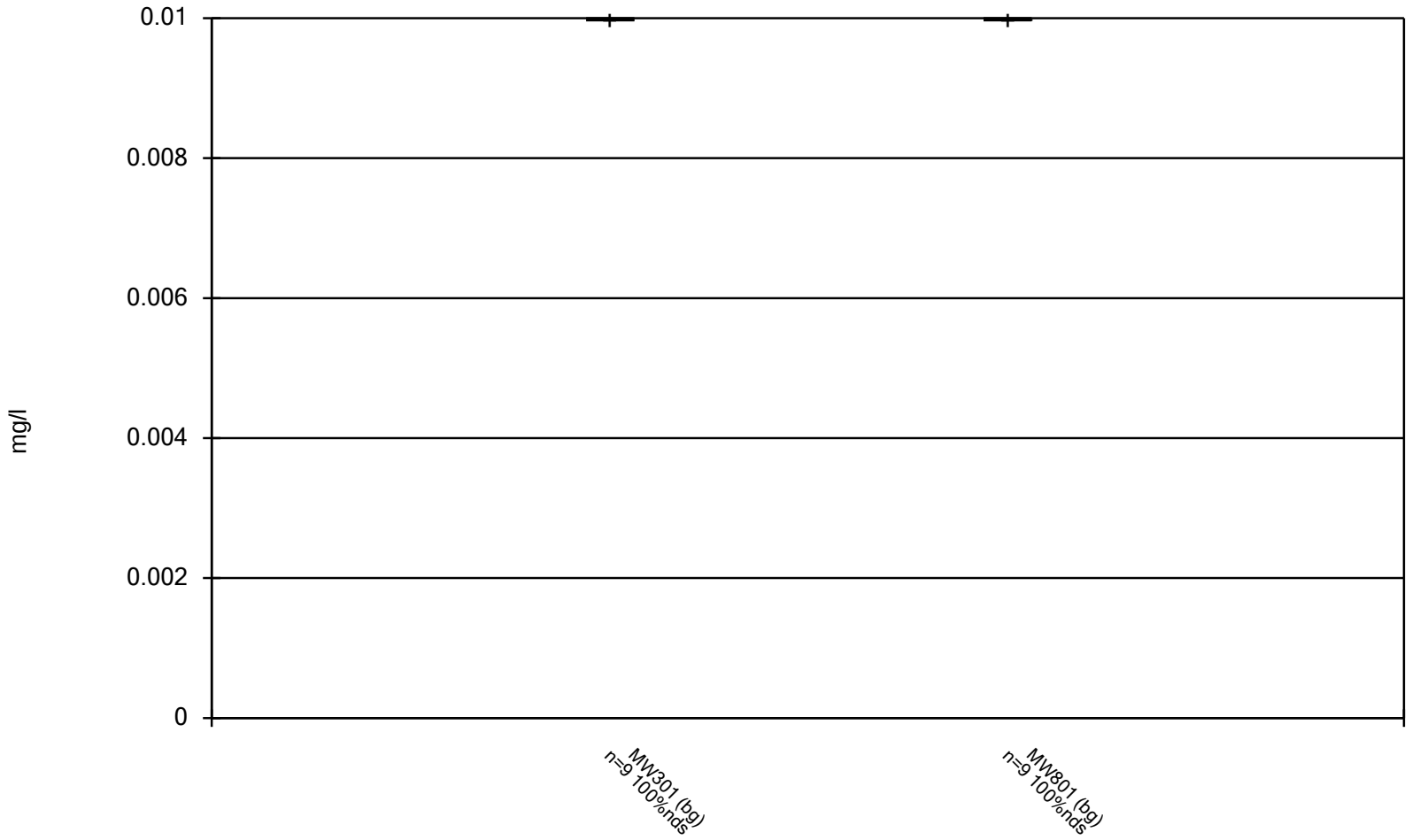
# Box & Whiskers Plot




Constituent: Chloride  Analysis Run 4/4/2018 3:01 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

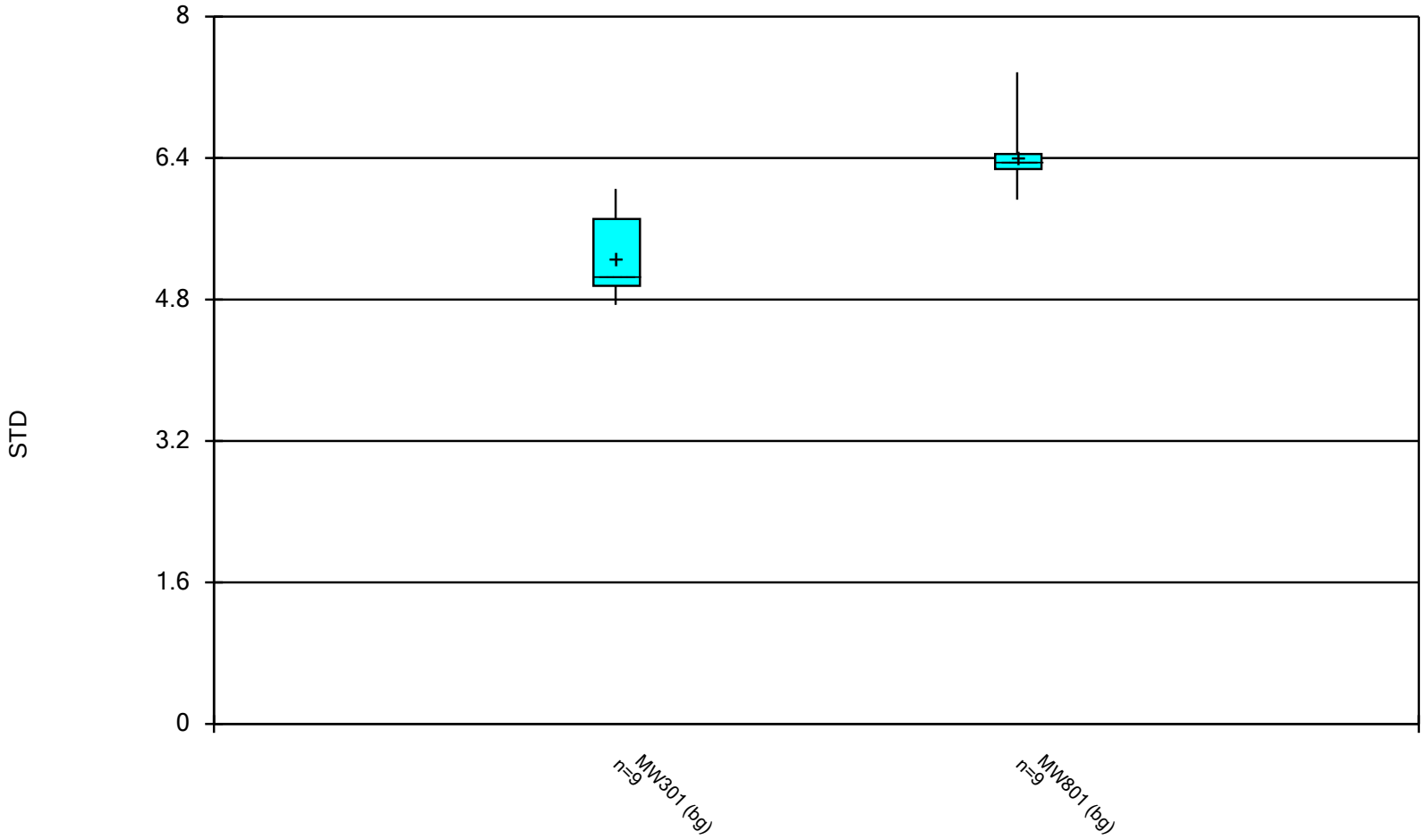
# Box & Whiskers Plot




Constituent: Fluoride  Analysis Run 4/4/2018 3:01 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

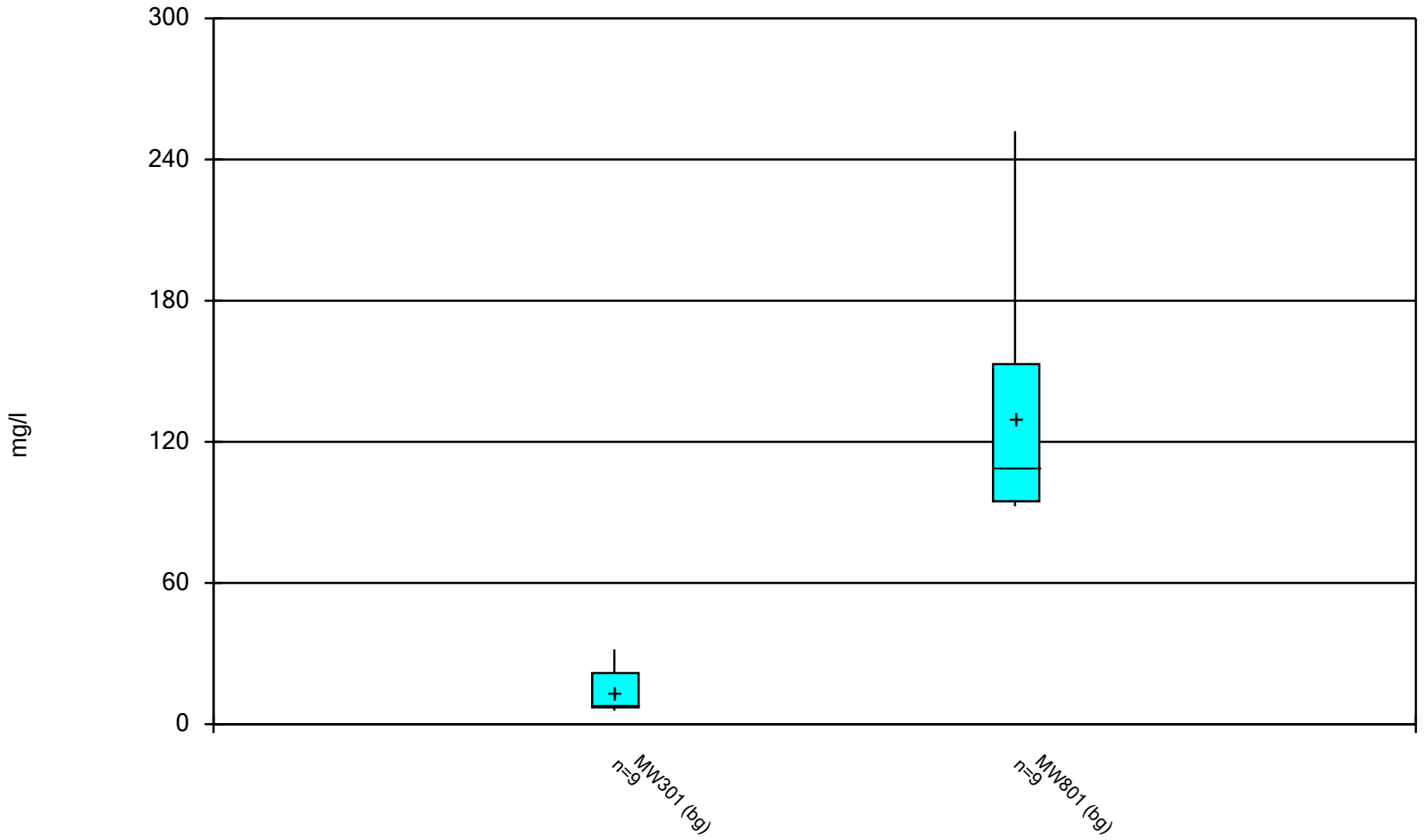
# Box & Whiskers Plot




Constituent: pH [field] Analysis Run 4/4/2018 3:01 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

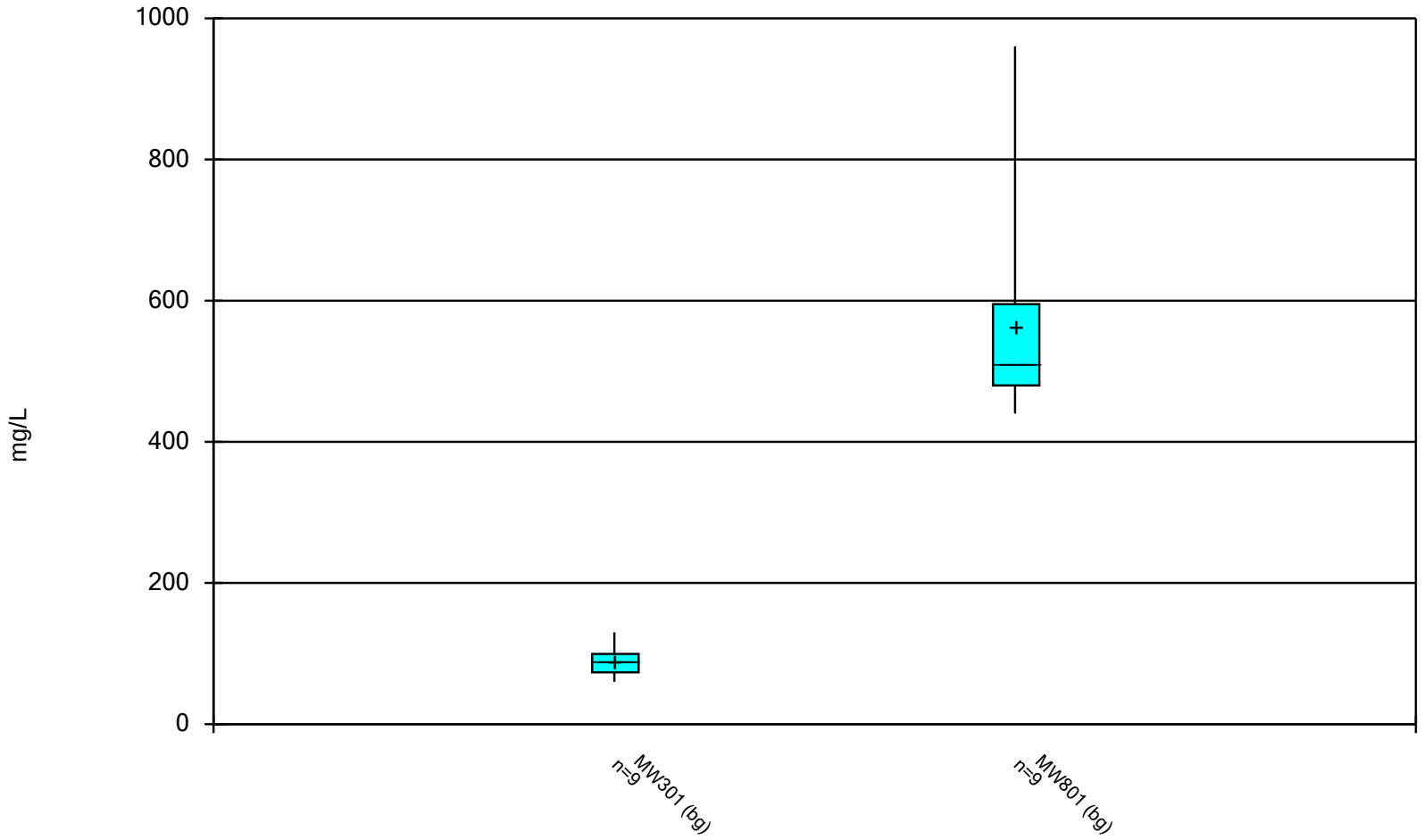
# Box & Whiskers Plot




Constituent: Sulfate  Analysis Run 4/4/2018 3:01 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

# Box & Whiskers Plot




Constituent: Total Dissolved Solids  Analysis Run 4/4/2018 3:01 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

# Box & Whiskers Plot

Brayton Point Client: GEI Data: Brayton Point CCR Database Printed 4/4/2018, 3:02 PM

| Constituent | Well | N | Mean | Std. Dev. | Std. Err. | Median | Min. | Max. | %NDs |
|---|---|---|---|---|---|---|---|---|---|
| Boron, total (mg/L) | MW301 (bg) | 9 | 0.02841 | 0.02058 | 0.006859 | 0.0357 | 0.002 | 0.049 | 33.33 |
| Boron, total (mg/L) | MW801 (bg) | 9 | 0.226 | 0.02471 | 0.008236 | 0.222 | 0.2 | 0.276 | 0 |
| Calcium, total (mg/L) | MW301 (bg) | 9 | 10.38 | 3.453 | 1.151 | 8.93 | 6.86 | 17.3 | 0 |
| Calcium, total (mg/L) | MW801 (bg) | 9 | 78.74 | 23.79 | 7.93 | 73 | 60.2 | 127 | 0 |
| Chloride (mg/l) | MW301 (bg) | 9 | 16.49 | 3.52 | 1.173 | 17.1 | 12.2 | 22.5 | 0 |
| Chloride (mg/l) | MW801 (bg) | 9 | 99.16 | 26.63 | 8.878 | 96.6 | 76.5 | 164 | 0 |
| Fluoride (mg/l) | MW301 (bg) | 9 | 0.01 | 0 | 0 | 0.01 | 0.01 | 0.01 | 100 |
| Fluoride (mg/l) | MW801 (bg) | 9 | 0.01 | 0 | 0 | 0.01 | 0.01 | 0.01 | 100 |
| pH [field] (STD) | MW301 (bg) | 9 | 5.268 | 0.445 | 0.1483 | 5.06 | 4.74 | 6.05 | 0 |
| pH [field] (STD) | MW801 (bg) | 9 | 6.423 | 0.3876 | 0.1292 | 6.37 | 5.93 | 7.37 | 0 |
| Sulfate (mg/l) | MW301 (bg) | 9 | 13.66 | 10.08 | 3.36 | 8.2 | 5.75 | 31.8 | 0 |
| Sulfate (mg/l) | MW801 (bg) | 9 | 129.5 | 51.53 | 17.18 | 109 | 92.6 | 252 | 0 |
| Total Dissolved Solids (mg/L) | MW301 (bg) | 9 | 89.33 | 20.08 | 6.694 | 90 | 60 | 130 | 0 |
| Total Dissolved Solids (mg/L) | MW801 (bg) | 9 | 565.6 | 156.7 | 52.23 | 510 | 440 | 960 | 0 |

