



*Prepared for*

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**SEMI-ANNUAL GROUNDWATER  
MONITORING REPORT NO. 20  
JANUARY THROUGH JUNE 2018  
CHEMTRADE SITE  
EAST POINT, GEORGIA  
HSI# 10498**

*Prepared by*

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## PROFESSIONAL ENGINEER CERTIFICATION

I certify that I am a qualified engineer who has received a baccalaureate or post-graduate degree in the natural science or engineering and have sufficient training and experience in environmental assessment and corrective measures, as demonstrated by state registration and completion of accredited university courses, that enable me to make sound professional judgments. I further certify that this report was prepared by myself or by a subordinate working under my direction.

  
7/15/18  
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## **1. INTRODUCTION**

### **1.1 Background**

#### **1.1.1 Site Location and Description**

The Chemtrade Solutions LLC (Chemtrade), formerly General Chemical LCC facility (Site) is located on Central Avenue in the City of East Point, Fulton County, Georgia (**Figure 1-1**). The approximate Site location corresponds to latitude of 33.67 and longitude of 84.44. The Site property is bounded by North Martin Street and the John D. Milner Sports Complex on the north side, Randall and Bayard Streets on the east side, Central Avenue and an industrial (metal recycling) facility on the south side, and Central Avenue on the west side. The general area surrounding the Site consists of industrial land uses bordered by some residential properties toward the north and northeast directions. Another industrial site is located on the adjacent property to the northwest of the Site.

The Site, as shown in an aerial view on **Figure 1-1**, consists of a process building, a warehouse structure, and an office building. During operation, there were four Hi-Clay Alumina (HCA) storage cells (herein referred to as HCA cells) located on the Site. These cells were removed during the period of 2003 to 2005, and the area was returned to beneficial use in 2006.

#### **1.1.2 Summary of Recent Regulatory Activities**

Subsequent to the issue of the 2002 Corrective Action Plan (CAP), General Chemical voluntarily elected to remove the HCA material from the on-site cells.

Following excavation and removal of the HCA, a revised CAP was issued by General Chemical on 2 October 2006. A Georgia Environmental Protection Division (GaEPD) letter dated 16 January 2007 provided comments and a request for additional work followed by resubmission of the revised CAP.

General Chemical submitted a revised CAP incorporating GaEPD comments on 30 March 2007.

GaEPD completed review and issued a conditional approval of the revised CAP on 4 September 2007. Pursuant to the revised CAP, groundwater and surface water samples were collected for aluminum and sulfate analysis.

General Chemical submitted a voluntary remediation plan application (VRPA) in January 2013. The VRPA proposed: (i) delineation of the horizontal extent of sulfate contamination in groundwater; (ii) continued semi-annual sampling of monitoring wells screened in the partially weathered rock (PWR) and surface water sampling locations; (iii) conduct a storm water drain assessment and implement any necessary repairs to prevent groundwater from entering the storm drain system; and (iv) institutional controls on affected properties through the placement of unified environmental covenants.

In a letter dated 10 April 2013, GaEPD approved the VRPA. GaEPD issued comments on the VRPA on 12 April 2013.

General Chemical LLC was acquired by Chemtrade Solutions LLC on 24 January 2014. The General Chemical LLC name will be used when historically accurate and Chemtrade Solutions will be used for activities after the acquisition date.

## **1.2 Objectives and Scope**

The objective of this report is to present the results for the semi-annual groundwater monitoring activities conducted at the Site in April 2018. This is the ninth semi-annual report submitted to Georgia EPD following approval of the VRPA in April 2013. However, this report is issued as “Semi-Annual Groundwater Monitoring Report No. 20” to avoid confusion with previous reports issued under the CAP. This report provides a summary of the activities performed and the results of the field and laboratory measurements that were obtained during this monitoring period.

This report presents the results of the following activities:

- Sampling of 6 on-site wells (**Figure 1-2**);
- Sampling of 3 off-site wells (**Figure 1-2**); and
- Sampling of surface water at one on-site and three off-site locations (**Figure 1-3**).

## **1.3 Overview**

This semi-annual groundwater monitoring report summarizes the results of field sampling activities performed by Geosyntec in April 2018. The report is organized as follows:

- Section 2 presents a summary of site characterization information including site geology and hydrogeology, field investigations, nature and extent of environmental impact, and site-specific groundwater and contaminant transport conceptual modeling.
- Section 3 presents the results from sampling of monitoring wells and stormwater from the Site.
- Section 4 discusses the sampling procedures used to obtain groundwater and stormwater samples from the Site
- Section 5 summarizes the results of quality assurance/quality control (QA/QC) evaluation of the data obtained during this monitoring period.
- Section 6 presents conclusions that are based on the data and provide recommendations for future activities.
- Data from this monitoring period are presented in the Appendices. Analytical laboratory reports for water samples are presented in **Appendix A**. Field Forms used during well sampling are presented in **Appendix B**. Mann-Kendall trend analysis output is presented in **Appendix C**.

## 2 SITE CHARACTERIZATION

### 2.1 Site Geology and Hydrogeology

This section presents an overview of the Site hydrogeologic conditions. Information on the Site hydrogeology was obtained during the Site investigation activities, conducted in May 1998 in support of the Compliance Status Report (CSR) [Geosyntec, 1999].

The occurrence and movement of groundwater in the Piedmont formation is generally within two hydrogeologic units. A shallow hydrogeologic unit typically occurs within the soils and saprolite (weathered residuum which mantles bedrock). A layer of partially weathered rock (PWR) typically forms a transition between the saprolite and the fractured bedrock. A deeper hydrogeologic unit generally occurs within the fractured bedrock.

Groundwater in the shallow hydrogeologic unit usually occurs under water table (i.e., unconfined) conditions. Groundwater flow is controlled by local topographic features, where recharge occurs in upland areas and discharge occurs in drainage features such as streams, rivers, or lakes. Recharge to the shallow hydrogeologic unit is primarily the result of infiltrating precipitation. Groundwater in the deeper water-bearing zone is associated with secondary porosity (fractures or open spaces) within the crystalline bedrock and flow is controlled by the distribution and degree of interconnection of these openings in the rock. The deeper hydrogeologic unit is fully saturated.

Based on the results of the field investigation, the shallow hydrogeologic unit is conceptualized as an unconfined, homogeneous, and isotropic deposit of sandy clay with a hydraulic conductivity of approximately  $4 \times 10^{-5}$  to  $2 \times 10^{-4}$  cm/s, a hydraulic gradient of approximately 0.003 to 0.03, and an effective porosity of about 20 percent. Groundwater is believed to generally flow at about 16.4 ft per year from west to east across the Site and advection is believed to be the dominant contaminant transport mechanism.

The Site is in an area of relatively steep topography adjacent to a small intermittent stream that discharges to the South River. As can be seen on the aerial photograph of the Site presented in **Figure 1.2**, industrial operations at the Site have resulted in regrading and leveling of a significant portion of the Site (i.e., vegetated areas east of the process buildings). Groundwater flow at the Site is generally west to east.

The lithology of the Site consists primarily of clayey fill material overlying saprolite as depicted on **Figures 2-1 through 2-3**, which illustrate hydrogeologic cross-sections that show the Site features and geology. The fill material, which varies in thickness, covers most of the Site and consists of sandy to gravelly red micaceous clay. The saprolite, encountered in all fourteen of the monitoring wells drilled at the Site, consists of highly weathered schist consisting of orange to red clay with kaolinite and mica. Foliation and other relict rock texture are still well preserved and were visible in samples, but the material comprises mostly clay and mica which is formed by the deep weathering of the feldspar minerals. Competent bedrock, as defined by auger refusal, was generally encountered between 20 to 60 feet below ground surface (bgs).

## **2.2 Summary of Previous Site Investigations**

The aluminum concentrations observed in the Site soil during the CSR investigation are within the range typically seen in Piedmont soils (i.e., 70,000 to 100,000 mg/kg). The samples, in which the aluminum concentrations were elevated, were limited to locations of accumulation of more strongly weathered material. Therefore, based on detected concentrations of aluminum in soil samples, industrial activities at the Site have not resulted in a significant increase in aluminum concentrations in the soil [Geosyntec, 1999].

The HCA was removed between 2003 and 2006. Sulfate concentrations vary according to the nature of the material analyzed and were related to the proximity to former HCA cells. In places where the undisturbed soils directly underlie former HCA cells, sulfate concentrations in these soils were typically higher than those of other undisturbed soils. Following removal of the HCA, underlying soils were sampled and analyzed for sulfate, and soils exhibiting sulfate concentrations over 10,300 mg/kg (95% Upper Confidence Limit for all samples was 3,143 mg/kg) were removed.

### 3. GROUNDWATER AND STORM DRAIN SAMPLING

This section presents the details of the sampling of six on-site wells, and three off-site groundwater wells and one on-site and three off-site stormwater storm drains.

#### 3.1 Groundwater Potentiometric Conditions

Groundwater elevations were measured prior to sampling wells during the April sampling event. The measurements were performed on 3-4 April 2018. All monitoring wells were gauged. The results of the groundwater elevation measurements are provided in **Table 3-1**.

The potentiometric map for April 2018 readings is shown in **Figure 3-1**. This map shows the typical Piedmont pattern of flow following topography towards surface water features, which act as collectors and discharge points for the groundwater. Since there are no streams at the Site, the groundwater is flowing towards the local topographic low which is aligned parallel with North Martin Street and the storm drain system. The general potentiometric pattern is consistent with the overall drainage flow pattern to the east-southeast towards the South River.

Water level measurements were recorded in wells screened in saprolite and shallow competent rock. In preparing the potentiometric map from water level measurements, generally no distinction was made as to whether the wells were shallow or deep, in saprolite or bedrock. Such distinctions were not appropriate for two reasons: (i) the Piedmont is characterized by a single saturated zone consisting of saprolite and bedrock that are hydraulically connected; and (ii) the vertical components of the head gradient are similar or small compared to the horizontal components.

#### 3.2 Groundwater Sampling

##### 3.2.1 Introduction

Groundwater samples were collected on 3-4 April 2018. Groundwater samples were submitted for analysis for sulfate using EPA Method 9056A and aluminum using EPA Method 6010C. The pH was measured in the field using EPA Method 150.1. The groundwater sampling results are presented in **Table 3-2**. Laboratory results are presented in **Appendix A** and field forms are presented in **Appendix B**.

### 3.2.2 Groundwater Constituent Summary

Sulfate was detected at the nine monitoring wells sampled during the April 2018 sampling event. The sulfate concentrations were typically lower in the off-site wells, 69.4 mg/l at EPW-01 at the northwestern boundary of the Site, and 7.2 mg/l at EPW-02 to the east of the Site. Sulfate concentration in off-site well EPW-03D was 21.2 mg/l. On-site well OW-1A at the western boundary was measured at 41.0 mg/l. The background monitoring well GCW-01D at the upgradient edge of the Site had 167 mg/l of sulfate. The results indicate groundwater entering the Site contains background concentrations of sulfate between 41.0 and 69.4 mg/l as measured at OW-1A and EPW-01. These values are also consistent with the upgradient storm drain location SW-09 where sulfate was measured at 105 mg/l. The sulfate concentration along the northern property boundary at GCW-04D was 26.2 mg/l in April 2018. GCW-04D well is located outside the former impoundment areas. Sulfate at the eastern boundary at GCW-02D and GCW-03D were 1,670 and 3,130 mg/l, respectively. The source area monitoring well (GCW-05) sulfate concentration was 350 mg/l. The April 2018 sampling result sulfate concentrations were generally similar to or less than October 2017 sulfate concentrations.

Aluminum was detected at six of the nine monitoring wells sampled during the April 2018 sampling event. The concentrations were low at the off-site wells, 11.7 mg/l at EPW-01 at the northwestern boundary of the Site and <0.1 at EPW-02 and EPW-03D, located to the east and northeast of the Site, respectively. On-site well OW-1A at the western boundary had 0.75 mg/l of aluminum. The background monitoring well GCW-01D at the upgradient edge of the Site contained 5.3 mg/l. The results indicate groundwater entering the Site contains background concentrations of aluminum between 0.75 to 11.7 mg/l as measured at OW-1A and EPW-01. These values are also consistent with the upgradient storm drain location SW-09 where aluminum was measured at 0.2 mg/l. The aluminum concentration along the northern property boundary at GCW-04D was 0.91 mg/l.

Aluminum concentrations at GCW-04D have been low since it was measured at 0.1 mg/l in March 2015 through May 2016 when it was measured at 0.6 mg/L. Aluminum concentration is directly related to pH. The pH at GCW-04D increased to background levels between March 2015 and May 2016, resulting in the decrease in aluminum concentration. During the October 2016 sampling event, the pH dropped to 3.6, resulting in an increase in the aluminum concentration. In April 2017, the pH was measured to be 3.4, resulting in an aluminum concentration of 420 mg/l and in October 2017, the pH was



measured to be 3.5, which is consistent with the concentration in October 2016. In April 2018, the pH increased to 6.2, resulting in a decreased aluminum concentration of 0.91 mg/l. Aluminum concentrations at the eastern boundary at GCW-02D and GCW-03D were 144 and 287 mg/l, respectively. The source area monitoring well (GCW-05) aluminum concentration was <0.1 mg/l.

The pH measurements were generally consistent with past measurements. The off-site wells EPW-01, -02, and -03 ranged from 4.9 to 5.8 standard units (s.u.). The upgradient wells GCW-01D and OW-1A were 3.9 and 4.4 s.u. respectively. The pH along the northern property boundary at well GCW-04D was 6.2 s.u. The northern and eastern wells GCW-02D and GCW-03D were measured at 3.6 and 3.1 s.u. The pH for source area monitoring well (GCW-05) was measured at 6.9 s.u.

### 3.2.3 Comparison to Previous Results for Groundwater

**Table 3-3** summarizes statistical trend analysis of both aluminum and sulfate data in groundwater. Mann-Kendall trend analysis was performed using available data for each monitoring well at a 95% confidence level. The data used for the Mann-Kendall trend analysis calculations is presented in **Appendix C**. The procedure and methodologies employed in the analysis of the data are consistent with Georgia EPD and United States Environmental Protection Agency (EPA) recommended procedures. These methods meet the performance criteria specified in the rules of the Georgia EPD, Chapter 391-3-4-.14(19) and the technical standards described in the EPA "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance," dated March 2009.

Historical trend graphs for sulfate and pH are shown in **Figure 3-2**. Sulfate concentrations generally decreased or were stable in off-site and on-site wells in groundwater. The sulfate concentrations in monitoring wells GCW-01D, GCW-02D, GCW-04D, EPW-02 and OW-1A showed a statistically significant decreasing trend. EPW-01 has historically shown an increasing trend, but the Mann-Kendall trend analysis conducted using the April 2018 sampling data shows that there is neither a statistically significant increasing nor decreasing trend. Neither a decreasing nor an increasing trend was calculated for sulfate concentration in monitoring well EPW-03D. Similarly, aluminum concentrations also decreased or were stable in groundwater. A statistically significant decreasing trend was calculated for aluminum in monitoring wells GCW-01D, GCW-02D, GCW-03D, GCW-04D, GCW-05, EPW-03D and OW-01A. Neither decreasing nor increasing trends were calculated for aluminum in the remainder of the wells. The pH measurements were

generally stable. The pH measured at on-site wells was generally lower than the pH measured at the off-site wells except for the source area well which had a higher pH than background.

Several conditions not related to the Site may slow the return of the Site to background concentrations of site constituents, following removal of source materials. These include the following:

- The pH of the groundwater in upgradient wells (OW-1A and GCW-01D) is low. Measured pH values 4.4 and 3.9 s.u. respectively. The low pH condition of groundwater entering the Site will slow a return to background conditions for pH and aluminum.
- The pH of rainwater at the Site was measured at less than 5 during the HCA removal, therefore infiltrating rainfall will not have a significant effect in terms of raising the groundwater pH in the short-term.
- The area surrounding the Site has a number of other sources of sulfate in groundwater resulting from previous operations. Potential sulfate sources include a former battery cracking plant, a former fertilizer manufacturer, two off-site HCA disposal areas operated by others, and a former agricultural chemical manufacturer.
- The former fertilizer manufacturer (Furman Fertilizer, now MGA Holdings) operated an acid pit (Sanborn, 1925). Downgradient of the acid pits at delineation boring DB-05 sulfate was observed at a concentration of 1,000 mg/l. The delineation boring location is upgradient and side gradient to the former HCA impoundments shown in **Figure 1-2**.

It is encouraging that no significant impacts have been detected at downgradient wells EPW-02 or EPW-03D. The sulfate concentrations at EPW-02 appear stable and are similar or lower than regional background conditions of 46 to 140 mg/l as observed at well EPW-01. EPW-03D is located approximately 200 feet from the Site boundary. Sulfate concentrations at EPW-03D are similar to the regional background, and trends are decreasing. The pH trend at the EPW-03D is stable and typical for the Piedmont with measurements generally between 5 and 7 s.u. The decreasing sulfate concentrations and stable pH indicate impacts from the Site, if they ever existed, are minimal and decreasing

with time. The concentration of constituents of concern from both on-site and off-site sources appear to have attenuated to background levels prior to reaching EPW-02 or EPW-03D.

The removal of the HCA source material appears to be resulting in the Site returning to background conditions over time. The sulfate concentrations are in decline at downgradient wells. However, it will take time for residuals to mix with infiltration and incoming groundwater and for geochemical conditions to stabilize.

The groundwater measurements were compared to Type 4 Risk Reduction Standards (RRS) of 1,200 mg/l for sulfate and 102 mg/l for aluminum. The measured concentrations were interpolated to develop limits of area in excess of the Type 4 RRs. Comparisons of the Site groundwater to Type 4 RRS for sulfate and aluminum are presented in **Figures 3-4 and 3-5**.

### **3.3 Storm Drain Sampling**

#### **3.3.1 Introduction**

Storm drain water samples were collected from one on-site and three off-site storm drains in April 2018. Surface water flows in the storm drain system in the following sequence: SW-09, SW-06, SW-02, SW-07 from upstream to downstream. The purpose of the storm drain sampling program was to evaluate potential impacts to the storm drain system as requested by Georgia EPD. Stormwater samples were submitted for analysis for sulfate using EPA Method 9056A and aluminum using EPA Method 6010C. The pH was measured in the field using EPA Method 150.1. The stormwater sampling locations are shown on **Figure 1-3**. The stormwater sampling results are presented in **Table 3-4**. Laboratory results are presented in **Appendix A** and field forms are presented in **Appendix B**.

#### **3.3.2 Storm Drain Constituent Summary**

Sulfate was detected in the four storm drain samples during the April 2018 sampling event. The upgradient (SW-09) sulfate concentration was measured at 105 mg/l. A sample was collected cross-gradient (SW-06) at a location in the John D. Milner Sports Complex. Sulfate was measured at 1,370 mg/l. At the on-site location (SW-02), sulfate was measured at 737 mg/l. The sulfate concentration at the discharge of the storm drain to surface water at SW-07 was measured at 434 mg/l.

Aluminum was detected in the four storm drain water monitoring locations during the April 2018 sampling event. The upgradient (SW-09) aluminum concentration was 0.16 mg/l. The sample for aluminum collected cross-gradient (SW-06) was measured at 134.0 mg/l. At the on-site location (SW-02) aluminum was measured at 66.0 mg/l. The aluminum concentration at the discharge of the storm drain to surface water at SW-07 was measured at 38.0 mg/l.

### 3.3.3 Comparison to Previous Results for Storm Drains

**Table 3-5** summarizes statistical trend analysis of both aluminum and sulfate data in storm drains. Mann-Kendall trend analysis was performed using available data for each storm drain at a 95% confidence level. The data used for the Mann-Kendall trend analysis calculations is presented in **Appendix C**. The procedure and methodologies employed in the analysis of the data are consistent with Georgia EPD and United States Environmental Protection Agency (EPA) recommended procedures. These methods meet the performance criteria specified in the rules of the Georgia EPD, Chapter 391-3-4-.14(19) and the technical standards described in the EPA "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Unified Guidance," dated March 2009.

Historical trend graphs for sulfate, aluminum, and pH are shown in **Figure 3-3**. Sulfate concentrations were generally stable. A statistically significant increasing trend was calculated for sulfate in SW-06 (cross-gradient storm drain). Neither decreasing nor increasing trends were calculated for sulfate in the remainder of the wells. Aluminum concentrations were generally stable. The pH measurements were relatively stable showing minor changes between sampling events at the same location. The trend at SW-06 has changed from no trend to increasing between this sampling event and the previous sampling event. Neither decreasing nor increasing trends were calculated for aluminum in the remainder of the wells. The pH measurements were generally stable. The pH measured upgradient was generally higher than the pH measured at the on-site, cross-gradient, and downgradient storm drains.

Several conditions not related to the Site may slow the return of the Site to background concentrations of site constituents, following removal of source materials. These include the following:

- The pH of rainwater at the Site was measured at less than 5 during the HCA removal, therefore infiltrating rainfall will not have a significant effect in terms of raising the stormwater pH.
- The area surrounding the Site has a number of other sources of sulfate in groundwater resulting from previous operations. Potential sulfate sources include a former battery cracking plant, a former fertilizer manufacturer, two off-site HCA disposal areas operated by others, and a former agricultural chemical manufacturer.
- The former fertilizer manufacturer (Furman Fertilizer, now MGA Holdings) operated an acid pit (Sanborn, 1925). Downgradient of the acid pits at delineation boring DB-05 sulfate was observed at a concentration of 1,000 mg/l. The delineation boring location is upgradient and side gradient to the former HCA impoundments.

## 4. SAMPLE COLLECTION PROCEDURES

### 4.1 Summary

In April 2018, samples were collected from nine monitoring wells. Samples from monitoring wells were collected using dedicated tubing and low-flow purging techniques. Dedicated 1/8" polyethylene sampling tubing has been installed in each well. The end of the tubing is set in the middle of the screened interval. The end of tubing for EPW-01, EPW-02, and OW-01A is approximately 5 feet off the bottom of the well. Samples were placed in 250 ml and 150 ml polyethylene containers for aluminum and sulfate analyses, respectively. The containers for aluminum were preserved with approximately 2 ml of nitric acid and ice. Sulfate samples were preserved with ice. The sampling containers and preservatives were provided by Pace Analytical Services, LLC. located in Peachtree Corners, Georgia. The containers were labeled and stored on ice in a cooler until time for shipment to the laboratory. The samples were packed in ice in a cooler and hand delivered by a courier to the laboratory. Chain-of-custody documents were completed and included with each shipment.

### 4.2 Monitoring Well Sampling Procedure

Monitoring wells were sampled using peristaltic pumps. The samples were collected in general accordance with EPA's Field Branches Quality System and Technical Procedures (FBQSTP) Operating Procedure for "Groundwater Sampling", SESDPROC-301-R3 using the MicroPurge procedures for the "Tubing-in-Screened-Interval" Method. Peristaltic pumps were used since the depth to water was less than 29 ft bgs, which is the maximum practical lift a peristaltic pump can achieve. The advantages of peristaltic pumps are that they produce low rates of flow with minimal surging and can be decontaminated more thoroughly when compared to bailers or other types of pumps by simply replacing the tubing in the pump head. The pump-head tubing is silicone, while the down-hole tubing is polyethylene. The sample tubing is polyethylene instead of Teflon lined since the constituent concentrations are high (i.e., ppm not ppb) and sulfate and aluminum do not bind to polyethylene tubing.

Low flow purging was conducted by purging groundwater from the well at a low, constant rate for an extended period of time with the pump intake (i.e., the end of the dedicated tubing) set directly opposite the middle of the well screen. This method creates a localized flow system in the well directly between the screen and pump intake,

eliminating the need to remove large volumes of casing storage while ensuring that the sample collected is representative of the surrounding ground water. For this project, a purge rate of approximately 400 mL/min was extracted until the turbidity was stable at less than 20 NTUs or until other field parameters were stable. Additionally, a purge volume of two and one-half to five gallons was removed, when possible, to represent at least one and one-half to three pore volumes of the screened zone of the well.

To ensure that the samples collected are representative of the ground water in the formation, field parameters were measured throughout the purging process at least every 5 minutes. Temperature (°C), conductivity (mS/cm), pH (s.u.), redox potential (mV), dissolved oxygen (mg/l), and turbidity (NTU) were measured using a Horiba U-52 or equivalent water quality meter. Measurements were taken in an enclosed flow-through cell to minimize the effects of contact with air.

After the field parameters stabilized, the flow-through cell was disconnected, and the sample was collected directly from the pump discharge tubing without adjusting the flow rate. This method ensured that the sample was representative of the groundwater at the respective location.

#### **4.3 Groundwater Sampling Decontamination Procedure**

Down well tubing was dedicated to each monitoring well by securing to the well cap and placing the tubing completely in the well when not in use. Pump-head tubing for the peristaltic pump was discarded after each use.

#### **4.4 Storm Drain Sampling Procedure**

Storm drain water was sampled using peristaltic pumps or by hand. The pump-head tubing is silicone, while the down-hole tubing is polyethylene. Four locations were sampled for sulfate and aluminum in April 2018.

Storm drain water sampling was performed at the upgradient (SW-09), on-site (SW-02) and cross-gradient (SW-06) locations by lowering tubing into storm drain manholes and placing the end of the tube near the outlet for the manhole. This ensured water from multiple inlets was mixed prior to sample collection. The downgradient (SW-07) sample was collected by hand at the outlet to the storm drain at the discharge to the stream.

For peristaltic pump samples, a purge rate of approximately 500 mL/min was maintained until the turbidity was stable at less than 20 NTUs or until other field parameters were stable. At SW-02, the turbidity was measured above 20 NTUs during purging, but due to the limited amount of water in the storm drain, SW-02 was sampled after two consistent measurements of field parameters. To ensure that the samples collected are representative of the storm drain water, field parameters are measured throughout the purging process. Temperature (°C), conductivity (mS/cm), pH (s.u.), redox potential (mV), dissolved oxygen (mg/l), and turbidity (NTU) are measured using a Horiba U-52 or equivalent water quality meter. Measurements were taken in an enclosed flow-through cell to minimize the effects of contact with air.

After the field parameters have stabilized, the flow-through cell was disconnected, and the sample was collected directly from the pump discharge tubing without adjusting the flow rate. This method ensures that the sample is representative of the storm drain water surrounding the respective location.

For hand sampling (i.e., for SW-07), a location near the center of the flow and free of surface debris was selected. The sample was collected from beneath the surface by inserting the container opening down into the water then inverting underwater. A set of field parameters were measured by inserting the water quality instrument in the flow at the sampling location.

#### **4.5 Storm Drain Sampling Decontamination Procedure**

Drop tubing and pump-head tubing for the peristaltic pump were discarded after each use.



## **5. QUALITY ASSURANCE/QUALITY CONTROL**

The field and analytical data from this semi-annual groundwater monitoring period was reviewed by Mr. Brian Jacobson with Geosyntec. The data review included evaluation of the field and laboratory quality assurance/quality control (QA/QC) parameters in order to assess the integrity of the data obtained for this project including: documentation, holding times, laboratory control samples, and laboratory matrix spike analyses. The documentation and results of the QA/QC analyses are found in the laboratory reports provided in **Appendix A**. Evaluation of these parameters was used to assess the precision, accuracy, representativeness, comparability, and completeness of the data.

Based on the review of the field and laboratory data, the data obtained from this field investigation are considered to be of acceptable quality and are fully usable with the qualifications as designated by the data validation process. Details of the QA/QC review of the data are presented in the following sections.

### **5.1 Documentation**

Field sampling forms and chain-of-custody forms were evaluated for completeness. Field records were considered to be usable and to provide a reasonable record of field activities and samples collected. This review indicated that field sampling and custody transfer procedures were adequately documented and the integrity of the samples was not compromised.

### **5.2 Holding Times**

All samples were processed and analyzed by the laboratory using the correct analytical methods and within the prescribed holding times.

### **5.3 Reporting Limits**

The laboratory reporting limits for sulfate by Method 9056A varied from 5 to 500 mg/l depending on the required dilution to measure a result. The laboratory reporting limit for aluminum by Method 6010D was 0.1 mg/l. The required quantitation limits for this project were met for all data, except in cases where sample dilution was required because of high concentrations of target analytes or matrix interference.

#### **5.4 Accuracy**

The accuracy of the data was evaluated by examining the percent recovery (%R) of matrix spikes and matrix spike duplicate (MS and MSD), and laboratory control samples (LCS). A post digestion spike was also performed for aluminum analysis to evaluate possible matrix effects of the digestate. The %Rs met the laboratory-specific QC limits for the laboratory QC LCS samples. The MS samples for sulfate and aluminum were outside the %R limits for MS and MSD samples as well as for the post digestion spike. The low recoveries were due to the low spike concentration in relation to the actual sample concentration of aluminum and sulfate (sample concentration much greater than the spiked amount). The data were judged acceptable for use based on the acceptable %R for the LCS samples.

#### **5.5 Representativeness**

Representativeness was evaluated to assess the degree to which sample results represent the actual concentrations of constituents in groundwater. Representativeness was evaluated qualitatively by reviewing sampling procedures and laboratory analytical procedures. Based on this review, the samples yielded results that provided a good qualitative representation of constituent concentrations in groundwater.

A qualitative evaluation of representativeness was also performed by examining the analysis of laboratory method blanks. Constituents were not detected above the reporting limit in any of the method blanks. This evaluation further demonstrates that the analytical data are representative of actual conditions.

#### **5.6 Comparability**

The current field and laboratory methods were compared to methods used during past monitoring periods in order to evaluate the comparability of data obtained during the current monitoring period to data previously obtained. The recommended reporting limits were used for all constituents. The data presented in this report are consistent with the data presented in previous reports.

## 5.7 Completeness

Completeness was measured by determining the percentage of usable data obtained from samples for this project. The project sample results were found to be 100 percent complete and usable without qualification.

## 6. CONCLUSIONS

### 6.1 Groundwater

The results of the ten years of data collection indicate concentrations of constituents of concern are generally showing significant decreasing trends or stability for on-site monitoring wells. The HCA source material has been removed for over ten years. While many factors can influence concentrations at any given point in time, (e.g., time since removal of the source, hydrogeologic conditions, and precipitation patterns) it is encouraging to see that the general trend of concentrations of monitored constituents is decreasing. Groundwater levels (elevations) have been generally stable since 2008.

Sulfate concentrations show a statistically significant decreasing trend in the six on-site groundwater wells. The decreasing trends are consistent with source removal followed by natural attenuation of the remaining pore water.

Aluminum concentrations did not vary in a consistent direction between sampling events. Total aluminum concentration is pH dependent and since Piedmont soils contain high levels of naturally occurring aluminum, this phenomenon is not unexpected. Additionally, aluminum hydroxide can migrate as a colloid in groundwater. As shown in **Figure 6-1**, on-site wells consistently had aluminum concentrations above solubility limits indicating solid colloidal aluminum was likely being measured in the groundwater samples. Elimination of the colloidal aluminum would result in at least an order of magnitude reduction in total aluminum measured. For example, as shown on **Figure 6-1**, the measured total aluminum concentration was 26 mg/l, whereas the maximum soluble concentration at pH 4.0 is 0.6 mg/l, a 98 percent decrease from the reported value. The natural filtering of the aluminum floc particles by the soil as the water migrates off site may explain the rapid reduction in observed aluminum concentrations with increasing distance from the former source area.

The pH measurements were generally stable between the sampling events. While this is encouraging, we believe that local precipitation which has been measured with a pH less than 5 standard units will limit recovery of groundwater pH. The depressed pH will continue to allow naturally occurring aluminum to be mobilized from site soils. However, the aluminum does not appear to be migrating off site.

## 6.2 Storm Drains

Storm drains at the Site have been sampled during 24 sampling events. Storm drain water and groundwater are related due to leaks in the storm drains that allow the infiltration/exfiltration of stormwater and groundwater depending on the relative water levels. The stormwater constituent concentrations and pH will vary slowly due to the low groundwater flow velocity across the Site (previously estimated at 16.4 ft. per year). The potential presence of off-site sources may slow the return of the stormwater to background conditions. Factors that may slow a return to background include the following:

- The pH of the groundwater in upgradient wells (OW-1A and GCW-01D) is low. Measured pH values were 4.4 and 3.9 s.u., respectively. The low pH values of groundwater entering the Site will slow a return to background conditions of stormwater mixed with groundwater exiting the Site. The pH of stormwater in the cross-gradient sampling location (SW-06) was measured at 4.1 s.u. This water mixes with on-site stormwater lowering the pH.
- The pH of rainwater at the Site was measured at less than 5 during the HCA removal, therefore infiltrated rainfall and stormwater will not have a significant effect in terms of raising the stormwater pH in the short-term.
- The area surrounding the Site has a number of other sources of sulfate in groundwater resulting from previous operations. These sources may be contributing the elevated sulfate concentrations noted at SW-02 that were measured at 737 mg/l. Potential sulfate sources include a former battery cracking plant, a former fertilizer manufacturer, two off-site HCA disposal areas operated by others, and a former agricultural chemical manufacturer.

The sulfate concentrations at the upgradient monitoring point (SW-09) were lower than on-site (SW-02) or cross-gradient (SW-06) monitoring points. Downgradient (SW-07) sulfate concentration at the exit to the storm drain and the start of open channel flow was measured at 434 mg/l which is greater than the background concentration of 105 mg/l.

The cross-gradient (SW-06) concentrations of sulfate and aluminum were higher than the on-site (SW-02) concentrations during the last sampling event. Since the on-site source has been removed and potential off-site sources likely remain the relative contribution

from the Site would be expected to continue to decrease with time. As presented in **Figure 3-3**, the time trend analysis shows a continued impact from the cross-gradient SW-06, which is consistent with source removal on site and active potential impacts by a residual plume.

## **6.2 East Point Storm Drain Negotiations**

The City of East Point requested a series of meetings during the period of February to March 2017 to discuss storm drain concerns related to the Newell Recycling property and the adjacent Chemtrade site. The meetings participants included representatives from The City of East Point, Newell Recycling, Chemtrade, and GaEPD. Chemtrade requested a meeting to discuss access and scope of work with the City of East Point on August 3<sup>rd</sup>, August 18<sup>th</sup>, and December 18<sup>th</sup> 2017. Chemtrade restarted the process of negotiations with the City of East Point on January 12<sup>th</sup>, 2018. A site meeting was conducted on June 7<sup>th</sup>, 2018 to discuss logistics of installing the liner in a section of storm drain. The City of East Point was cooperative with scheduling work in the fall pending reaching an agreement with the City for a letter of No Further Action (NFA). The NFA discussions have not progressed to date.

## 7. REFERENCES

Geosyntec (1999), “*Compliance Status Report*”, General Chemical Corporation, East Point, Georgia”, prepared by Geosyntec Consultants, February 1999

Geosyntec (2002), “*Revised Corrective Action Plan, General Chemical Corporation, East Point, Georgia*”, prepared by Geosyntec Consultants, February 2002

Geosyntec (2006), “*Site restoration Report, General Chemical Corporation, East Point, Georgia*”, prepared by Geosyntec Consultants, February 2006

Geosyntec (2007), “*Revised Corrective Action Plan, General Chemical Corporation, East Point, Georgia*”, prepared by Geosyntec Consultants, February 2007

Geosyntec (2013), “*Voluntary Remediation Plan Application, General Chemical Corporation, East Point, Georgia*”, prepared by Geosyntec Consultants, January 2013

# TABLES



**Table 3-1**  
**Well Construction Data and Groundwater Elevations**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

Location	Well Casing Elevation	Adjacent Soil Elevation	Screen Interval (ft bgs)	Depth to Water (ft)	Groundwater Elevation (ft msl)
				Apr-18	Apr-18
GCW-01S	1023.6	1024	182	10.5	1013.2
GCW-01M	1023.8	1024	34-44	10.5	1013.3
GCW-01D	1023.9	1024	58-68	10.0	1013.9
GCW-02S	983.6	984	16-26	4.0	979.6
GCW-02D	983.4	984	34-44	3.5	980.0
GCW-02V	984.7	985.0	85.5-95.5	3.5	981.2
GCW-03S	981.3	981.6	11-21	4.6	976.6
GCW-03D	981.2	982	28-38	4.3	976.9
GCW-04S	996.6	997.0	13-23	8.4	988.3
GCW-04M	997.0	997.4	30-40	8.6	988.4
GCW-04D	996.8	997.1	50-60	8.2	988.6
GCW-04V	996.7	997.0	114-124	8.9	987.8
GCW-05	995.1	994.9	80-90	4.0	991.1
EPW-01	1017.5	1017.7	24.51 <sup>(1)</sup>	15.9	1001.6
EPW-02	980.0	980.3	19.41 <sup>(1)</sup>	10.0	969.9
EPW-03S	984.5	984.8	12-22	9.6	974.9
EPW-03M	984.3	984.6	29-39	9.3	975.0
EPW-03D	984.6	984.9	46-56	9.3	975.3
OW-1A <sup>(2)</sup>	1030.6	1027.9	23.5-33.5 <sup>(3)</sup>	12.7	1018.0

**Notes:**

<sup>(1)</sup>: Screen length is unknown. Total depth of the well is indicated in the table.

<sup>(2)</sup>: Well OW-1A has a casing extending above ground surface 2.7 ft.

<sup>(3)</sup>: Screen interval measured 7 November 2012.

NA: Not available

**Table 3-2  
Groundwater Sampling Results  
Chemtrade Solutions Site  
East Point, Georgia**

Location	pH (-) EPA 150.1	Sulfate (mg/l) EPA 9056A	Aluminum (mg/l) EPA6010C	Type 4 RRS Exceeded	
				Sulfate 1200 mg/l	Aluminum 102 mg/l
GCW-01D	3.9	167	5.3	No	No
GCW-02D	3.6	1670	144	Yes	Yes
GCW-03D	3.1	3130	287	Yes	Yes
GCW-04D	6.2	26.2	0.91	No	No
GCW-05	6.9	350	< 0.1	No	No
EPW-01	4.9	69.4	11.7	No	No
EPW-02	5.6	7.2	< 0.1	No	No
EPW-03D	5.8	21.2	< 0.1	No	No
OW-1A	4.4	41.0	0.75	No	No
Duplicate <sup>(1)</sup>	6.2	25.8	0.86	No	No

**Notes:**

<sup>(1)</sup>: Duplicate was taken from GCW-04D

**Table 3-3**  
**Summary of Statistical Trend Analysis**  
**Groundwater Samples**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

Well ID	Parameter	Mann-Kendall Trend Analysis at 95% Confidence Level
GCW-01D	Alumimum	Decreasing
GCW-02D		Decreasing
GCW-03D		No trend
GCW-04D		Decreasing
GCW-05		No trend
EPW-01		No trend
EPW-02		Decreasing
EPW-03D		No trend
OW-1A		Decreasing
GCW-01D		Sulfate
GCW-02D	Decreasing	
GCW-03D	Decreasing	
GCW-04D	Decreasing	
GCW-05	Decreasing	
EPW-01	No trend	
EPW-02	No trend	
EPW-03D	Decreasing	
OW-1A	Decreasing	

**Table 3-4**  
**Storm Drain Sampling Results**  
**April 2018**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

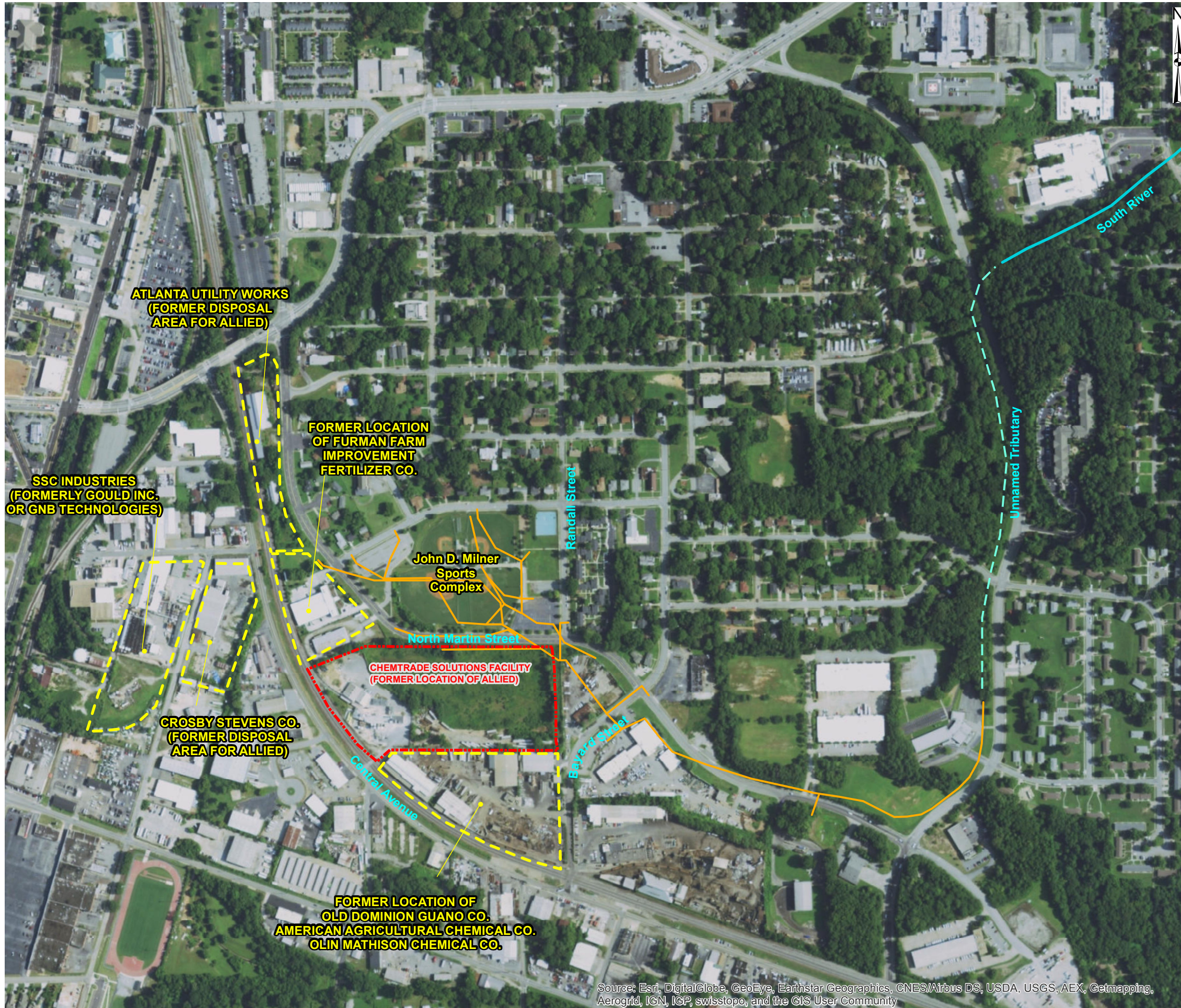
Location	Description	pH (-) EPA 150.1	Sulfate (mg/l) EPA 9056A	Aluminum (mg/l) EPA6010C
SW-02	On-site	4.2	737	66.0
SW-06	Cross-Gradient	4.1	1370	134.0
SW-07	Downgradient	4.6	434	38.0
SW-09	Upgradient	6.1	105	0.16
Duplicate	Duplicate SW-02	4.2	751	64.9

**Table 3-5**  
**Summary of Statistical Trend Analysis**  
**Storm Drain Samples**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

Sample Location	Parameter	Mann-Kendall Trend Analysis at 95% Confidence Level
SW-02	Alumimum	No trend
SW-06		No trend
SW-07		No trend
SW-09		No trend
SW-02	Sulfate	No trend
SW-06		Increasing
SW-07		No trend
SW-09		No trend

# FIGURES



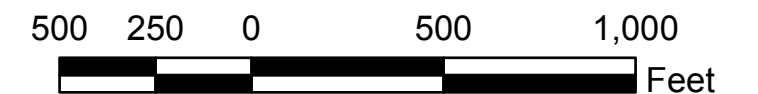


# SITE VICINITY MAP

## Chemtrade Solutions EAST POINT, GEORGIA

### Legend

- - - Approximate Property Line
- . - . - Approximate Site Property
- Storm Drain
- - - Unnamed Tributary
- SouthRiver



**Geosyntec**  
consultants

ATLANTA, GEORGIA

April 2018	SCALE: 1" = 500'
PROJECT NO. GR5060	FIGURE NO. 1-1
DOCUMENT NO.	FILE NO. Figure 1-1.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





<b>Legend</b>	Monitoring Well selection
	Excavation Cell
	Approximate Property Boundary

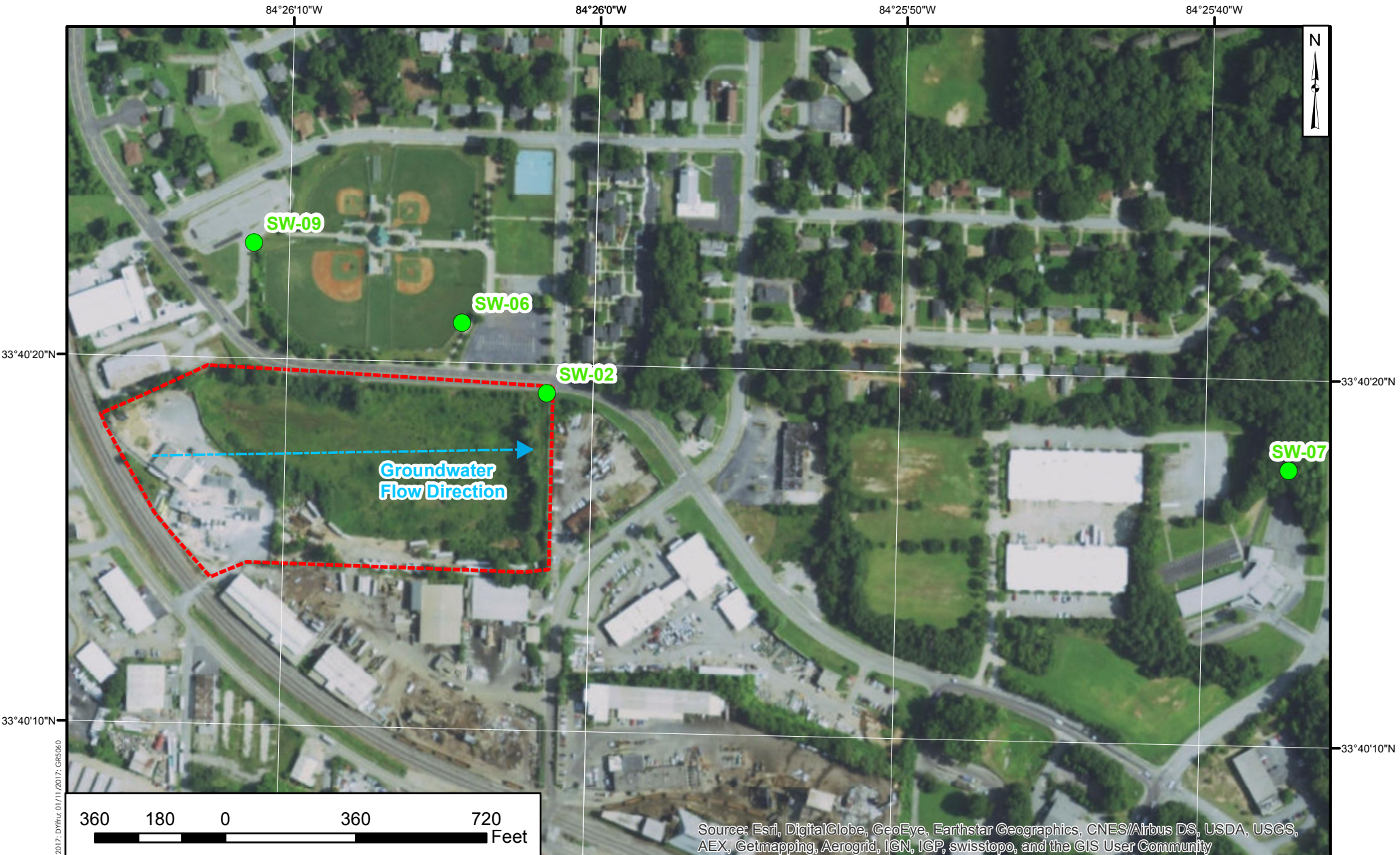
**Geosyntec**  
 consultants  
 Kennesaw, GA  
 April 2018

**MONITORING WELLS LOCATION MAP**  
 Chemtrade Solutions, East Point, GA

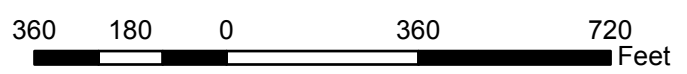
Figure  
 1-2

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



**Legend**

- Surface Water Sample Location
- Approximate Property Boundary

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Kennesaw, GA

April 2018

**STORM DRAIN SAMPLE LOCATION MAP**

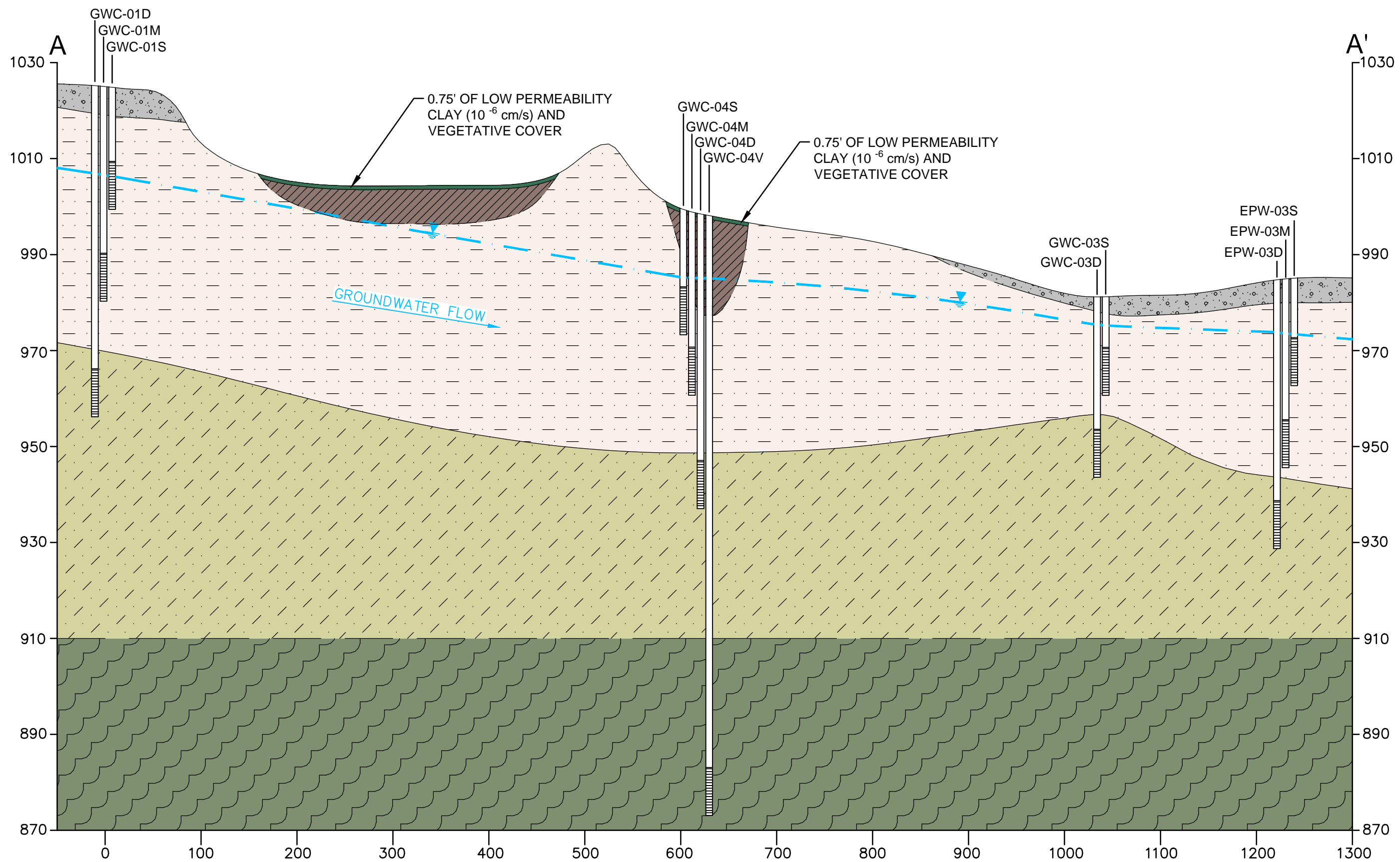
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**Figure  
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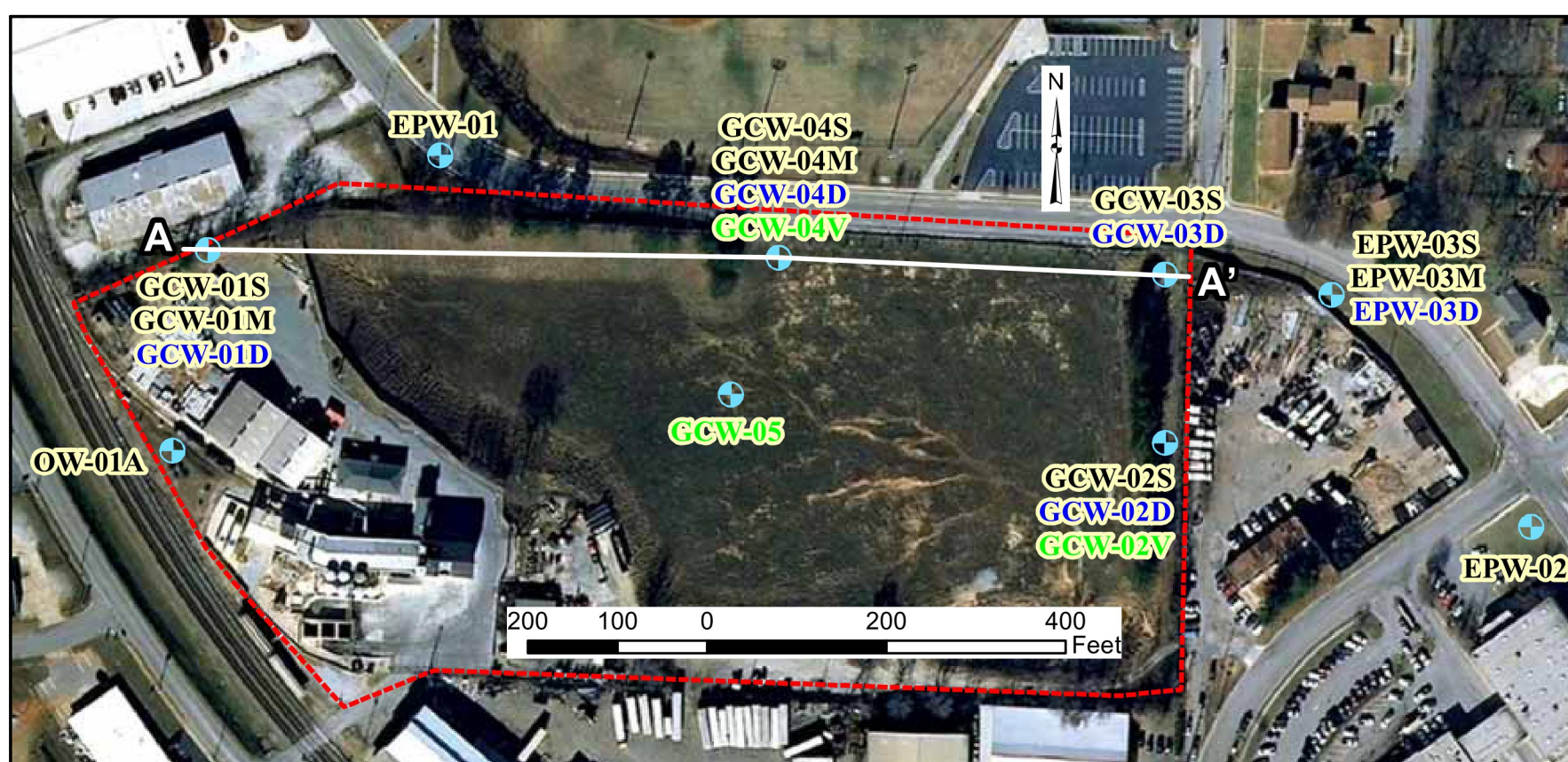
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# GEOLOGIC AND HYDROGEOLOGIC CROSS SECTION ALONG A-A'



## KEY MAP



## LEGEND

- 0.75' THICK LOW PERMEABILITY CLAY ( $10^{-6}$  cm/s) AND VEGETATIVE COVER
- GRAVELLY CLAY, FILL
- CLAY, FILL AFTER EXCAVATION
- SILTY SAND, RELICT SCHISTOCITY, MICACEOUS (SAPROLITE)
- PARTIALLY WEATHERED SCHIST
- BEDROCK (SCHIST)
- LITHOLOGIC CONTACT, DASHED WHERE INFERRED
- MONITORING WELL SCREEN ZONE WITH WATER ELEVATION (FEET MSL), NOVEMBER, 2012

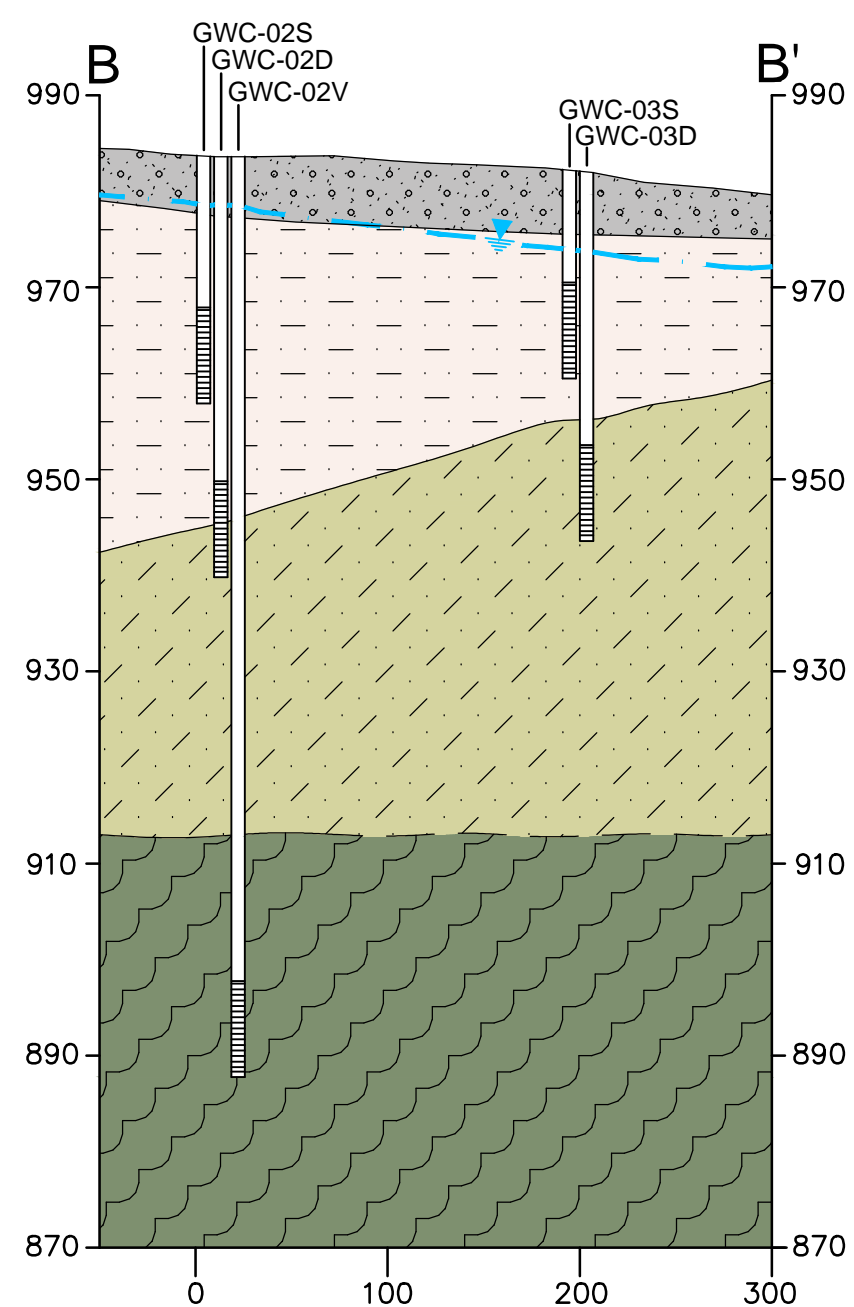
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 HORIZONTAL SCALE IN FEET  
 VERTICAL EXAGGERATION = 5X

**Geosyntec**  
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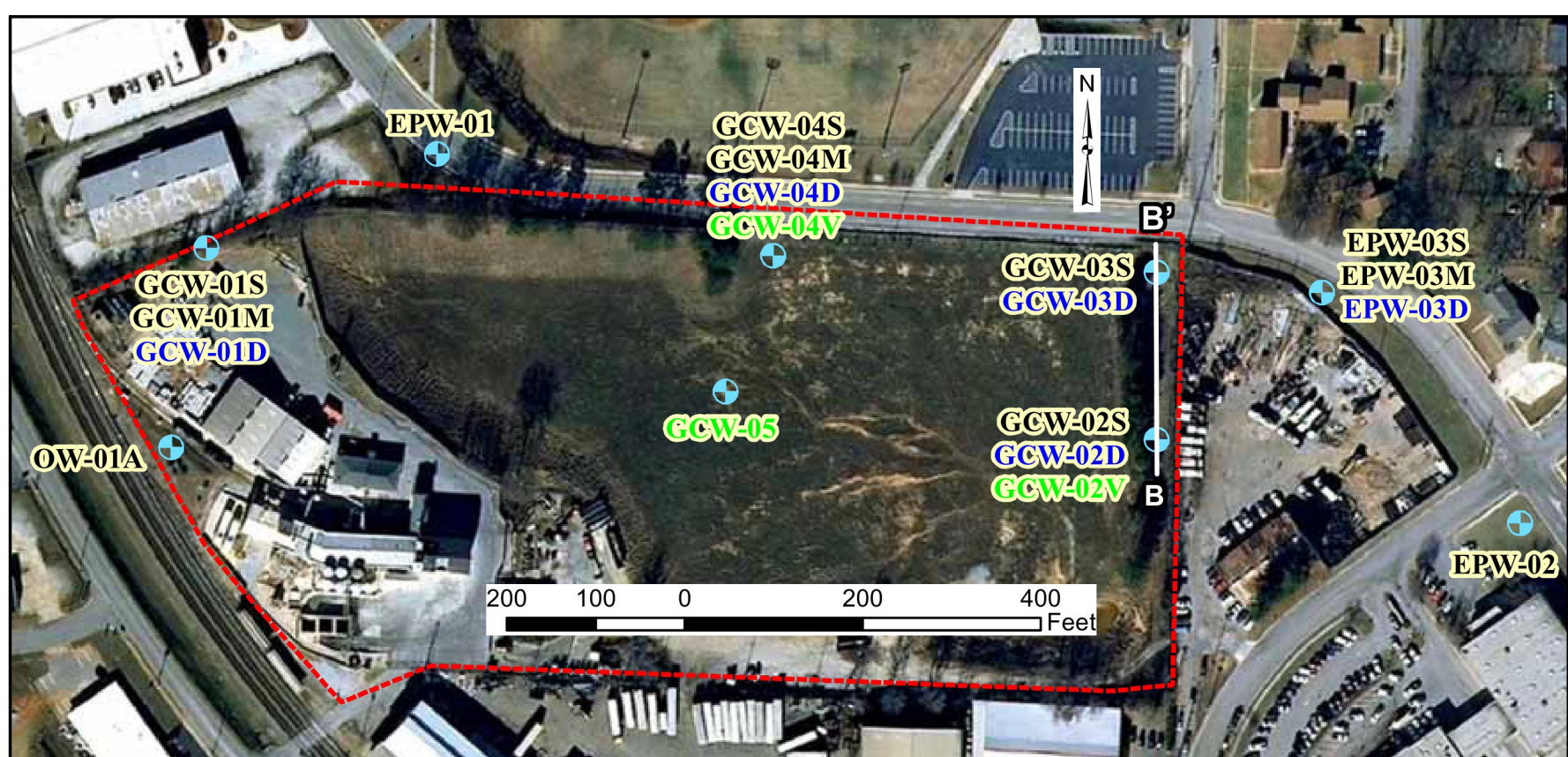
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PROJECT NO.	GR5060/12	FILE NO.	5060F001
DOCUMENT NO.	GA 130020	FIGURE NO.	2-1



# GEOLOGIC AND HYDROGEOLOGIC CROSS SECTION ALONG B-B'



## KEY MAP



## LEGEND

- GRAVELLY CLAY, FILL
- SILTY SAND, RELICT SCHISTOCITY, MICACEOUS (SAPROLITE)
- PARTIALLY WEATHERED SCHIST
- BEDROCK (SCHIST)
- LITHOLOGIC CONTACT, DASHED WHERE INFERRED
- MONITORING WELL SCREEN ZONE WITH WATER ELEVATION (FEET MSL), NOVEMBER, 2012