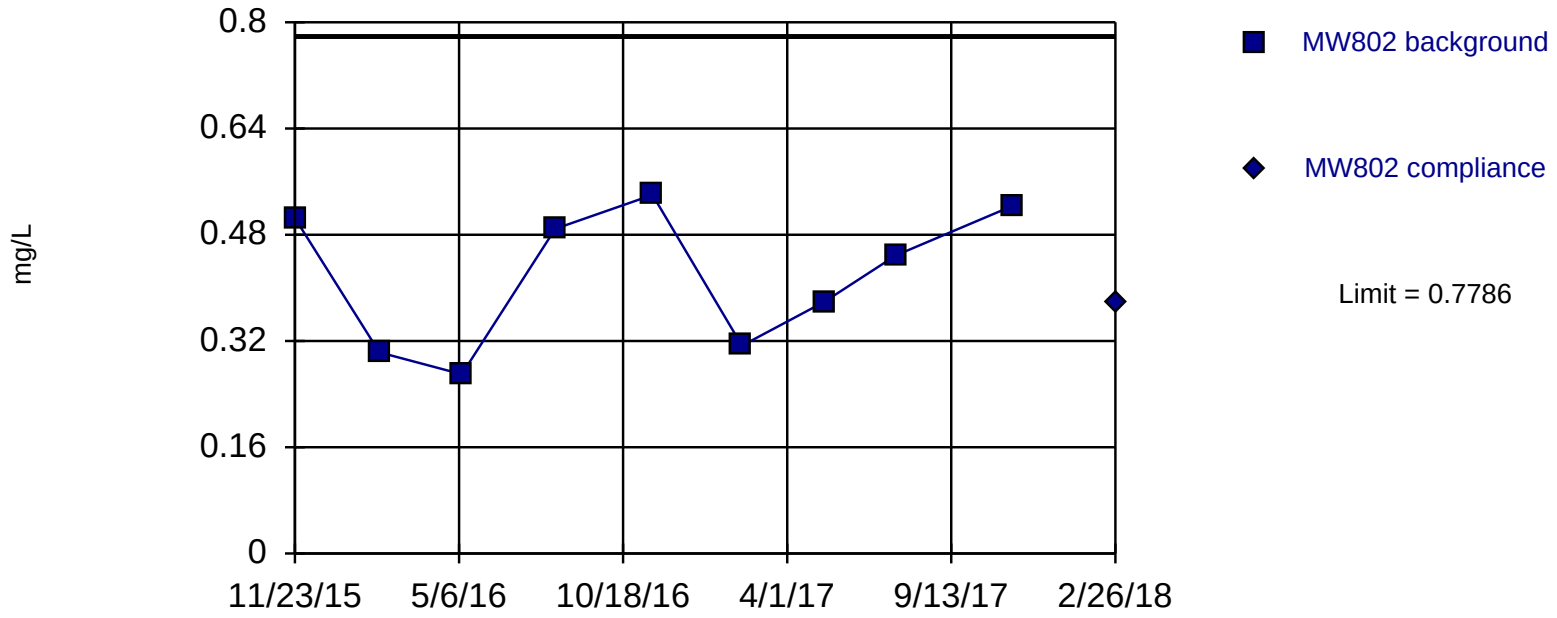
# Appendix C

## Intrawell Upper Prediction Limits

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=0.419, Std. Dev.=0.1044, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8913, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

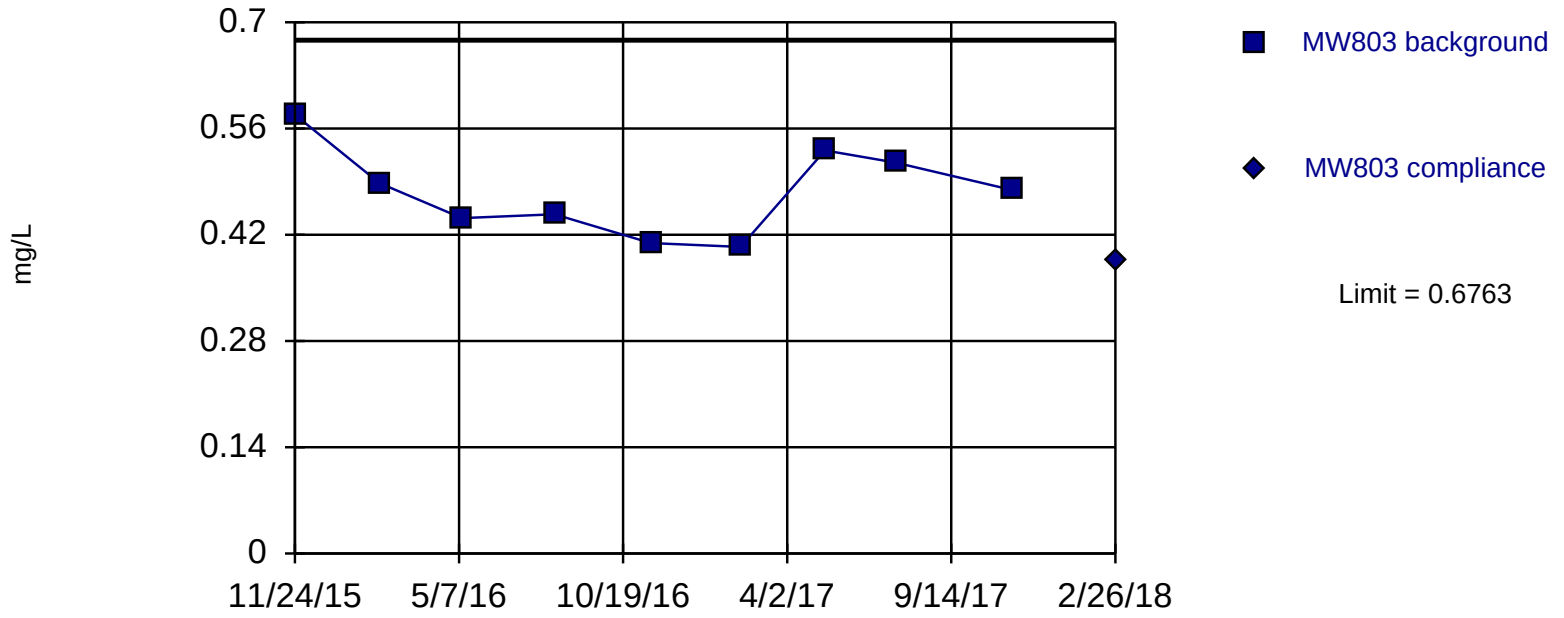
Constituent: Boron, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=0.477, Std. Dev.=0.05784, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9605, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

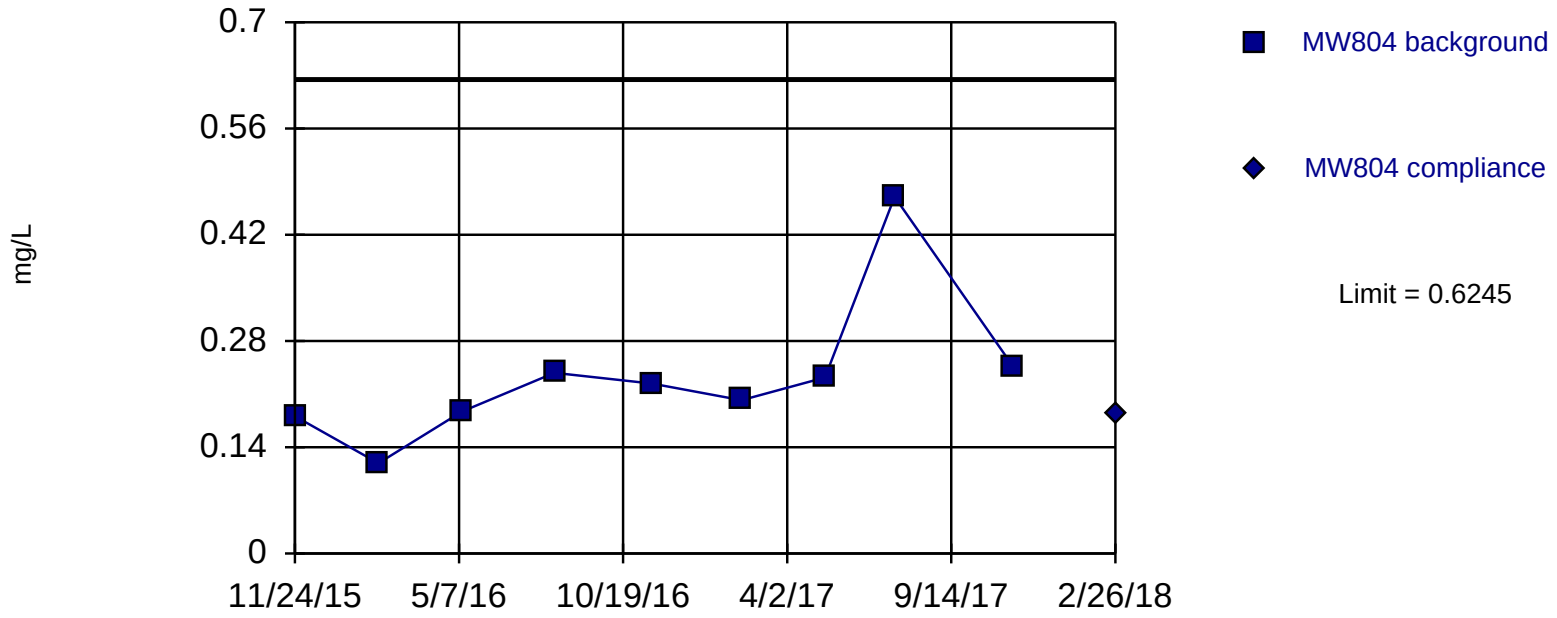
Constituent: Boron, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary (based on square root transformation): Mean=0.4753, Std. Dev.=0.09142, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8454, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

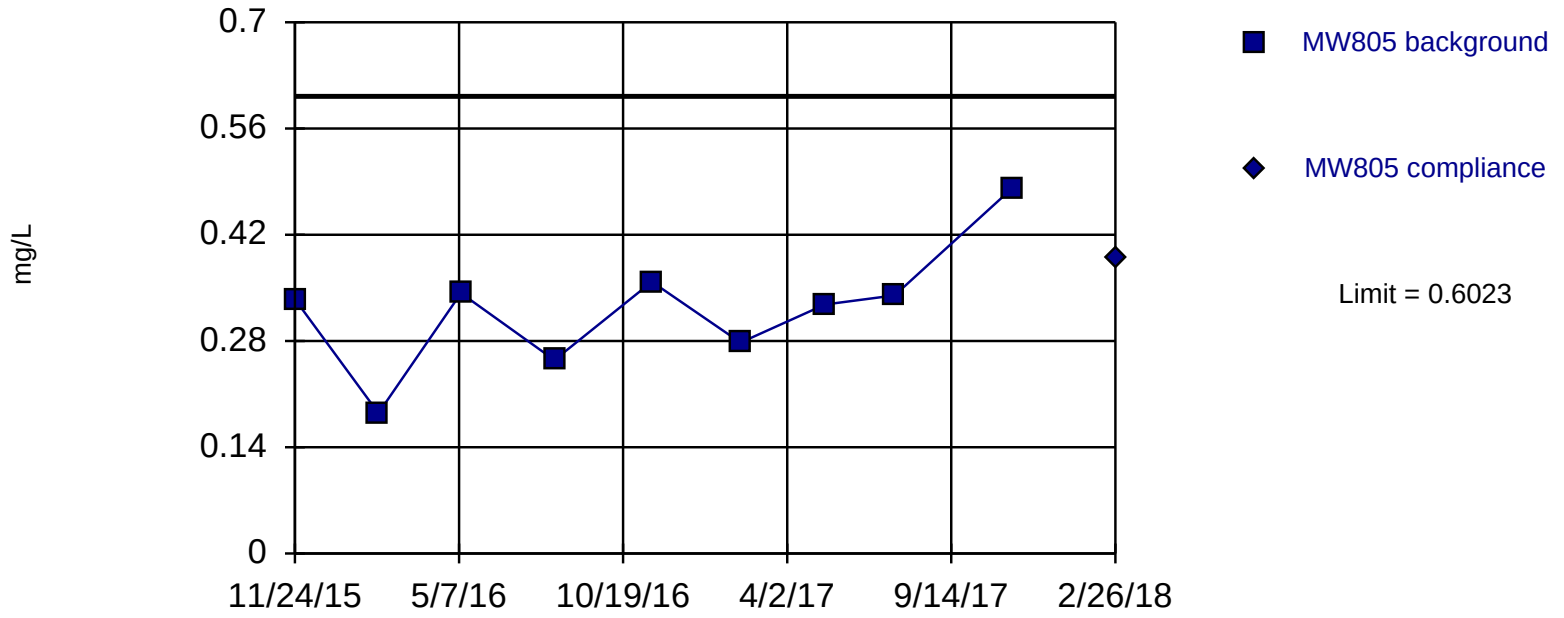
Constituent: Boron, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=0.3226, Std. Dev.=0.08119, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9318, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

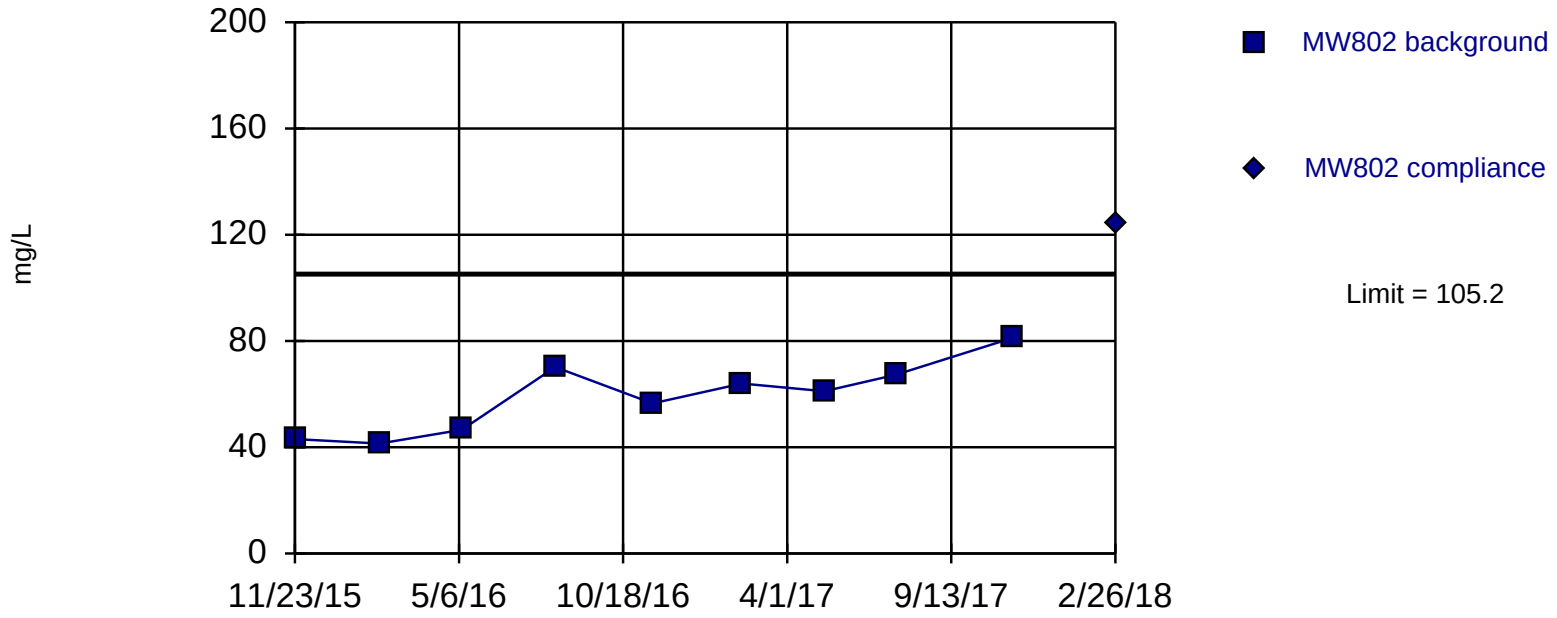
Constituent: Boron, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Exceeds Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=59.03, Std. Dev.=13.39, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9525, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

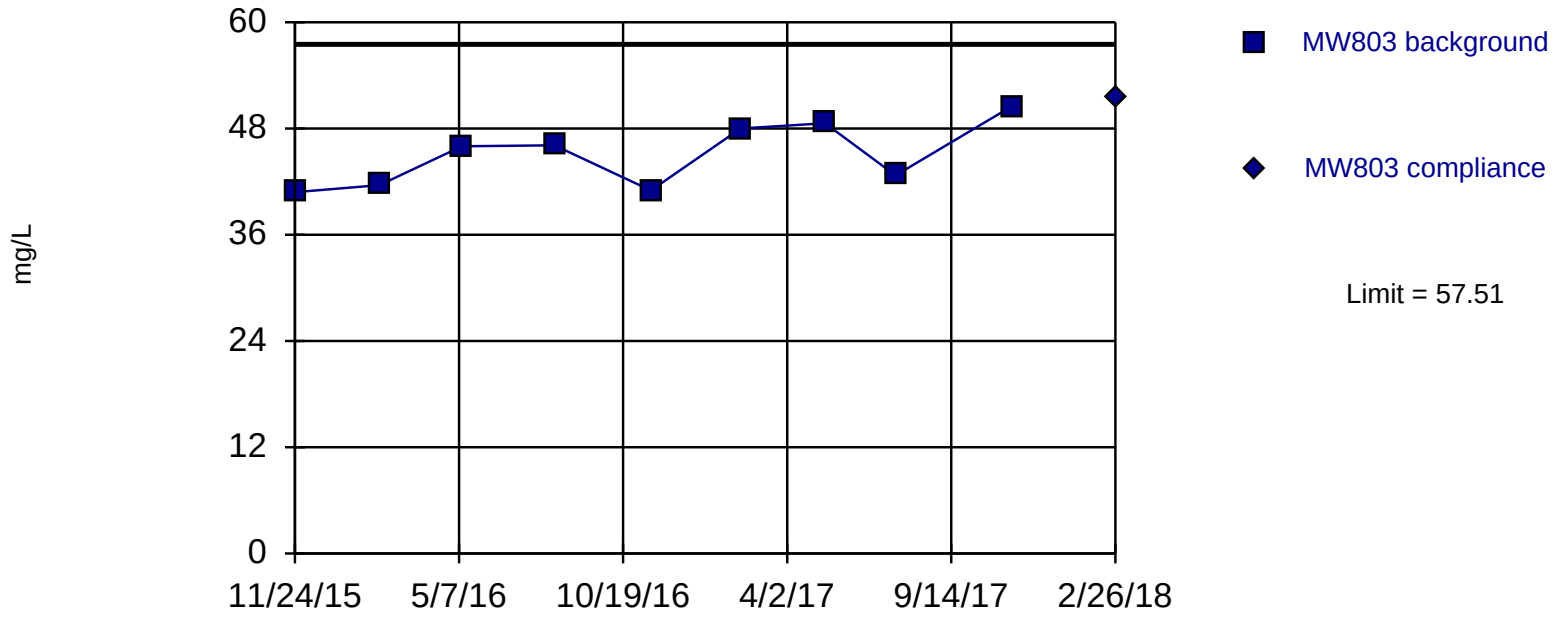
Constituent: Calcium, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=45.03, Std. Dev.=3.621, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9087, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

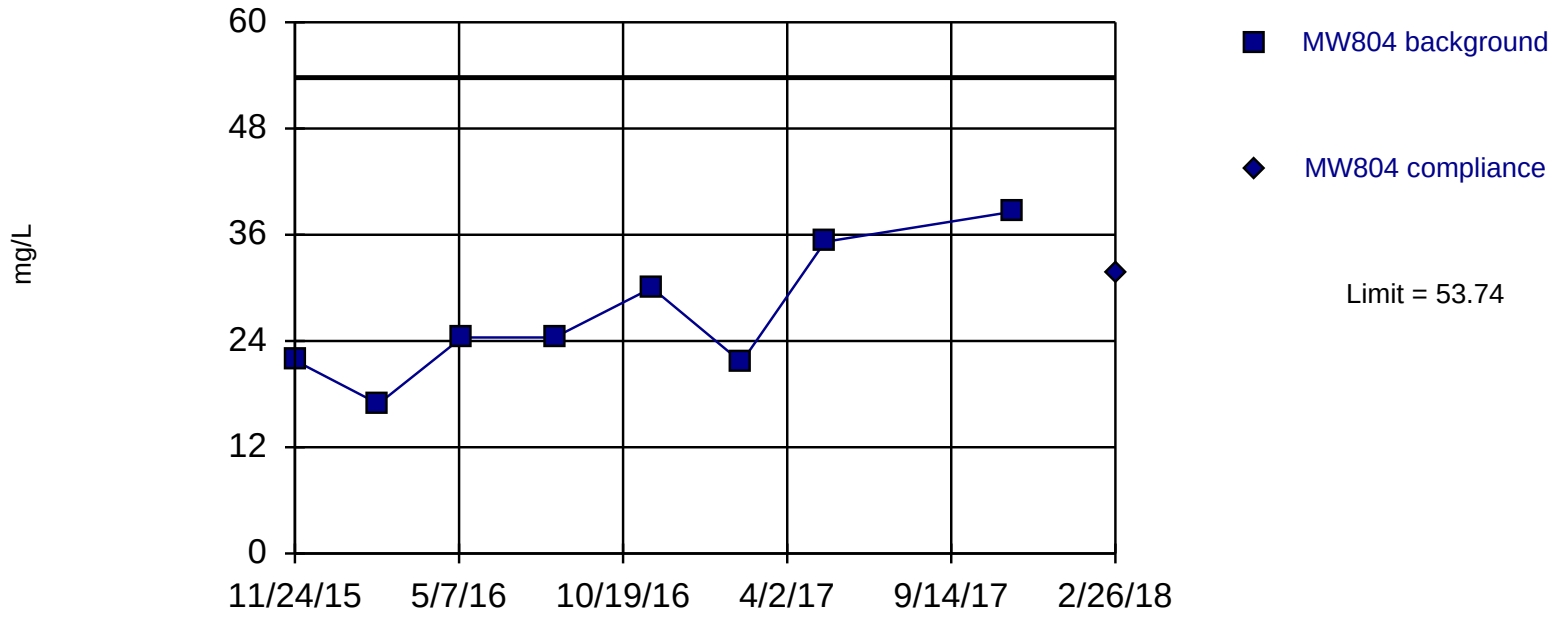
Constituent: Calcium, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=26.61, Std. Dev.=7.381, n=8. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9333, critical = 0.818. Kappa = 3.675 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

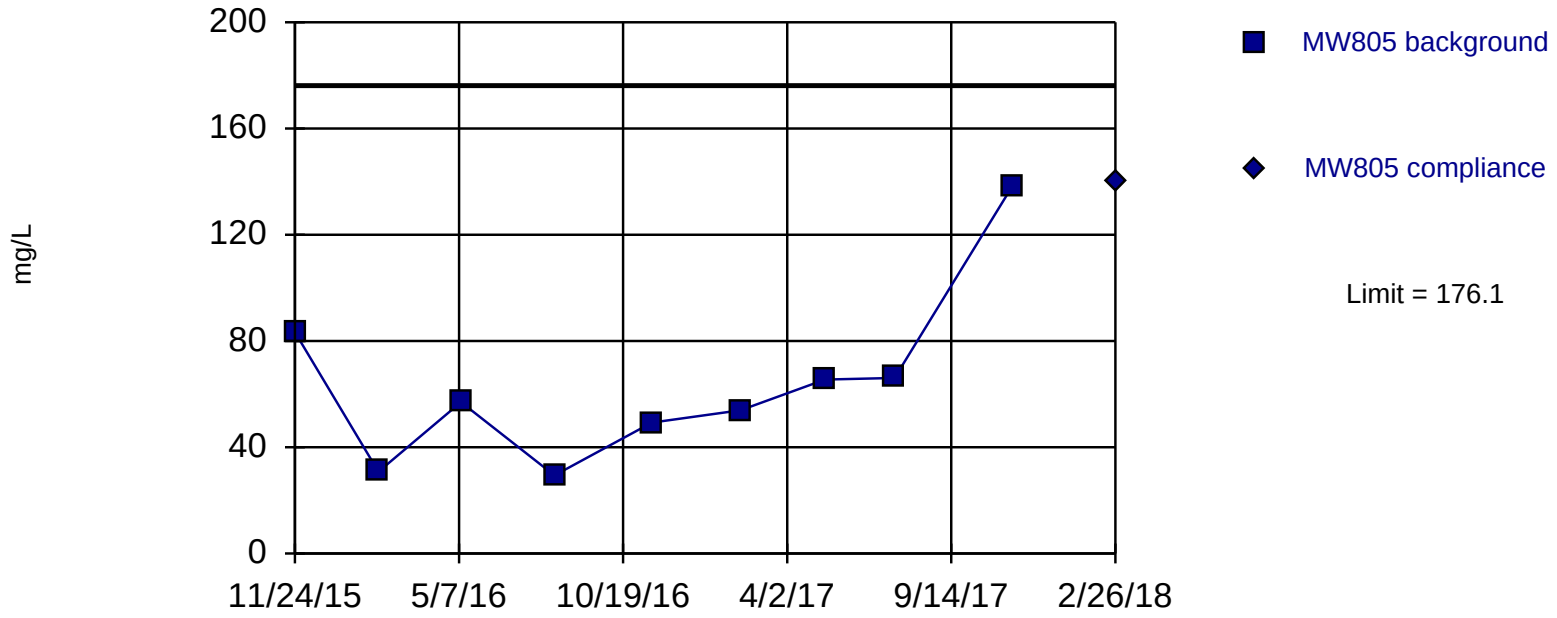
Constituent: Calcium, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=63.7, Std. Dev.=32.64, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8558, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

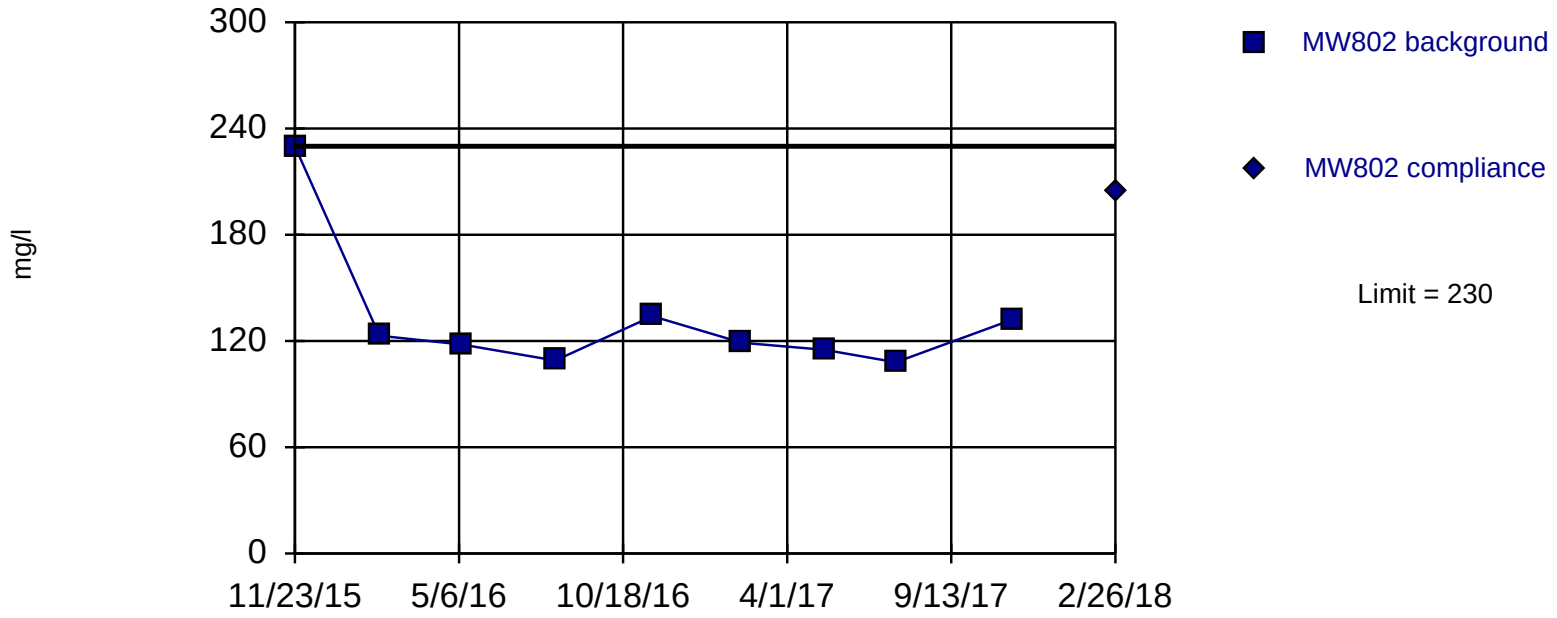
Constituent: Calcium, total Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Non-parametric




Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.05 alpha level. Limit is highest of 9 background values. Well-constituent pair annual alpha = 0.03586. Individual comparison alpha = 0.01809 (1 of 2).

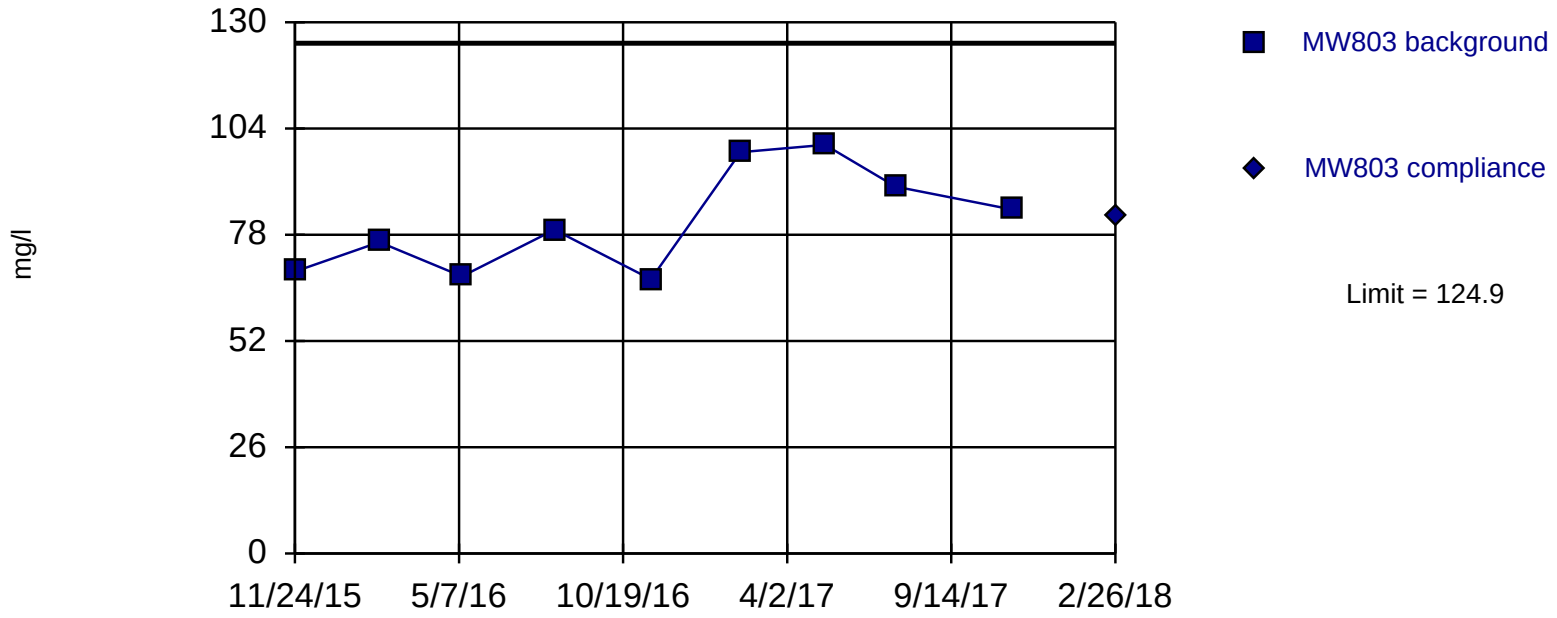
Constituent: Chloride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=81.28, Std. Dev.=12.66, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9074, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

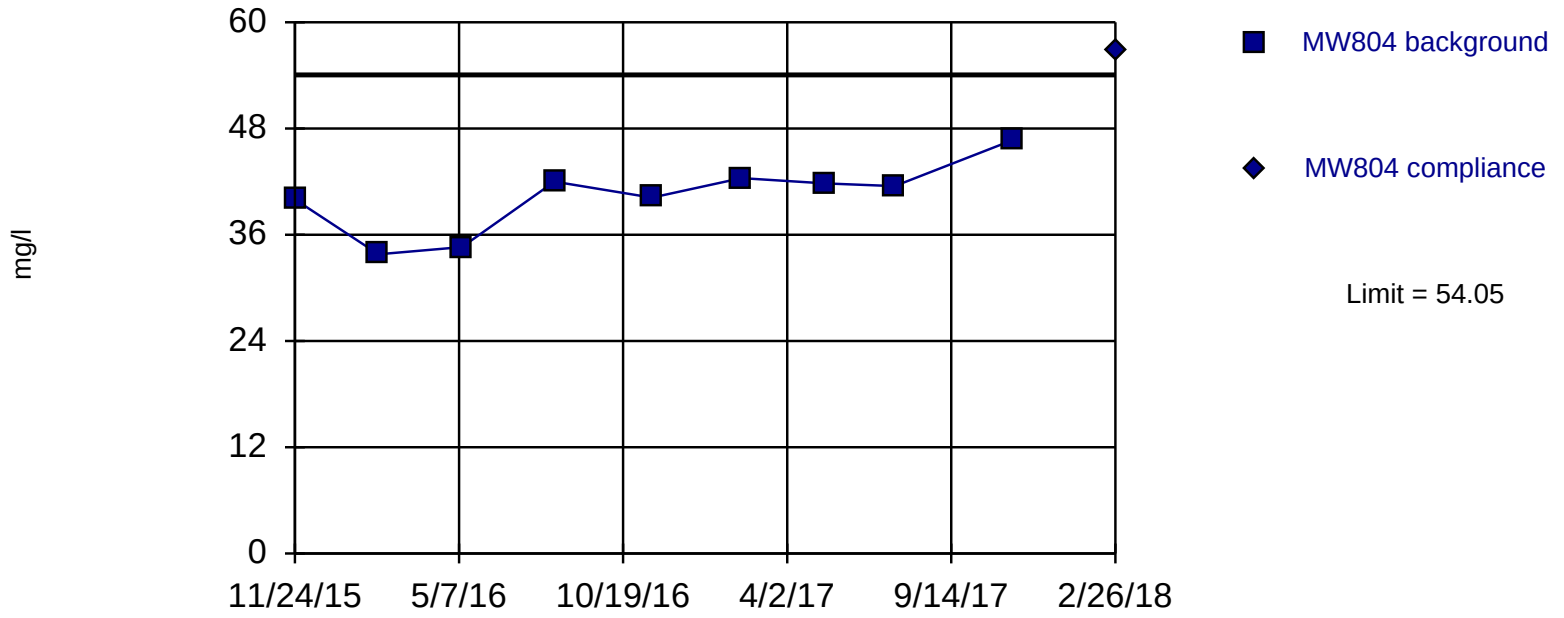
Constituent: Chloride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Exceeds Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=40.33, Std. Dev.=3.981, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8984, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