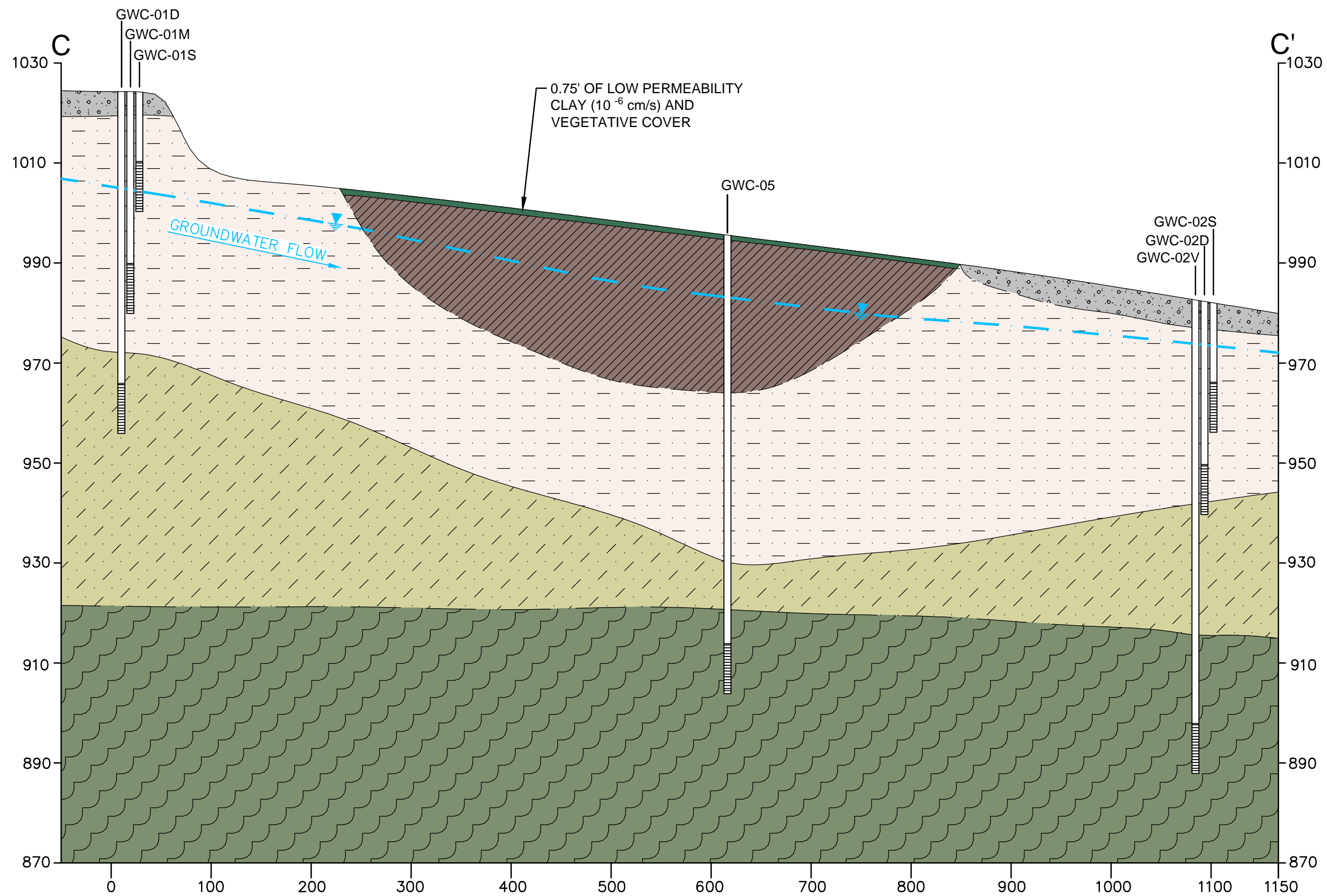
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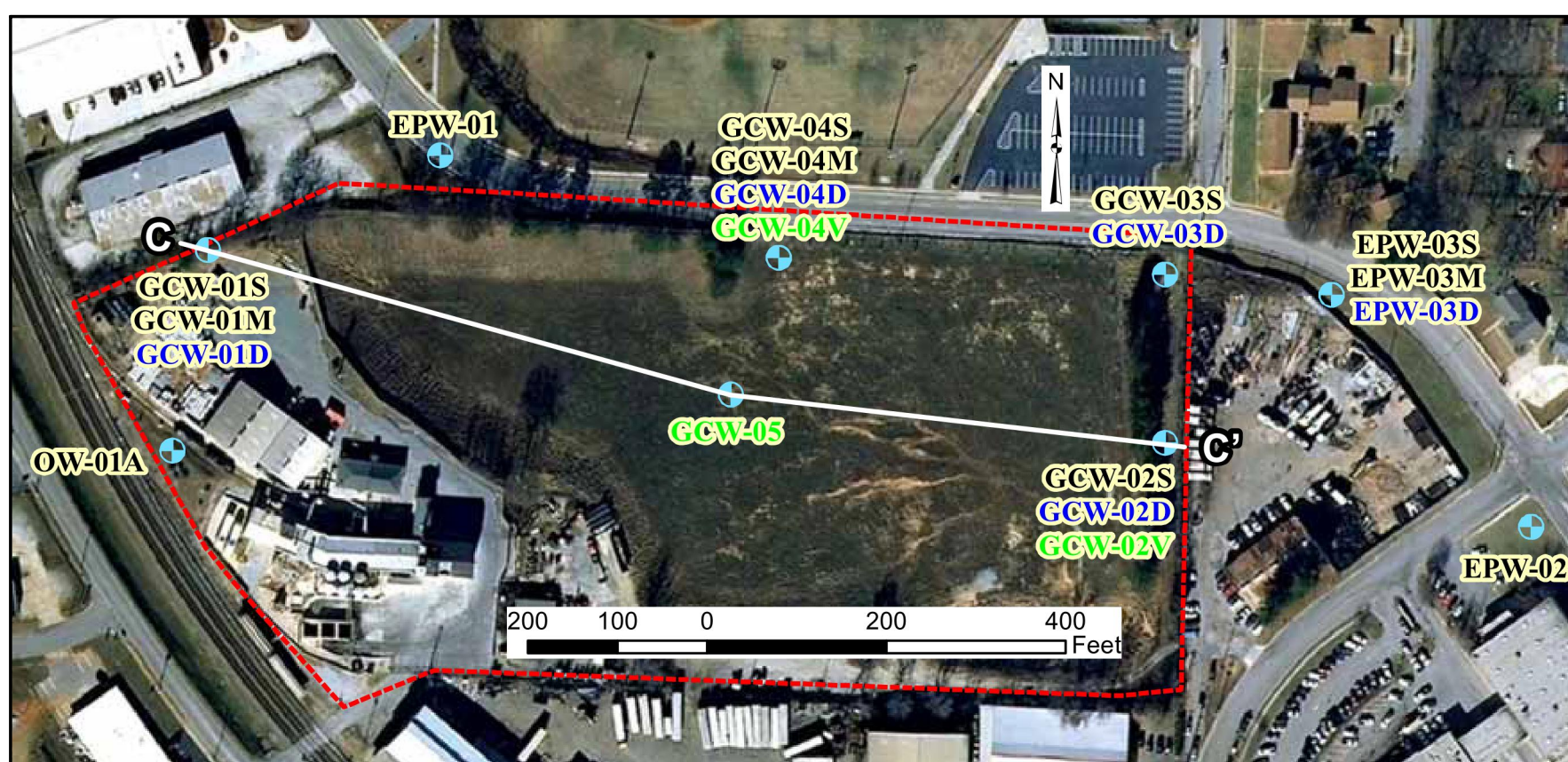
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DOCUMENT NO. GA 130020	FIGURE NO. 2-2



# GEOLOGIC AND HYDROGEOLOGIC CROSS SECTION ALONG C-C'

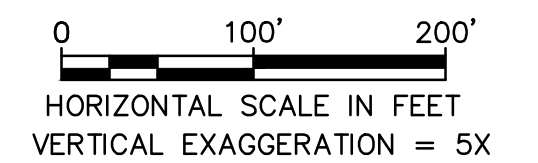


## KEY MAP



## LEGEND

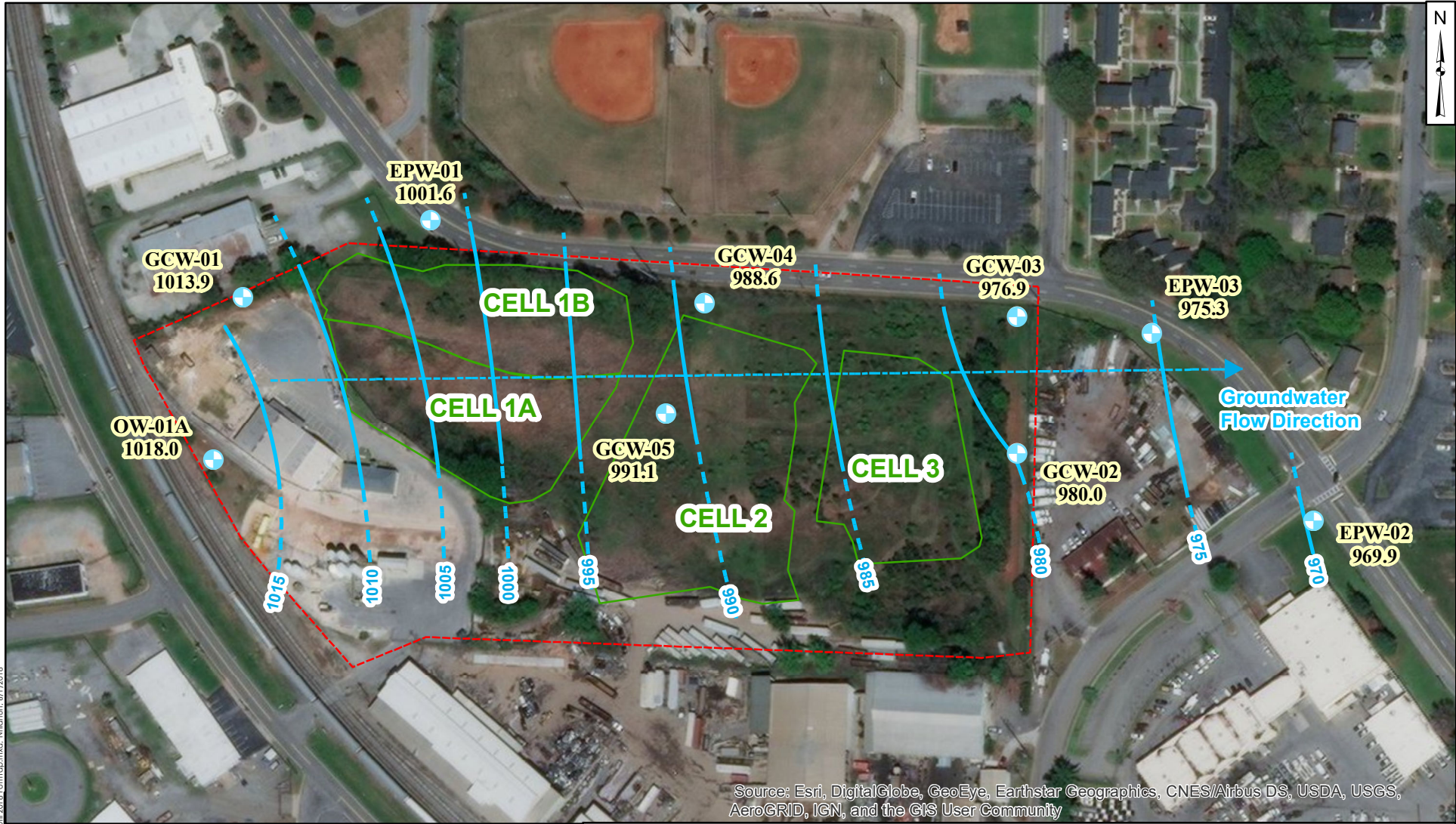
- 0.75' THICK LOW PERMEABILITY CLAY ( $10^{-6}$  cm/s) AND VEGETATIVE COVER
- GRAVELLEY CLAY, FILL
- CLAY, FILL AFTER EXCAVATION
- SILTY SAND, RELICT SCHISTOCITY, MICACEOUS (SAPROLITE)
- PARTRIALY WEATHERED SCHIST
- BEDROCK (SCHIST)
- LITHOLOGIC CONTACT, DASHED WHERE INFERRED
- MONITORING WELL SCREEN ZONE WITH WATER ELEVATION (FEET MSL), NOVEMBER, 2012



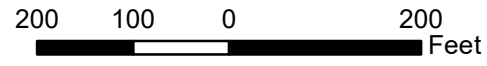
**Geosyntec**  
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DATE: JUN-13	SCALE: AS SHOWN
PROJECT NO. GR5060/12	FILE NO. 5060F001
DOCUMENT NO. GA 130020	FIGURE NO. 2-3





Legend	
	Monitoring Well (Groundwater Elevation in ft MSL)
	April 2018 Groundwater Contours (Dashed where Inferred)
	Excavation Cell
	Approximate Property Boundary



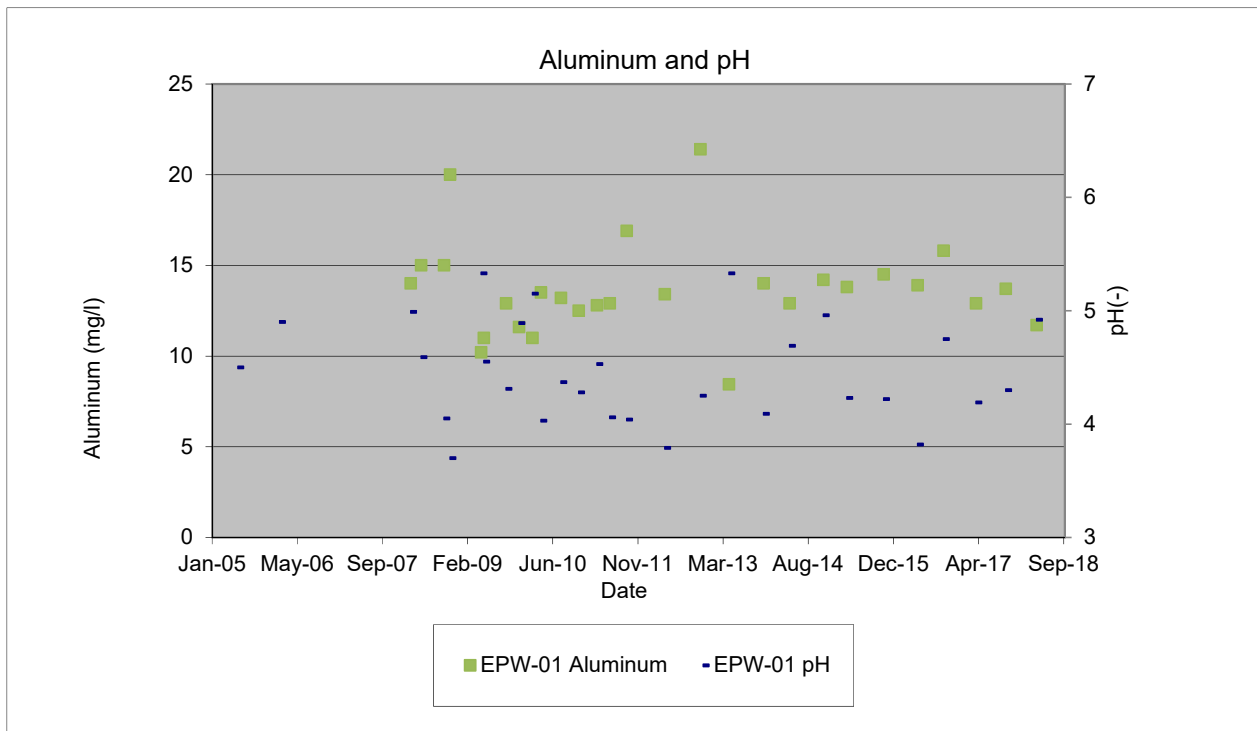
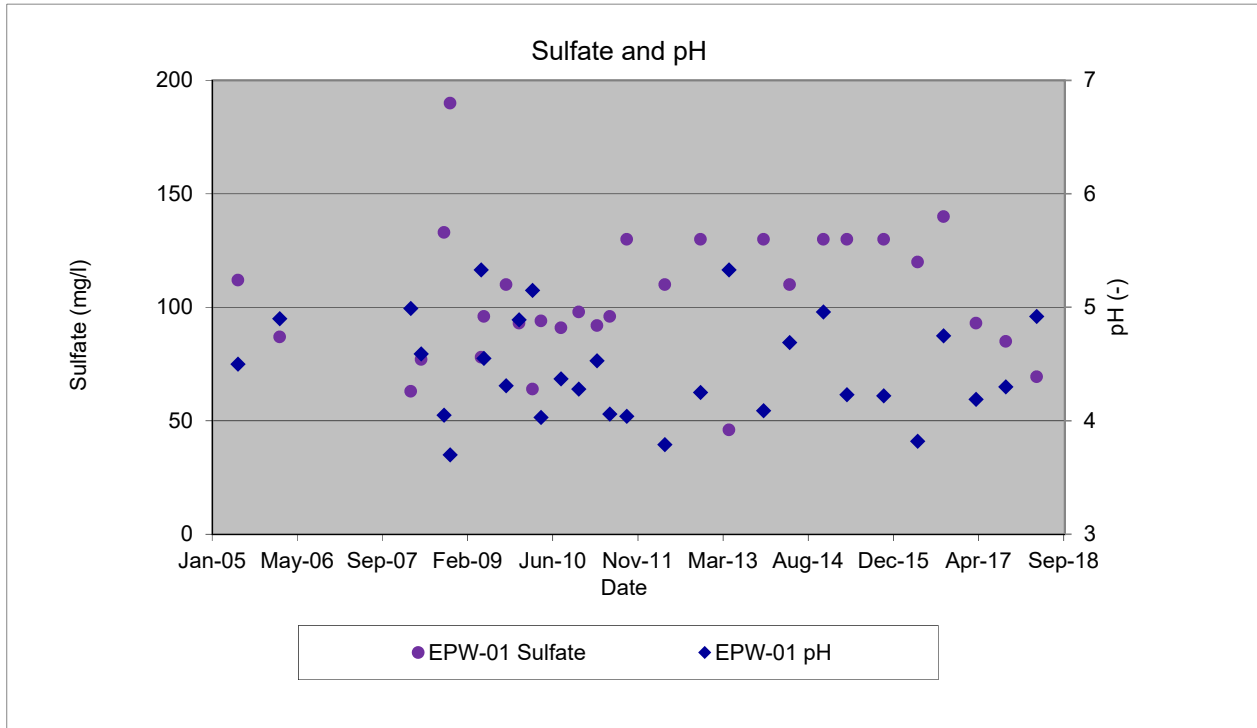
**Geosyntec**  
consultants  
Kennesaw, GA  
April 2018

**POTENTIOMETRIC SURFACE MAP**  
Chemtrade Solutions, East Point, GA

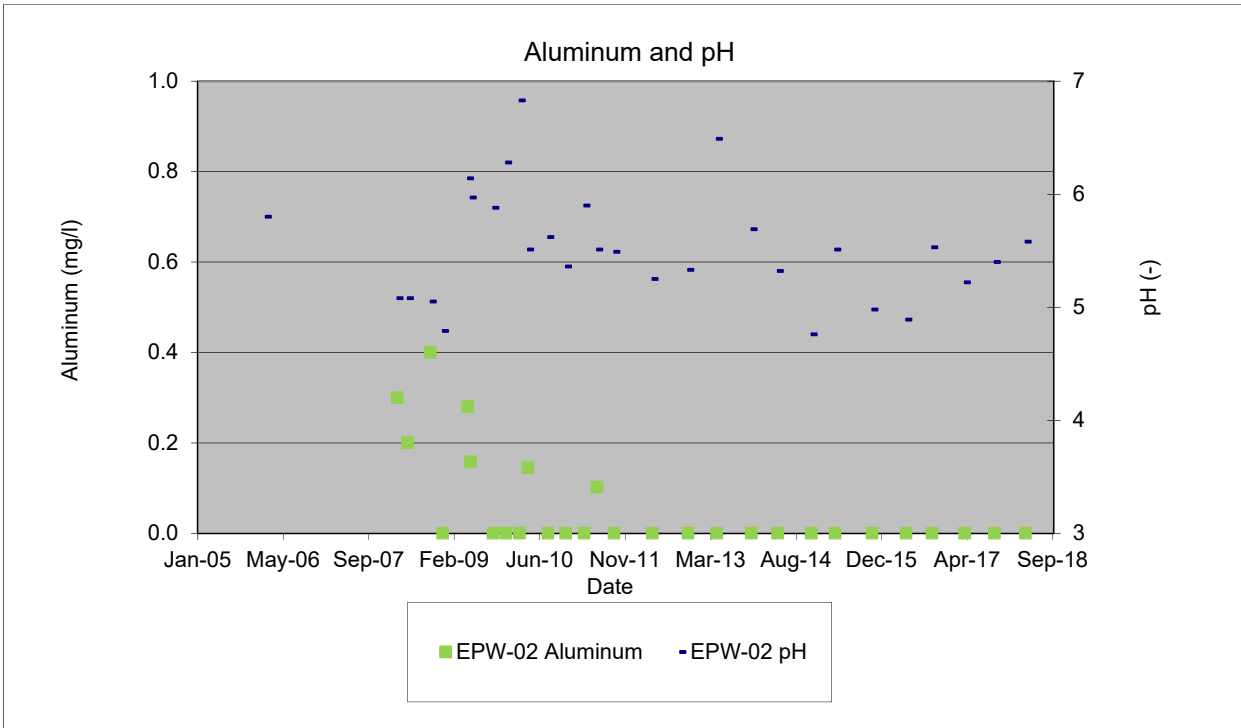
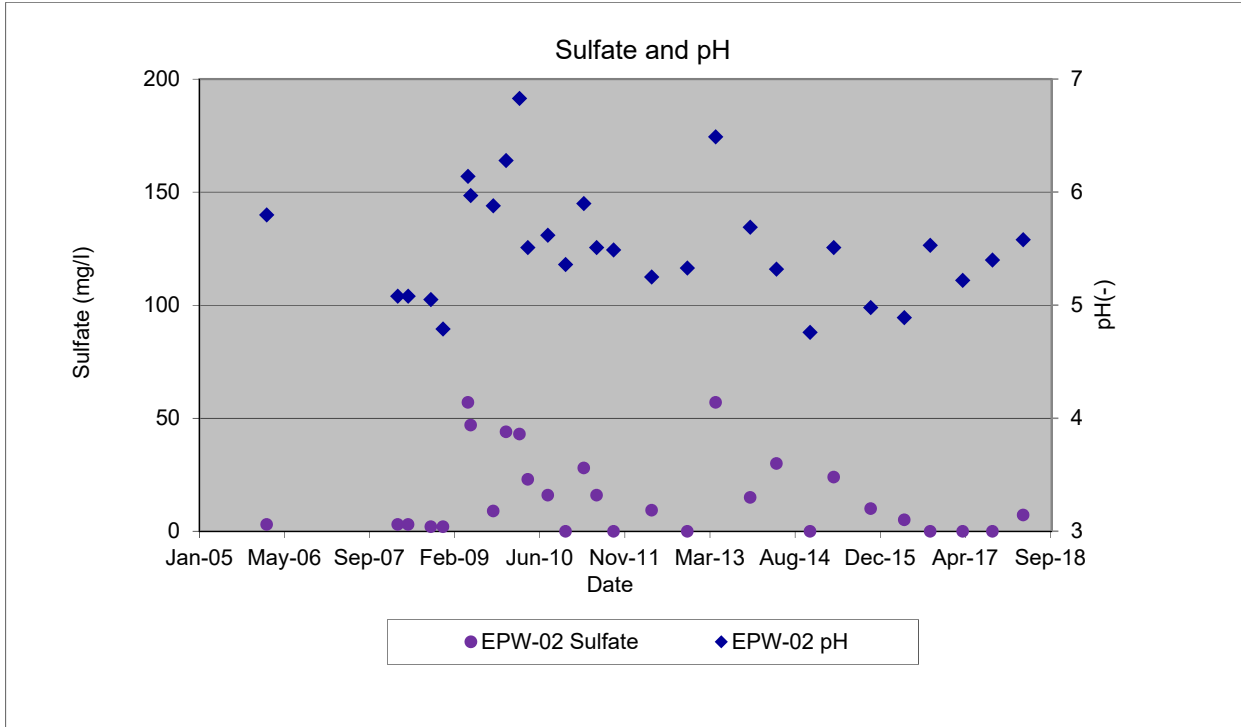
Figure  
**3-1**

\\kpc01\April\Agencies\GIS\MapDocs\April 2018\Fig 3-1 April 2018 Pot map.mxd: N:\fighnt; 6/1/2018

**Figure 3-2**  
**EPW-01 Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**



**Figure 3-2 (Cont)**  
**EPW-02 Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**



**Figure 3-2 (Cont)**  
**EPW-03S -M -D Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

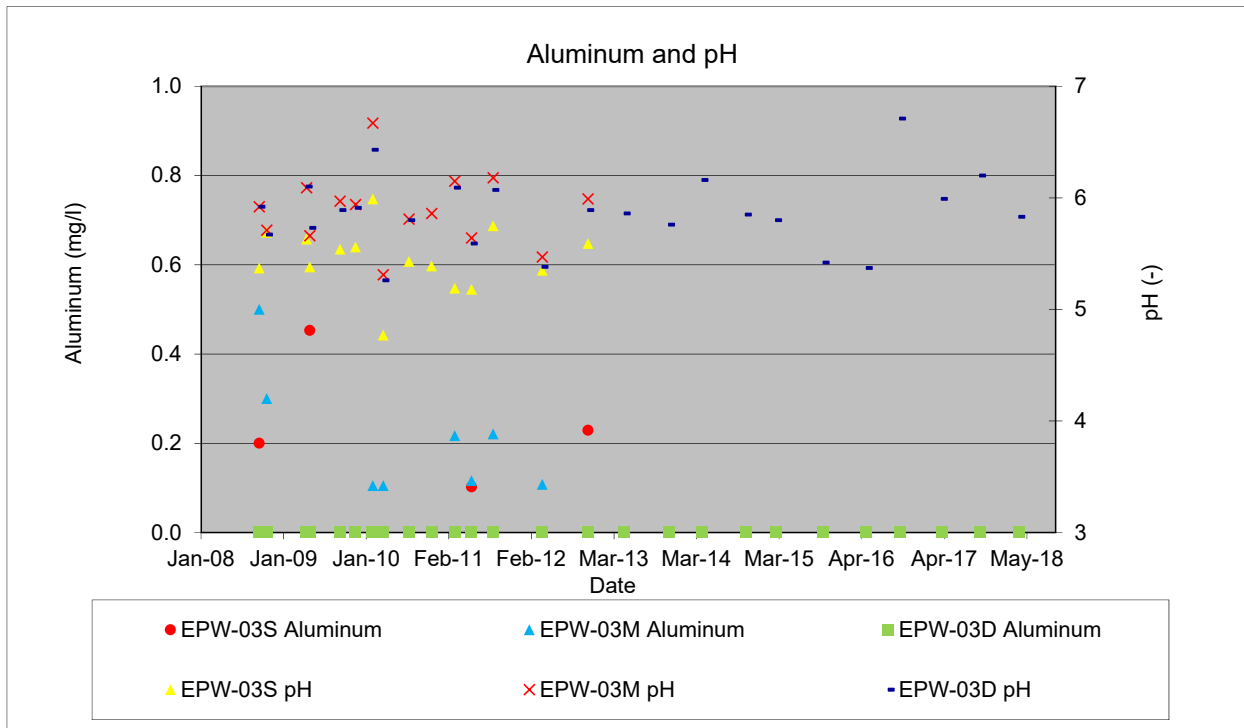
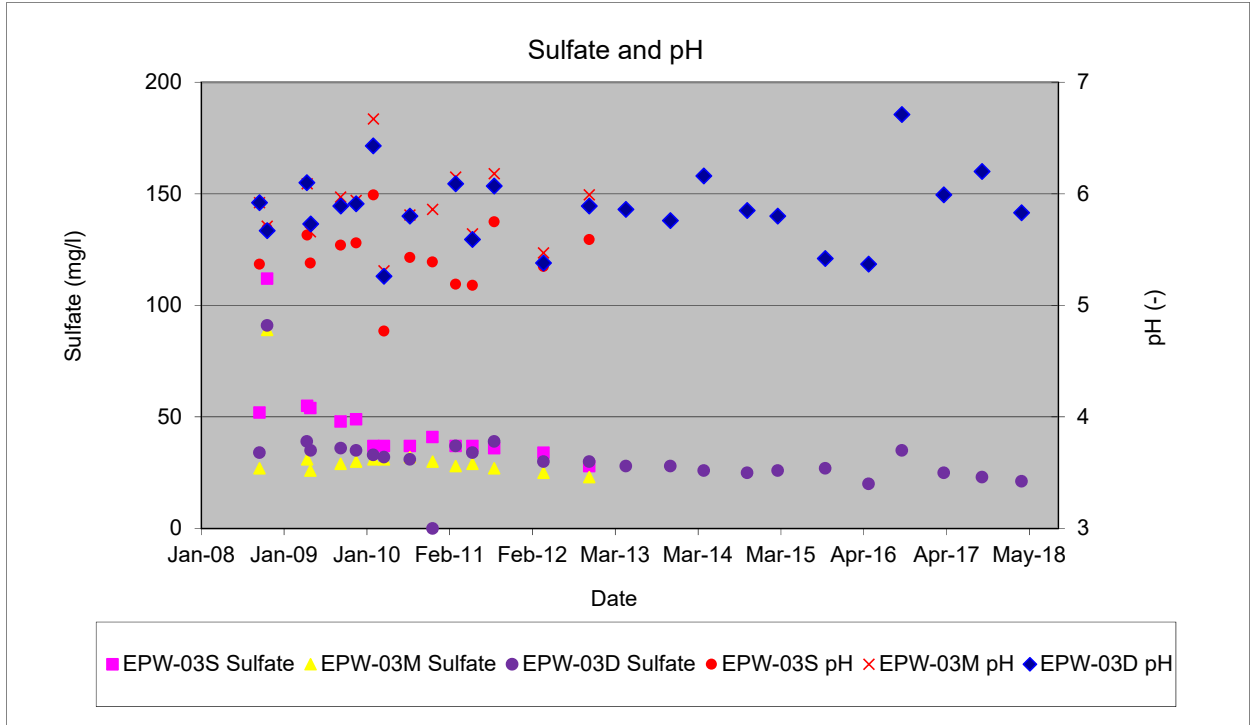
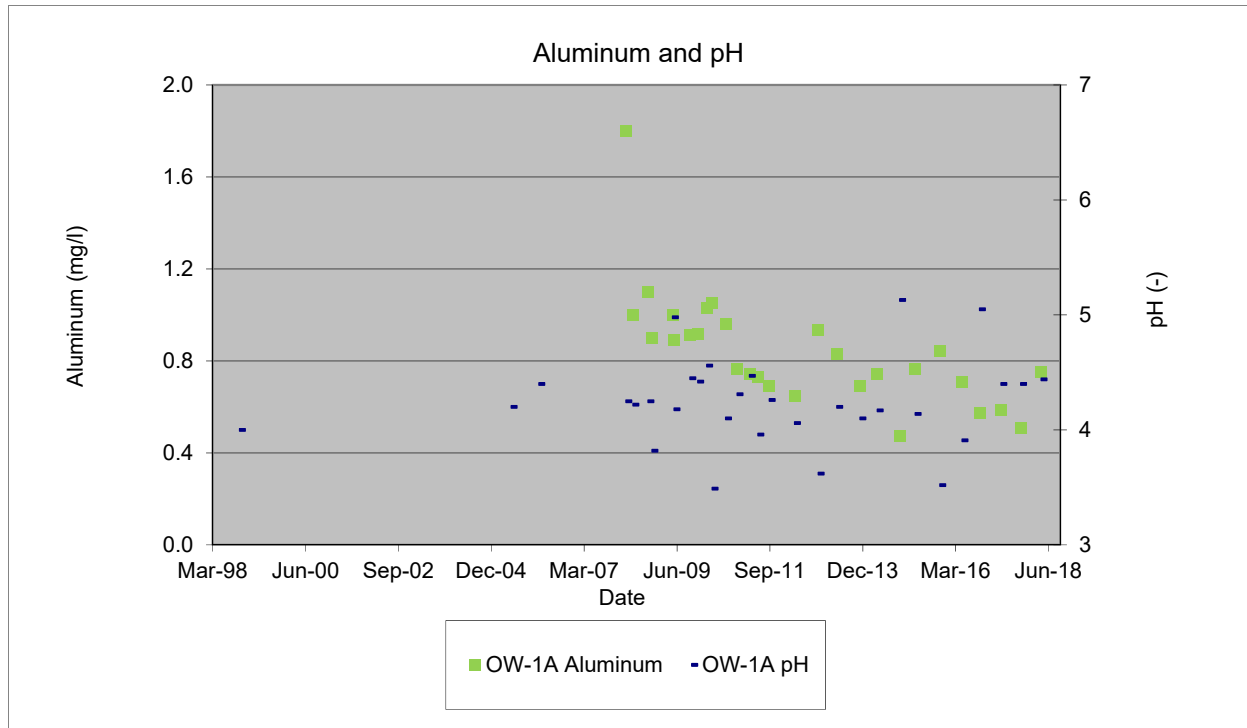
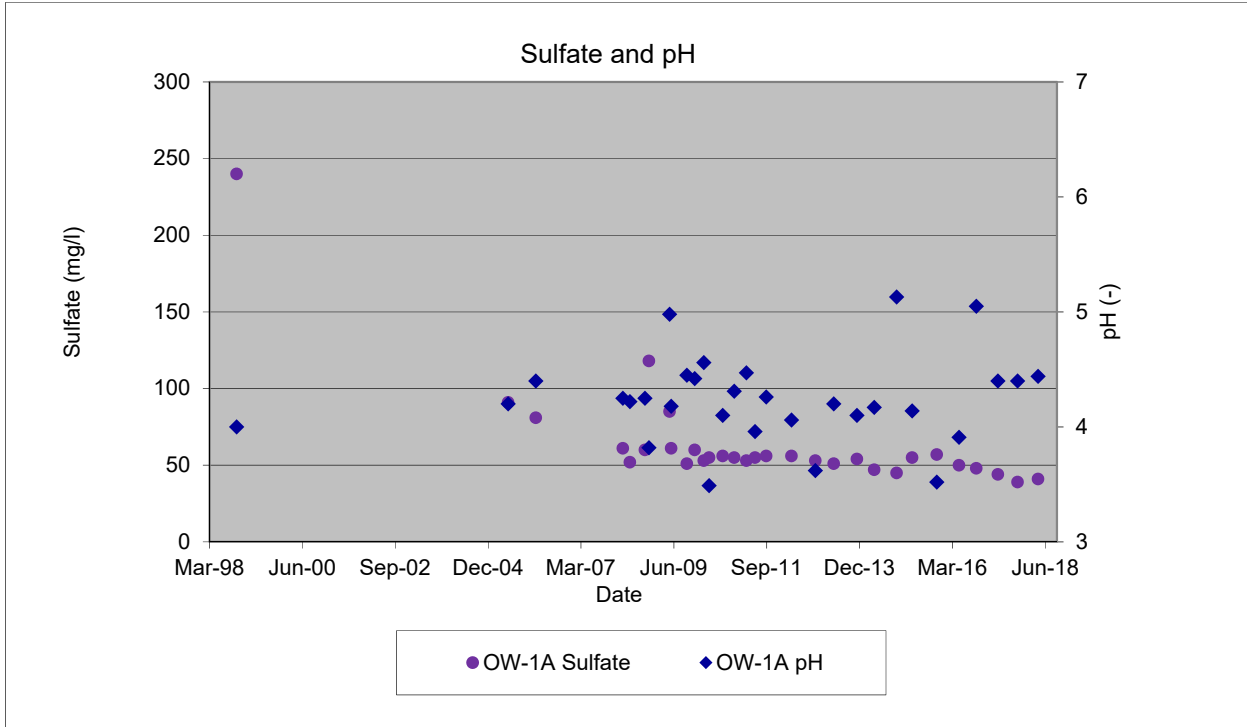
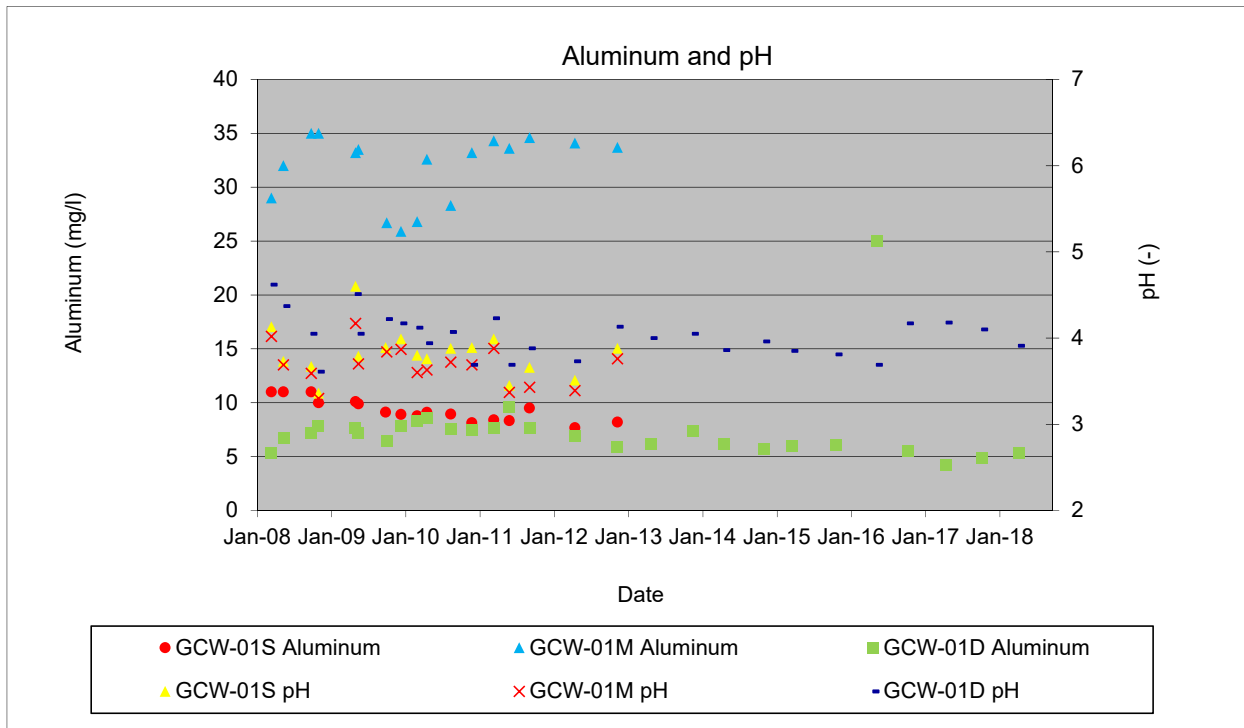
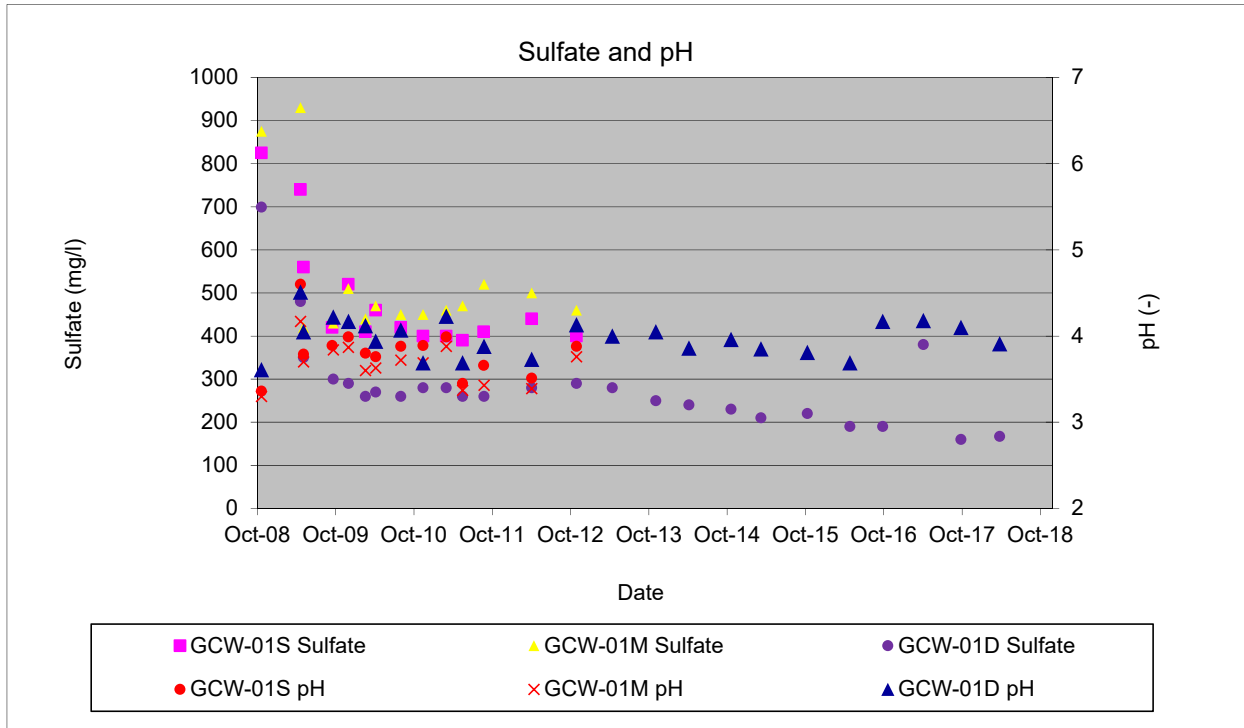