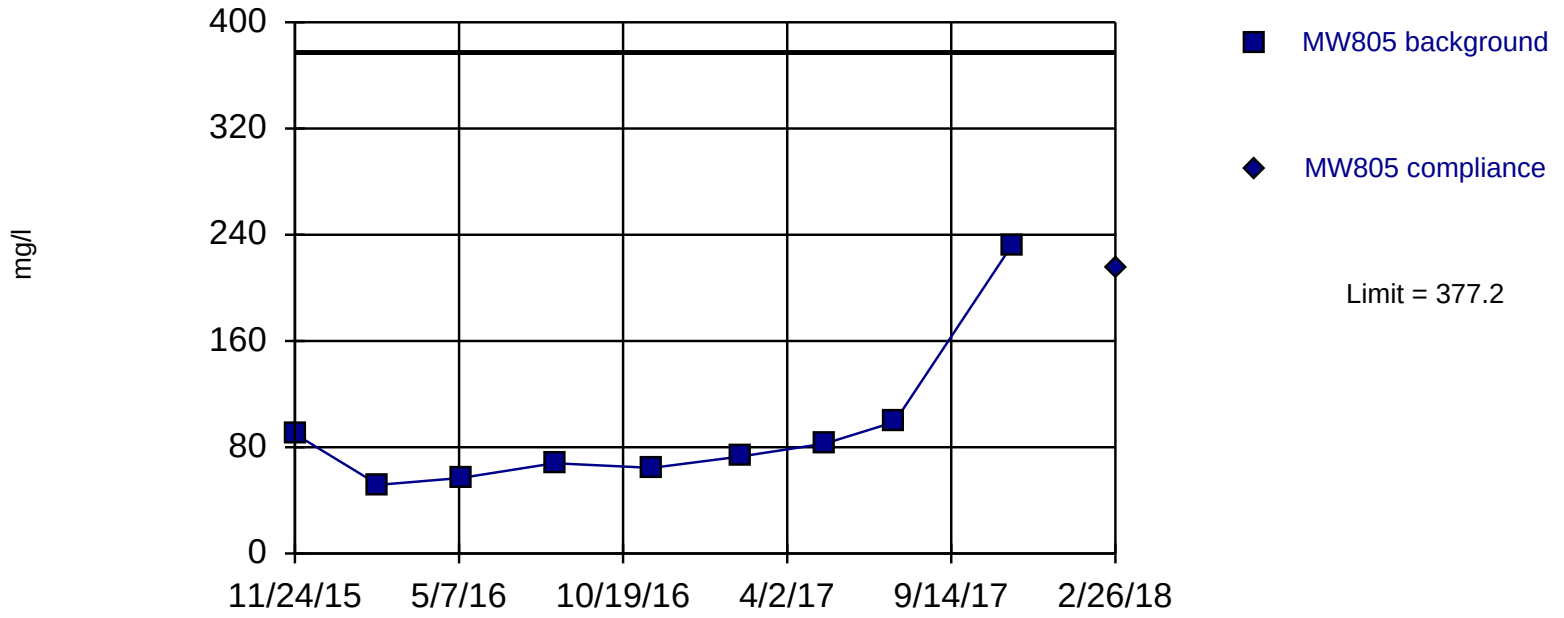
Constituent: Chloride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary (based on natural log transformation): Mean=4.402, Std. Dev.=0.4442, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8355, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

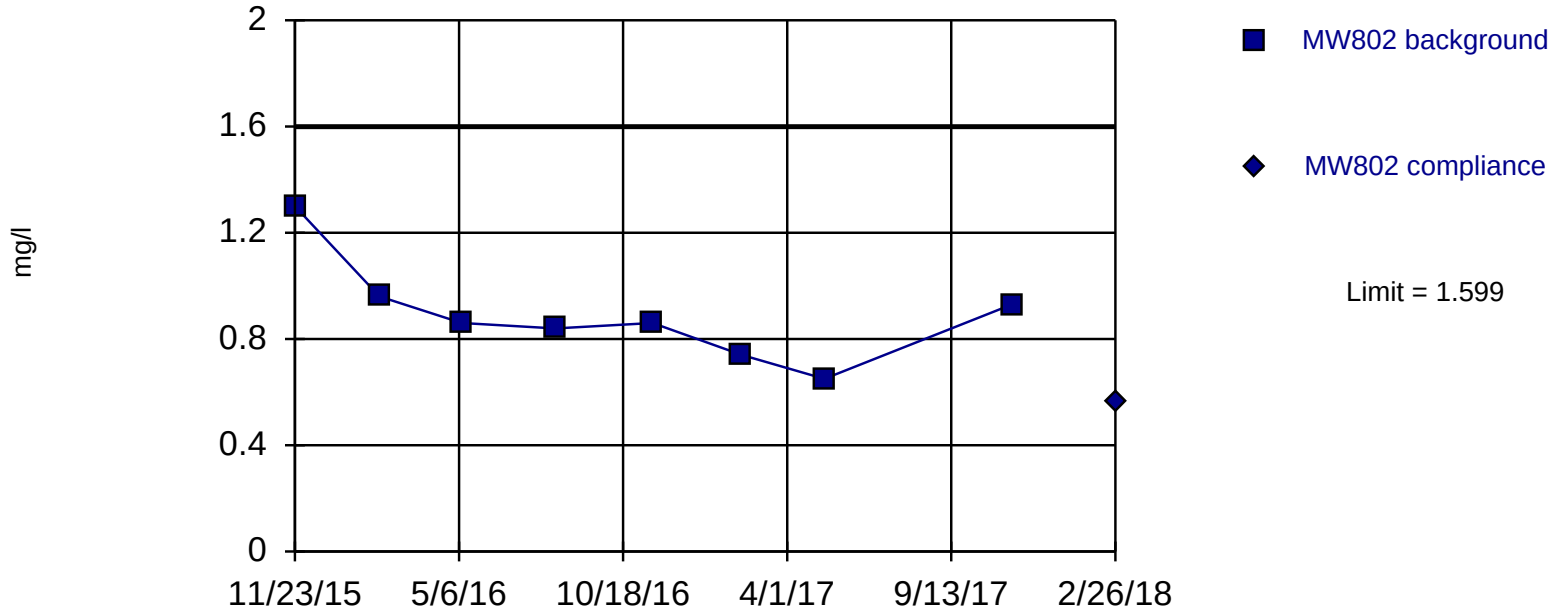
Constituent: Chloride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric



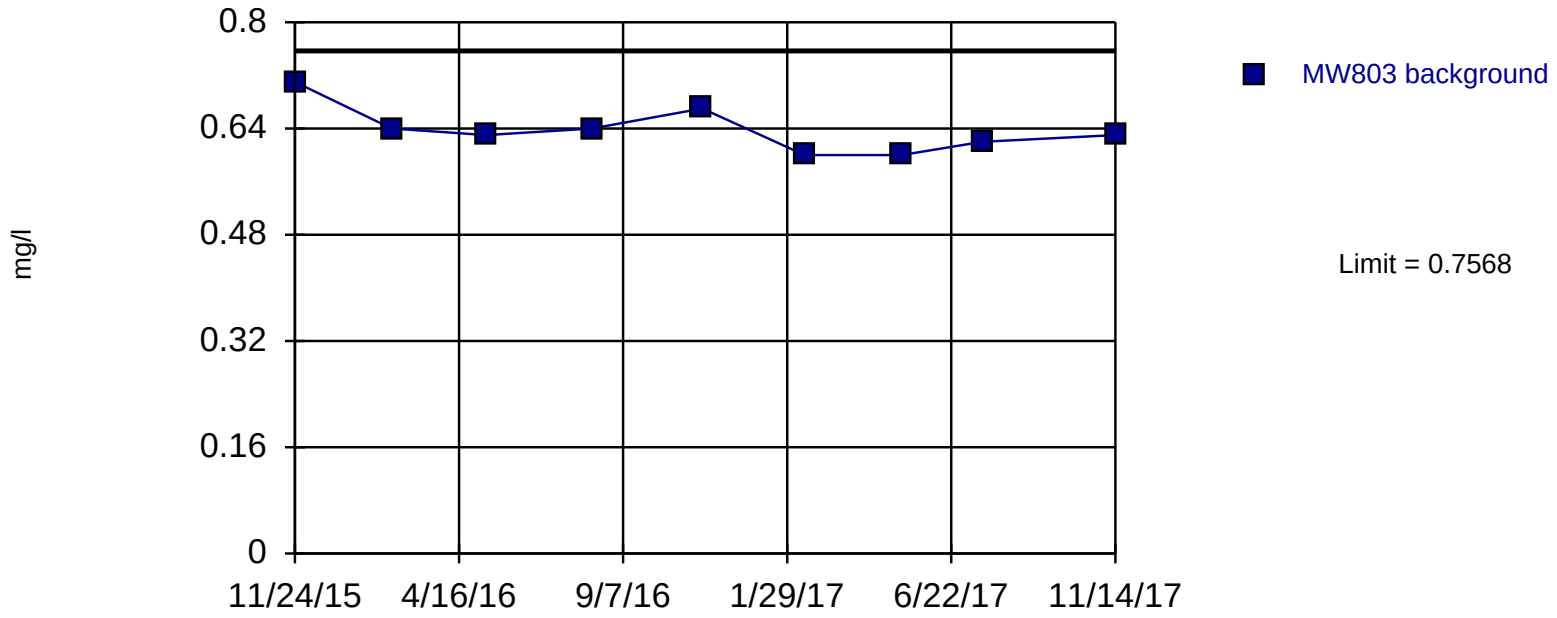

Background Data Summary: Mean=0.8925, Std. Dev.=0.1923, n=8. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8848, critical = 0.818. Kappa = 3.675 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

Constituent: Fluoride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

# Prediction Limit

## Intrawell Parametric, MW803




Background Data Summary: Mean=0.6378, Std. Dev.=0.03456, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.893, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192. Assumes 1 future value.

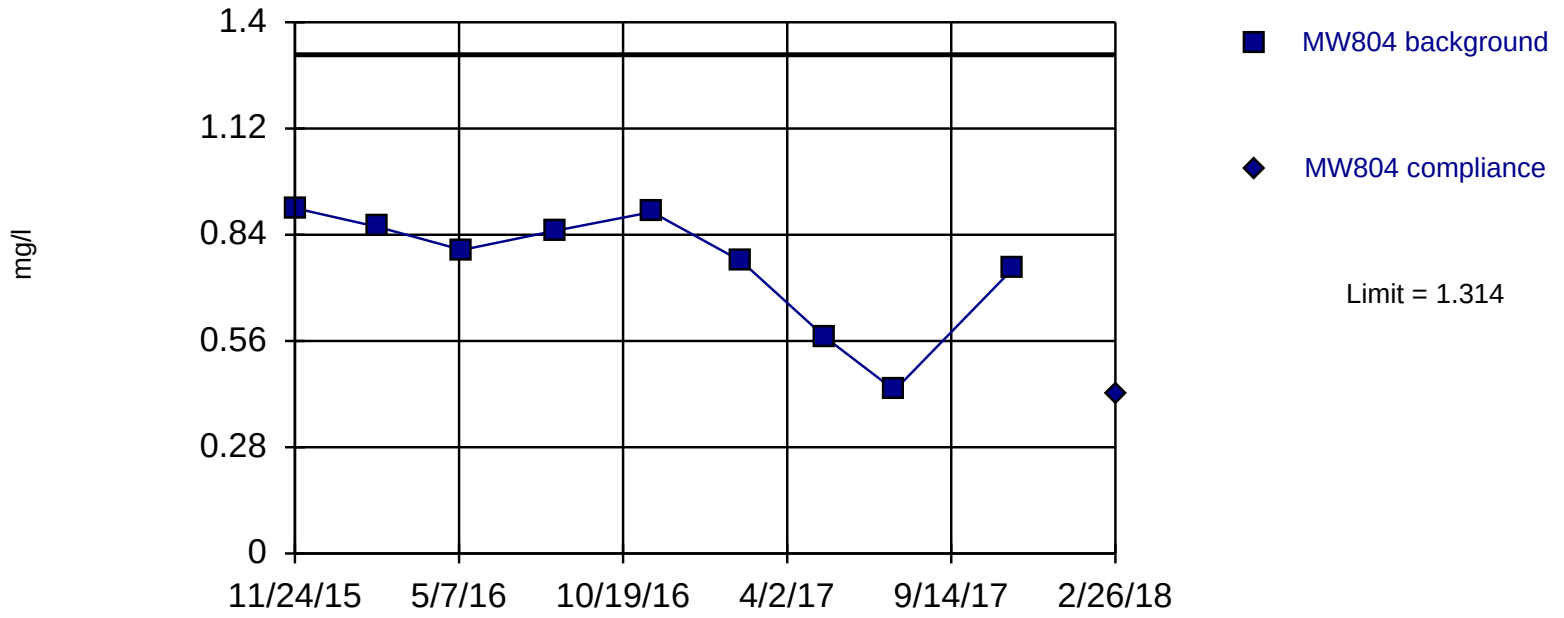
Constituent: Fluoride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=0.76, Std. Dev.=0.1609, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8481, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

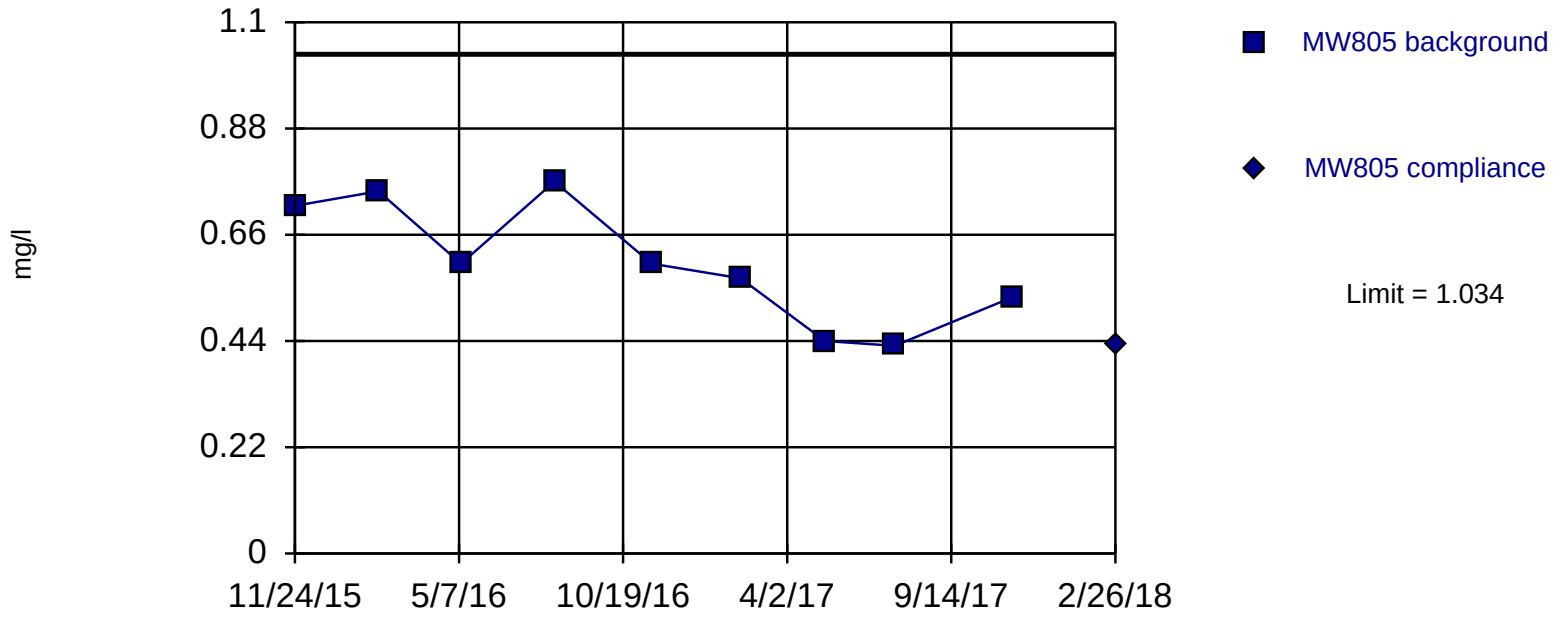
Constituent: Fluoride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric



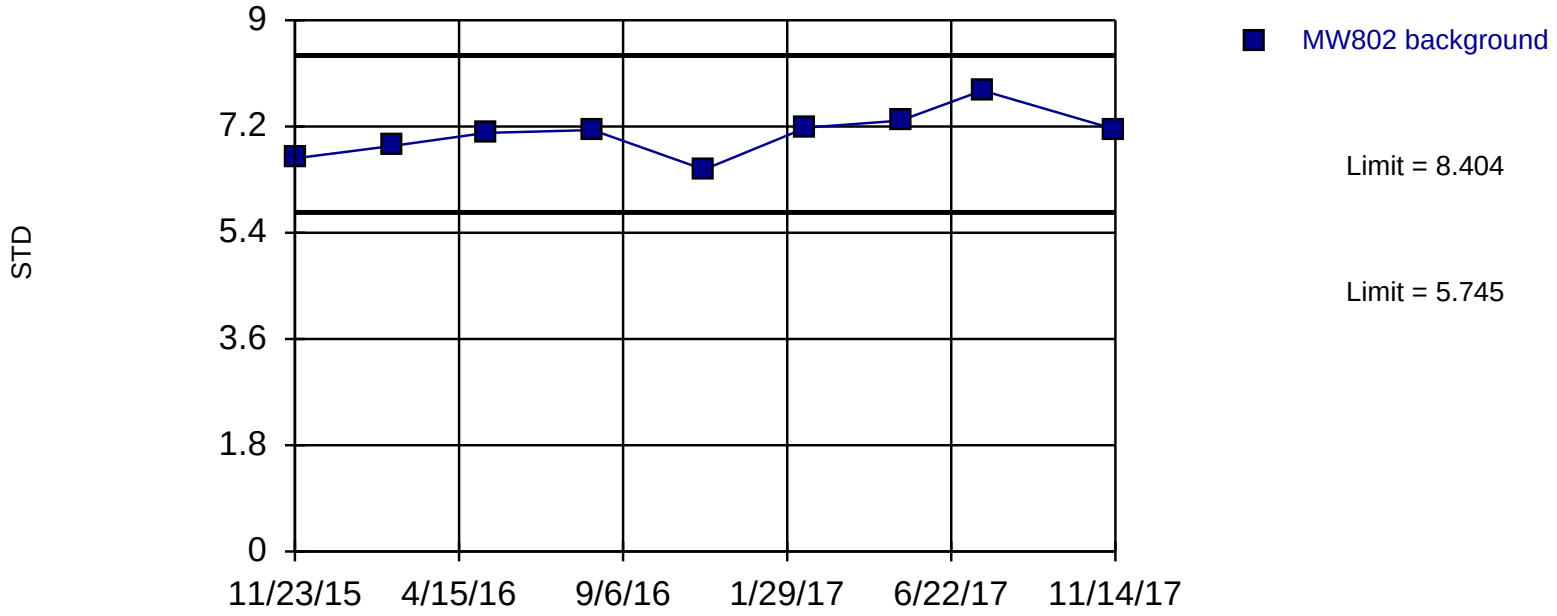

Background Data Summary: Mean=0.6011, Std. Dev.=0.1255, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.923, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

Constituent: Fluoride Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

# Prediction Limit

## Intrawell Parametric, MW802



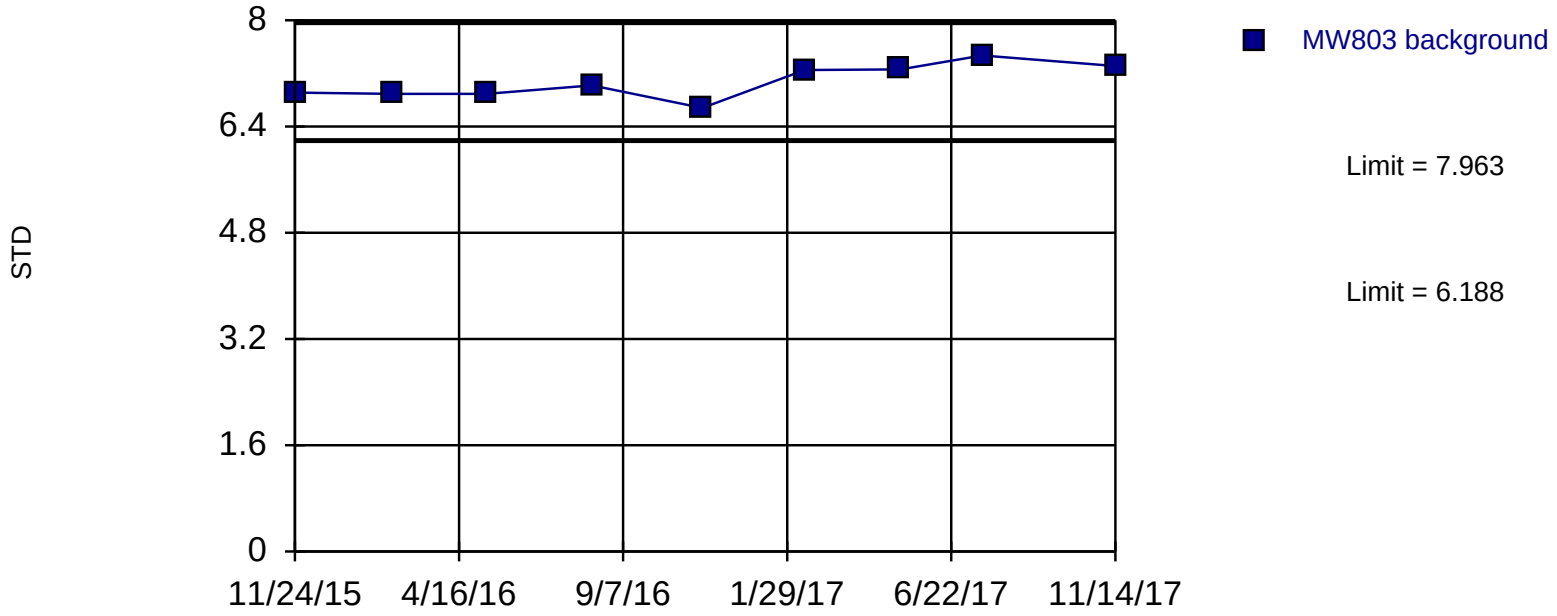

Background Data Summary: Mean=7.074, Std. Dev.=0.386, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9488, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192. Assumes 1 future value.

Constituent: pH [field] Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

# Prediction Limit

## Intrawell Parametric, MW803



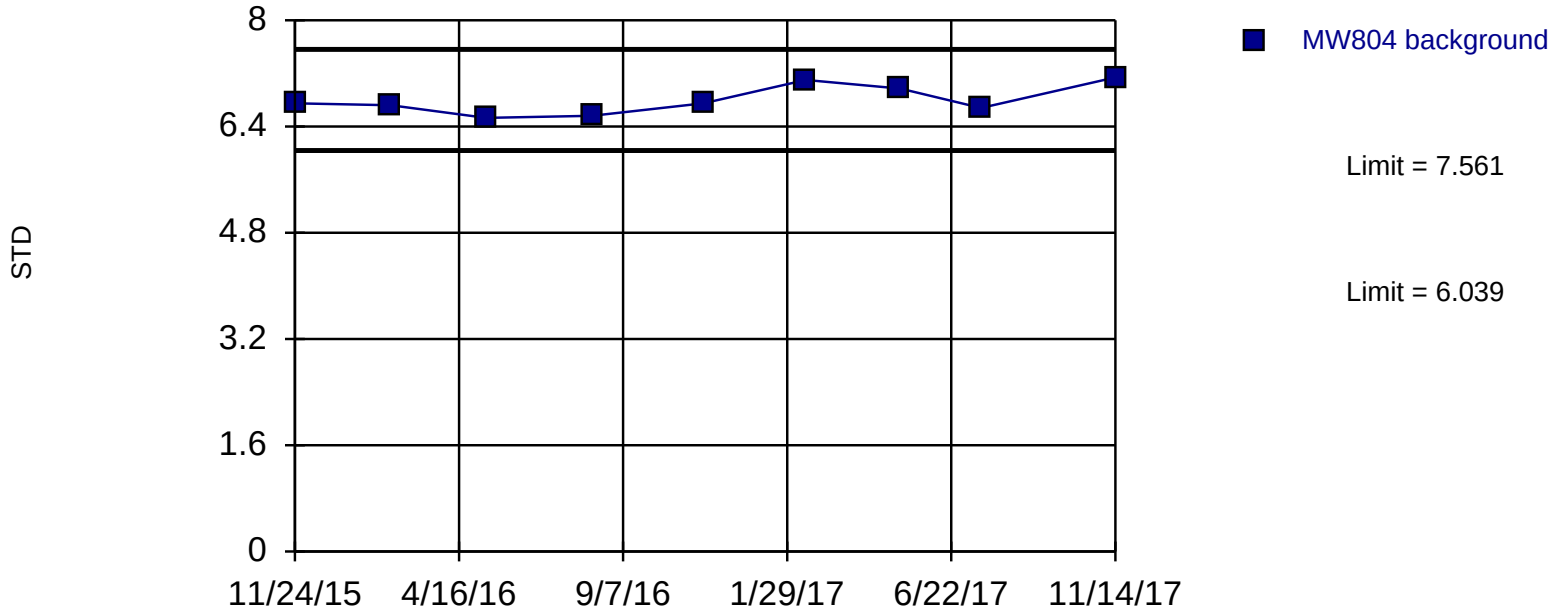

Background Data Summary: Mean=7.076, Std. Dev.=0.2576, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9409, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192. Assumes 1 future value.

Constituent: pH [field] Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

# Prediction Limit

## Intrawell Parametric, MW804



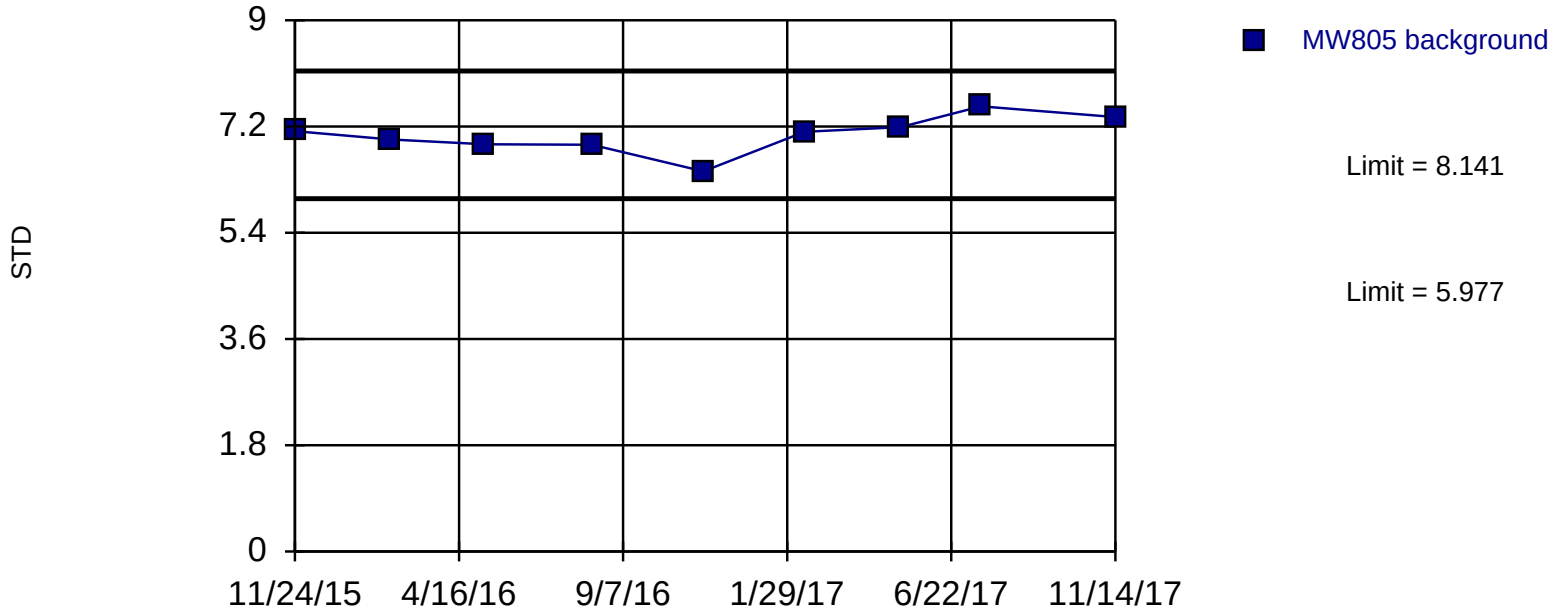

Background Data Summary: Mean=6.8, Std. Dev.=0.221, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9043, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192. Assumes 1 future value.

Constituent: pH [field] Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

# Prediction Limit

## Intrawell Parametric, MW805




Background Data Summary: Mean=7.059, Std. Dev.=0.314, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9613, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192. Assumes 1 future value.

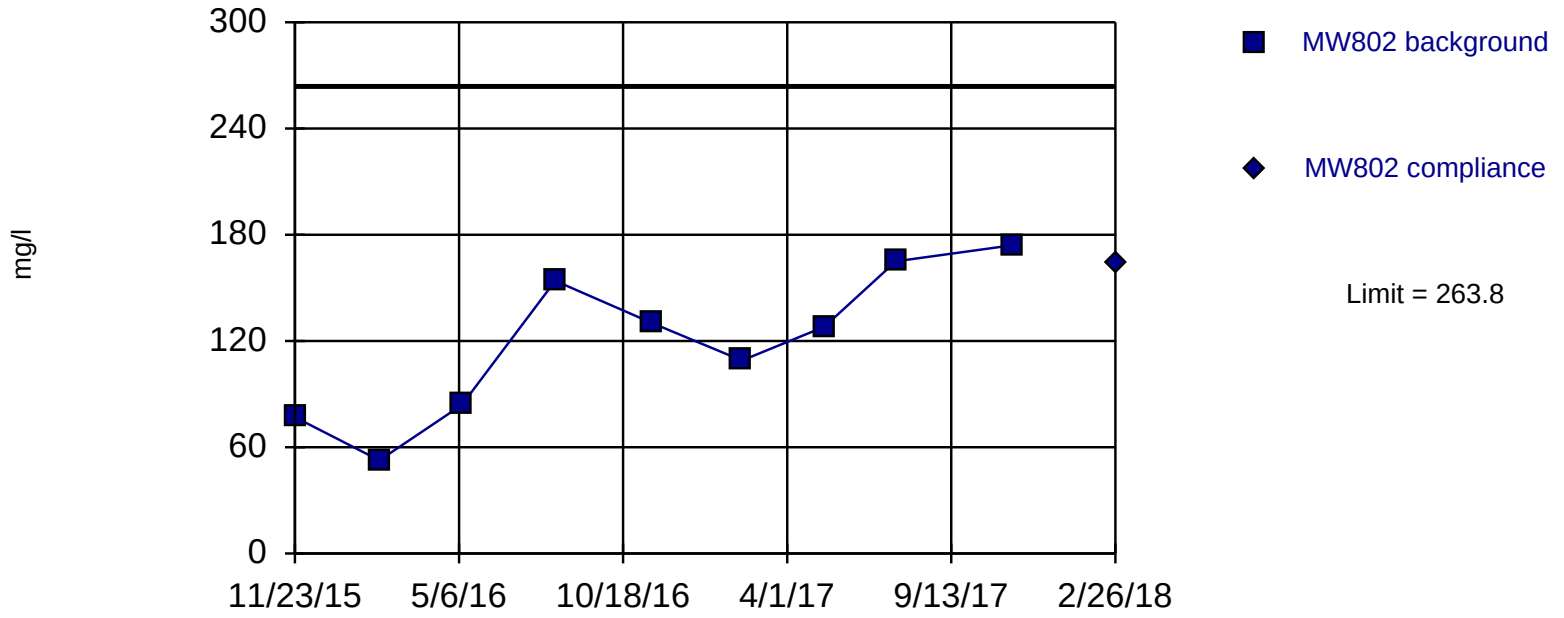
Constituent: pH [field] Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=119.3, Std. Dev.=41.94, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.954, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

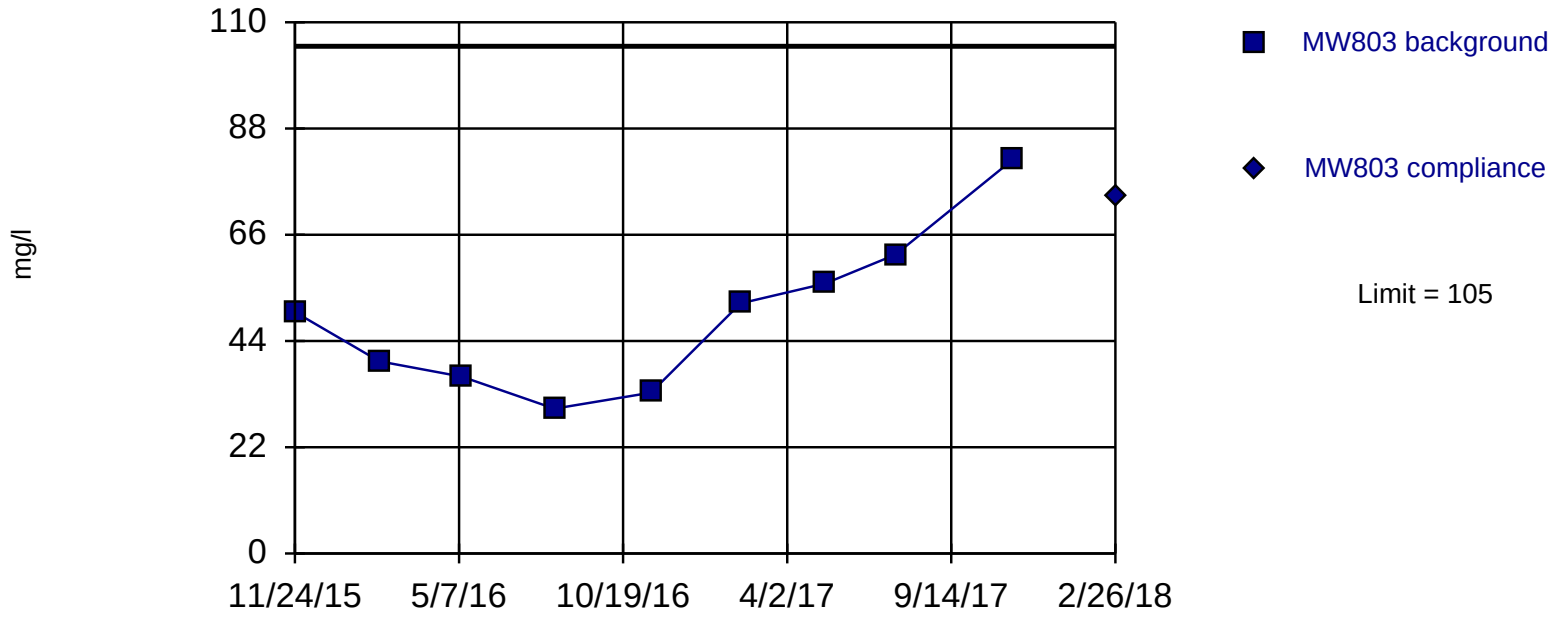
Constituent: Sulfate Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=48.97, Std. Dev.=16.27, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9344, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

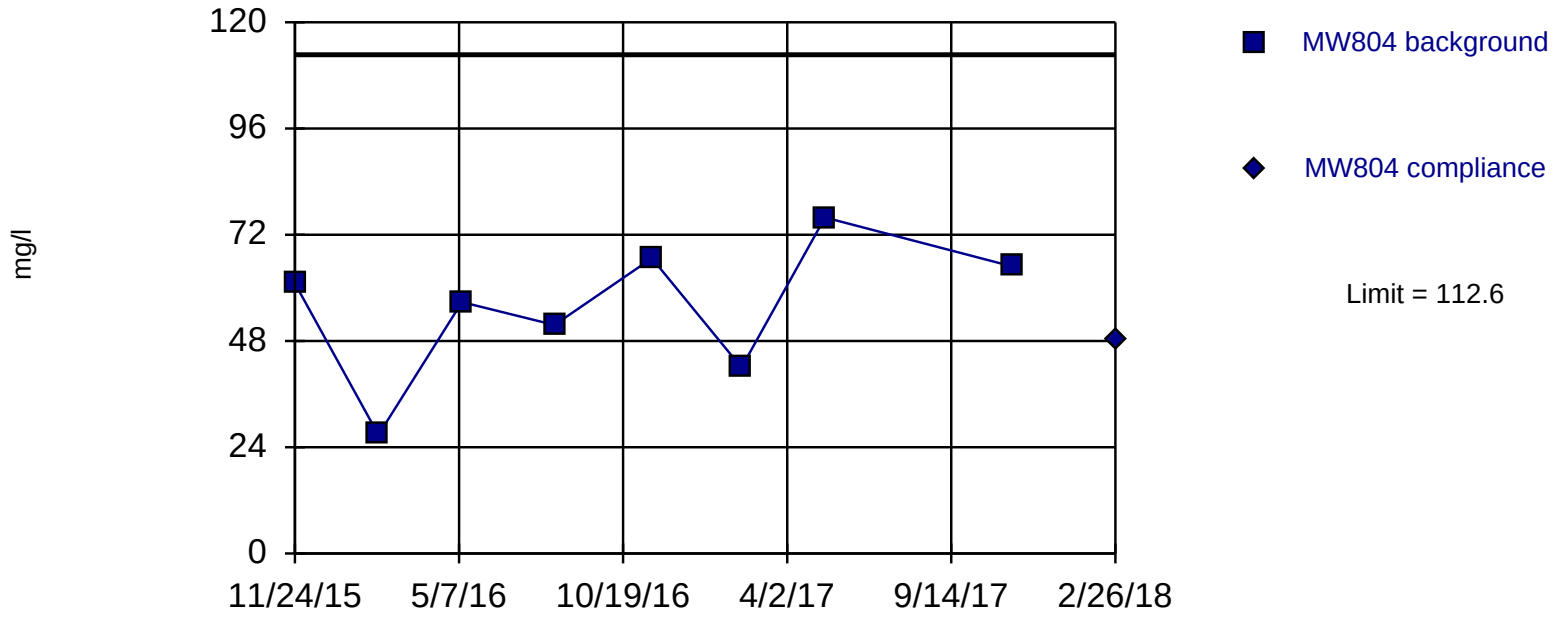
Constituent: Sulfate Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=55.7, Std. Dev.=15.5, n=8. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9551, critical = 0.818. Kappa = 3.675 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