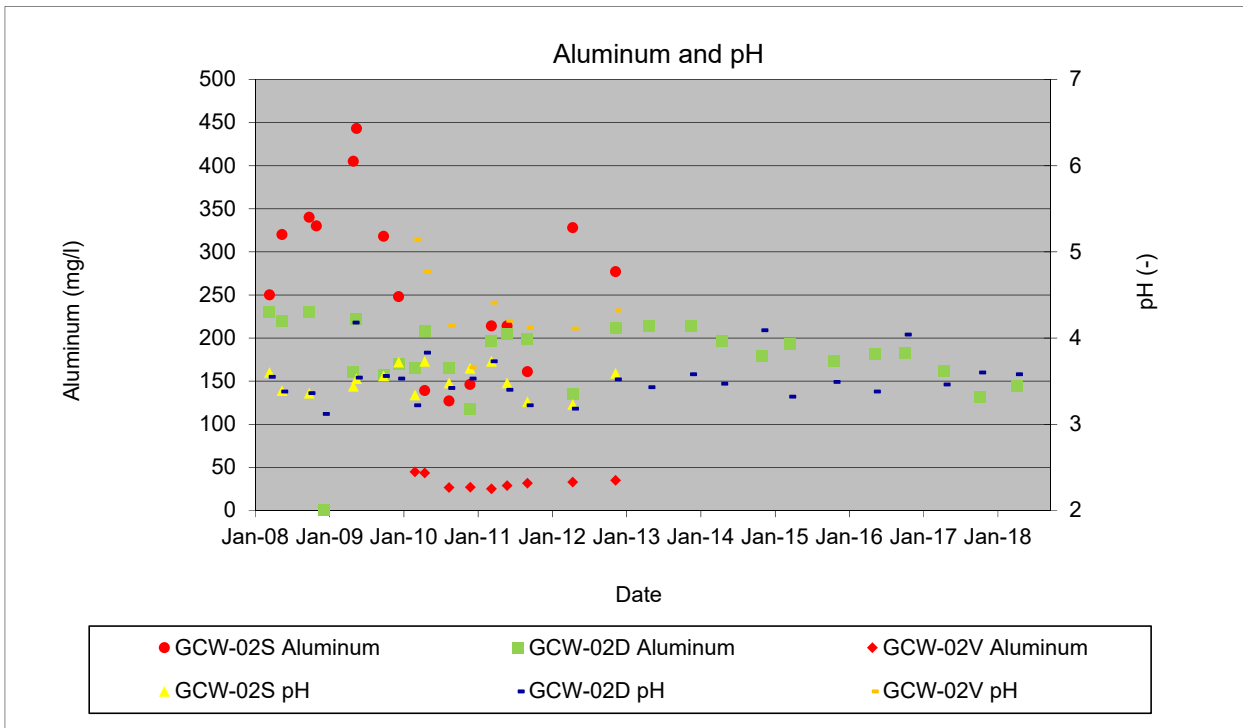
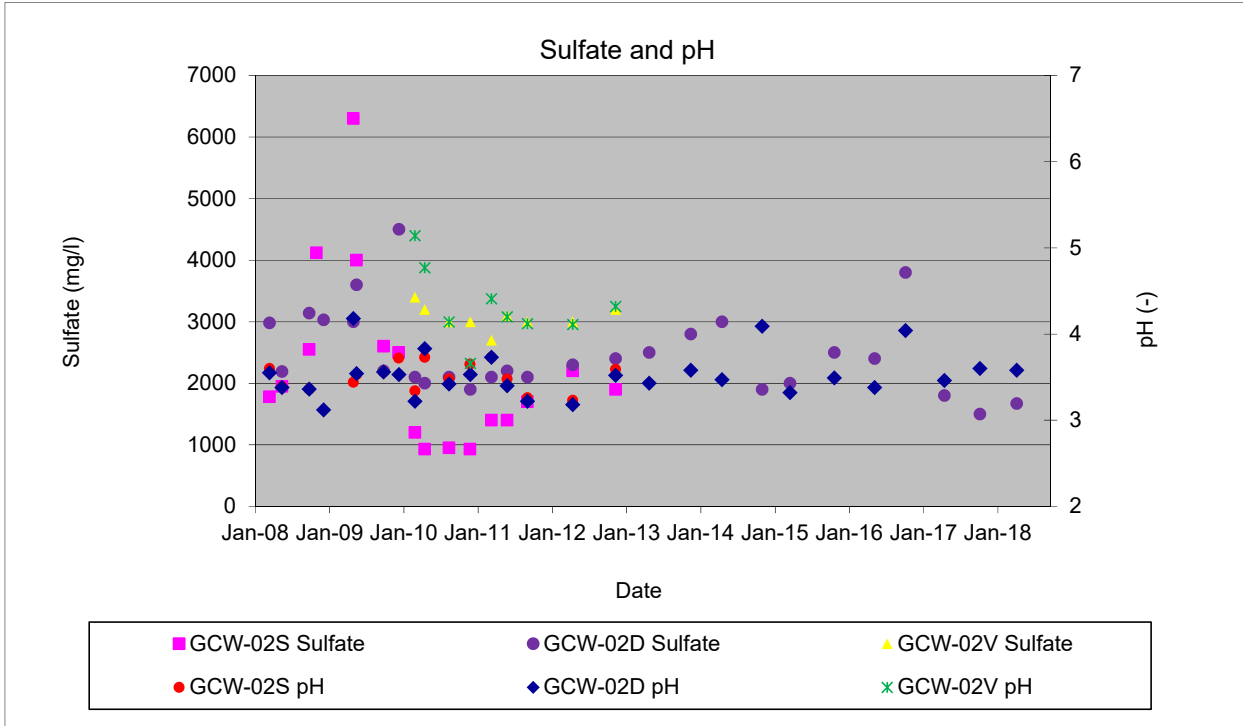
Figure 3-2 (Cont)  
OW-1A Sulfate and pH Trends and Aluminum and pH Trends  
Chemtrade Solutions Site  
East Point, Georgia



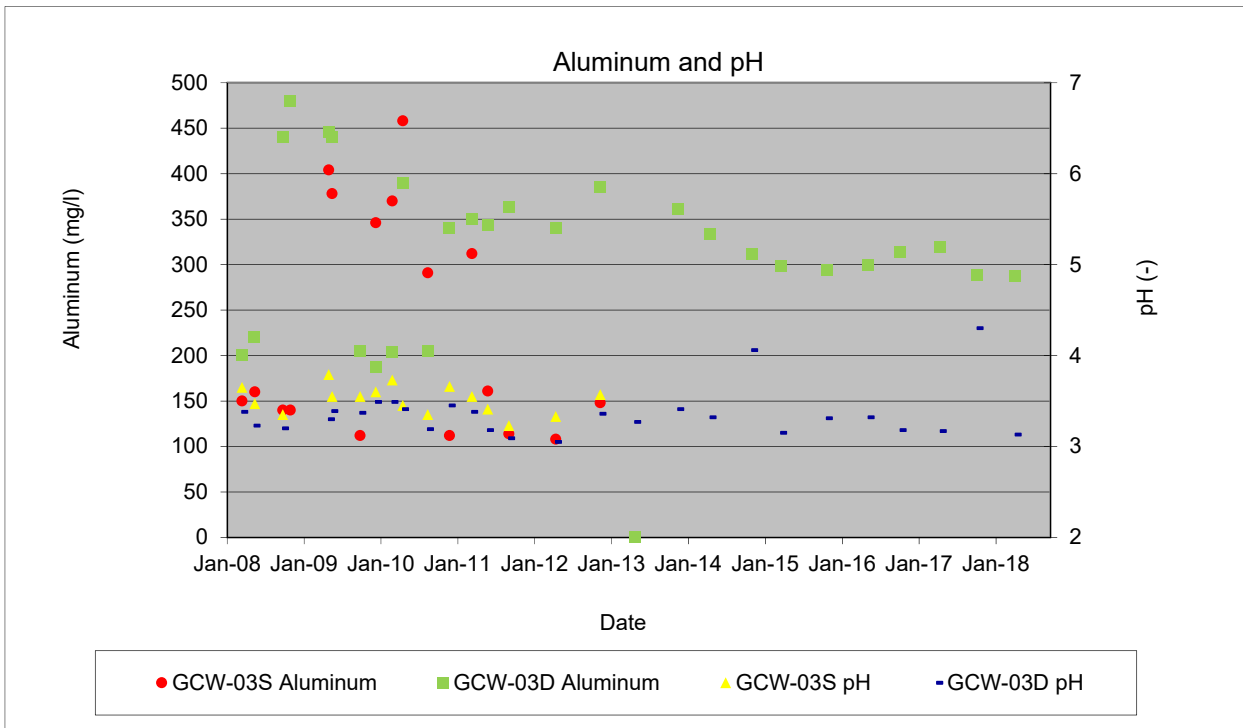
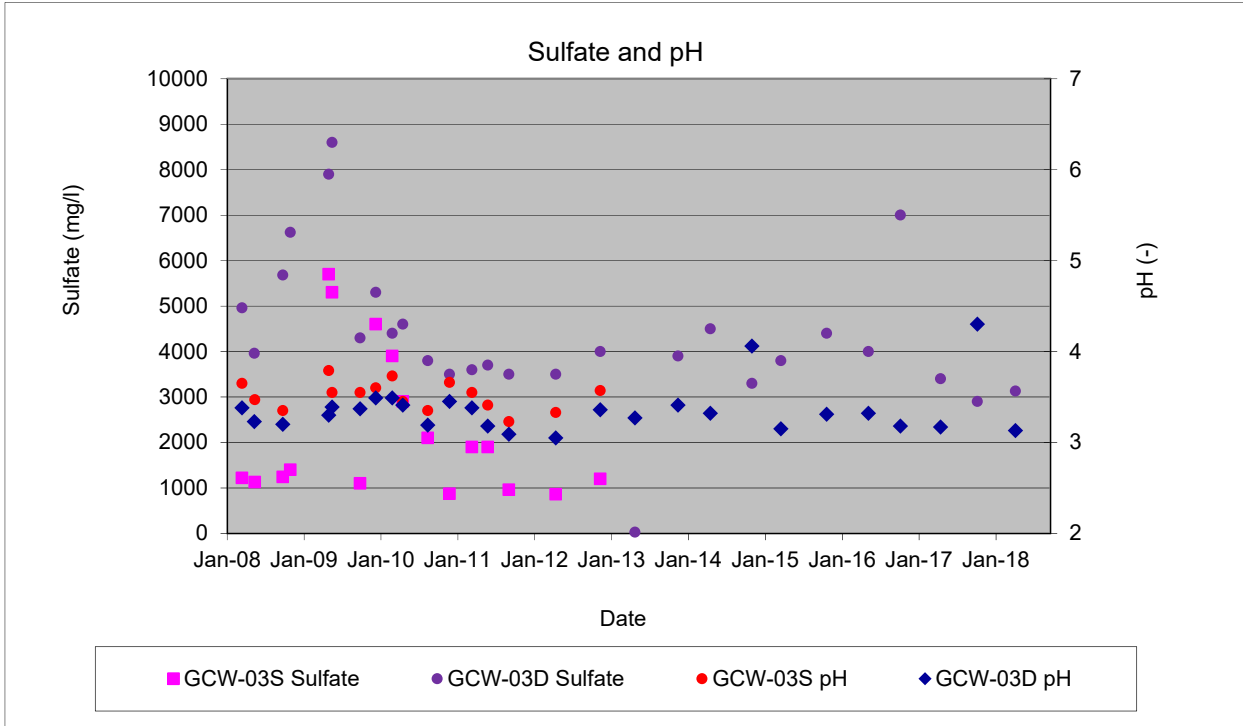
**Figure 3-2 (Cont)**  
**GCW-01S -M -D Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**



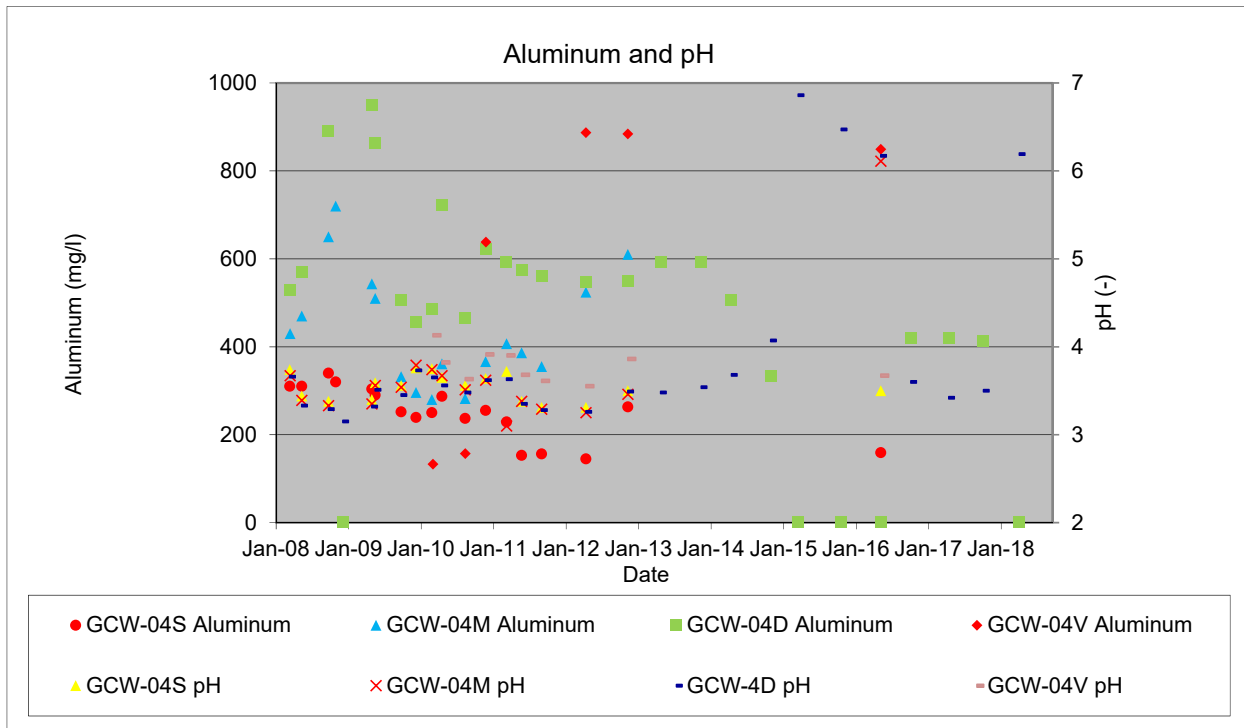
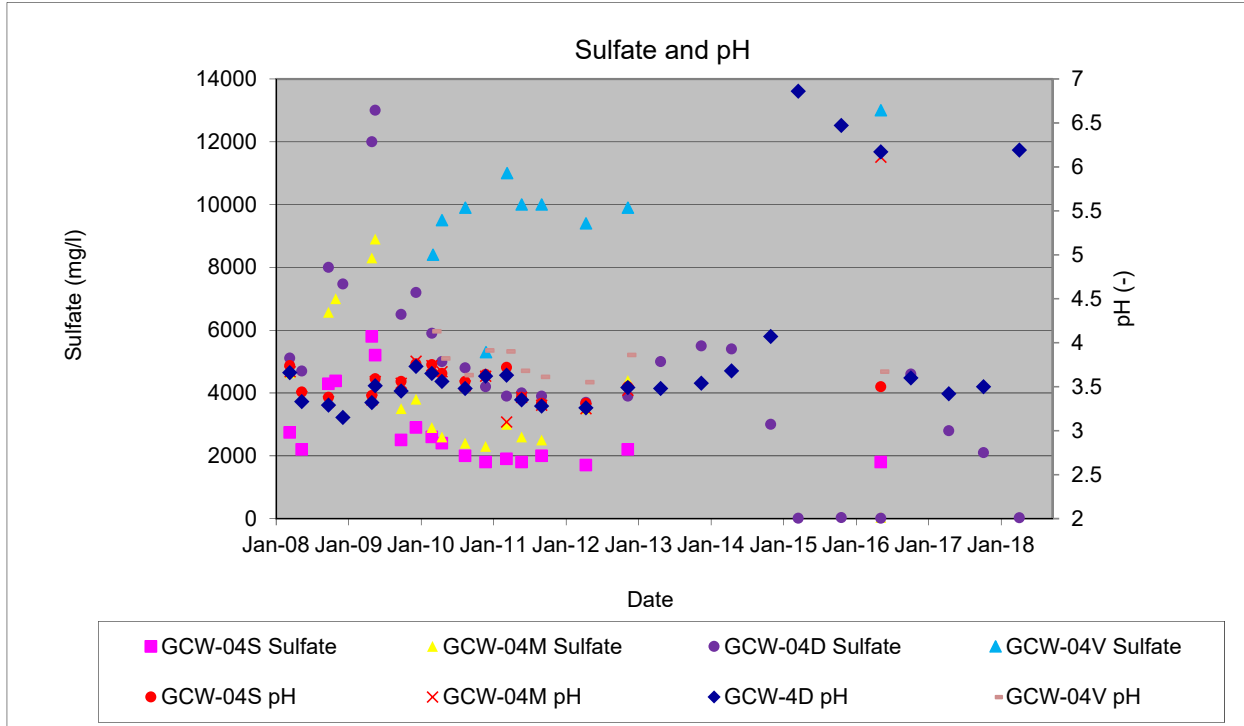
**Figure 3-2 (Cont)**  
**GCW-02S -D-V Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**



**Figure 3-2 (Cont)**  
**GCW-03S -D Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

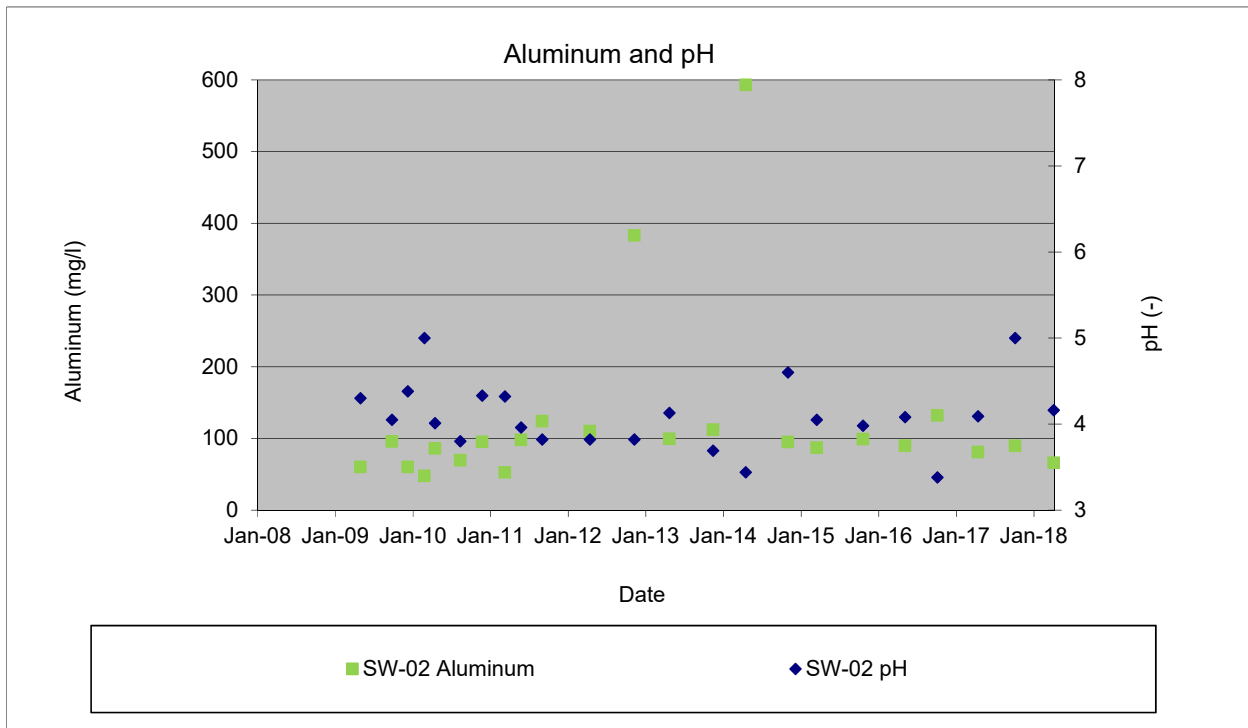
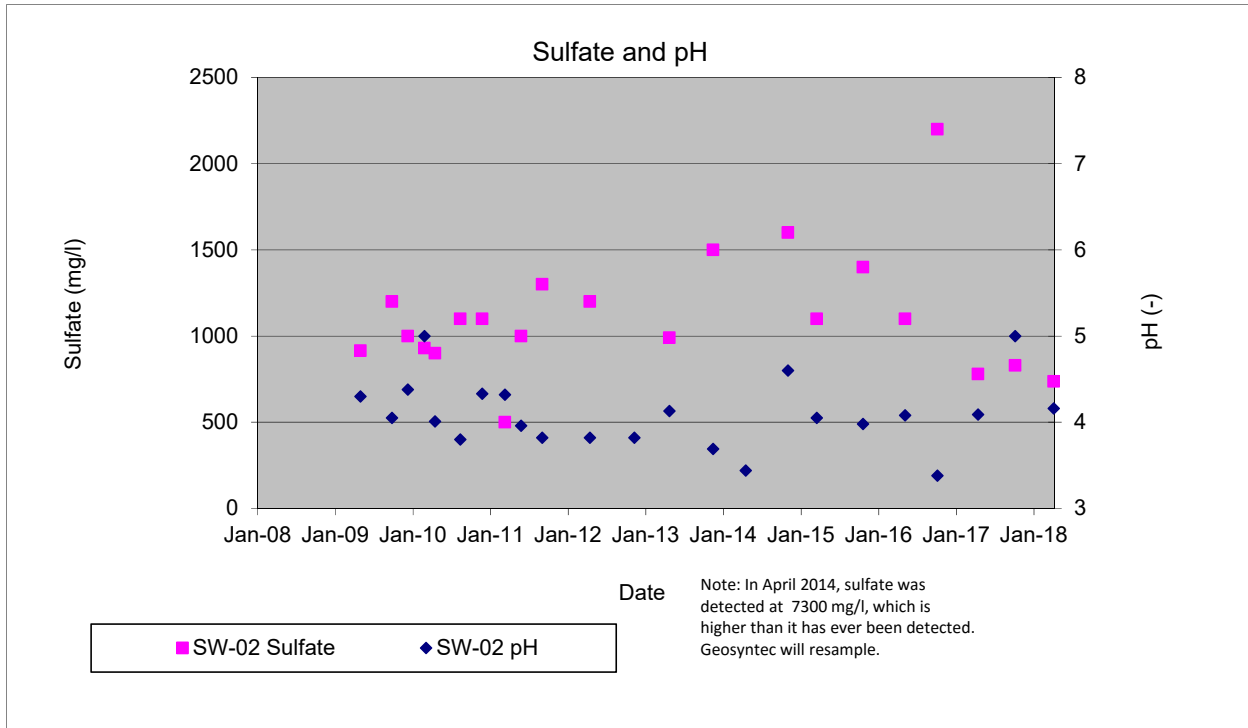