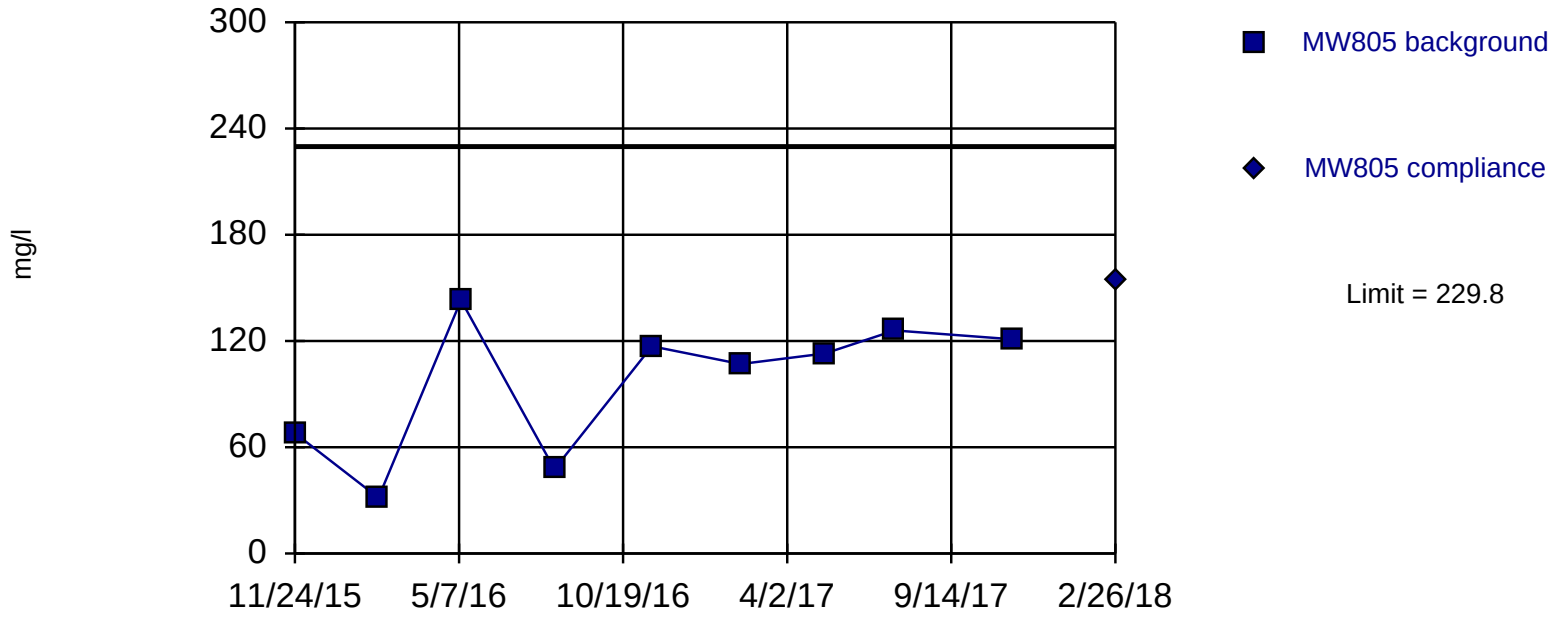
Constituent: Sulfate Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=97.12, Std. Dev.=38.5, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8859, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

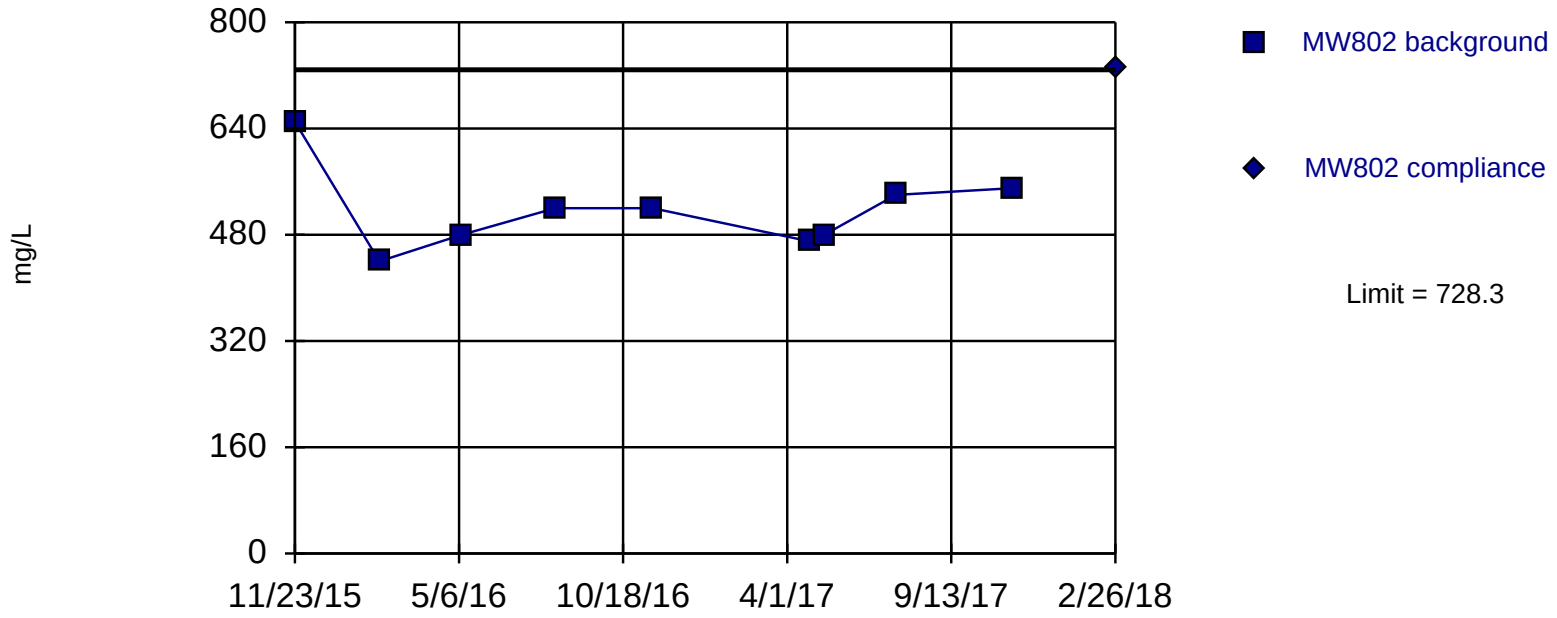
Constituent: Sulfate Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Exceeds Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=516.7, Std. Dev.=61.44, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.9042, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

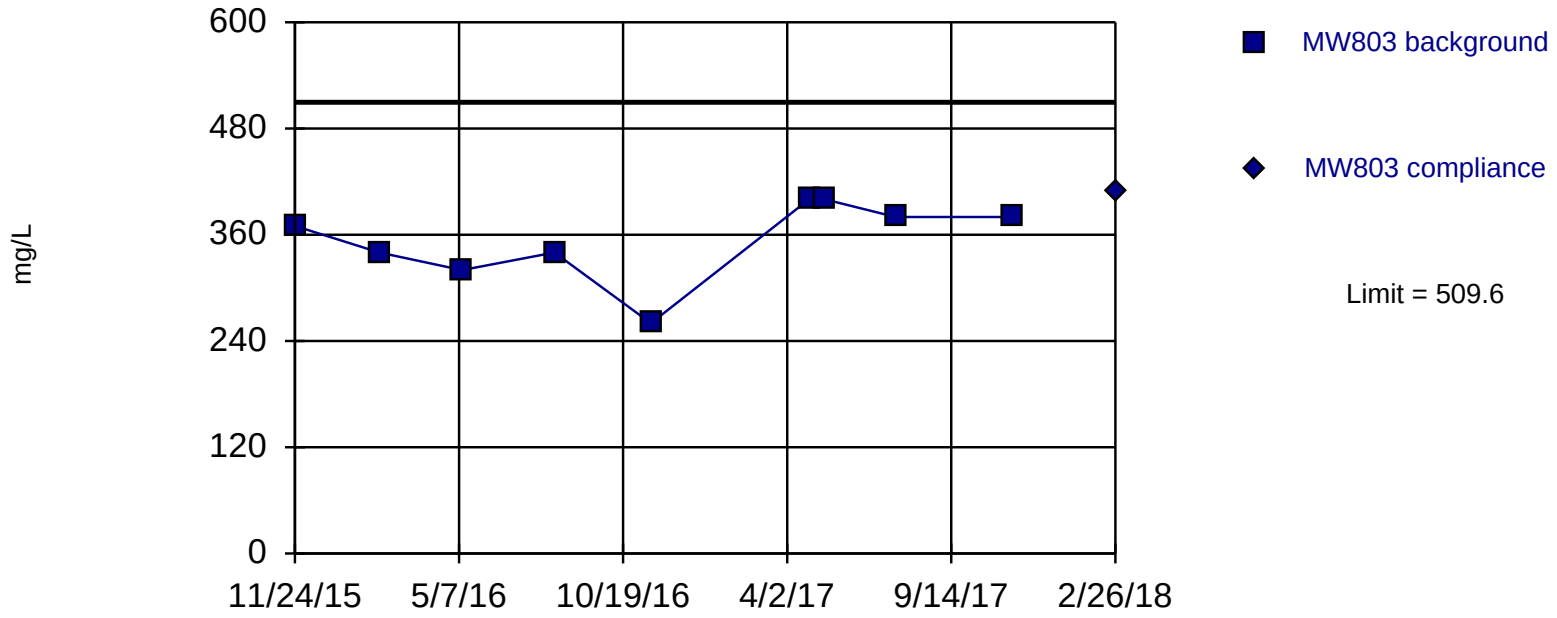
Constituent: Total Dissolved Solids Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=354.4, Std. Dev.=45.03, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8888, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

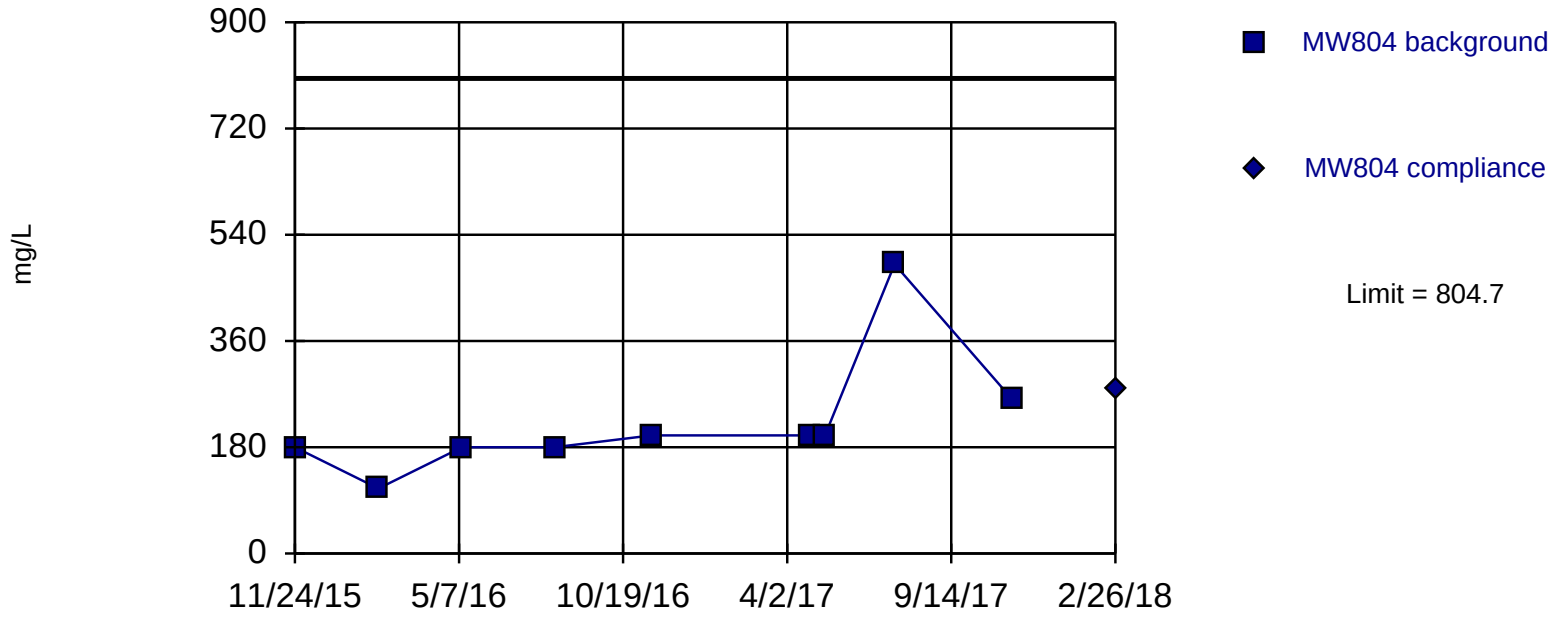
Constituent: Total Dissolved Solids Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary (based on natural log transformation): Mean=5.325, Std. Dev.=0.3962, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8443, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

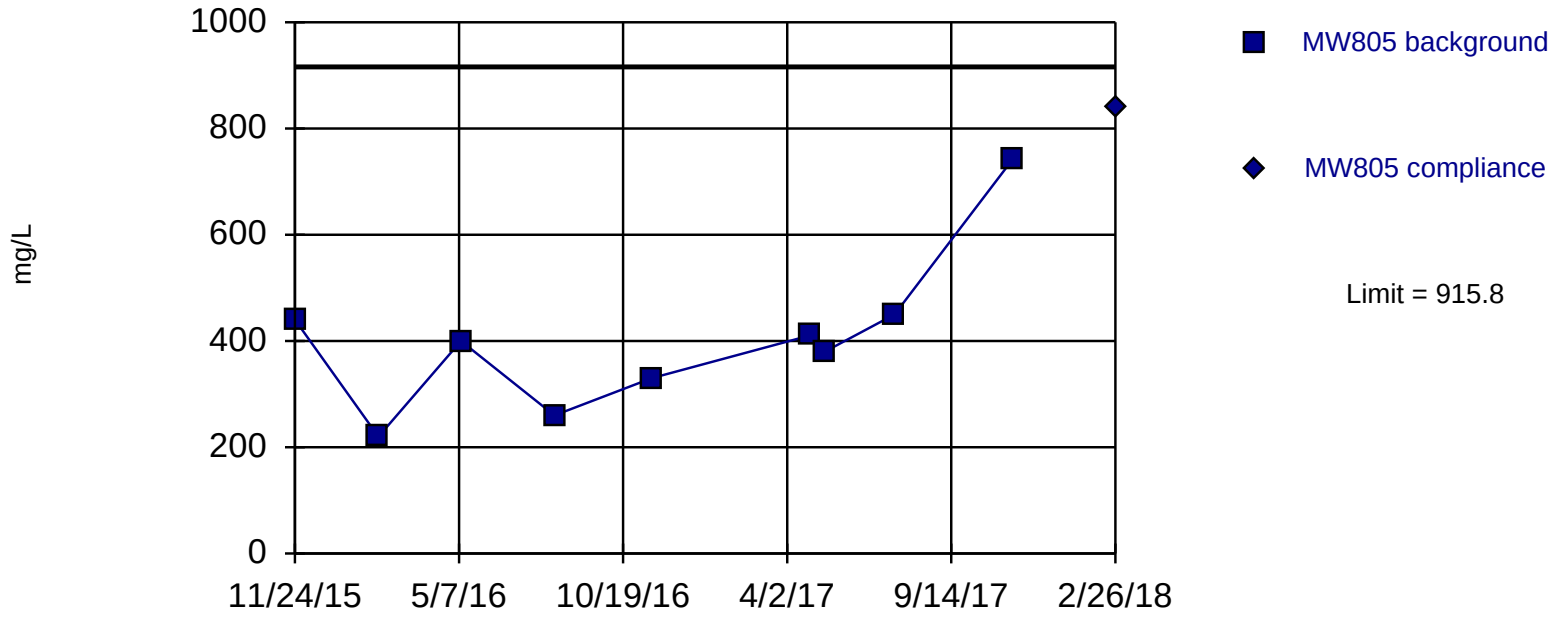
Constituent: Total Dissolved Solids Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

Within Limit

# Prediction Limit

## Intrawell Parametric




Background Data Summary: Mean=403.3, Std. Dev.=148.7, n=9. Normality test: Shapiro Wilk @alpha = 0.05, calculated = 0.8699, critical = 0.829. Kappa = 3.445 (c=15, w=11, 1 of 2, event alpha = 0.05132). Report alpha = 0.0003192.

Constituent: Total Dissolved Solids Analysis Run 4/4/2018 3:54 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

# Prediction Limit

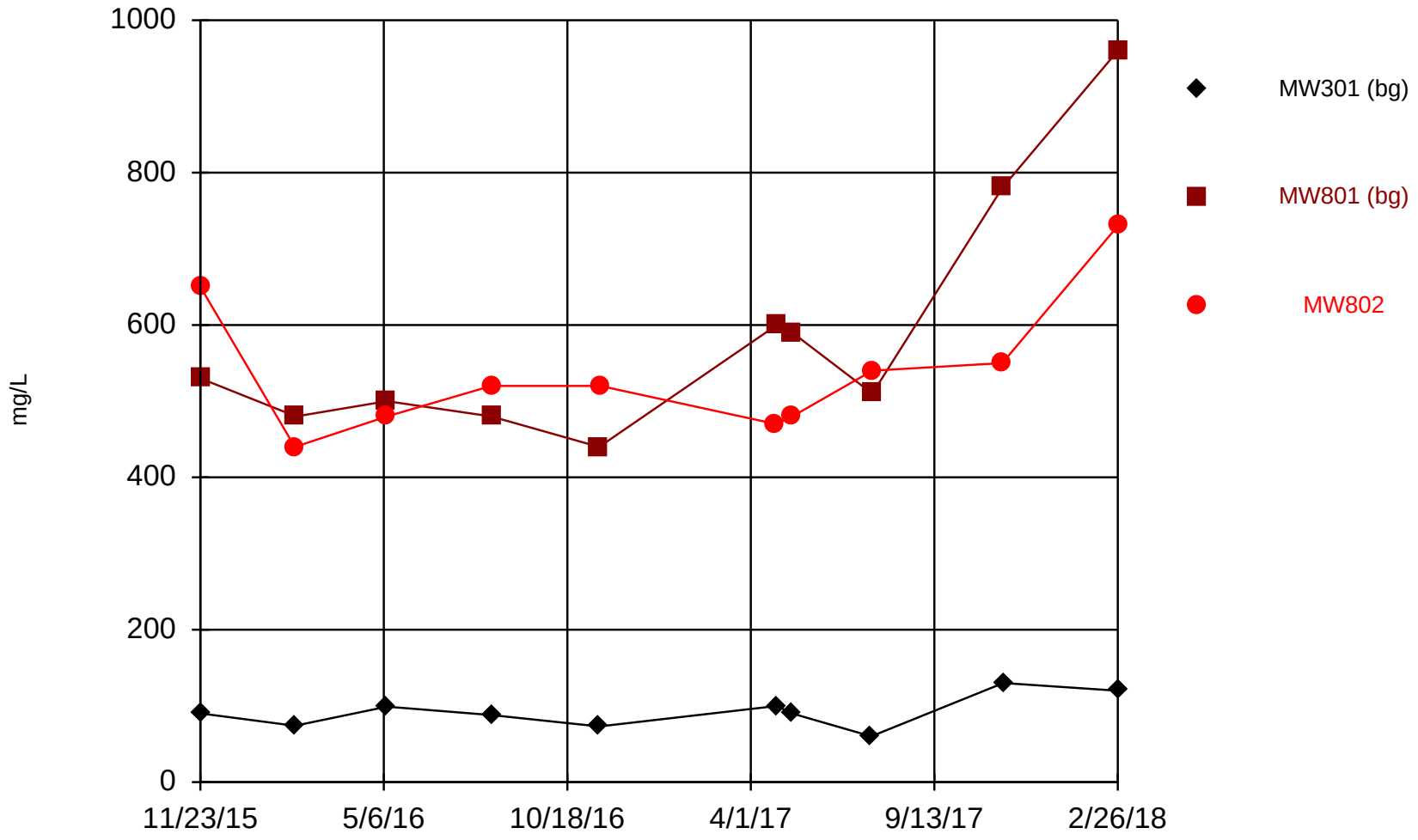
Brayton Point Client: GEI Data: Brayton Point CCR Database Printed 4/4/2018, 3:55 PM

| Constituent | Well | Upper Lim. | Lower Lim. | Date | Observ. | Sig. | Bg N | %NDs | Trans... | Alpha | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Calcium, total (mg/L)** | **MW802** | **105.2** | **n/a** | **2/26/2018** | **124** | **Yes** | **9** | **0** | **No** | **0.0003192** | **Param Intra 1 of 2** |
| **Chloride (mg/l)** | **MW804** | **54.05** | **n/a** | **2/26/2018** | **56.7** | **Yes** | **9** | **0** | **No** | **0.0003192** | **Param Intra 1 of 2** |
| **Total Dissolved Solids (mg/L)** | **MW802** | **728.3** | **n/a** | **2/26/2018** | **730** | **Yes** | **9** | **0** | **No** | **0.0003192** | **Param Intra 1 of 2** |

# Appendix D

## Time-Series Concentration Plots

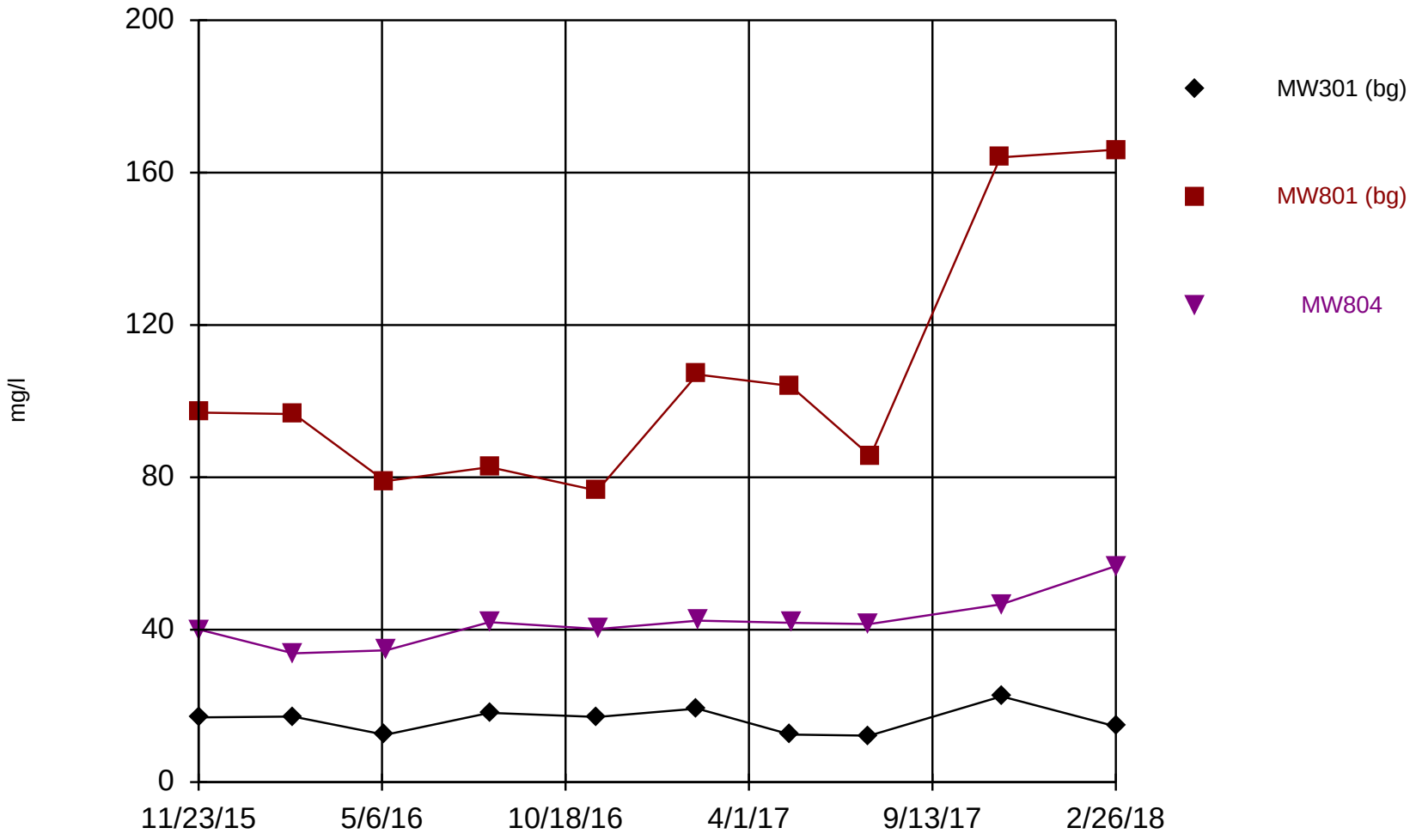
# Time Series




Constituent: Total Dissolved Solids Analysis Run 4/5/2018 12:03 PM

Plant McIntosh Client: GEI Data: Brayton Point CCR Database

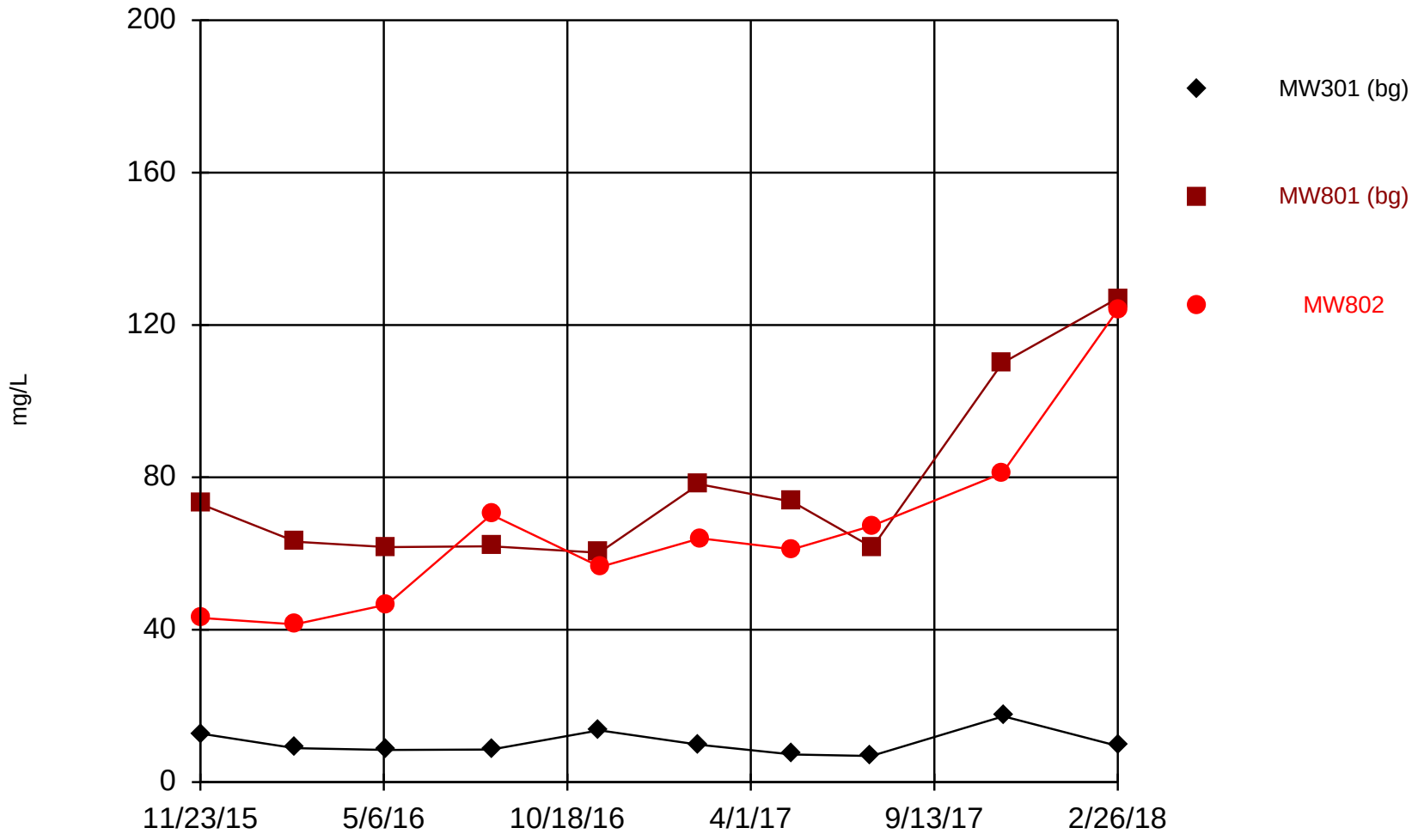
# Time Series




Constituent: Chloride  Analysis Run 4/5/2018 12:03 PM

Plant McIntosh  Client: GEI  Data: Brayton Point CCR Database

# Time Series




Constituent: Calcium, total  Analysis Run 4/5/2018 12:03 PM

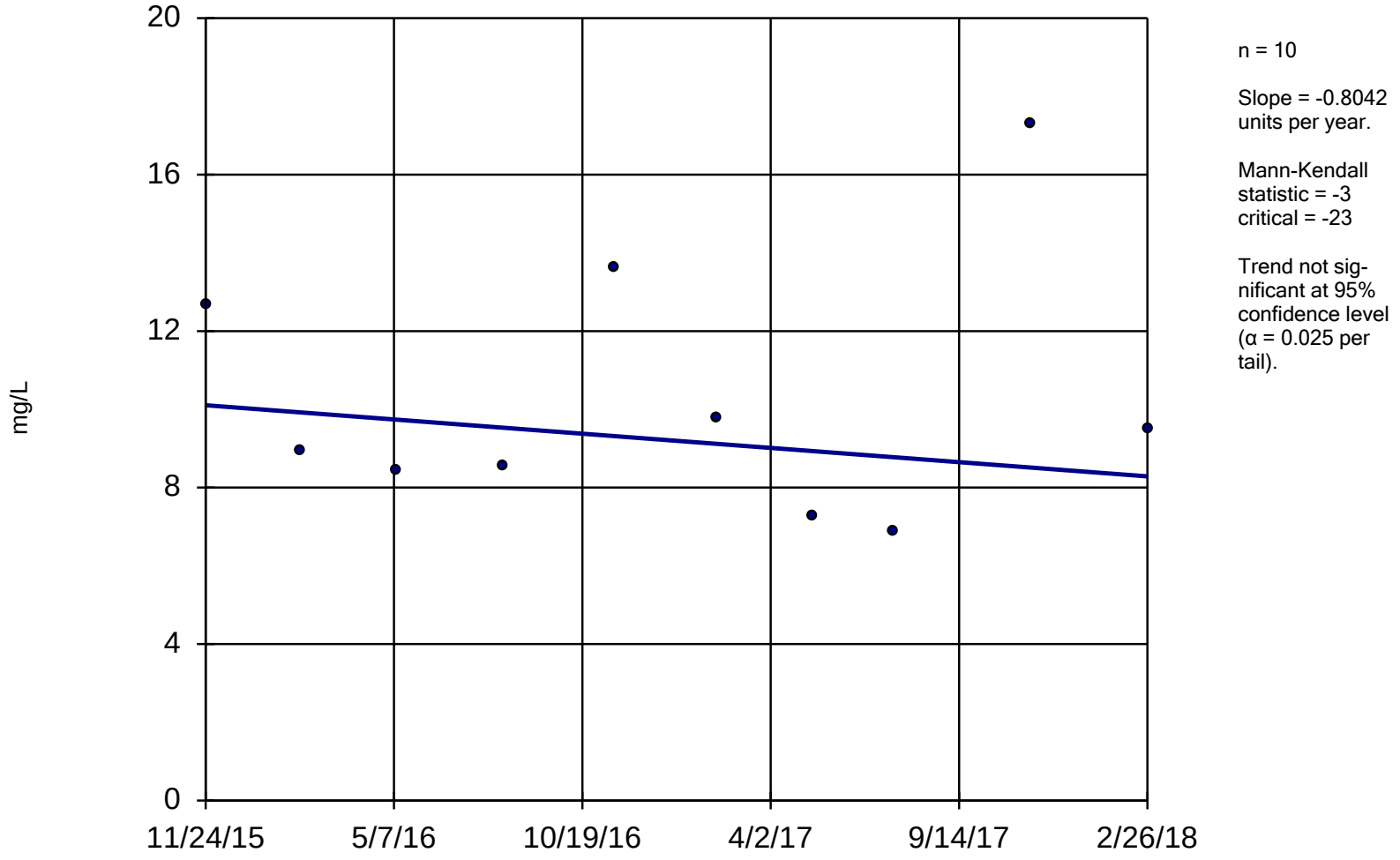
Plant McIntosh  Client: GEI  Data: Brayton Point CCR Database

# Appendix E

## Mann-Kendall / Sen's Estimate of Slope Plots

# Sen's Slope Estimator

## MW301 (bg)




n = 10

Slope = -0.8042 units per year.

Mann-Kendall statistic = -3
critical = -23

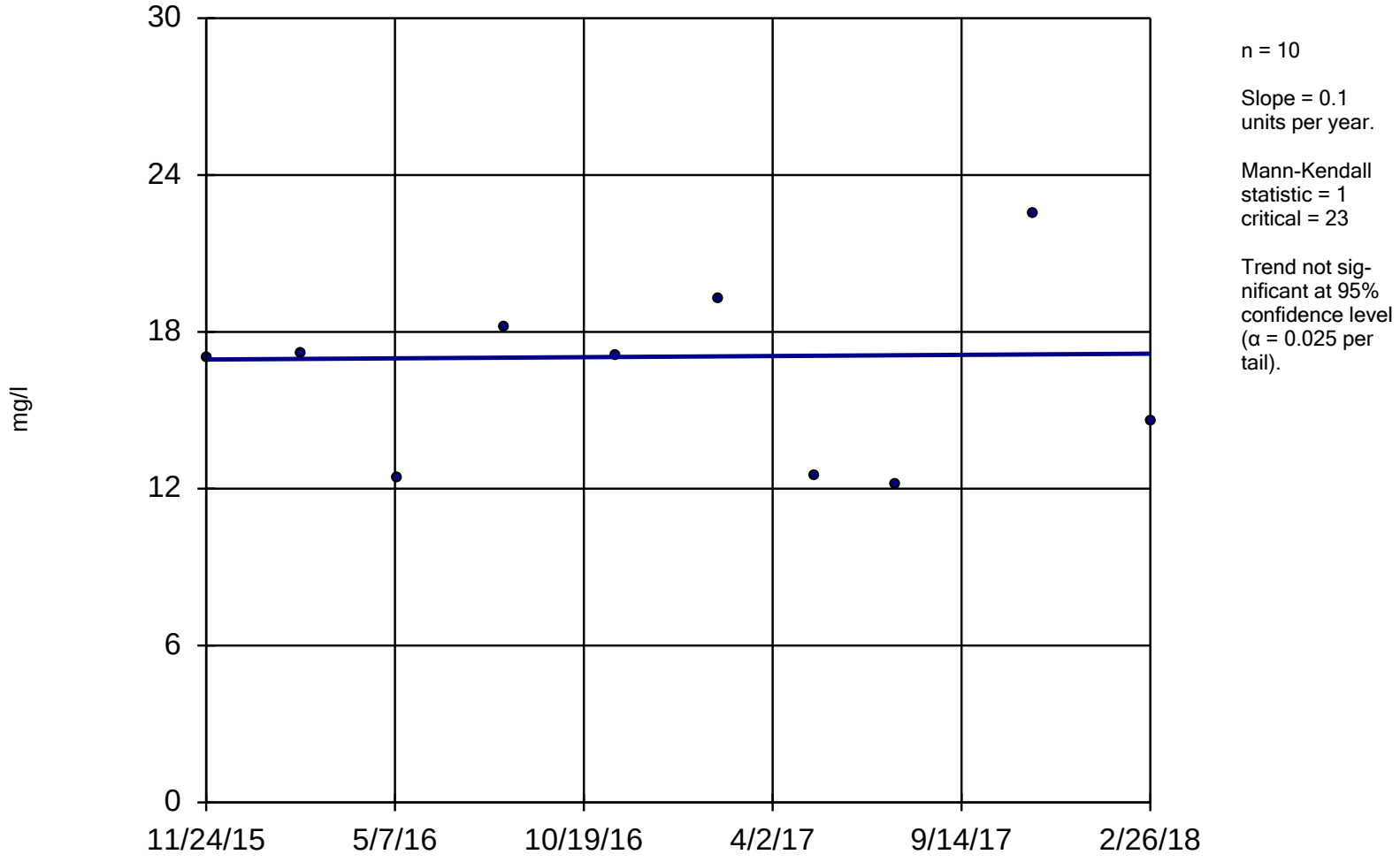
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Calcium, total  Analysis Run 4/4/2018 4:13 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

# Sen's Slope Estimator

## MW301 (bg)




n = 10

Slope = 0.1 units per year.