**Figure 3-2 (Cont)**  
**GCW-04S -M -D -V Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

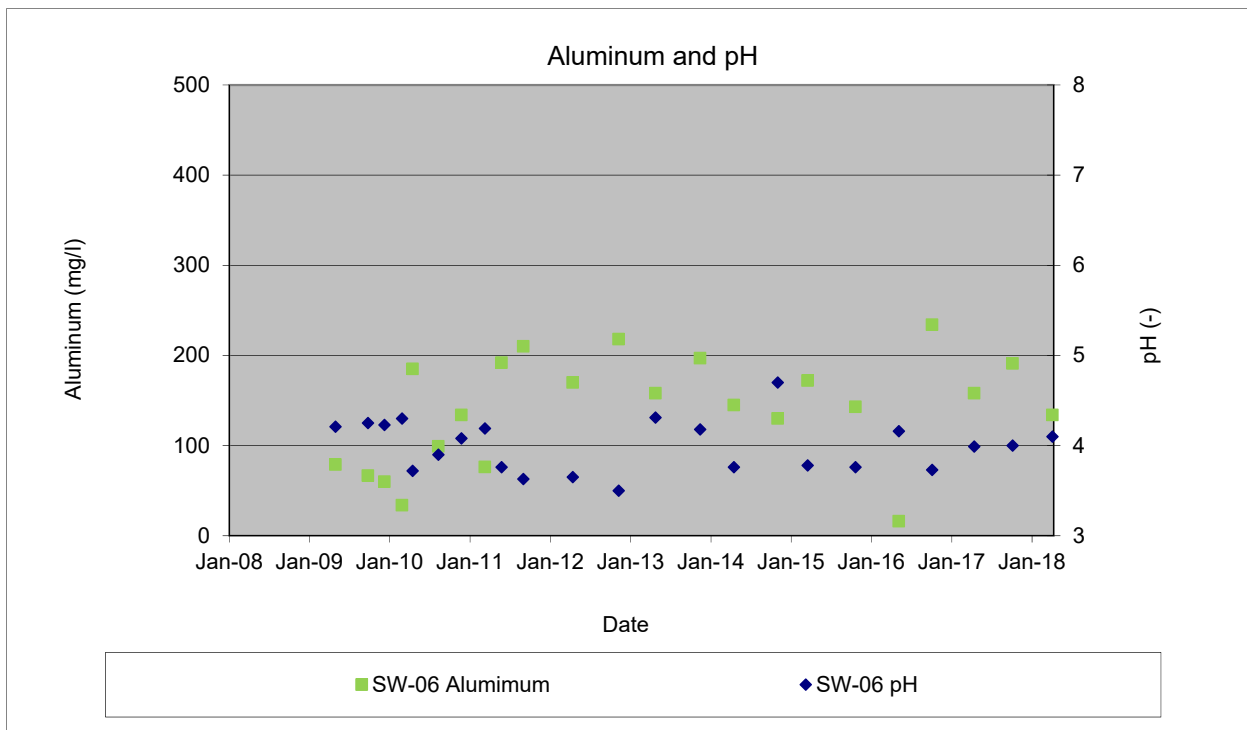
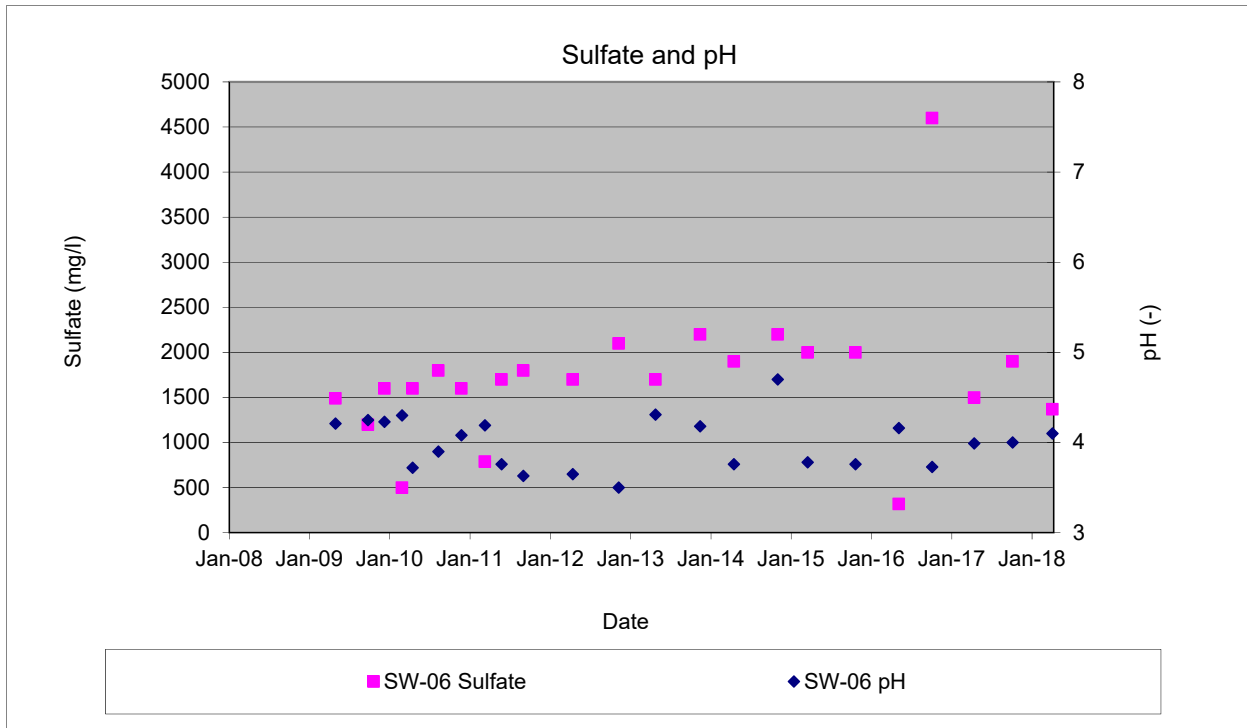




**Figure 3-3**  
**SW-02 (On-site) Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

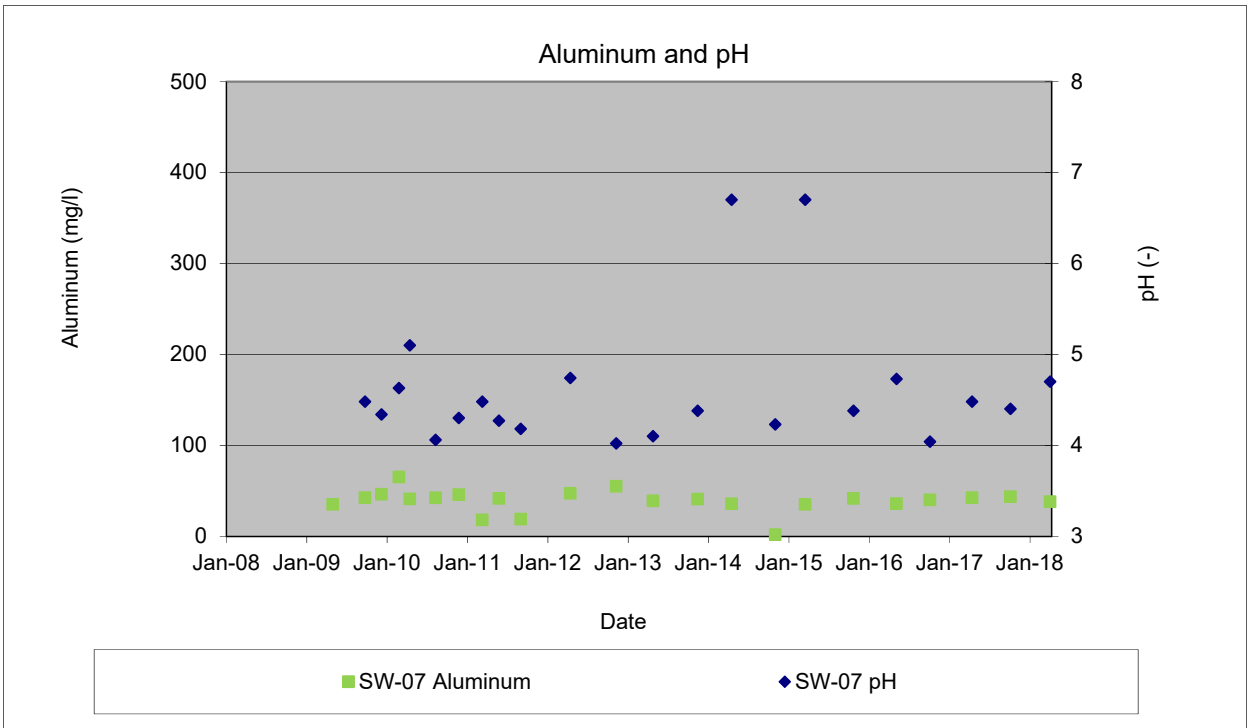
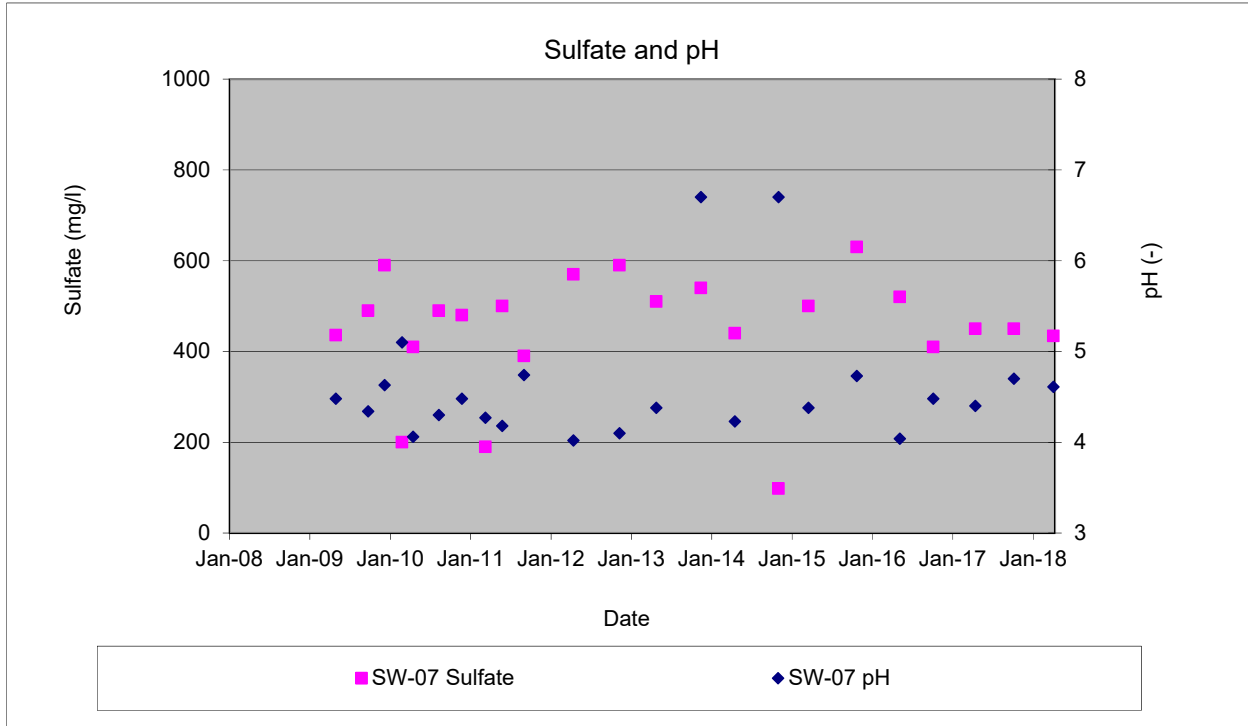


**Figure 3-3 (Cont)**  
**SW-06 (John D Milner Sports Complex) Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**

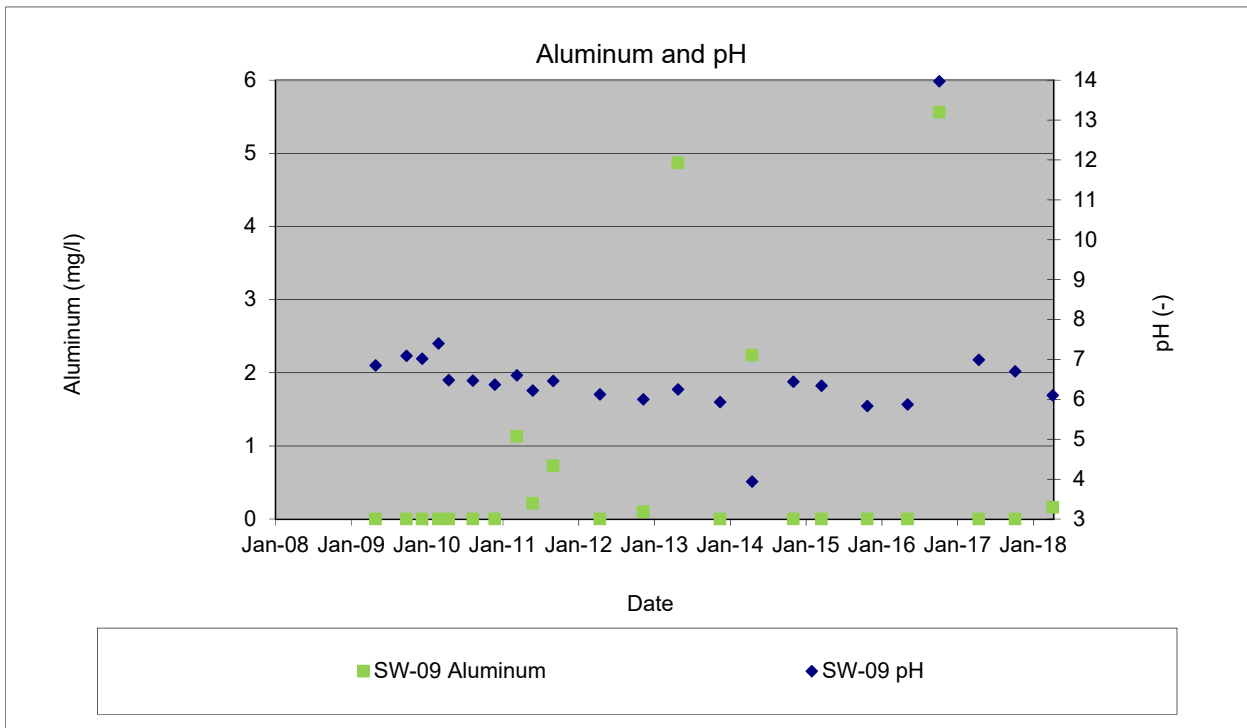
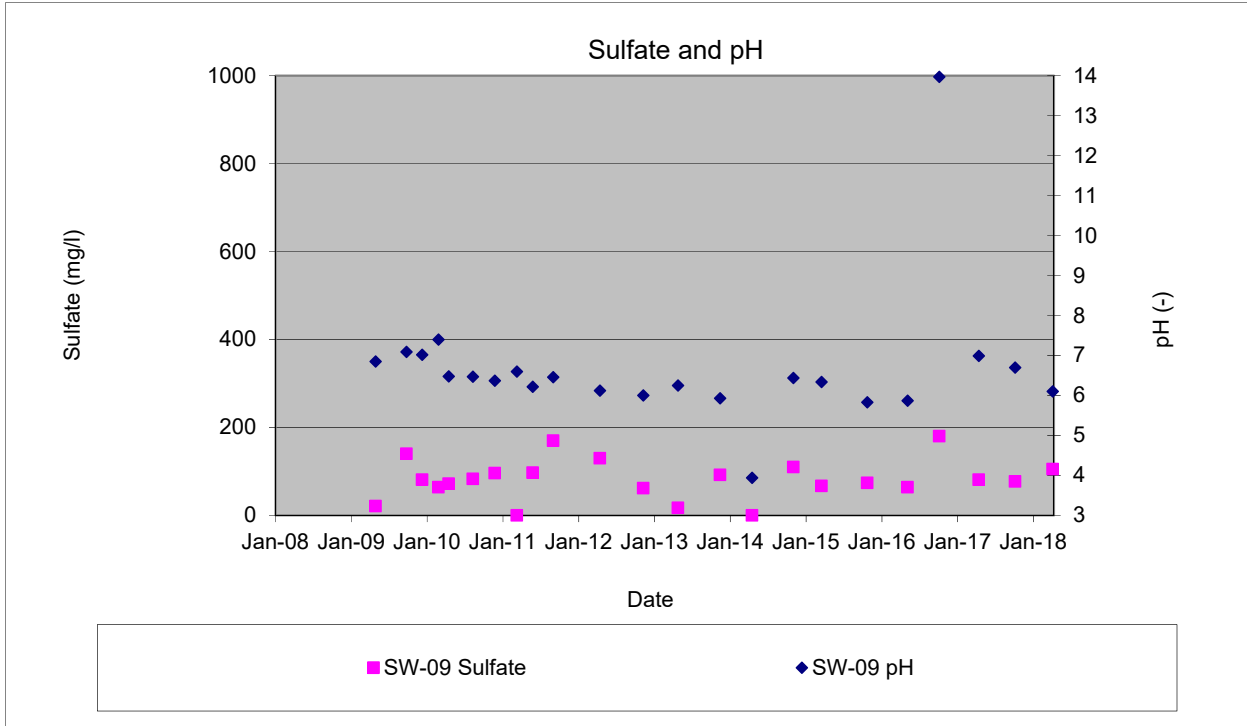


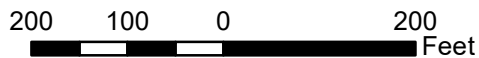


**Figure 3-3 (Cont)**  
**SW-07 (Unnamed Tributary) Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**



**Figure 3-3 (Cont)**  
**SW-09 (Upgradient) Sulfate and pH Trends and Aluminum and pH Trends**  
**Chemtrade Solutions Site**  
**East Point, Georgia**





**Legend**

- Monitoring Well
- Sulfate Concentration (Inferred)
- Sulfate Concentration (mg/L)
- Approximate Property Boundary

**Geosyntec**  
consultants  
Kennesaw, GA

April 2018

**APRIL 2018 SULFATE  
CONCENTRATION ABOVE THE  
TYPE 4 RRS**

Chemtrade Solutions, East Point, GA

Figure

**3-4**





\\sco-01\April\GIS\chem\GIS\Map\April 2018\EP\_3-5\_April\_2018\_Al\_Concentration.mxd; Nitahuri; 6/1/2018

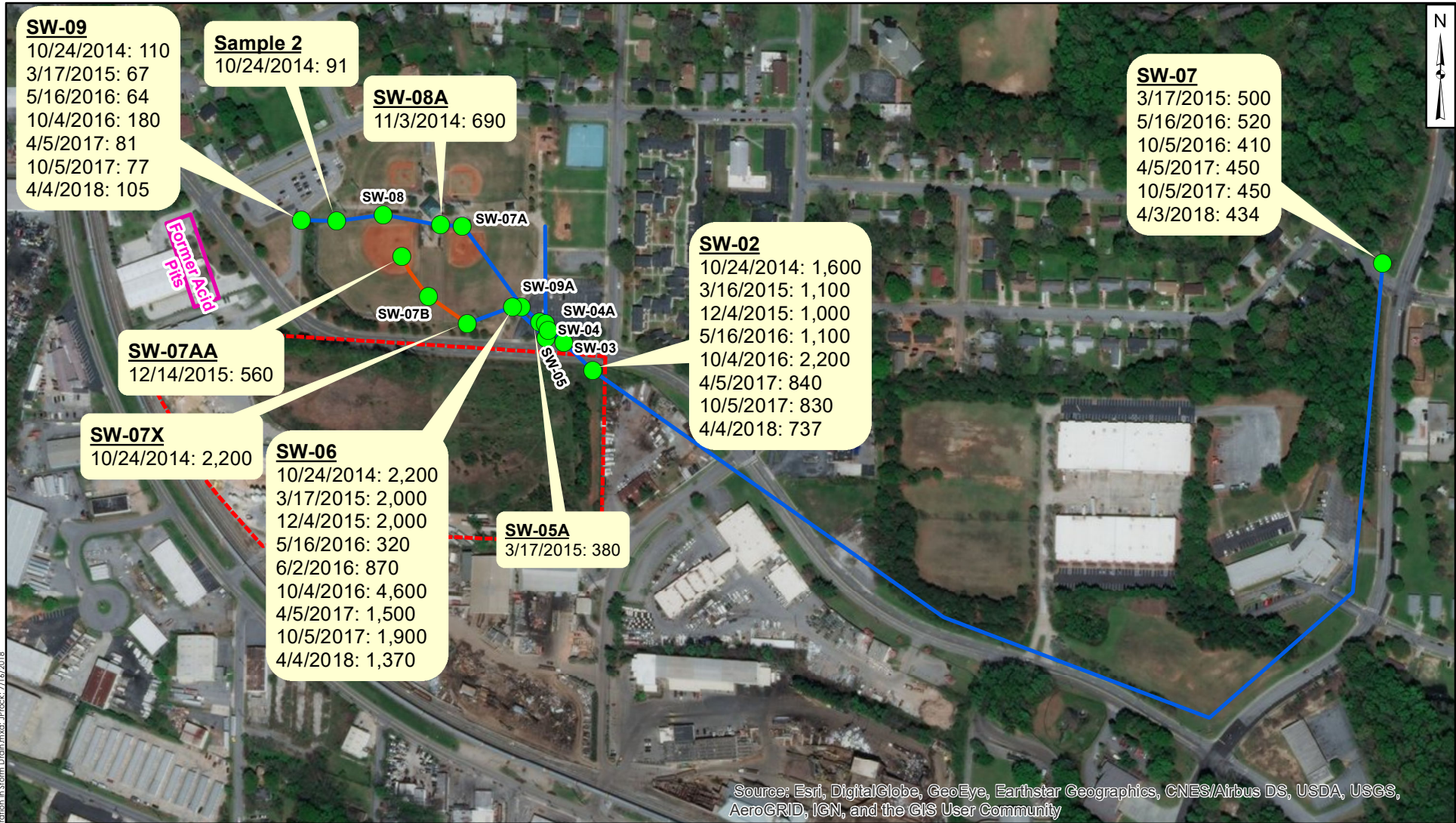
<b>Legend</b>	
	Monitoring Well
	Aluminum Concentration (mg/L)
	Aluminum Concentration (inferred)
	Approximate Property Boundary

**Geosyntec**  
 consultants  
 Kennesaw, GA  
  
 April 2018

**APRIL 2018 ALUMINUM  
 CONCENTRATION ABOVE THE  
 TYPE 4 RRS**  
  
 Chemtrade Solutions, East Point, GA

Figure  
  
**3-5**





**Legend**

- Former Acid Pits
- Approximate Property Boundary
- Storm Drain Sample (Sulfate Concentration in mg/L)
- Storm Drain
- High Sulfate Storm Drain



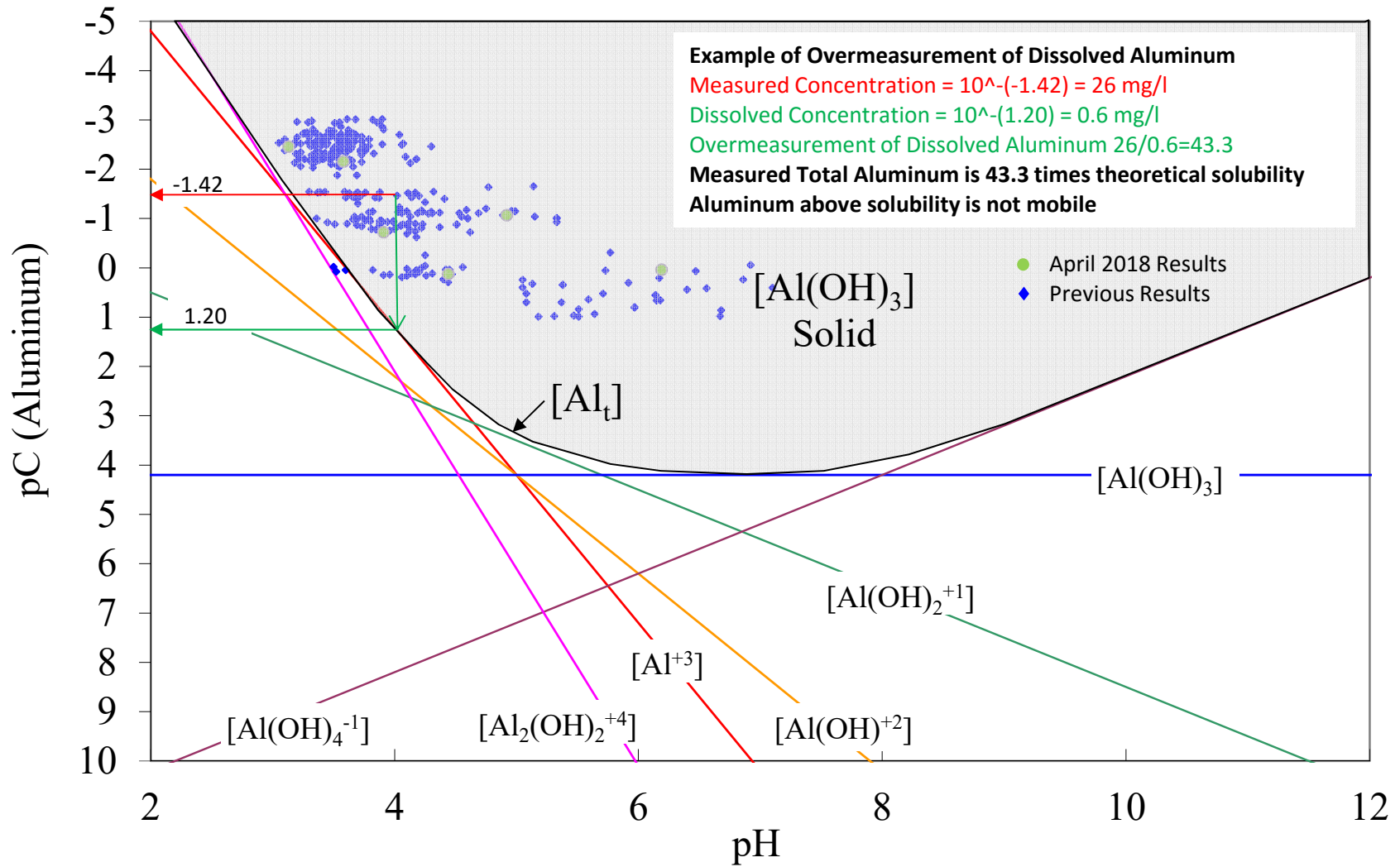
**Geosyntec**  
 consultants  
 Kennesaw, GA  
 April 2018

**SULFATE CONCENTRATION IN STORM DRAIN**  
 Chemtrade Solutions, East Point, GA

Figure  
**3-6**

N:\geosyntech\GIS\MapDocs\April 2018\Eg 3-4 Sulfate Concentration in Storm Drain.mxd: jPreck: 7/16/2018

Figure 6-1  
 Chemtrade Solutions  
 Groundwater Sampling  
 April 2018  
 Aluminum Results Analysis



## APPENDIX A

# GROUNDWATER AND STORM DRAIN LABORATORY RESULTS

April 17, 2018

Brian Jacobson  
Geosyntec Consultants, Inc.  
1255 Roberts Blvd NW  
Suite 200  
Kennesaw, GA 30144

RE: Project: Chemtrade  
Pace Project No.: 263656

Dear Brian Jacobson:

Enclosed are the analytical results for sample(s) received by the laboratory on April 05, 2018. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

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

Sincerely,



Betsy McDaniel  
betsy.mcdaniel@pacelabs.com  
(770)734-4200  
Project Manager

Enclosures

cc: Shira Colsky, Geosyntec Consultants, Inc.



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## CERTIFICATIONS

Project: Chemtrade

Pace Project No.: 263656

---

### Atlanta Certification IDs

110 Technology Parkway Peachtree Corners, GA 30092

Florida DOH Certification #: E87315

Georgia DW Inorganics Certification #: 812

Georgia DW Microbiology Certification #: 812

North Carolina Certification #: 381

South Carolina Certification #: 98011001

Texas Certification #: T104704397-08-TX

Virginia Certification #: 460204

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## SAMPLE SUMMARY

Project: Chemtrade  
Pace Project No.: 263656

Lab ID	Sample ID	Matrix	Date Collected	Date Received
263656001	GCW-04D-0418	Water	04/03/18 11:00	04/05/18 14:30
263656002	GCW-05-0418	Water	04/03/18 13:05	04/05/18 14:30
263656003	Dup-01-0418	Water	04/03/18 00:00	04/05/18 14:30
263656004	EPW-02-0418	Water	04/03/18 15:35	04/05/18 14:30
263656005	EPW-03D-0418	Water	04/03/18 16:35	04/05/18 14:30
263656006	SW-07-0418	Water	04/03/18 16:20	04/05/18 14:30
263656007	Dup-02-0418	Water	04/04/18 00:00	04/05/18 14:30
263656008	SW-02-0418	Water	04/04/18 09:35	04/05/18 14:30
263656009	GCW-03D-0418	Water	04/04/18 09:20	04/05/18 14:30
263656010	GCW-02D-0418	Water	04/04/18 09:25	04/05/18 14:30
263656011	SW-06-0418	Water	04/04/18 10:15	04/05/18 14:30
263656012	SW-09-0418	Water	04/04/18 10:45	04/05/18 14:30
263656013	EPW-01-0418	Water	04/04/18 11:20	04/05/18 14:30
263656014	GCW-01D-0418	Water	04/04/18 12:40	04/05/18 14:30
263656015	OW-01A-0418	Water	04/04/18 12:15	04/05/18 14:30

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### SAMPLE ANALYTE COUNT

Project: Chemtrade

Pace Project No.: 263656

Lab ID	Sample ID	Method	Analysts	Analytes Reported
263656001	GCW-04D-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656002	GCW-05-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656003	Dup-01-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656004	EPW-02-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656005	EPW-03D-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656006	SW-07-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656007	Dup-02-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656008	SW-02-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656009	GCW-03D-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656010	GCW-02D-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656011	SW-06-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656012	SW-09-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656013	EPW-01-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656014	GCW-01D-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1
263656015	OW-01A-0418	EPA 6010D	KLH	1
		EPA 9056A	RLC	1

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: GCW-04D-0418</b>		<b>Lab ID: 263656001</b>		Collected: 04/03/18 11:00	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>0.91</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 19:30	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>26.2</b>	mg/L	5.0	1		04/11/18 10:21	14808-79-8	M1

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: GCW-05-0418</b>		<b>Lab ID: 263656002</b>		Collected: 04/03/18 13:05	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	ND	mg/L	0.10	1	04/09/18 09:16	04/10/18 19:45	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>350</b>	mg/L	125	25		04/16/18 17:53	14808-79-8	M1

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: Dup-01-0418</b>		<b>Lab ID: 263656003</b>		Collected: 04/03/18 00:00	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>0.86</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 19:48	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>25.8</b>	mg/L	5.0	1		04/11/18 22:28	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: EPW-02-0418</b>		<b>Lab ID: 263656004</b>		Collected: 04/03/18 15:35	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	ND	mg/L	0.10	1	04/09/18 09:16	04/10/18 19:52	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>7.2</b>	mg/L	5.0	1		04/11/18 22:49	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

Sample: <b>EPW-03D-0418</b>	Lab ID: <b>263656005</b>	Collected: 04/03/18 16:35	Received: 04/05/18 14:30	Matrix: Water				
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	ND	mg/L	0.10	1	04/09/18 09:16	04/10/18 19:56	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>21.2</b>	mg/L	5.0	1		04/11/18 23:10	14808-79-8	

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### ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: SW-07-0418</b>		<b>Lab ID: 263656006</b>		Collected: 04/03/18 16:20	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>38.0</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 19:59	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>434</b>	mg/L	125	25		04/16/18 18:13	14808-79-8	

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### ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: Dup-02-0418</b>		<b>Lab ID: 263656007</b>		Collected: 04/04/18 00:00	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>64.9</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 20:03	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>751</b>	mg/L	250	50		04/17/18 12:30	14808-79-8	

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### ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: SW-02-0418</b>		<b>Lab ID: 263656008</b>		Collected: 04/04/18 09:35	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>66.0</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 20:14	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>737</b>	mg/L	250	50		04/16/18 18:34	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: GCW-03D-0418</b>		<b>Lab ID: 263656009</b>		Collected: 04/04/18 09:20	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>287</b>	mg/L	1.0	10	04/09/18 09:16	04/11/18 16:19	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>3130</b>	mg/L	500	100		04/16/18 18:55	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>Sample: GCW-02D-0418      Lab ID: 263656010      Collected: 04/04/18 09:25      Received: 04/05/18 14:30      Matrix: Water</b>								
<b>6010D MET ICP</b> Analytical Method: EPA 6010D      Preparation Method: EPA 3010A								
Aluminum	<b>144</b>	mg/L	1.0	10	04/09/18 09:16	04/11/18 16:30	7429-90-5	
<b>9056 IC Anions</b> Analytical Method: EPA 9056A								
Sulfate	<b>1670</b>	mg/L	250	50		04/16/18 19:15	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: SW-06-0418</b>		<b>Lab ID: 263656011</b>		Collected: 04/04/18 10:15	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>134</b>	mg/L	1.0	10	04/09/18 09:16	04/11/18 16:36	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>1370</b>	mg/L	250	50		04/16/18 19:36	14808-79-8	

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### ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: SW-09-0418</b>		<b>Lab ID: 263656012</b>		Collected: 04/04/18 10:45	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>0.16</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 20:29	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>105</b>	mg/L	50.0	10		04/16/18 19:57	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: EPW-01-0418</b>		<b>Lab ID: 263656013</b>		Collected: 04/04/18 11:20	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>11.7</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 20:33	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>69.4</b>	mg/L	25.0	5		04/16/18 20:17	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: GCW-01D-0418</b>		<b>Lab ID: 263656014</b>		Collected: 04/04/18 12:40	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>5.3</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 20:36	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>167</b>	mg/L	50.0	10		04/16/18 20:38	14808-79-8	

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## ANALYTICAL RESULTS

Project: Chemtrade

Pace Project No.: 263656

<b>Sample: OW-01A-0418</b>		<b>Lab ID: 263656015</b>		Collected: 04/04/18 12:15	Received: 04/05/18 14:30	Matrix: Water		
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
<b>6010D MET ICP</b>		Analytical Method: EPA 6010D Preparation Method: EPA 3010A						
Aluminum	<b>0.75</b>	mg/L	0.10	1	04/09/18 09:16	04/10/18 20:40	7429-90-5	
<b>9056 IC Anions</b>		Analytical Method: EPA 9056A						
Sulfate	<b>41.0</b>	mg/L	5.0	1		04/12/18 04:28	14808-79-8	

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### QUALITY CONTROL DATA

Project: Chemtrade  
Pace Project No.: 263656

QC Batch: 3947 Analysis Method: EPA 6010D  
QC Batch Method: EPA 3010A Analysis Description: 6010D MET  
Associated Lab Samples: 263656001, 263656002, 263656003, 263656004, 263656005, 263656006, 263656007, 263656008, 263656009, 263656010, 263656011, 263656012, 263656013, 263656014, 263656015

METHOD BLANK: 19994 Matrix: Water  
Associated Lab Samples: 263656001, 263656002, 263656003, 263656004, 263656005, 263656006, 263656007, 263656008, 263656009, 263656010, 263656011, 263656012, 263656013, 263656014, 263656015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Aluminum	mg/L	ND	0.10	04/10/18 19:15	

LABORATORY CONTROL SAMPLE: 19995

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Aluminum	mg/L	1	0.97	97	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 20003 20004

Parameter	Units	263656001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Aluminum	mg/L	0.91	1	1	1.9	2.0	99	108	75-125	4	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

### REPORT OF LABORATORY ANALYSIS

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### QUALITY CONTROL DATA

Project: Chemtrade  
Pace Project No.: 263656

QC Batch: 4036 Analysis Method: EPA 9056A  
QC Batch Method: EPA 9056A Analysis Description: 9056 IC Anions  
Associated Lab Samples: 263656001, 263656002, 263656003, 263656004, 263656005, 263656006, 263656007, 263656008, 263656009, 263656010, 263656011, 263656012, 263656013, 263656014, 263656015

METHOD BLANK: 20211 Matrix: Water  
Associated Lab Samples: 263656001, 263656002, 263656003, 263656004, 263656005, 263656006, 263656007, 263656008, 263656009, 263656010, 263656011, 263656012, 263656013, 263656014, 263656015

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	5.0	04/11/18 08:58	

LABORATORY CONTROL SAMPLE: 20212

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	10	9.7	97	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 20213 20214

Parameter	Units	263656001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	Max RPD	Qual
Sulfate	mg/L	26.2	10	10	33.4	33.4	72	72	90-110	0 15	M1

MATRIX SPIKE SAMPLE: 20215

Parameter	Units	263656002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	350	1	230	-12000	90-110	E,M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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## QUALIFIERS

Project: Chemtrade

Pace Project No.: 263656

---

### DEFINITIONS

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

ND - Not Detected at or above adjusted reporting limit.