Mann-Kendall statistic = 1
critical = 23

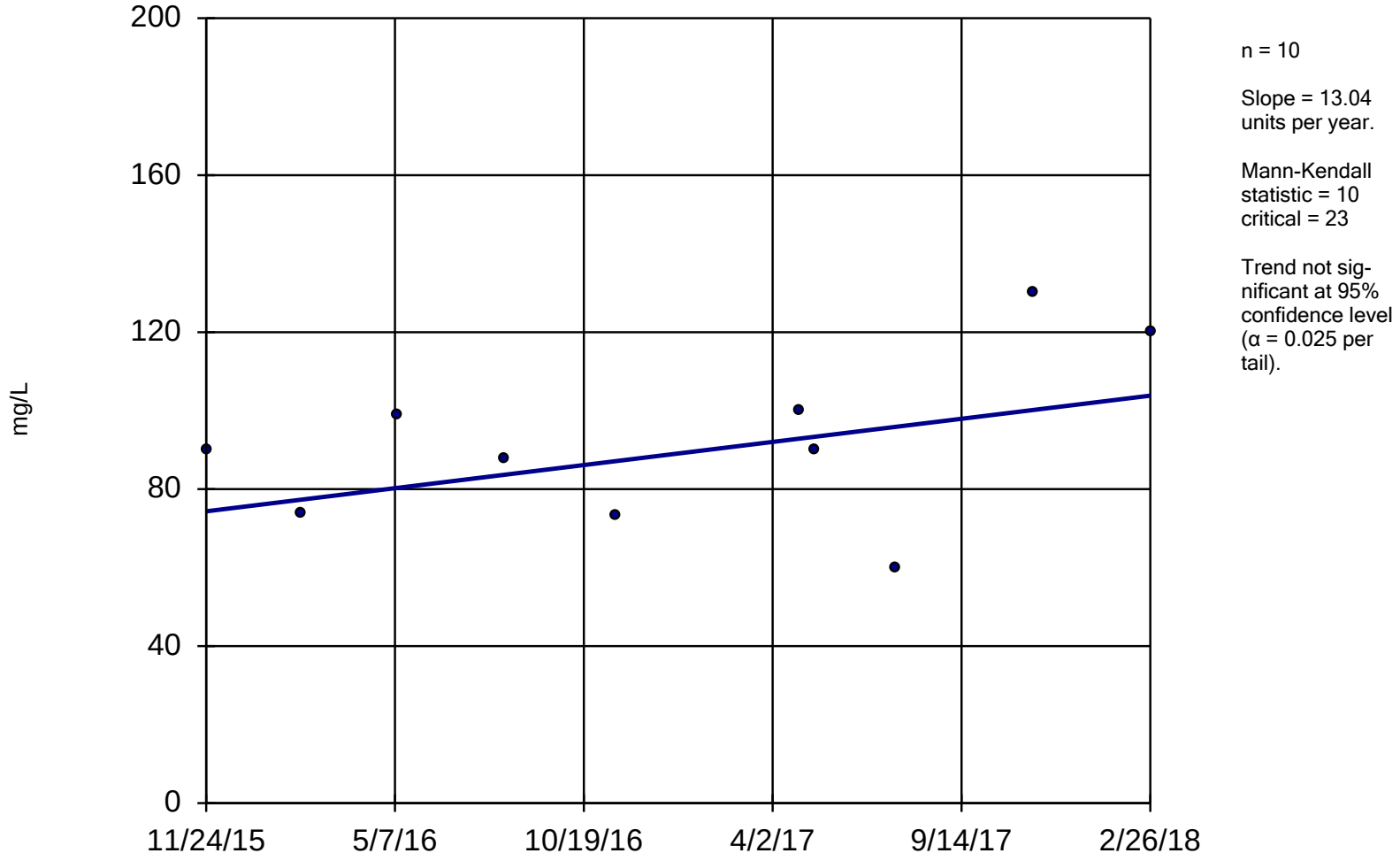
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Chloride  Analysis Run 4/4/2018 4:13 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

# Sen's Slope Estimator

## MW301 (bg)




n = 10

Slope = 13.04 units per year.

Mann-Kendall statistic = 10 critical = 23

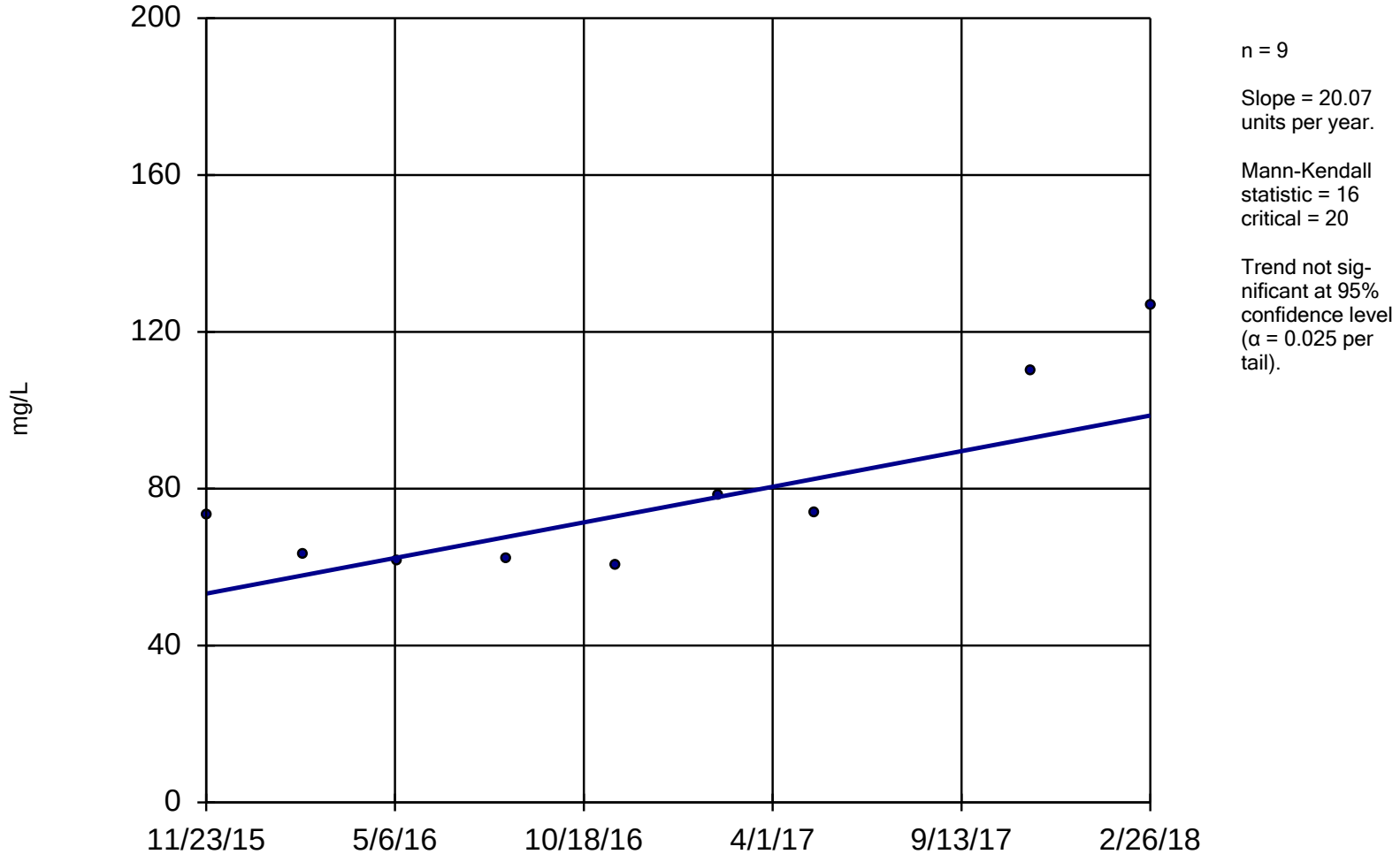
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Total Dissolved Solids Analysis Run 4/4/2018 4:13 PM

Brayton Point Client: GEI Data: Brayton Point CCR Database

# Sen's Slope Estimator

## MW801 (bg)




n = 9

Slope = 20.07 units per year.

Mann-Kendall statistic = 16
critical = 20

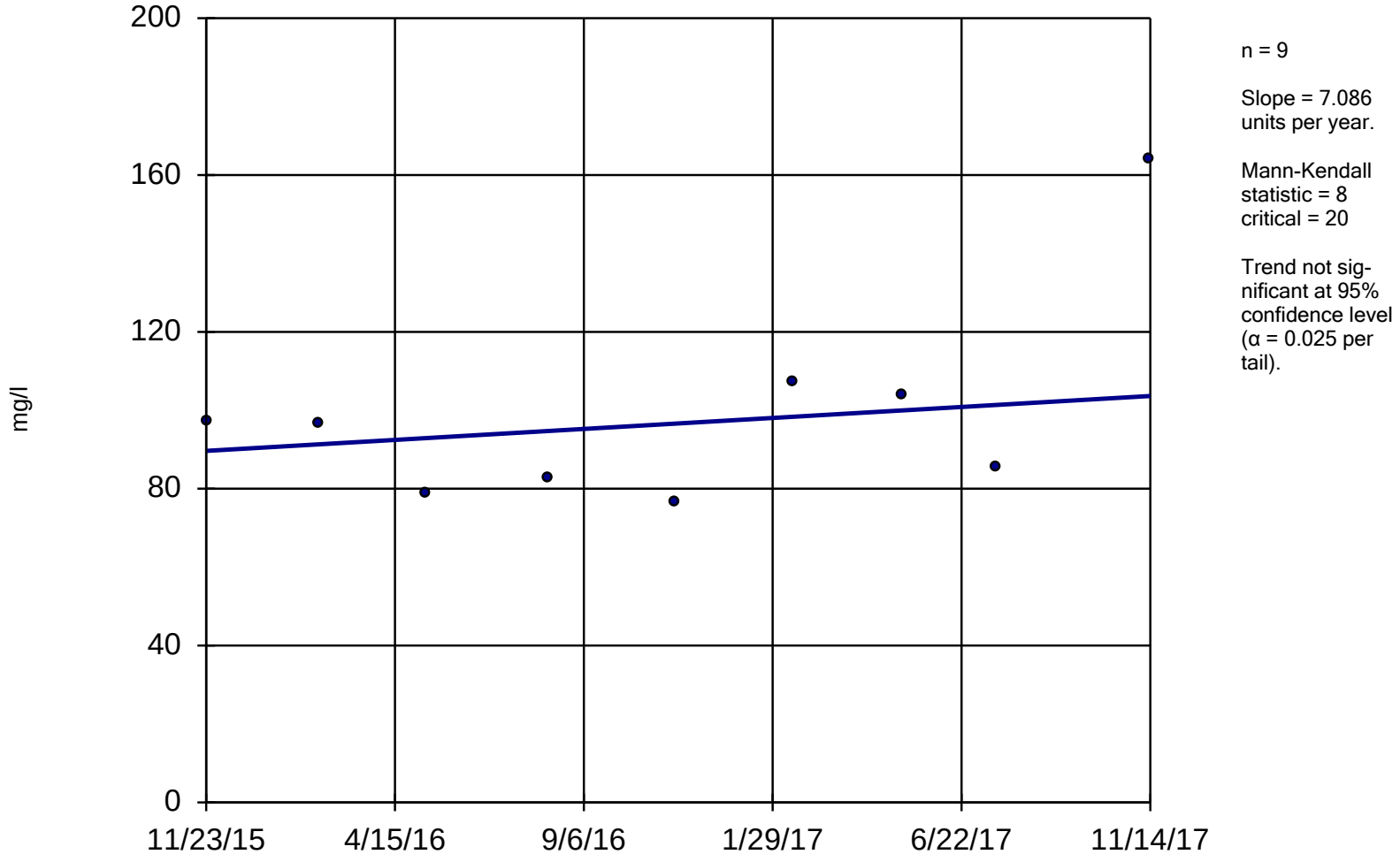
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Calcium, total  Analysis Run 4/4/2018 3:06 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

# Sen's Slope Estimator

## MW801 (bg)




n = 9

Slope = 7.086 units per year.

Mann-Kendall statistic = 8
critical = 20

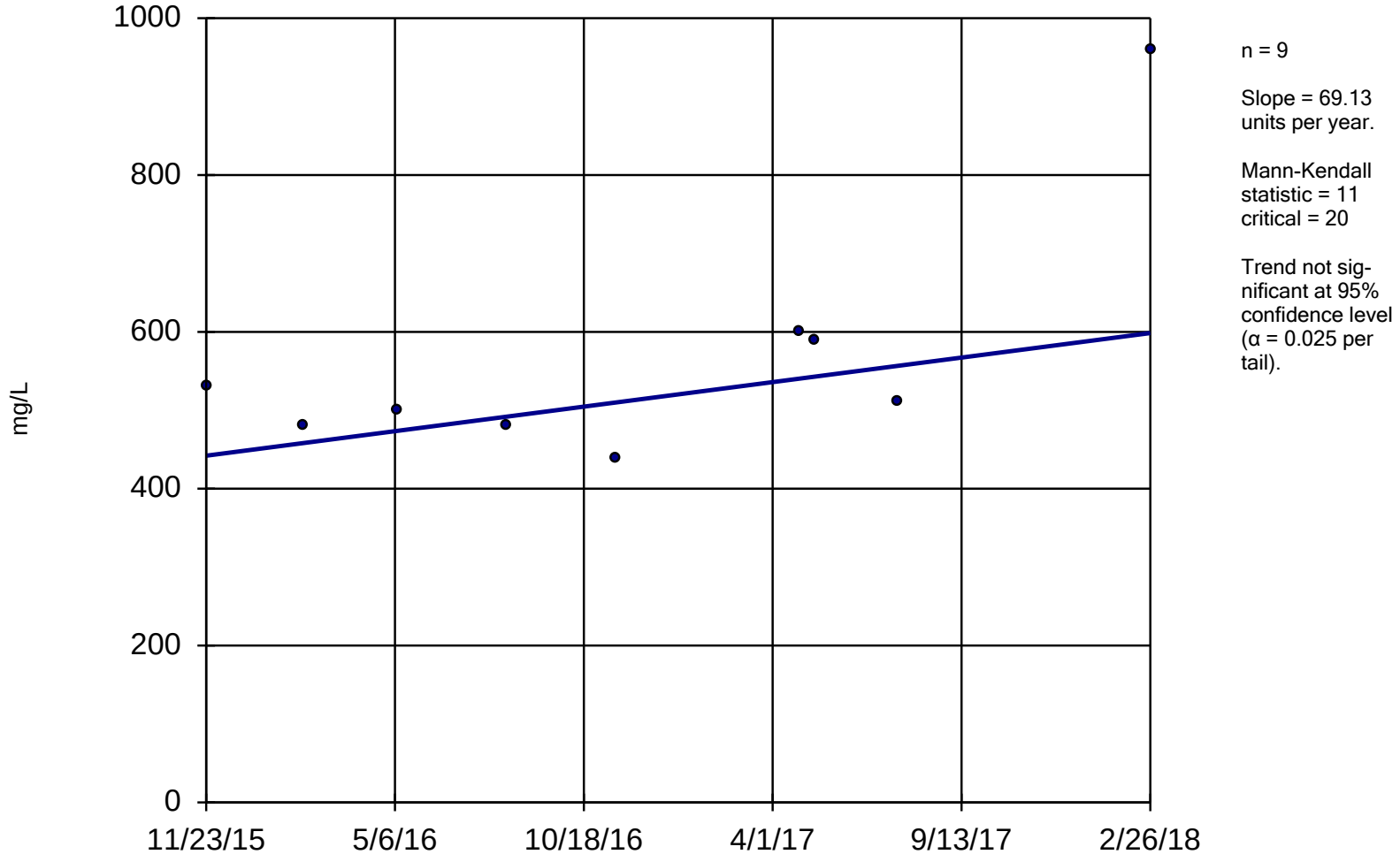
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Chloride  Analysis Run 4/4/2018 3:06 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database

# Sen's Slope Estimator

## MW801 (bg)




n = 9

Slope = 69.13 units per year.

Mann-Kendall statistic = 11
critical = 20

Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Total Dissolved Solids  Analysis Run 4/4/2018 3:06 PM

Brayton Point  Client: GEI  Data: Brayton Point CCR Database