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

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

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

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

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

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

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

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

TNI - The NELAC Institute.

### ANALYTE QUALIFIERS

E Analyte concentration exceeded the calibration range. The reported result is estimated.

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

## REPORT OF LABORATORY ANALYSIS

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### QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Chemtrade

Pace Project No.: 263656

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
263656001	GCW-04D-0418	EPA 3010A	3947	EPA 6010D	4112
263656002	GCW-05-0418	EPA 3010A	3947	EPA 6010D	4112
263656003	Dup-01-0418	EPA 3010A	3947	EPA 6010D	4112
263656004	EPW-02-0418	EPA 3010A	3947	EPA 6010D	4112
263656005	EPW-03D-0418	EPA 3010A	3947	EPA 6010D	4112
263656006	SW-07-0418	EPA 3010A	3947	EPA 6010D	4112
263656007	Dup-02-0418	EPA 3010A	3947	EPA 6010D	4112
263656008	SW-02-0418	EPA 3010A	3947	EPA 6010D	4112
263656009	GCW-03D-0418	EPA 3010A	3947	EPA 6010D	4112
263656010	GCW-02D-0418	EPA 3010A	3947	EPA 6010D	4112
263656011	SW-06-0418	EPA 3010A	3947	EPA 6010D	4112
263656012	SW-09-0418	EPA 3010A	3947	EPA 6010D	4112
263656013	EPW-01-0418	EPA 3010A	3947	EPA 6010D	4112
263656014	GCW-01D-0418	EPA 3010A	3947	EPA 6010D	4112
263656015	OW-01A-0418	EPA 3010A	3947	EPA 6010D	4112
263656001	GCW-04D-0418	EPA 9056A	4036		
263656002	GCW-05-0418	EPA 9056A	4036		
263656003	Dup-01-0418	EPA 9056A	4036		
263656004	EPW-02-0418	EPA 9056A	4036		
263656005	EPW-03D-0418	EPA 9056A	4036		
263656006	SW-07-0418	EPA 9056A	4036		
263656007	Dup-02-0418	EPA 9056A	4036		
263656008	SW-02-0418	EPA 9056A	4036		
263656009	GCW-03D-0418	EPA 9056A	4036		
263656010	GCW-02D-0418	EPA 9056A	4036		
263656011	SW-06-0418	EPA 9056A	4036		
263656012	SW-09-0418	EPA 9056A	4036		
263656013	EPW-01-0418	EPA 9056A	4036		
263656014	GCW-01D-0418	EPA 9056A	4036		
263656015	OW-01A-0418	EPA 9056A	4036		

### REPORT OF LABORATORY ANALYSIS

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**CHAIN OF CUSTODY RECORD**



Pace Analytical Services, LLC - Atlanta GA  
 110 TECHNOLOGY PARKWAY, PEACHTREE CORNERS, GA 30092  
 (770) 734-4200 : FAX (770) 734-4201

PAGE: 1 OF 2

CLIENT NAME: Geosyntec Consultants, Inc.  
 CLIENT ADDRESS: 1755 Roberts Blvd NW  
Kennesaw, GA 30144  
 PHONE NUMBER: (678) 202-9500  
 REPORT TO: Brian Jacobs  
Shira Colsky  
 CC: —  
 REQUESTED COMPLETION DATE: 5/18/18  
 PROJECT NAME: STAT NIMVAL TAT  
 PROJECT NAME STATE: Chemtrade, GA  
 PROJECT #: G105060

CONTAINER TYPE	PRESERVATION	ANALYSIS REQUESTED	CONTAINER TYPE	PRESERVATION	L A B I D N U M B E R	SAMPLE IDENTIFICATION				
						DATE	Collection TIME	MATRIX CODE*	C O R A B	
P - PLASTIC	1 - HCl, ≤6°C					4/3/18	1100	GW	X	GW-04D-0418
A - AMBER GLASS	2 - H <sub>2</sub> SO <sub>4</sub> , ≤6°C					4/3/18	1305	GW	X	GW-05-0418
G - CLEAR GLASS	3 - HNO <sub>3</sub>					4/3/18	—	GW	X	DUP-01-0418
V - VOA VIAL	4 - NaOH, ≤6°C					4/3/18	1535	GW	X	EPW-02-0418
S - STERILE	5 - NaOH/ZnAc, ≤6°C					4/3/18	1635	GW	X	EPW-03D-0418
O - OTHER	6 - Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> , ≤6°C					4/3/18	1620	GW	X	SW-07-0418
	7 - ≤6°C not frozen					4/4/18	—	GW	X	DUP-02-0418
						4/4/18	0925	GW	X	SW-02-0418
						4/4/18	0920	GW	X	GCW-03D-0418
						4/4/18	0925	GW	X	GCW-02D-0418
						4/4/18	1015	GW	X	SW-06-0418
						4/4/18	1045	GW	X	SW-09-0418

CONTAINER TYPE: 150 ml 120 ml  
 PRESERVATION: HNO<sub>3</sub>  
 # of CONTAINERS: 17  
 ANALYSIS REQUESTED: Metals (Al only) Sulfate  
 DATE/TIME: 4/5/18 9:11  
 DATE/TIME: 4/5/18 11:24  
 DATE/TIME: 4/5/18 09:51  
 DATE/TIME: 4/5/18 14:30  
 RECEIVED BY: Mike Noyes  
 RECEIVED BY: Mike Noyes  
 RECEIVED BY: Mike Noyes  
 RECEIVED BY: Mike Noyes  
 SAMPLE SHIPPED VIA: USPS  
 SAMPLE SHIPPED VIA: USPS  
 SAMPLE SHIPPED VIA: USPS  
 SAMPLE SHIPPED VIA: USPS  
 Coolant ID: face  
 Coolant ID: face  
 Coolant ID: face  
 Coolant ID: face

WO#: 263656

LAB #: 263656  
 ENTERED INTO LIMS: 4/5/18 11:24  
 TRACKING #: 4/5/18 09:51  
 RECEIVED BY: Mike Noyes  
 RECEIVED BY: Mike Noyes  
 RECEIVED BY: Mike Noyes  
 RECEIVED BY: Mike Noyes  
 SAMPLE SHIPPED VIA: USPS  
 SAMPLE SHIPPED VIA: USPS  
 SAMPLE SHIPPED VIA: USPS  
 SAMPLE SHIPPED VIA: USPS  
 Coolant ID: face  
 Coolant ID: face  
 Coolant ID: face  
 Coolant ID: face



CHAIN OF CUSTODY RECORD

Pace Analytical Services, LLC - Atlanta GA  
110 TECHNOLOGY PARKWAY, PEACHTREE CORNERS, GA 30092  
(770) 734-4200 : FAX (770) 734-4201

PAGE: 2 OF 2

CLIENT NAME: GEOSYNHC CONSULTANTS  
 CLIENT ADDRESS/PHONE NUMBER/FAX NUMBER:  
1255 Roberts Blvd N. Suite 200 678-202-9500  
Kennewick, WA 98544  
 REPORT TO: Brian Jacobson CC: Shira Coisken  
 REQUESTED COMPLETION DATE: NOV 17 11 PO #: GDSD060  
 PROJECT NAME/STATE: Chemtrade GA  
 PROJECT #: GDSD060

CONTAINER TYPE	ANALYSIS REQUESTED	LAB #	PRESERVATION	
			2 TO 14	150 ML
P - PLASTIC			3	7
A - AMBER GLASS				
G - CLEAR GLASS				
V - VOA VIAL				
S - STERILE				
O - OTHER				

CONTAINER TYPE: P - PLASTIC  
 PRESERVATION: 1 - HCl, 56°C  
 2 - H<sub>2</sub>SO<sub>4</sub>, 56°C  
 3 - HNO<sub>3</sub>  
 4 - NaOH, 56°C  
 5 - NaOH/ZnAc, 56°C  
 6 - Na<sub>2</sub>S<sub>2</sub>O<sub>8</sub>, 56°C  
 7 - 56°C not frozen

\*MATRIX CODES:  
 DW - DRINKING WATER S - SOIL  
 WW - WASTEWATER SL - SLUDGE  
 GW - GROUNDWATER SD - SOLID  
 SW - SURFACE WATER A - AIR  
 ST - STORM WATER L - LIQUID  
 W - WATER P - PRODUCT

REMARKS/ADDITIONAL INFORMATION

Collection DATE	Collection TIME	MATRIX CODE*	SAMPLE IDENTIFICATION				DATE/TIME	DATE/TIME
			C	G	R	A		
4/4/18	1120	GW	X			EPW-01-0418	4/11/18	
4/4/18	1240	GW	X			GW-01D-0418	4/11/18	
4/4/18	1215	GW	X			GW-01A-0418	4/11/18	

SAMPLED BY AND TITLE: Mike Naven  
 RECEIVED BY: Mike Naven  
 RECEIVED BY LAB: Mike Naven  
 DATE/TIME: 4/3/18 11:41 AM  
 DATE/TIME: 4/15/18 09:51  
 DATE/TIME: 4/15/18 14:50  
 Temperature: 3.9 Meq: 3.9

RELINQUISHED BY: Mike Naven  
 RELINQUISHED BY: Mike Naven  
 SAMPLE SHIPPED VIA: UPS  
 UPS FED-EX USPS OTHER FS  
 COURIER CLIENT  
 DATE/TIME: 4/15/18 09:51  
 DATE/TIME:  
 LAB #: 31  
 Entered into LIMS:  
 Tracking #:



**Sample Condition Upon Receipt**



Client Name: Geosyntec Consulting Project # \_\_\_\_\_

**WO#: 263656**

Courier:  Fed Ex  UPS  USPS  Client  Commercial  Pace Other \_\_\_\_\_

Tracking #: \_\_\_\_\_

PM: BM Due Date: **04/16/18**

Custody Seal on Cooler/Box Present:  yes  no Seals intact:  yes  no

CLIENT: **Geosyntec**

Packing Material:  Bubble Wrap  Bubble Bags  None  Other \_\_\_\_\_

Thermometer Used 83 Type of Ice: Wet Blue None  Samples on ice, cooling process has begun

Cooler Temperature 3.9 Biological Tissue is Frozen: Yes No

Date and Initials of person examining contents: 4/15/18 MR

Temp should be above freezing to 6°C

		Comments:	
Chain of Custody Present:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		1.
Chain of Custody Filled Out:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		2.
Chain of Custody Relinquished:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		3.
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		4.
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		5.
Short Hold Time Analysis (<72hr):	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A		6.
Rush Turn Around Time Requested:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A		7.
Sufficient Volume:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		8.
Correct Containers Used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		9.
-Pace Containers Used:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
Containers Intact:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		10.
Filtered volume received for Dissolved tests	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A		11.
Sample Labels match COC:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		12.
-Includes date/time/ID/Analysis Matrix:	<u>6/10/18</u>		
All containers needing preservation have been checked.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		13.
All containers needing preservation are found to be in compliance with EPA recommendation.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Initial when completed	Lot # of added preservative
Samples checked for dechlorination:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A		14.
Headspace in VOA Vials (>6mm):	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A		15.
Trip Blank Present:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A		16.
Trip Blank Custody Seals Present	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A		
Pace Trip Blank Lot # (if purchased):	_____		

Client Notification/ Resolution:

Field Data Required? Y / N

Person Contacted: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Comments/ Resolution: \_\_\_\_\_

Project Manager Review: \_\_\_\_\_

Date: \_\_\_\_\_

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

## APPENDIX B

# GROUNDWATER AND STORM DRAIN SAMPLING FORM



# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade Geosyntec Project No.: GR5060-2018  
 Monitoring Well: MW-(X) GCW-01D Sampling Date: 4/4/18  
 Sample ID: MW-(30) GCW-01D-0418 Sampler: SC

Time	Start Purge Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
11:55	X			-	-	-	-	-	-	clear
11:56	X			18.03	3.91	353	0.287	43.6	10.82	"
12:01	X			18.37	3.89	393	0.244	18.8	11.01	"
12:06	X			18.54	3.89	418	0.274	16.0	10.77	"
12:11	X			18.69	3.89	416	0.272	13.2	10.51	"
12:16	X			18.79	3.89	419	0.272	11.7	10.50	"
12:21	X			18.90	3.89	421	0.271	14.8	10.44	"
12:26	X			18.96	3.90	422	0.272	11.8	10.41	"
12:31	X			19.05	3.90	422	0.270	11.8	10.33	"
12:36	X			19.12	3.91	422	0.271	10.9	10.32	
12:40		X	X							

Prime & Quality Control Samples		Miscellaneous	
Sample ID	Description	Depth to Water:	<u>10.20</u> ft (initial)
		Turbidity:	<u>10.9</u> NTUs
		Dis. Oxygen:	- ppm
		Pump Rate:	<u>400 mL</u> in <u>80</u> min, <u>0</u> sec.

**Weather:** Overcast. 66°F

**Notes:** (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)  
Total purge volume = 7.5 gal  
Final b/w = 10.35 ft b/w  
Meter not reading DO accurately despite calibration & DO cap fluid replacement but DO did stabilize

# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade

Geosyntec Project No.: GR5060-2018

Monitoring Well: MW-<sup>SP</sup> GCW-020

Sampling Date: 4/4/18

Sample ID: MW<sup>SP</sup> GCW-020-0418

Sampler: SP

Time	Start Purge Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
835	X			—	—	—	—	—	—	clear
840	X			16.66	3.60	390	2.13	0.00	0.85	"
845	X			16.64	3.58	411	2.07	0.00	0.24	"
850	X			16.67	3.58	418	2.01	0.00	0.00	"
855	X			16.62	3.57	420	1.98	0.00	0.00	"
900	X			16.60	3.57	423	1.93	0.00	0.00	"
905	X			16.60	3.57	425	1.89	0.00	0.00	"
910	X			16.61	3.58	426	1.85	0.00	0.00	"
915	X			16.60	3.58	427	1.83	0.00	0.00	"
920	X			16.57	3.58	428	1.81	0.00	0.00	"
925		X	X	—	—	—	—	—	—	"

Prime & Quality Control Samples		Miscellaneous	
Sample ID	Description	Depth to Water: <u>3.48</u> ft	(final)
		Turbidity: <u>0.00</u> NTUs	(final)
		Dis. Oxygen: <u>0.00</u> ppm	(final)
		Pump Rate: <u>300</u> gpm	
		<u>1</u> min, <u>0</u> sec.	

Weather: 58°F, Cloudy

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

Start DTW: 3.49

End DTW: 3.48

~ 3.75 gallons purged

well purged & sampled per EPA SESD guidance



# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade

Geosyntec Project No.: GR5060-2018

Monitoring Well: MW-<sup>20</sup>

GCW-03D

Sampling Date: 4/4/18

Sample ID: MW-<sup>20</sup>

GCW-03D-0418

Sampler: SC

Time	Start Purge Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
8:35	X									clear.
8:37	X			17.43	3.20	406	3.13	16.8	10.29	"
8:42	X			17.23	3.15	449	3.15	13.5	12.22	"
8:48	X			17.16	3.14	464	3.11	13.5	9.89	"
8:52	X			17.12	3.14	468	3.11	12.2	8.61	"
8:58	X			17.05	3.14	471	3.11	12.2	6.95	"
① 8:59.02	X			17.01	3.16	469	3.14	8.17	5.81	"
9:08	X			17.00	3.15	460	3.12	8.29	4.16	"
9:12	X			16.98	3.14	456	3.13	7.31	3.60	"
9:18	X			16.98	3.13	456	3.13	4.16	3.37	"
9:20		X	X							

Prime & Quality Control Samples		Miscellaneous	
Sample ID	Description	Depth to Water: <u>4.20</u> ft (fine)	
		Turbidity: <u>4.16</u> NTUs (fine)	
		Dis. Oxygen: <u>8</u> - ppm (fine)	
		Pump Rate: <u>400</u> mL in <u>1</u> min, <u>0</u> sec.	

**Weather:** Overcast, cloudy, 60°F

**Notes:** (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)  
 total purge volume = 5.1 gal.  
 DO meter on Horiba U-5000 not reading accurately (despite calibration and DO cap replacement)  
 Well purged & sampled per EPA SWP guidance (DO not reading properly)

# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade

Geosyntec Project No.: GR5060-2018

Monitoring Well: MW-<sup>SO</sup> GCW-04D

Sampling Date: 4/3/18

Sample ID: MW-<sup>SO</sup> GCW-04D-0418

Sampler: SC/JP

Time	Start Purge Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1015	X			—	—	—	—	—	—	Clear
1018	X			17.33	5.65	283	0.078	18.1	3.86	"
1023	X			17.33	5.90	272	0.075	11.5	3.83	"
1028	X			17.32	6.05	266	0.075	11.5	4.50	"
1033	X			17.51	5.83	278	0.074	8.29	3.61	"
1038	X			17.62	5.85	278	0.074	6.09	3.42	"
1043	X			17.80	5.99	271	0.074	5.55	3.37	"
1048	X			17.99	6.15	261	0.076	4.69	3.36	"
1053	X			18.08	6.20	258	0.076	4.69	3.26	"
1058	X			18.11	6.19	258	0.076	2.82	3.17	"
1100		X	X	—	—	—	—	—	—	

(JP)

Prime & Quality Control Samples		Miscellaneous	
Sample ID	Description	Depth to Water:	8.12 ft (start)
DUP-01-0418	Field duplicate	Turbidity:	3.17 2.82 NTUs (end)
		Dis. Oxygen:	3.17 ppm (end)
		Pump Rate:	300 in mL
			1 min, 0 sec.

**Weather:** Overcast, DCS

**Notes:** (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

Start WL → 8.12 FT BTCL  
 End WL → 10.58 FT BTCL  
 Well purged and sampled in general accordance with EPA SESD guidelines.  
 Wells easy to find, marked with rebar and caution tape, well pen mowed.  
 Purged 4 gal total.

# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade Geosyntec Project No.: GR5060-2018  
 Monitoring Well: MW-<sup>SP</sup> GCW-05-0418 Sampling Date: 4/3/18  
 Sample ID: MW-<sup>SP</sup> GCW-05-0418 Sampler: JP

Time	Start Purge Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1120	X			-	-	-	-	-	-	clear
1125	X			17.82	6.75	-59	0.667	0.00	0.00	"
1130	X			17.80	6.78	-47	0.662	11.1	6.03	"
1135	X			18.20	6.80	-49	0.664	40.4	5.10	"
1140	X			18.20	6.80	-49	0.664	149	5.10	slightly turbid
1145	X			18.26	6.82	-42	0.666	149	3.73	"
1150	X			18.28	6.83	-36	0.663	209	3.18	"
1155	X			18.45	6.79	-29	0.660	27.2	2.69	clear
1200	X			18.60	6.82	-25	0.656	15.3	2.11	clear
1205	X			18.85	6.82	-21	0.661	20.7	1.66	"
1210	X			18.94	6.83	-14	0.668	16.5	1.28	"
1215	X			18.90	6.83	-10	0.665	23.0	1.10	"
1220	X			19.47	6.84	0	0.660	17.7	0.62	"
1225	X			19.70	6.84	4	0.657	19.1	0.40	"
1230	X			20.06	6.85	32	0.652	20.1	0.68	"
1235	X			20.23	6.87	40	0.646	22.0	1.05	"
1245	X			19.42	6.87	56	0.672	46.7	4.28	"
1250	X			19.61	6.86	49	0.666	46.7	3.03	"

Prime & Quality Control Samples		Miscellaneous
Sample ID	Description	Depth to Water: <u>-</u> ft
		Turbidity: <u>-</u> NTUs
		Dis. Oxygen: <u>-</u> ppm
		Pump Rate: <u>400</u> # ml <sup>SP</sup>
		<u>1</u> min, <u>0</u> sec.

Weather: SUNNY, 69°F  
 Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)  
@1240 pump & tubing were adjusted and purge restarted due to clay/sediment in tubing.  
Red ants in well vault. Missing bolts.  
Well sampled & purged in general accordance with EPA JESD sampling procedures.





# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade Geosyntec Project No.: GR5060-2018  
 Monitoring Well: MW-(SP) EPW-01- Sampling Date: 4/4/18  
 Sample ID: MW-(SP) EPW-01-0418 Sampler: SP

Time	Start Purge	Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1050	X				—	—	—	—	—	—	clear
1055		X			16.28	4.77	247	0.107	1.13	1.25	"
1107		X			16.17	4.85	296	0.103	2.50	0.95	"
1105		X			16.24	4.97	301	0.096	2.50	0.92	"
1110		X			16.18	5.02	296	0.088	2.00	0.84	"
1115		X			16.18	4.98	789	0.086	<del>2.50</del> 0.79	0.79	"
1120		X			16.24	4.92	289	0.086	0.05	0.75	"
1120			X	X	—	—	—	—	—	—	"
<div style="border: 1px solid black; border-radius: 50%; width: 50px; height: 50px; display: flex; align-items: center; justify-content: center; margin: 0 auto;"> <span style="font-size: 2em; font-weight: bold;">SP</span> </div>											
Prime & Quality Control Samples										Miscellaneous	
Sample ID					Description					Depth to Water: <u>18.06</u> ft	
										Turbidity: <u>0.05</u> NTUs	
										Dis. Oxygen: <u>0.75</u> ppm	
										Pump Rate: <u>350</u> <del>ml</del> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">SP</span>	
										<u>1</u> min, <u>0</u> sec.	
Weather: <u>55°F Cloudy</u>											
Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)											
Start DTW: <u>16.05</u> End DTW: <u>18.06</u> ~3 gallons purged Well purged & sampled per EPA JESD guidance.											

Turb: 1.93

(final)  
(final)  
(final)  
(SP)

# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade Geosyntec Project No.: GR5060-2018  
 Monitoring Well: MW-EPW-02 Sampling Date: 4/3/18  
 Sample ID: MW-EPW-02-0418 Sampler: SC

Time	Start Purge Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
14:45	X			-	-	-	-	-	-	clear
14:50	X			66.7	6.23	-49	0.091	7.28	2.43	"
14:55	X			66.0	6.08	-43	0.077	5.13	0.71	"
15:00	X			66.4	5.91	7	0.069	2.18	1.03	"
1505 15:05	X			66.0	5.78	44	0.065	1.17	1.28	"
1510	X			66.5	5.71	64	0.063	1.17	1.40	"
1515	X			66.3	5.63	84	0.061	1.50	1.52	"
1520	X			66.3	5.59	93	0.061	0.00	1.52	"
1525	X			66.4	5.56	100	0.061	0.00	1.55	"
1530	X			66.6	5.58	101	0.061	0.00	1.57	"
1535		X	X							

Prime & Quality Control Samples		Miscellaneous	
Sample ID	Description	Depth to Water: <u>3.1</u> ft	(end)
		Turbidity: <u>0.00</u> NTUs	(end)
		Dis. Oxygen: <u>1.57</u> ppm	(end)
		Pump Rate: <u>300</u> mL in @ <u>400</u> mL	
		<u>1</u> min, <u>0</u> sec.	

Weather: Cloudy, 70°  
 Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)  
poor well condition - no well cap & cover.  
total purge volume = 25 gal.  
well purged & sampled per EPA SESD guidance.





# Geosyntec Consultants

## Ground Water Sampling Measurements for Low-Flow Purging

Site: Chemtrade

Geosyntec Project No.: GR5060-2018

Monitoring Well: MW-~~SP~~ OW-01A

Sampling Date: 4/4/18

Sample ID: MW-~~SP~~ OW-01A-0418

Sampler: JP

Time	Start Purge Readings	Start Samp.	End Samp.	Temperature (°C)	pH (ATC)	Redox Potential (± mv)	Conductivity (mS/cm) (ATC)	Turbidity (NTU)	DO (mg/L)	Appearance of Water
1155	X			-	-	-	-	-	-	clear
1200	X			17.25	4.45	356	0.079	0.03	5.56	"
1205	X			17.37	4.44	361	0.079	0.00	5.50	"
1210	X			17.42	4.44	364	0.079	0.00	5.66	"
1215		X	X	-	-	-	-	-	-	"

JP

### Prime & Quality Control Samples

Sample ID	Description

### Miscellaneous

Depth to Water: 13.44 ft  
 Turbidity: 0.00 NTUs  
 Dis. Oxygen: 5.66 ppm mg/L  
 Pump Rate: 300 in mL  
1 min, 0 sec.

(final)  
 (final)  
 (JP) (final)  
 (JP)

Weather: 55°F, cloudy

Notes: (well condition, nearby activities or changes in land use, odors, problems, deviations from plan, etc.)

Start DTW: 12.81  
 End DTW: 13.44  
~1.5 gallons purged

well purged & sampled per EPA JES D guidance











## APPENDIX C

### MANN-KENDALL TREND ANALYSIS DATA

(provided in electronic submittal only)

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: EPW-01

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
15	14	1	1	0
15	14	1	2	0
20	14	6	3	0
10.2	14	-3.8	3	1
11	14	-3	3	2
12.9	14	-1.1	3	3
11.6	14	-2.4	3	4
11	14	-3	3	5
13.5	14	-0.5	3	6
13.2	14	-0.8	3	7
12.5	14	-1.5	3	8
12.8	14	-1.2	3	9
12.9	14	-1.1	3	10
16.9	14	2.9	4	10
13.4	14	-0.6	4	11
21.4	14	7.4	5	11
8.44	14	-5.56	5	12
14	14	0	5	12
12.9	14	-1.1	5	13
14.2	14	0.2	6	13
13.8	14	-0.2	6	14
14.5	14	0.5	7	14
13.9	14	-0.1	7	15
15.8	14	1.8	8	15
12.9	14	-1.1	8	16
13.7	14	-0.3	8	17
11.7	14	-2.3	8	18
15	15	0	8	18
20	15	5	9	18
10.2	15	-4.8	9	19
11	15	-4	9	20
12.9	15	-2.1	9	21
11.6	15	-3.4	9	22
11	15	-4	9	23
13.5	15	-1.5	9	24
13.2	15	-1.8	9	25
12.5	15	-2.5	9	26
12.8	15	-2.2	9	27
12.9	15	-2.1	9	28
16.9	15	1.9	10	28
13.4	15	-1.6	10	29
21.4	15	6.4	11	29
8.44	15	-6.56	11	30
14	15	-1	11	31
12.9	15	-2.1	11	32

14.2	15	-0.8	11	33
13.8	15	-1.2	11	34
14.5	15	-0.5	11	35
13.9	15	-1.1	11	36
15.8	15	0.8	12	36
12.9	15	-2.1	12	37
13.7	15	-1.3	12	38
11.7	15	-3.3	12	39
20	15	5	13	39
10.2	15	-4.8	13	40
11	15	-4	13	41
12.9	15	-2.1	13	42
11.6	15	-3.4	13	43
11	15	-4	13	44
13.5	15	-1.5	13	45
13.2	15	-1.8	13	46
12.5	15	-2.5	13	47
12.8	15	-2.2	13	48
12.9	15	-2.1	13	49
16.9	15	1.9	14	49
13.4	15	-1.6	14	50
21.4	15	6.4	15	50
8.44	15	-6.56	15	51
14	15	-1	15	52
12.9	15	-2.1	15	53
14.2	15	-0.8	15	54
13.8	15	-1.2	15	55
14.5	15	-0.5	15	56
13.9	15	-1.1	15	57
15.8	15	0.8	16	57
12.9	15	-2.1	16	58
13.7	15	-1.3	16	59
11.7	15	-3.3	16	60
10.2	20	-9.8	16	61
11	20	-9	16	62
12.9	20	-7.1	16	63
11.6	20	-8.4	16	64
11	20	-9	16	65
13.5	20	-6.5	16	66
13.2	20	-6.8	16	67
12.5	20	-7.5	16	68
12.8	20	-7.2	16	69
12.9	20	-7.1	16	70
16.9	20	-3.1	16	71
13.4	20	-6.6	16	72
21.4	20	1.4	17	72
8.44	20	-11.56	17	73
14	20	-6	17	74
12.9	20	-7.1	17	75
14.2	20	-5.8	17	76
13.8	20	-6.2	17	77
14.5	20	-5.5	17	78
13.9	20	-6.1	17	79
15.8	20	-4.2	17	80
12.9	20	-7.1	17	81

13.7	20	-6.3	17	82
11.7	20	-8.3	17	83
11	10.2	0.8	18	83
12.9	10.2	2.7	19	83
11.6	10.2	1.4	20	83
11	10.2	0.8	21	83
13.5	10.2	3.3	22	83
13.2	10.2	3	23	83
12.5	10.2	2.3	24	83
12.8	10.2	2.6	25	83
12.9	10.2	2.7	26	83
16.9	10.2	6.7	27	83
13.4	10.2	3.2	28	83
21.4	10.2	11.2	29	83
8.44	10.2	-1.76	29	84
14	10.2	3.8	30	84
12.9	10.2	2.7	31	84
14.2	10.2	4	32	84
13.8	10.2	3.6	33	84
14.5	10.2	4.3	34	84
13.9	10.2	3.7	35	84
15.8	10.2	5.6	36	84
12.9	10.2	2.7	37	84
13.7	10.2	3.5	38	84
11.7	10.2	1.5	39	84
12.9	11	1.9	40	84
11.6	11	0.6	41	84
11	11	0	41	84
13.5	11	2.5	42	84
13.2	11	2.2	43	84
12.5	11	1.5	44	84
12.8	11	1.8	45	84
12.9	11	1.9	46	84
16.9	11	5.9	47	84
13.4	11	2.4	48	84
21.4	11	10.4	49	84
8.44	11	-2.56	49	85
14	11	3	50	85
12.9	11	1.9	51	85
14.2	11	3.2	52	85
13.8	11	2.8	53	85
14.5	11	3.5	54	85
13.9	11	2.9	55	85
15.8	11	4.8	56	85
12.9	11	1.9	57	85
13.7	11	2.7	58	85
11.7	11	0.7	59	85
11.6	12.9	-1.3	59	86
11	12.9	-1.9	59	87
13.5	12.9	0.6	60	87
13.2	12.9	0.3	61	87
12.5	12.9	-0.4	61	88
12.8	12.9	-0.1	61	89
12.9	12.9	0	61	89

16.9	12.9	4	62	89
13.4	12.9	0.5	63	89
21.4	12.9	8.5	64	89
8.44	12.9	-4.46	64	90
14	12.9	1.1	65	90
12.9	12.9	0	65	90
14.2	12.9	1.3	66	90
13.8	12.9	0.9	67	90
14.5	12.9	1.6	68	90
13.9	12.9	1	69	90
15.8	12.9	2.9	70	90
12.9	12.9	0	70	90
13.7	12.9	0.8	71	90
11.7	12.9	-1.2	71	91
11	11.6	-0.6	71	92
13.5	11.6	1.9	72	92
13.2	11.6	1.6	73	92
12.5	11.6	0.9	74	92
12.8	11.6	1.2	75	92
12.9	11.6	1.3	76	92
16.9	11.6	5.3	77	92
13.4	11.6	1.8	78	92
21.4	11.6	9.8	79	92
8.44	11.6	-3.16	79	93
14	11.6	2.4	80	93
12.9	11.6	1.3	81	93
14.2	11.6	2.6	82	93
13.8	11.6	2.2	83	93
14.5	11.6	2.9	84	93
13.9	11.6	2.3	85	93
15.8	11.6	4.2	86	93
12.9	11.6	1.3	87	93
13.7	11.6	2.1	88	93
11.7	11.6	0.1	89	93
13.5	11	2.5	90	93
13.2	11	2.2	91	93
12.5	11	1.5	92	93
12.8	11	1.8	93	93
12.9	11	1.9	94	93
16.9	11	5.9	95	93
13.4	11	2.4	96	93
21.4	11	10.4	97	93
8.44	11	-2.56	97	94
14	11	3	98	94
12.9	11	1.9	99	94
14.2	11	3.2	100	94
13.8	11	2.8	101	94
14.5	11	3.5	102	94
13.9	11	2.9	103	94
15.8	11	4.8	104	94
12.9	11	1.9	105	94
13.7	11	2.7	106	94
11.7	11	0.7	107	94
13.2	13.5	-0.3	107	95



12.5	13.5	-1	107	96
12.8	13.5	-0.7	107	97
12.9	13.5	-0.6	107	98
16.9	13.5	3.4	108	98
13.4	13.5	-0.1	108	99
21.4	13.5	7.9	109	99
8.44	13.5	-5.06	109	100
14	13.5	0.5	110	100
12.9	13.5	-0.6	110	101
14.2	13.5	0.7	111	101
13.8	13.5	0.3	112	101
14.5	13.5	1	113	101
13.9	13.5	0.4	114	101
15.8	13.5	2.3	115	101
12.9	13.5	-0.6	115	102
13.7	13.5	0.2	116	102
11.7	13.5	-1.8	116	103
12.5	13.2	-0.7	116	104
12.8	13.2	-0.4	116	105
12.9	13.2	-0.3	116	106
16.9	13.2	3.7	117	106
13.4	13.2	0.2	118	106
21.4	13.2	8.2	119	106
8.44	13.2	-4.76	119	107
14	13.2	0.8	120	107
12.9	13.2	-0.3	120	108
14.2	13.2	1	121	108
13.8	13.2	0.6	122	108
14.5	13.2	1.3	123	108
13.9	13.2	0.7	124	108
15.8	13.2	2.6	125	108
12.9	13.2	-0.3	125	109
13.7	13.2	0.5	126	109
11.7	13.2	-1.5	126	110
12.8	12.5	0.3	127	110
12.9	12.5	0.4	128	110
16.9	12.5	4.4	129	110
13.4	12.5	0.9	130	110
21.4	12.5	8.9	131	110
8.44	12.5	-4.06	131	111
14	12.5	1.5	132	111
12.9	12.5	0.4	133	111
14.2	12.5	1.7	134	111
13.8	12.5	1.3	135	111
14.5	12.5	2	136	111
13.9	12.5	1.4	137	111
15.8	12.5	3.3	138	111
12.9	12.5	0.4	139	111
13.7	12.5	1.2	140	111
11.7	12.5	-0.8	140	112
12.9	12.8	0.1	141	112
16.9	12.8	4.1	142	112
13.4	12.8	0.6	143	112
21.4	12.8	8.6	144	112

8.44	12.8	-4.36	144	113
14	12.8	1.2	145	113
12.9	12.8	0.1	146	113
14.2	12.8	1.4	147	113
13.8	12.8	1	148	113
14.5	12.8	1.7	149	113
13.9	12.8	1.1	150	113
15.8	12.8	3	151	113
12.9	12.8	0.1	152	113
13.7	12.8	0.9	153	113
11.7	12.8	-1.1	153	114
16.9	12.9	4	154	114
13.4	12.9	0.5	155	114
21.4	12.9	8.5	156	114
8.44	12.9	-4.46	156	115
14	12.9	1.1	157	115
12.9	12.9	0	157	115
14.2	12.9	1.3	158	115
13.8	12.9	0.9	159	115
14.5	12.9	1.6	160	115
13.9	12.9	1	161	115
15.8	12.9	2.9	162	115
12.9	12.9	0	162	115
13.7	12.9	0.8	163	115
11.7	12.9	-1.2	163	116
13.4	16.9	-3.5	163	117
21.4	16.9	4.5	164	117
8.44	16.9	-8.46	164	118
14	16.9	-2.9	164	119
12.9	16.9	-4	164	120
14.2	16.9	-2.7	164	121
13.8	16.9	-3.1	164	122
14.5	16.9	-2.4	164	123
13.9	16.9	-3	164	124
15.8	16.9	-1.1	164	125
12.9	16.9	-4	164	126
13.7	16.9	-3.2	164	127
11.7	16.9	-5.2	164	128
21.4	13.4	8	165	128
8.44	13.4	-4.96	165	129
14	13.4	0.6	166	129
12.9	13.4	-0.5	166	130
14.2	13.4	0.8	167	130
13.8	13.4	0.4	168	130
14.5	13.4	1.1	169	130
13.9	13.4	0.5	170	130
15.8	13.4	2.4	171	130
12.9	13.4	-0.5	171	131
13.7	13.4	0.3	172	131
11.7	13.4	-1.7	172	132
8.44	21.4	-12.96	172	133
14	21.4	-7.4	172	134
12.9	21.4	-8.5	172	135

14.2	21.4	-7.2	172	136
13.8	21.4	-7.6	172	137
14.5	21.4	-6.9	172	138
13.9	21.4	-7.5	172	139
15.8	21.4	-5.6	172	140
12.9	21.4	-8.5	172	141
13.7	21.4	-7.7	172	142
11.7	21.4	-9.7	172	143
14	8.44	5.56	173	143
12.9	8.44	4.46	174	143
14.2	8.44	5.76	175	143
13.8	8.44	5.36	176	143
14.5	8.44	6.06	177	143
13.9	8.44	5.46	178	143
15.8	8.44	7.36	179	143
12.9	8.44	4.46	180	143
13.7	8.44	5.26	181	143
11.7	8.44	3.26	182	143
12.9	14	-1.1	182	144
14.2	14	0.2	183	144
13.8	14	-0.2	183	145
14.5	14	0.5	184	145
13.9	14	-0.1	184	146
15.8	14	1.8	185	146
12.9	14	-1.1	185	147
13.7	14	-0.3	185	148
11.7	14	-2.3	185	149
14.2	12.9	1.3	186	149
13.8	12.9	0.9	187	149
14.5	12.9	1.6	188	149
13.9	12.9	1	189	149
15.8	12.9	2.9	190	149
12.9	12.9	0	190	149
13.7	12.9	0.8	191	149
11.7	12.9	-1.2	191	150
13.8	14.2	-0.4	191	151
14.5	14.2	0.3	192	151
13.9	14.2	-0.3	192	152
15.8	14.2	1.6	193	152
12.9	14.2	-1.3	193	153
13.7	14.2	-0.5	193	154
11.7	14.2	-2.5	193	155
14.5	13.8	0.7	194	155
13.9	13.8	0.1	195	155
15.8	13.8	2	196	155
12.9	13.8	-0.9	196	156
13.7	13.8	-0.1	196	157
11.7	13.8	-2.1	196	158
13.9	14.5	-0.6	196	159
15.8	14.5	1.3	197	159
12.9	14.5	-1.6	197	160

13.7	14.5	-0.8	197	161
11.7	14.5	-2.8	197	162
15.8	13.9	1.9	198	162
12.9	13.9	-1	198	163
13.7	13.9	-0.2	198	164
11.7	13.9	-2.2	198	165
12.9	15.8	-2.9	198	166
13.7	15.8	-2.1	198	167
11.7	15.8	-4.1	198	168
13.7	12.9	0.8	199	168
11.7	12.9	-1.2	199	169
11.7	13.7	-2	199	170

S Statistic = 199 - 170 = 29

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<b>Tied Group Value</b>		<b>Members</b>
1	14	2
2	15	2
3	11	2
4	12.9	4

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 210  
B = 0  
C = 24  
D = 0  
E = 18  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2550.33  
Z-Score = 0.554446  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
0.554446 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: EPW-01

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
15	14	1	1	0
15	14	1	2	0
20	14	6	3	0
10.2	14	-3.8	3	1
11	14	-3	3	2
12.9	14	-1.1	3	3
11.6	14	-2.4	3	4
11	14	-3	3	5
13.5	14	-0.5	3	6
13.2	14	-0.8	3	7
12.5	14	-1.5	3	8
12.8	14	-1.2	3	9
12.9	14	-1.1	3	10
16.9	14	2.9	4	10
13.4	14	-0.6	4	11
21.4	14	7.4	5	11
8.44	14	-5.56	5	12
14	14	0	5	12
12.9	14	-1.1	5	13
14.2	14	0.2	6	13
13.8	14	-0.2	6	14
14.5	14	0.5	7	14
13.9	14	-0.1	7	15
15.8	14	1.8	8	15
12.9	14	-1.1	8	16
13.7	14	-0.3	8	17
11.7	14	-2.3	8	18
15	15	0	8	18
20	15	5	9	18
10.2	15	-4.8	9	19
11	15	-4	9	20
12.9	15	-2.1	9	21
11.6	15	-3.4	9	22
11	15	-4	9	23
13.5	15	-1.5	9	24
13.2	15	-1.8	9	25
12.5	15	-2.5	9	26
12.8	15	-2.2	9	27
12.9	15	-2.1	9	28
16.9	15	1.9	10	28
13.4	15	-1.6	10	29
21.4	15	6.4	11	29
8.44	15	-6.56	11	30
14	15	-1	11	31
12.9	15	-2.1	11	32



14.2	15	-0.8	11	33
13.8	15	-1.2	11	34
14.5	15	-0.5	11	35
13.9	15	-1.1	11	36
15.8	15	0.8	12	36
12.9	15	-2.1	12	37
13.7	15	-1.3	12	38
11.7	15	-3.3	12	39
20	15	5	13	39
10.2	15	-4.8	13	40
11	15	-4	13	41
12.9	15	-2.1	13	42
11.6	15	-3.4	13	43
11	15	-4	13	44
13.5	15	-1.5	13	45
13.2	15	-1.8	13	46
12.5	15	-2.5	13	47
12.8	15	-2.2	13	48
12.9	15	-2.1	13	49
16.9	15	1.9	14	49
13.4	15	-1.6	14	50
21.4	15	6.4	15	50
8.44	15	-6.56	15	51
14	15	-1	15	52
12.9	15	-2.1	15	53
14.2	15	-0.8	15	54
13.8	15	-1.2	15	55
14.5	15	-0.5	15	56
13.9	15	-1.1	15	57
15.8	15	0.8	16	57
12.9	15	-2.1	16	58
13.7	15	-1.3	16	59
11.7	15	-3.3	16	60
10.2	20	-9.8	16	61
11	20	-9	16	62
12.9	20	-7.1	16	63
11.6	20	-8.4	16	64
11	20	-9	16	65
13.5	20	-6.5	16	66
13.2	20	-6.8	16	67
12.5	20	-7.5	16	68
12.8	20	-7.2	16	69
12.9	20	-7.1	16	70
16.9	20	-3.1	16	71
13.4	20	-6.6	16	72
21.4	20	1.4	17	72
8.44	20	-11.56	17	73
14	20	-6	17	74
12.9	20	-7.1	17	75
14.2	20	-5.8	17	76
13.8	20	-6.2	17	77
14.5	20	-5.5	17	78
13.9	20	-6.1	17	79
15.8	20	-4.2	17	80
12.9	20	-7.1	17	81

13.7	20	-6.3	17	82
11.7	20	-8.3	17	83
11	10.2	0.8	18	83
12.9	10.2	2.7	19	83
11.6	10.2	1.4	20	83
11	10.2	0.8	21	83
13.5	10.2	3.3	22	83
13.2	10.2	3	23	83
12.5	10.2	2.3	24	83
12.8	10.2	2.6	25	83
12.9	10.2	2.7	26	83
16.9	10.2	6.7	27	83
13.4	10.2	3.2	28	83
21.4	10.2	11.2	29	83
8.44	10.2	-1.76	29	84
14	10.2	3.8	30	84
12.9	10.2	2.7	31	84
14.2	10.2	4	32	84
13.8	10.2	3.6	33	84
14.5	10.2	4.3	34	84
13.9	10.2	3.7	35	84
15.8	10.2	5.6	36	84
12.9	10.2	2.7	37	84
13.7	10.2	3.5	38	84
11.7	10.2	1.5	39	84
12.9	11	1.9	40	84
11.6	11	0.6	41	84
11	11	0	41	84
13.5	11	2.5	42	84
13.2	11	2.2	43	84
12.5	11	1.5	44	84
12.8	11	1.8	45	84
12.9	11	1.9	46	84
16.9	11	5.9	47	84
13.4	11	2.4	48	84
21.4	11	10.4	49	84
8.44	11	-2.56	49	85
14	11	3	50	85
12.9	11	1.9	51	85
14.2	11	3.2	52	85
13.8	11	2.8	53	85
14.5	11	3.5	54	85
13.9	11	2.9	55	85
15.8	11	4.8	56	85
12.9	11	1.9	57	85
13.7	11	2.7	58	85
11.7	11	0.7	59	85
11.6	12.9	-1.3	59	86
11	12.9	-1.9	59	87
13.5	12.9	0.6	60	87
13.2	12.9	0.3	61	87
12.5	12.9	-0.4	61	88
12.8	12.9	-0.1	61	89
12.9	12.9	0	61	89

16.9	12.9	4	62	89
13.4	12.9	0.5	63	89
21.4	12.9	8.5	64	89
8.44	12.9	-4.46	64	90
14	12.9	1.1	65	90
12.9	12.9	0	65	90
14.2	12.9	1.3	66	90
13.8	12.9	0.9	67	90
14.5	12.9	1.6	68	90
13.9	12.9	1	69	90
15.8	12.9	2.9	70	90
12.9	12.9	0	70	90
13.7	12.9	0.8	71	90
11.7	12.9	-1.2	71	91
11	11.6	-0.6	71	92
13.5	11.6	1.9	72	92
13.2	11.6	1.6	73	92
12.5	11.6	0.9	74	92
12.8	11.6	1.2	75	92
12.9	11.6	1.3	76	92
16.9	11.6	5.3	77	92
13.4	11.6	1.8	78	92
21.4	11.6	9.8	79	92
8.44	11.6	-3.16	79	93
14	11.6	2.4	80	93
12.9	11.6	1.3	81	93
14.2	11.6	2.6	82	93
13.8	11.6	2.2	83	93
14.5	11.6	2.9	84	93
13.9	11.6	2.3	85	93
15.8	11.6	4.2	86	93
12.9	11.6	1.3	87	93
13.7	11.6	2.1	88	93
11.7	11.6	0.1	89	93
13.5	11	2.5	90	93
13.2	11	2.2	91	93
12.5	11	1.5	92	93
12.8	11	1.8	93	93
12.9	11	1.9	94	93
16.9	11	5.9	95	93
13.4	11	2.4	96	93
21.4	11	10.4	97	93
8.44	11	-2.56	97	94
14	11	3	98	94
12.9	11	1.9	99	94
14.2	11	3.2	100	94
13.8	11	2.8	101	94
14.5	11	3.5	102	94
13.9	11	2.9	103	94
15.8	11	4.8	104	94
12.9	11	1.9	105	94
13.7	11	2.7	106	94
11.7	11	0.7	107	94
13.2	13.5	-0.3	107	95

12.5	13.5	-1	107	96
12.8	13.5	-0.7	107	97
12.9	13.5	-0.6	107	98
16.9	13.5	3.4	108	98
13.4	13.5	-0.1	108	99
21.4	13.5	7.9	109	99
8.44	13.5	-5.06	109	100
14	13.5	0.5	110	100
12.9	13.5	-0.6	110	101
14.2	13.5	0.7	111	101
13.8	13.5	0.3	112	101
14.5	13.5	1	113	101
13.9	13.5	0.4	114	101
15.8	13.5	2.3	115	101
12.9	13.5	-0.6	115	102
13.7	13.5	0.2	116	102
11.7	13.5	-1.8	116	103
12.5	13.2	-0.7	116	104
12.8	13.2	-0.4	116	105
12.9	13.2	-0.3	116	106
16.9	13.2	3.7	117	106
13.4	13.2	0.2	118	106
21.4	13.2	8.2	119	106
8.44	13.2	-4.76	119	107
14	13.2	0.8	120	107
12.9	13.2	-0.3	120	108
14.2	13.2	1	121	108
13.8	13.2	0.6	122	108
14.5	13.2	1.3	123	108
13.9	13.2	0.7	124	108
15.8	13.2	2.6	125	108
12.9	13.2	-0.3	125	109
13.7	13.2	0.5	126	109
11.7	13.2	-1.5	126	110
12.8	12.5	0.3	127	110
12.9	12.5	0.4	128	110
16.9	12.5	4.4	129	110
13.4	12.5	0.9	130	110
21.4	12.5	8.9	131	110
8.44	12.5	-4.06	131	111
14	12.5	1.5	132	111
12.9	12.5	0.4	133	111
14.2	12.5	1.7	134	111
13.8	12.5	1.3	135	111
14.5	12.5	2	136	111
13.9	12.5	1.4	137	111
15.8	12.5	3.3	138	111
12.9	12.5	0.4	139	111
13.7	12.5	1.2	140	111
11.7	12.5	-0.8	140	112
12.9	12.8	0.1	141	112
16.9	12.8	4.1	142	112
13.4	12.8	0.6	143	112
21.4	12.8	8.6	144	112

8.44	12.8	-4.36	144	113
14	12.8	1.2	145	113
12.9	12.8	0.1	146	113
14.2	12.8	1.4	147	113
13.8	12.8	1	148	113
14.5	12.8	1.7	149	113
13.9	12.8	1.1	150	113
15.8	12.8	3	151	113
12.9	12.8	0.1	152	113
13.7	12.8	0.9	153	113
11.7	12.8	-1.1	153	114
16.9	12.9	4	154	114
13.4	12.9	0.5	155	114
21.4	12.9	8.5	156	114
8.44	12.9	-4.46	156	115
14	12.9	1.1	157	115
12.9	12.9	0	157	115
14.2	12.9	1.3	158	115
13.8	12.9	0.9	159	115
14.5	12.9	1.6	160	115
13.9	12.9	1	161	115
15.8	12.9	2.9	162	115
12.9	12.9	0	162	115
13.7	12.9	0.8	163	115
11.7	12.9	-1.2	163	116
13.4	16.9	-3.5	163	117
21.4	16.9	4.5	164	117
8.44	16.9	-8.46	164	118
14	16.9	-2.9	164	119
12.9	16.9	-4	164	120
14.2	16.9	-2.7	164	121
13.8	16.9	-3.1	164	122
14.5	16.9	-2.4	164	123
13.9	16.9	-3	164	124
15.8	16.9	-1.1	164	125
12.9	16.9	-4	164	126
13.7	16.9	-3.2	164	127
11.7	16.9	-5.2	164	128
21.4	13.4	8	165	128
8.44	13.4	-4.96	165	129
14	13.4	0.6	166	129
12.9	13.4	-0.5	166	130
14.2	13.4	0.8	167	130
13.8	13.4	0.4	168	130
14.5	13.4	1.1	169	130
13.9	13.4	0.5	170	130
15.8	13.4	2.4	171	130
12.9	13.4	-0.5	171	131
13.7	13.4	0.3	172	131
11.7	13.4	-1.7	172	132
8.44	21.4	-12.96	172	133
14	21.4	-7.4	172	134
12.9	21.4	-8.5	172	135

14.2	21.4	-7.2	172	136
13.8	21.4	-7.6	172	137
14.5	21.4	-6.9	172	138
13.9	21.4	-7.5	172	139
15.8	21.4	-5.6	172	140
12.9	21.4	-8.5	172	141
13.7	21.4	-7.7	172	142
11.7	21.4	-9.7	172	143
14	8.44	5.56	173	143
12.9	8.44	4.46	174	143
14.2	8.44	5.76	175	143
13.8	8.44	5.36	176	143
14.5	8.44	6.06	177	143
13.9	8.44	5.46	178	143
15.8	8.44	7.36	179	143
12.9	8.44	4.46	180	143
13.7	8.44	5.26	181	143
11.7	8.44	3.26	182	143
12.9	14	-1.1	182	144
14.2	14	0.2	183	144
13.8	14	-0.2	183	145
14.5	14	0.5	184	145
13.9	14	-0.1	184	146
15.8	14	1.8	185	146
12.9	14	-1.1	185	147
13.7	14	-0.3	185	148
11.7	14	-2.3	185	149
14.2	12.9	1.3	186	149
13.8	12.9	0.9	187	149
14.5	12.9	1.6	188	149
13.9	12.9	1	189	149
15.8	12.9	2.9	190	149
12.9	12.9	0	190	149
13.7	12.9	0.8	191	149
11.7	12.9	-1.2	191	150
13.8	14.2	-0.4	191	151
14.5	14.2	0.3	192	151
13.9	14.2	-0.3	192	152
15.8	14.2	1.6	193	152
12.9	14.2	-1.3	193	153
13.7	14.2	-0.5	193	154
11.7	14.2	-2.5	193	155
14.5	13.8	0.7	194	155
13.9	13.8	0.1	195	155
15.8	13.8	2	196	155
12.9	13.8	-0.9	196	156
13.7	13.8	-0.1	196	157
11.7	13.8	-2.1	196	158
13.9	14.5	-0.6	196	159
15.8	14.5	1.3	197	159
12.9	14.5	-1.6	197	160

13.7	14.5	-0.8	197	161
11.7	14.5	-2.8	197	162
15.8	13.9	1.9	198	162
12.9	13.9	-1	198	163
13.7	13.9	-0.2	198	164
11.7	13.9	-2.2	198	165
12.9	15.8	-2.9	198	166
13.7	15.8	-2.1	198	167
11.7	15.8	-4.1	198	168
13.7	12.9	0.8	199	168
11.7	12.9	-1.2	199	169
11.7	13.7	-2	199	170

S Statistic = 199 - 170 = 29

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<b>Tied Group Value</b>		<b>Members</b>
1	14	2
2	15	2
3	11	2
4	12.9	4

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---



A = 210  
B = 0  
C = 24  
D = 0  
E = 18  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2550.33  
Z-Score = 0.554446  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
0.554446 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: EPW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
0.2	0.3	-0.1	0	1
0.4	0.3	0.1	1	1
ND<0	0.3	-0.3	1	2
0.3	0.3	0	1	2
0.2	0.3	-0.1	1	3
ND<0	0.3	-0.3	1	4
ND<0	0.3	-0.3	1	5
ND<0	0.3	-0.3	1	6
0.1	0.3	-0.2	1	7
ND<0	0.3	-0.3	1	8
ND<0	0.3	-0.3	1	9
ND<0	0.3	-0.3	1	10
0.1	0.3	-0.2	1	11
ND<0	0.3	-0.3	1	12
ND<0	0.3	-0.3	1	13
ND<0	0.3	-0.3	1	14
ND<0	0.3	-0.3	1	15
ND<0	0.3	-0.3	1	16
ND<0	0.3	-0.3	1	17
ND<0	0.3	-0.3	1	18
ND<0	0.3	-0.3	1	19
ND<0	0.3	-0.3	1	20
ND<0	0.3	-0.3	1	21
ND<0	0.3	-0.3	1	22
ND<0	0.3	-0.3	1	23
ND<0	0.3	-0.3	1	24
ND<0	0.3	-0.3	1	25
0.4	0.2	0.2	2	25
ND<0	0.2	-0.2	2	26
0.3	0.2	0.1	3	26
0.2	0.2	0	3	26
ND<0	0.2	-0.2	3	27
ND<0	0.2	-0.2	3	28
ND<0	0.2	-0.2	3	29
0.1	0.2	-0.1	3	30
ND<0	0.2	-0.2	3	31
ND<0	0.2	-0.2	3	32
ND<0	0.2	-0.2	3	33
0.1	0.2	-0.1	3	34
ND<0	0.2	-0.2	3	35
ND<0	0.2	-0.2	3	36
ND<0	0.2	-0.2	3	37
ND<0	0.2	-0.2	3	38
ND<0	0.2	-0.2	3	39
ND<0	0.2	-0.2	3	40



ND<0	ND<0	0	7	73
ND<0	ND<0	0	7	73
0.2	0.3	-0.1	7	74
ND<0	0.3	-0.3	7	75
ND<0	0.3	-0.3	7	76
ND<0	0.3	-0.3	7	77
0.1	0.3	-0.2	7	78
ND<0	0.3	-0.3	7	79
ND<0	0.3	-0.3	7	80
ND<0	0.3	-0.3	7	81
0.1	0.3	-0.2	7	82
ND<0	0.3	-0.3	7	83
ND<0	0.3	-0.3	7	84
ND<0	0.3	-0.3	7	85
ND<0	0.3	-0.3	7	86
ND<0	0.3	-0.3	7	87
ND<0	0.3	-0.3	7	88
ND<0	0.3	-0.3	7	89
ND<0	0.3	-0.3	7	90
ND<0	0.3	-0.3	7	91
ND<0	0.3	-0.3	7	92
ND<0	0.3	-0.3	7	93
ND<0	0.3	-0.3	7	94
ND<0	0.3	-0.3	7	95
ND<0	0.3	-0.3	7	96
ND<0	0.2	-0.2	7	97
ND<0	0.2	-0.2	7	98
ND<0	0.2	-0.2	7	99
0.1	0.2	-0.1	7	100
ND<0	0.2	-0.2	7	101
ND<0	0.2	-0.2	7	102
ND<0	0.2	-0.2	7	103
0.1	0.2	-0.1	7	104
ND<0	0.2	-0.2	7	105
ND<0	0.2	-0.2	7	106
ND<0	0.2	-0.2	7	107
ND<0	0.2	-0.2	7	108
ND<0	0.2	-0.2	7	109
ND<0	0.2	-0.2	7	110
ND<0	0.2	-0.2	7	111
ND<0	0.2	-0.2	7	112
ND<0	0.2	-0.2	7	113
ND<0	0.2	-0.2	7	114
ND<0	0.2	-0.2	7	115
ND<0	0.2	-0.2	7	116
ND<0	0.2	-0.2	7	117
ND<0	0.2	-0.2	7	118
ND<0	ND<0	0	7	118
ND<0	ND<0	0	7	118
0.1	ND<0	0.1	8	118
ND<0	ND<0	0	8	118
ND<0	ND<0	0	8	118
ND<0	ND<0	0	8	118
0.1	ND<0	0.1	9	118











ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149

S Statistic = 16 - 149 = -133

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<b>Tied Group Value</b>		<b>Members</b>
1	0.3	2
2	0.2	2
3	0	21
4	0.1	2

---

<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/29/2009	1
5/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 19794  
B = 0  
C = 7980  
D = 0  
E = 426  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 1462.33  
Z-Score = -3.45184  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
-3.45184 < -1.65463 indicating a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: EPW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
0.2	0.3	-0.1	0	1
0.4	0.3	0.1	1	1
ND<0	0.3	-0.3	1	2
0.3	0.3	0	1	2
0.2	0.3	-0.1	1	3
ND<0	0.3	-0.3	1	4
ND<0	0.3	-0.3	1	5
ND<0	0.3	-0.3	1	6
0.1	0.3	-0.2	1	7
ND<0	0.3	-0.3	1	8
ND<0	0.3	-0.3	1	9
ND<0	0.3	-0.3	1	10
0.1	0.3	-0.2	1	11
ND<0	0.3	-0.3	1	12
ND<0	0.3	-0.3	1	13
ND<0	0.3	-0.3	1	14
ND<0	0.3	-0.3	1	15
ND<0	0.3	-0.3	1	16
ND<0	0.3	-0.3	1	17
ND<0	0.3	-0.3	1	18
ND<0	0.3	-0.3	1	19
ND<0	0.3	-0.3	1	20
ND<0	0.3	-0.3	1	21
ND<0	0.3	-0.3	1	22
ND<0	0.3	-0.3	1	23
ND<0	0.3	-0.3	1	24
ND<0	0.3	-0.3	1	25
0.4	0.2	0.2	2	25
ND<0	0.2	-0.2	2	26
0.3	0.2	0.1	3	26
0.2	0.2	0	3	26
ND<0	0.2	-0.2	3	27
ND<0	0.2	-0.2	3	28
ND<0	0.2	-0.2	3	29
0.1	0.2	-0.1	3	30
ND<0	0.2	-0.2	3	31
ND<0	0.2	-0.2	3	32
ND<0	0.2	-0.2	3	33
0.1	0.2	-0.1	3	34
ND<0	0.2	-0.2	3	35
ND<0	0.2	-0.2	3	36
ND<0	0.2	-0.2	3	37
ND<0	0.2	-0.2	3	38
ND<0	0.2	-0.2	3	39
ND<0	0.2	-0.2	3	40



ND<0	ND<0	0	7	73
ND<0	ND<0	0	7	73
0.2	0.3	-0.1	7	74
ND<0	0.3	-0.3	7	75
ND<0	0.3	-0.3	7	76
ND<0	0.3	-0.3	7	77
0.1	0.3	-0.2	7	78
ND<0	0.3	-0.3	7	79
ND<0	0.3	-0.3	7	80
ND<0	0.3	-0.3	7	81
0.1	0.3	-0.2	7	82
ND<0	0.3	-0.3	7	83
ND<0	0.3	-0.3	7	84
ND<0	0.3	-0.3	7	85
ND<0	0.3	-0.3	7	86
ND<0	0.3	-0.3	7	87
ND<0	0.3	-0.3	7	88
ND<0	0.3	-0.3	7	89
ND<0	0.3	-0.3	7	90
ND<0	0.3	-0.3	7	91
ND<0	0.3	-0.3	7	92
ND<0	0.3	-0.3	7	93
ND<0	0.3	-0.3	7	94
ND<0	0.3	-0.3	7	95
ND<0	0.3	-0.3	7	96
ND<0	0.2	-0.2	7	97
ND<0	0.2	-0.2	7	98
ND<0	0.2	-0.2	7	99
0.1	0.2	-0.1	7	100
ND<0	0.2	-0.2	7	101
ND<0	0.2	-0.2	7	102
ND<0	0.2	-0.2	7	103
0.1	0.2	-0.1	7	104
ND<0	0.2	-0.2	7	105
ND<0	0.2	-0.2	7	106
ND<0	0.2	-0.2	7	107
ND<0	0.2	-0.2	7	108
ND<0	0.2	-0.2	7	109
ND<0	0.2	-0.2	7	110
ND<0	0.2	-0.2	7	111
ND<0	0.2	-0.2	7	112
ND<0	0.2	-0.2	7	113
ND<0	0.2	-0.2	7	114
ND<0	0.2	-0.2	7	115
ND<0	0.2	-0.2	7	116
ND<0	0.2	-0.2	7	117
ND<0	0.2	-0.2	7	118
ND<0	ND<0	0	7	118
ND<0	ND<0	0	7	118
0.1	ND<0	0.1	8	118
ND<0	ND<0	0	8	118
ND<0	ND<0	0	8	118
ND<0	ND<0	0	8	118
0.1	ND<0	0.1	9	118







ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135
ND<0	ND<0	0	16	135

ND<0	0.1	-0.1	16	136
ND<0	0.1	-0.1	16	137
ND<0	0.1	-0.1	16	138
ND<0	0.1	-0.1	16	139
ND<0	0.1	-0.1	16	140
ND<0	0.1	-0.1	16	141
ND<0	0.1	-0.1	16	142
ND<0	0.1	-0.1	16	143
ND<0	0.1	-0.1	16	144
ND<0	0.1	-0.1	16	145
ND<0	0.1	-0.1	16	146
ND<0	0.1	-0.1	16	147
ND<0	0.1	-0.1	16	148
ND<0	0.1	-0.1	16	149

ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149

ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149

ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149
ND<0	ND<0	0	16	149





A = 19794  
B = 0  
C = 7980  
D = 0  
E = 426  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 1462.33  
Z-Score = -3.45184  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-3.45184 <= 1.65463 indicating no evidence of an upward trend















9/24/2008	1
10/29/2008	1
4/28/2009	1
5/15/2009	1
9/30/2009	1
12/9/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
3/8/2011	1
5/24/2011	1
8/31/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 33000

B = 0

C = 13800

D = 0

E = 600

F = 0

a = 33000

b = 124200

c = 1200

Group Variance = 0

Z-Score = 0

Comparison Level at 95% confidence level = -1.65463 (downward trend)

0 >= -1.65463 indicating no evidence of a downward trend















9/24/2008	1
10/29/2008	1
4/28/2009	1
5/15/2009	1
9/30/2009	1
12/9/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
3/8/2011	1
5/24/2011	1
8/31/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 33000

B = 0

C = 13800

D = 0

E = 600

F = 0

a = 33000

b = 124200

c = 1200

Group Variance = 0

Z-Score = 0

Comparison Level at 95% confidence level = 1.65463 (upward trend)

0 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-01D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
6.7	5.3	1.4	1	0
7.2	5.3	1.9	2	0
7.8	5.3	2.5	3	0
7.6	5.3	2.3	4	0
7.2	5.3	1.9	5	0
6.5	5.3	1.2	6	0
7.8	5.3	2.5	7	0
8.3	5.3	3	8	0
8.5	5.3	3.2	9	0
7.5	5.3	2.2	10	0
7.4	5.3	2.1	11	0
7.6	5.3	2.3	12	0
9.6	5.3	4.3	13	0
7.6	5.3	2.3	14	0
6.9	5.3	1.6	15	0
5.9	5.3	0.6	16	0
6.1	5.3	0.8	17	0
7.4	5.3	2.1	18	0
6.2	5.3	0.9	19	0
5.7	5.3	0.4	20	0
6	5.3	0.7	21	0
6.1	5.3	0.8	22	0
25	5.3	19.7	23	0
5.49	5.3	0.19	24	0
4.2	5.3	-1.1	24	1
4.89	5.3	-0.41	24	2
5.3	5.3	0	24	2
7.2	6.7	0.5	25	2
7.8	6.7	1.1	26	2
7.6	6.7	0.9	27	2
7.2	6.7	0.5	28	2
6.5	6.7	-0.2	28	3
7.8	6.7	1.1	29	3
8.3	6.7	1.6	30	3
8.5	6.7	1.8	31	3
7.5	6.7	0.8	32	3
7.4	6.7	0.7	33	3
7.6	6.7	0.9	34	3
9.6	6.7	2.9	35	3
7.6	6.7	0.9	36	3
6.9	6.7	0.2	37	3
5.9	6.7	-0.8	37	4
6.1	6.7	-0.6	37	5
7.4	6.7	0.7	38	5
6.2	6.7	-0.5	38	6

5.7	6.7	-1	38	7
6	6.7	-0.7	38	8
6.1	6.7	-0.6	38	9
25	6.7	18.3	39	9
5.49	6.7	-1.21	39	10
4.2	6.7	-2.5	39	11
4.89	6.7	-1.81	39	12
5.3	6.7	-1.4	39	13
7.8	7.2	0.6	40	13
7.6	7.2	0.4	41	13
7.2	7.2	0	41	13
6.5	7.2	-0.7	41	14
7.8	7.2	0.6	42	14
8.3	7.2	1.1	43	14
8.5	7.2	1.3	44	14
7.5	7.2	0.3	45	14
7.4	7.2	0.2	46	14
7.6	7.2	0.4	47	14
9.6	7.2	2.4	48	14
7.6	7.2	0.4	49	14
6.9	7.2	-0.3	49	15
5.9	7.2	-1.3	49	16
6.1	7.2	-1.1	49	17
7.4	7.2	0.2	50	17
6.2	7.2	-1	50	18
5.7	7.2	-1.5	50	19
6	7.2	-1.2	50	20
6.1	7.2	-1.1	50	21
25	7.2	17.8	51	21
5.49	7.2	-1.71	51	22
4.2	7.2	-3	51	23
4.89	7.2	-2.31	51	24
5.3	7.2	-1.9	51	25
7.6	7.8	-0.2	51	26
7.2	7.8	-0.6	51	27
6.5	7.8	-1.3	51	28
7.8	7.8	0	51	28
8.3	7.8	0.5	52	28
8.5	7.8	0.7	53	28
7.5	7.8	-0.3	53	29
7.4	7.8	-0.4	53	30
7.6	7.8	-0.2	53	31
9.6	7.8	1.8	54	31
7.6	7.8	-0.2	54	32
6.9	7.8	-0.9	54	33
5.9	7.8	-1.9	54	34
6.1	7.8	-1.7	54	35
7.4	7.8	-0.4	54	36
6.2	7.8	-1.6	54	37
5.7	7.8	-2.1	54	38
6	7.8	-1.8	54	39
6.1	7.8	-1.7	54	40
25	7.8	17.2	55	40
5.49	7.8	-2.31	55	41
4.2	7.8	-3.6	55	42

4.89	7.8	-2.91	55	43
5.3	7.8	-2.5	55	44
7.2	7.6	-0.4	55	45
6.5	7.6	-1.1	55	46
7.8	7.6	0.2	56	46
8.3	7.6	0.7	57	46
8.5	7.6	0.9	58	46
7.5	7.6	-0.1	58	47
7.4	7.6	-0.2	58	48
7.6	7.6	0	58	48
9.6	7.6	2	59	48
7.6	7.6	0	59	48
6.9	7.6	-0.7	59	49
5.9	7.6	-1.7	59	50
6.1	7.6	-1.5	59	51
7.4	7.6	-0.2	59	52
6.2	7.6	-1.4	59	53
5.7	7.6	-1.9	59	54
6	7.6	-1.6	59	55
6.1	7.6	-1.5	59	56
25	7.6	17.4	60	56
5.49	7.6	-2.11	60	57
4.2	7.6	-3.4	60	58
4.89	7.6	-2.71	60	59
5.3	7.6	-2.3	60	60
6.5	7.2	-0.7	60	61
7.8	7.2	0.6	61	61
8.3	7.2	1.1	62	61
8.5	7.2	1.3	63	61
7.5	7.2	0.3	64	61
7.4	7.2	0.2	65	61
7.6	7.2	0.4	66	61
9.6	7.2	2.4	67	61
7.6	7.2	0.4	68	61
6.9	7.2	-0.3	68	62
5.9	7.2	-1.3	68	63
6.1	7.2	-1.1	68	64
7.4	7.2	0.2	69	64
6.2	7.2	-1	69	65
5.7	7.2	-1.5	69	66
6	7.2	-1.2	69	67
6.1	7.2	-1.1	69	68
25	7.2	17.8	70	68
5.49	7.2	-1.71	70	69
4.2	7.2	-3	70	70
4.89	7.2	-2.31	70	71
5.3	7.2	-1.9	70	72
7.8	6.5	1.3	71	72
8.3	6.5	1.8	72	72
8.5	6.5	2	73	72
7.5	6.5	1	74	72
7.4	6.5	0.9	75	72
7.6	6.5	1.1	76	72
9.6	6.5	3.1	77	72

7.6	6.5	1.1	78	72
6.9	6.5	0.4	79	72
5.9	6.5	-0.6	79	73
6.1	6.5	-0.4	79	74
7.4	6.5	0.9	80	74
6.2	6.5	-0.3	80	75
5.7	6.5	-0.8	80	76
6	6.5	-0.5	80	77
6.1	6.5	-0.4	80	78
25	6.5	18.5	81	78
5.49	6.5	-1.01	81	79
4.2	6.5	-2.3	81	80
4.89	6.5	-1.61	81	81
5.3	6.5	-1.2	81	82
8.3	7.8	0.5	82	82
8.5	7.8	0.7	83	82
7.5	7.8	-0.3	83	83
7.4	7.8	-0.4	83	84
7.6	7.8	-0.2	83	85
9.6	7.8	1.8	84	85
7.6	7.8	-0.2	84	86
6.9	7.8	-0.9	84	87
5.9	7.8	-1.9	84	88
6.1	7.8	-1.7	84	89
7.4	7.8	-0.4	84	90
6.2	7.8	-1.6	84	91
5.7	7.8	-2.1	84	92
6	7.8	-1.8	84	93
6.1	7.8	-1.7	84	94
25	7.8	17.2	85	94
5.49	7.8	-2.31	85	95
4.2	7.8	-3.6	85	96
4.89	7.8	-2.91	85	97
5.3	7.8	-2.5	85	98
8.5	8.3	0.2	86	98
7.5	8.3	-0.8	86	99
7.4	8.3	-0.9	86	100
7.6	8.3	-0.7	86	101
9.6	8.3	1.3	87	101
7.6	8.3	-0.7	87	102
6.9	8.3	-1.4	87	103
5.9	8.3	-2.4	87	104
6.1	8.3	-2.2	87	105
7.4	8.3	-0.9	87	106
6.2	8.3	-2.1	87	107
5.7	8.3	-2.6	87	108
6	8.3	-2.3	87	109
6.1	8.3	-2.2	87	110
25	8.3	16.7	88	110
5.49	8.3	-2.81	88	111
4.2	8.3	-4.1	88	112
4.89	8.3	-3.41	88	113
5.3	8.3	-3	88	114
7.5	8.5	-1	88	115

7.4	8.5	-1.1	88	116
7.6	8.5	-0.9	88	117
9.6	8.5	1.1	89	117
7.6	8.5	-0.9	89	118
6.9	8.5	-1.6	89	119
5.9	8.5	-2.6	89	120
6.1	8.5	-2.4	89	121
7.4	8.5	-1.1	89	122
6.2	8.5	-2.3	89	123
5.7	8.5	-2.8	89	124
6	8.5	-2.5	89	125
6.1	8.5	-2.4	89	126
25	8.5	16.5	90	126
5.49	8.5	-3.01	90	127
4.2	8.5	-4.3	90	128
4.89	8.5	-3.61	90	129
5.3	8.5	-3.2	90	130
7.4	7.5	-0.1	90	131
7.6	7.5	0.1	91	131
9.6	7.5	2.1	92	131
7.6	7.5	0.1	93	131
6.9	7.5	-0.6	93	132
5.9	7.5	-1.6	93	133
6.1	7.5	-1.4	93	134
7.4	7.5	-0.1	93	135
6.2	7.5	-1.3	93	136
5.7	7.5	-1.8	93	137
6	7.5	-1.5	93	138
6.1	7.5	-1.4	93	139
25	7.5	17.5	94	139
5.49	7.5	-2.01	94	140
4.2	7.5	-3.3	94	141
4.89	7.5	-2.61	94	142
5.3	7.5	-2.2	94	143
7.6	7.4	0.2	95	143
9.6	7.4	2.2	96	143
7.6	7.4	0.2	97	143
6.9	7.4	-0.5	97	144
5.9	7.4	-1.5	97	145
6.1	7.4	-1.3	97	146
7.4	7.4	0	97	146
6.2	7.4	-1.2	97	147
5.7	7.4	-1.7	97	148
6	7.4	-1.4	97	149
6.1	7.4	-1.3	97	150
25	7.4	17.6	98	150
5.49	7.4	-1.91	98	151
4.2	7.4	-3.2	98	152
4.89	7.4	-2.51	98	153
5.3	7.4	-2.1	98	154
9.6	7.6	2	99	154
7.6	7.6	0	99	154
6.9	7.6	-0.7	99	155
5.9	7.6	-1.7	99	156



6.1	7.6	-1.5	99	157
7.4	7.6	-0.2	99	158
6.2	7.6	-1.4	99	159
5.7	7.6	-1.9	99	160
6	7.6	-1.6	99	161
6.1	7.6	-1.5	99	162
25	7.6	17.4	100	162
5.49	7.6	-2.11	100	163
4.2	7.6	-3.4	100	164
4.89	7.6	-2.71	100	165
5.3	7.6	-2.3	100	166
7.6	9.6	-2	100	167
6.9	9.6	-2.7	100	168
5.9	9.6	-3.7	100	169
6.1	9.6	-3.5	100	170
7.4	9.6	-2.2	100	171
6.2	9.6	-3.4	100	172
5.7	9.6	-3.9	100	173
6	9.6	-3.6	100	174
6.1	9.6	-3.5	100	175
25	9.6	15.4	101	175
5.49	9.6	-4.11	101	176
4.2	9.6	-5.4	101	177
4.89	9.6	-4.71	101	178
5.3	9.6	-4.3	101	179
6.9	7.6	-0.7	101	180
5.9	7.6	-1.7	101	181
6.1	7.6	-1.5	101	182
7.4	7.6	-0.2	101	183
6.2	7.6	-1.4	101	184
5.7	7.6	-1.9	101	185
6	7.6	-1.6	101	186
6.1	7.6	-1.5	101	187
25	7.6	17.4	102	187
5.49	7.6	-2.11	102	188
4.2	7.6	-3.4	102	189
4.89	7.6	-2.71	102	190
5.3	7.6	-2.3	102	191
5.9	6.9	-1	102	192
6.1	6.9	-0.8	102	193
7.4	6.9	0.5	103	193
6.2	6.9	-0.7	103	194
5.7	6.9	-1.2	103	195
6	6.9	-0.9	103	196
6.1	6.9	-0.8	103	197
25	6.9	18.1	104	197
5.49	6.9	-1.41	104	198
4.2	6.9	-2.7	104	199
4.89	6.9	-2.01	104	200
5.3	6.9	-1.6	104	201
6.1	5.9	0.2	105	201
7.4	5.9	1.5	106	201
6.2	5.9	0.3	107	201

5.7	5.9	-0.2	107	202
6	5.9	0.1	108	202
6.1	5.9	0.2	109	202
25	5.9	19.1	110	202
5.49	5.9	-0.41	110	203
4.2	5.9	-1.7	110	204
4.89	5.9	-1.01	110	205
5.3	5.9	-0.6	110	206
7.4	6.1	1.3	111	206
6.2	6.1	0.1	112	206
5.7	6.1	-0.4	112	207
6	6.1	-0.1	112	208
6.1	6.1	0	112	208
25	6.1	18.9	113	208
5.49	6.1	-0.61	113	209
4.2	6.1	-1.9	113	210
4.89	6.1	-1.21	113	211
5.3	6.1	-0.8	113	212
6.2	7.4	-1.2	113	213
5.7	7.4	-1.7	113	214
6	7.4	-1.4	113	215
6.1	7.4	-1.3	113	216
25	7.4	17.6	114	216
5.49	7.4	-1.91	114	217
4.2	7.4	-3.2	114	218
4.89	7.4	-2.51	114	219
5.3	7.4	-2.1	114	220
5.7	6.2	-0.5	114	221
6	6.2	-0.2	114	222
6.1	6.2	-0.1	114	223
25	6.2	18.8	115	223
5.49	6.2	-0.71	115	224
4.2	6.2	-2	115	225
4.89	6.2	-1.31	115	226
5.3	6.2	-0.9	115	227
6	5.7	0.3	116	227
6.1	5.7	0.4	117	227
25	5.7	19.3	118	227
5.49	5.7	-0.21	118	228
4.2	5.7	-1.5	118	229
4.89	5.7	-0.81	118	230
5.3	5.7	-0.4	118	231
6.1	6	0.1	119	231
25	6	19	120	231
5.49	6	-0.51	120	232
4.2	6	-1.8	120	233
4.89	6	-1.11	120	234
5.3	6	-0.7	120	235
25	6.1	18.9	121	235
5.49	6.1	-0.61	121	236
4.2	6.1	-1.9	121	237

4.89	6.1	-1.21	121	238
5.3	6.1	-0.8	121	239
5.49	25	-19.51	121	240
4.2	25	-20.8	121	241
4.89	25	-20.11	121	242
5.3	25	-19.7	121	243
4.2	5.49	-1.29	121	244
4.89	5.49	-0.6	121	245
5.3	5.49	-0.19	121	246
4.89	4.2	0.69	122	246
5.3	4.2	1.1	123	246
5.3	4.89	0.41	124	246

S Statistic = 124 - 246 = -122

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<b>Tied Group Value</b>		<b>Members</b>
1	5.3	2
2	7.2	2
3	7.8	2
4	7.6	3
5	7.4	2
6	6.1	2

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<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/9/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 156

B = 0

C = 6

D = 0

E = 16

F = 0

a = 46116

b = 176904

c = 1512

Group Variance = 2553.33

Z-Score = -2.39459

Comparison Level at 95% confidence level = -1.65463 (downward trend)

-2.39459 < -1.65463 indicating a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-01D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
6.7	5.3	1.4	1	0
7.2	5.3	1.9	2	0
7.8	5.3	2.5	3	0
7.6	5.3	2.3	4	0
7.2	5.3	1.9	5	0
6.5	5.3	1.2	6	0
7.8	5.3	2.5	7	0
8.3	5.3	3	8	0
8.5	5.3	3.2	9	0
7.5	5.3	2.2	10	0
7.4	5.3	2.1	11	0
7.6	5.3	2.3	12	0
9.6	5.3	4.3	13	0
7.6	5.3	2.3	14	0
6.9	5.3	1.6	15	0
5.9	5.3	0.6	16	0
6.1	5.3	0.8	17	0
7.4	5.3	2.1	18	0
6.2	5.3	0.9	19	0
5.7	5.3	0.4	20	0
6	5.3	0.7	21	0
6.1	5.3	0.8	22	0
25	5.3	19.7	23	0
5.49	5.3	0.19	24	0
4.2	5.3	-1.1	24	1
4.89	5.3	-0.41	24	2
5.3	5.3	0	24	2
7.2	6.7	0.5	25	2
7.8	6.7	1.1	26	2
7.6	6.7	0.9	27	2
7.2	6.7	0.5	28	2
6.5	6.7	-0.2	28	3
7.8	6.7	1.1	29	3
8.3	6.7	1.6	30	3
8.5	6.7	1.8	31	3
7.5	6.7	0.8	32	3
7.4	6.7	0.7	33	3
7.6	6.7	0.9	34	3
9.6	6.7	2.9	35	3
7.6	6.7	0.9	36	3
6.9	6.7	0.2	37	3
5.9	6.7	-0.8	37	4
6.1	6.7	-0.6	37	5
7.4	6.7	0.7	38	5
6.2	6.7	-0.5	38	6

5.7	6.7	-1	38	7
6	6.7	-0.7	38	8
6.1	6.7	-0.6	38	9
25	6.7	18.3	39	9
5.49	6.7	-1.21	39	10
4.2	6.7	-2.5	39	11
4.89	6.7	-1.81	39	12
5.3	6.7	-1.4	39	13
7.8	7.2	0.6	40	13
7.6	7.2	0.4	41	13
7.2	7.2	0	41	13
6.5	7.2	-0.7	41	14
7.8	7.2	0.6	42	14
8.3	7.2	1.1	43	14
8.5	7.2	1.3	44	14
7.5	7.2	0.3	45	14
7.4	7.2	0.2	46	14
7.6	7.2	0.4	47	14
9.6	7.2	2.4	48	14
7.6	7.2	0.4	49	14
6.9	7.2	-0.3	49	15
5.9	7.2	-1.3	49	16
6.1	7.2	-1.1	49	17
7.4	7.2	0.2	50	17
6.2	7.2	-1	50	18
5.7	7.2	-1.5	50	19
6	7.2	-1.2	50	20
6.1	7.2	-1.1	50	21
25	7.2	17.8	51	21
5.49	7.2	-1.71	51	22
4.2	7.2	-3	51	23
4.89	7.2	-2.31	51	24
5.3	7.2	-1.9	51	25
7.6	7.8	-0.2	51	26
7.2	7.8	-0.6	51	27
6.5	7.8	-1.3	51	28
7.8	7.8	0	51	28
8.3	7.8	0.5	52	28
8.5	7.8	0.7	53	28
7.5	7.8	-0.3	53	29
7.4	7.8	-0.4	53	30
7.6	7.8	-0.2	53	31
9.6	7.8	1.8	54	31
7.6	7.8	-0.2	54	32
6.9	7.8	-0.9	54	33
5.9	7.8	-1.9	54	34
6.1	7.8	-1.7	54	35
7.4	7.8	-0.4	54	36
6.2	7.8	-1.6	54	37
5.7	7.8	-2.1	54	38
6	7.8	-1.8	54	39
6.1	7.8	-1.7	54	40
25	7.8	17.2	55	40
5.49	7.8	-2.31	55	41
4.2	7.8	-3.6	55	42

4.89	7.8	-2.91	55	43
5.3	7.8	-2.5	55	44
7.2	7.6	-0.4	55	45
6.5	7.6	-1.1	55	46
7.8	7.6	0.2	56	46
8.3	7.6	0.7	57	46
8.5	7.6	0.9	58	46
7.5	7.6	-0.1	58	47
7.4	7.6	-0.2	58	48
7.6	7.6	0	58	48
9.6	7.6	2	59	48
7.6	7.6	0	59	48
6.9	7.6	-0.7	59	49
5.9	7.6	-1.7	59	50
6.1	7.6	-1.5	59	51
7.4	7.6	-0.2	59	52
6.2	7.6	-1.4	59	53
5.7	7.6	-1.9	59	54
6	7.6	-1.6	59	55
6.1	7.6	-1.5	59	56
25	7.6	17.4	60	56
5.49	7.6	-2.11	60	57
4.2	7.6	-3.4	60	58
4.89	7.6	-2.71	60	59
5.3	7.6	-2.3	60	60
6.5	7.2	-0.7	60	61
7.8	7.2	0.6	61	61
8.3	7.2	1.1	62	61
8.5	7.2	1.3	63	61
7.5	7.2	0.3	64	61
7.4	7.2	0.2	65	61
7.6	7.2	0.4	66	61
9.6	7.2	2.4	67	61
7.6	7.2	0.4	68	61
6.9	7.2	-0.3	68	62
5.9	7.2	-1.3	68	63
6.1	7.2	-1.1	68	64
7.4	7.2	0.2	69	64
6.2	7.2	-1	69	65
5.7	7.2	-1.5	69	66
6	7.2	-1.2	69	67
6.1	7.2	-1.1	69	68
25	7.2	17.8	70	68
5.49	7.2	-1.71	70	69
4.2	7.2	-3	70	70
4.89	7.2	-2.31	70	71
5.3	7.2	-1.9	70	72
7.8	6.5	1.3	71	72
8.3	6.5	1.8	72	72
8.5	6.5	2	73	72
7.5	6.5	1	74	72
7.4	6.5	0.9	75	72
7.6	6.5	1.1	76	72
9.6	6.5	3.1	77	72

7.6	6.5	1.1	78	72
6.9	6.5	0.4	79	72
5.9	6.5	-0.6	79	73
6.1	6.5	-0.4	79	74
7.4	6.5	0.9	80	74
6.2	6.5	-0.3	80	75
5.7	6.5	-0.8	80	76
6	6.5	-0.5	80	77
6.1	6.5	-0.4	80	78
25	6.5	18.5	81	78
5.49	6.5	-1.01	81	79
4.2	6.5	-2.3	81	80
4.89	6.5	-1.61	81	81
5.3	6.5	-1.2	81	82
8.3	7.8	0.5	82	82
8.5	7.8	0.7	83	82
7.5	7.8	-0.3	83	83
7.4	7.8	-0.4	83	84
7.6	7.8	-0.2	83	85
9.6	7.8	1.8	84	85
7.6	7.8	-0.2	84	86
6.9	7.8	-0.9	84	87
5.9	7.8	-1.9	84	88
6.1	7.8	-1.7	84	89
7.4	7.8	-0.4	84	90
6.2	7.8	-1.6	84	91
5.7	7.8	-2.1	84	92
6	7.8	-1.8	84	93
6.1	7.8	-1.7	84	94
25	7.8	17.2	85	94
5.49	7.8	-2.31	85	95
4.2	7.8	-3.6	85	96
4.89	7.8	-2.91	85	97
5.3	7.8	-2.5	85	98
8.5	8.3	0.2	86	98
7.5	8.3	-0.8	86	99
7.4	8.3	-0.9	86	100
7.6	8.3	-0.7	86	101
9.6	8.3	1.3	87	101
7.6	8.3	-0.7	87	102
6.9	8.3	-1.4	87	103
5.9	8.3	-2.4	87	104
6.1	8.3	-2.2	87	105
7.4	8.3	-0.9	87	106
6.2	8.3	-2.1	87	107
5.7	8.3	-2.6	87	108
6	8.3	-2.3	87	109
6.1	8.3	-2.2	87	110
25	8.3	16.7	88	110
5.49	8.3	-2.81	88	111
4.2	8.3	-4.1	88	112
4.89	8.3	-3.41	88	113
5.3	8.3	-3	88	114
7.5	8.5	-1	88	115



7.4	8.5	-1.1	88	116
7.6	8.5	-0.9	88	117
9.6	8.5	1.1	89	117
7.6	8.5	-0.9	89	118
6.9	8.5	-1.6	89	119
5.9	8.5	-2.6	89	120
6.1	8.5	-2.4	89	121
7.4	8.5	-1.1	89	122
6.2	8.5	-2.3	89	123
5.7	8.5	-2.8	89	124
6	8.5	-2.5	89	125
6.1	8.5	-2.4	89	126
25	8.5	16.5	90	126
5.49	8.5	-3.01	90	127
4.2	8.5	-4.3	90	128
4.89	8.5	-3.61	90	129
5.3	8.5	-3.2	90	130
7.4	7.5	-0.1	90	131
7.6	7.5	0.1	91	131
9.6	7.5	2.1	92	131
7.6	7.5	0.1	93	131
6.9	7.5	-0.6	93	132
5.9	7.5	-1.6	93	133
6.1	7.5	-1.4	93	134
7.4	7.5	-0.1	93	135
6.2	7.5	-1.3	93	136
5.7	7.5	-1.8	93	137
6	7.5	-1.5	93	138
6.1	7.5	-1.4	93	139
25	7.5	17.5	94	139
5.49	7.5	-2.01	94	140
4.2	7.5	-3.3	94	141
4.89	7.5	-2.61	94	142
5.3	7.5	-2.2	94	143
7.6	7.4	0.2	95	143
9.6	7.4	2.2	96	143
7.6	7.4	0.2	97	143
6.9	7.4	-0.5	97	144
5.9	7.4	-1.5	97	145
6.1	7.4	-1.3	97	146
7.4	7.4	0	97	146
6.2	7.4	-1.2	97	147
5.7	7.4	-1.7	97	148
6	7.4	-1.4	97	149
6.1	7.4	-1.3	97	150
25	7.4	17.6	98	150
5.49	7.4	-1.91	98	151
4.2	7.4	-3.2	98	152
4.89	7.4	-2.51	98	153
5.3	7.4	-2.1	98	154
9.6	7.6	2	99	154
7.6	7.6	0	99	154
6.9	7.6	-0.7	99	155
5.9	7.6	-1.7	99	156

6.1	7.6	-1.5	99	157
7.4	7.6	-0.2	99	158
6.2	7.6	-1.4	99	159
5.7	7.6	-1.9	99	160
6	7.6	-1.6	99	161
6.1	7.6	-1.5	99	162
25	7.6	17.4	100	162
5.49	7.6	-2.11	100	163
4.2	7.6	-3.4	100	164
4.89	7.6	-2.71	100	165
5.3	7.6	-2.3	100	166
7.6	9.6	-2	100	167
6.9	9.6	-2.7	100	168
5.9	9.6	-3.7	100	169
6.1	9.6	-3.5	100	170
7.4	9.6	-2.2	100	171
6.2	9.6	-3.4	100	172
5.7	9.6	-3.9	100	173
6	9.6	-3.6	100	174
6.1	9.6	-3.5	100	175
25	9.6	15.4	101	175
5.49	9.6	-4.11	101	176
4.2	9.6	-5.4	101	177
4.89	9.6	-4.71	101	178
5.3	9.6	-4.3	101	179
6.9	7.6	-0.7	101	180
5.9	7.6	-1.7	101	181
6.1	7.6	-1.5	101	182
7.4	7.6	-0.2	101	183
6.2	7.6	-1.4	101	184
5.7	7.6	-1.9	101	185
6	7.6	-1.6	101	186
6.1	7.6	-1.5	101	187
25	7.6	17.4	102	187
5.49	7.6	-2.11	102	188
4.2	7.6	-3.4	102	189
4.89	7.6	-2.71	102	190
5.3	7.6	-2.3	102	191
5.9	6.9	-1	102	192
6.1	6.9	-0.8	102	193
7.4	6.9	0.5	103	193
6.2	6.9	-0.7	103	194
5.7	6.9	-1.2	103	195
6	6.9	-0.9	103	196
6.1	6.9	-0.8	103	197
25	6.9	18.1	104	197
5.49	6.9	-1.41	104	198
4.2	6.9	-2.7	104	199
4.89	6.9	-2.01	104	200
5.3	6.9	-1.6	104	201
6.1	5.9	0.2	105	201
7.4	5.9	1.5	106	201
6.2	5.9	0.3	107	201

5.7	5.9	-0.2	107	202
6	5.9	0.1	108	202
6.1	5.9	0.2	109	202
25	5.9	19.1	110	202
5.49	5.9	-0.41	110	203
4.2	5.9	-1.7	110	204
4.89	5.9	-1.01	110	205
5.3	5.9	-0.6	110	206
7.4	6.1	1.3	111	206
6.2	6.1	0.1	112	206
5.7	6.1	-0.4	112	207
6	6.1	-0.1	112	208
6.1	6.1	0	112	208
25	6.1	18.9	113	208
5.49	6.1	-0.61	113	209
4.2	6.1	-1.9	113	210
4.89	6.1	-1.21	113	211
5.3	6.1	-0.8	113	212
6.2	7.4	-1.2	113	213
5.7	7.4	-1.7	113	214
6	7.4	-1.4	113	215
6.1	7.4	-1.3	113	216
25	7.4	17.6	114	216
5.49	7.4	-1.91	114	217
4.2	7.4	-3.2	114	218
4.89	7.4	-2.51	114	219
5.3	7.4	-2.1	114	220
5.7	6.2	-0.5	114	221
6	6.2	-0.2	114	222
6.1	6.2	-0.1	114	223
25	6.2	18.8	115	223
5.49	6.2	-0.71	115	224
4.2	6.2	-2	115	225
4.89	6.2	-1.31	115	226
5.3	6.2	-0.9	115	227
6	5.7	0.3	116	227
6.1	5.7	0.4	117	227
25	5.7	19.3	118	227
5.49	5.7	-0.21	118	228
4.2	5.7	-1.5	118	229
4.89	5.7	-0.81	118	230
5.3	5.7	-0.4	118	231
6.1	6	0.1	119	231
25	6	19	120	231
5.49	6	-0.51	120	232
4.2	6	-1.8	120	233
4.89	6	-1.11	120	234
5.3	6	-0.7	120	235
25	6.1	18.9	121	235
5.49	6.1	-0.61	121	236
4.2	6.1	-1.9	121	237

4.89	6.1	-1.21	121	238
5.3	6.1	-0.8	121	239
5.49	25	-19.51	121	240
4.2	25	-20.8	121	241
4.89	25	-20.11	121	242
5.3	25	-19.7	121	243
4.2	5.49	-1.29	121	244
4.89	5.49	-0.6	121	245
5.3	5.49	-0.19	121	246
4.89	4.2	0.69	122	246
5.3	4.2	1.1	123	246
5.3	4.89	0.41	124	246

S Statistic = 124 - 246 = -122

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<b>Tied Group Value</b>		<b>Members</b>
1	5.3	2
2	7.2	2
3	7.8	2
4	7.6	3
5	7.4	2
6	6.1	2

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<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/9/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 156

B = 0

C = 6

D = 0

E = 16

F = 0

a = 46116

b = 176904

c = 1512

Group Variance = 2553.33

Z-Score = -2.39459

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-2.39459 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-02D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
220	230	-10	0	1
230	230	0	0	1
240	230	10	1	1
160	230	-70	1	2
222	230	-8	1	3
157	230	-73	1	4
170	230	-60	1	5
165	230	-65	1	6
208	230	-22	1	7
165	230	-65	1	8
118	230	-112	1	9
196	230	-34	1	10
205	230	-25	1	11
199	230	-31	1	12
135	230	-95	1	13
212	230	-18	1	14
214	230	-16	1	15
214	230	-16	1	16
197	230	-33	1	17
179	230	-51	1	18
193	230	-37	1	19
173	230	-57	1	20
181	230	-49	1	21
500	230	270	2	21
162	230	-68	2	22
132	230	-98	2	23
144	230	-86	2	24
230	220	10	3	24
240	220	20	4	24
160	220	-60	4	25
222	220	2	5	25
157	220	-63	5	26
170	220	-50	5	27
165	220	-55	5	28
208	220	-12	5	29
165	220	-55	5	30
118	220	-102	5	31
196	220	-24	5	32
205	220	-15	5	33
199	220	-21	5	34
135	220	-85	5	35
212	220	-8	5	36
214	220	-6	5	37
214	220	-6	5	38
197	220	-23	5	39

179	220	-41	5	40
193	220	-27	5	41
173	220	-47	5	42
181	220	-39	5	43
500	220	280	6	43
162	220	-58	6	44
132	220	-88	6	45
144	220	-76	6	46
240	230	10	7	46
160	230	-70	7	47
222	230	-8	7	48
157	230	-73	7	49
170	230	-60	7	50
165	230	-65	7	51
208	230	-22	7	52
165	230	-65	7	53
118	230	-112	7	54
196	230	-34	7	55
205	230	-25	7	56
199	230	-31	7	57
135	230	-95	7	58
212	230	-18	7	59
214	230	-16	7	60
214	230	-16	7	61
197	230	-33	7	62
179	230	-51	7	63
193	230	-37	7	64
173	230	-57	7	65
181	230	-49	7	66
500	230	270	8	66
162	230	-68	8	67
132	230	-98	8	68
144	230	-86	8	69
160	240	-80	8	70
222	240	-18	8	71
157	240	-83	8	72
170	240	-70	8	73
165	240	-75	8	74
208	240	-32	8	75
165	240	-75	8	76
118	240	-122	8	77
196	240	-44	8	78
205	240	-35	8	79
199	240	-41	8	80
135	240	-105	8	81
212	240	-28	8	82
214	240	-26	8	83
214	240	-26	8	84
197	240	-43	8	85
179	240	-61	8	86
193	240	-47	8	87
173	240	-67	8	88
181	240	-59	8	89
500	240	260	9	89
162	240	-78	9	90

132	240	-108	9	91
144	240	-96	9	92
222	160	62	10	92
157	160	-3	10	93
170	160	10	11	93
165	160	5	12	93
208	160	48	13	93
165	160	5	14	93
118	160	-42	14	94
196	160	36	15	94
205	160	45	16	94
199	160	39	17	94
135	160	-25	17	95
212	160	52	18	95
214	160	54	19	95
214	160	54	20	95
197	160	37	21	95
179	160	19	22	95
193	160	33	23	95
173	160	13	24	95
181	160	21	25	95
500	160	340	26	95
162	160	2	27	95
132	160	-28	27	96
144	160	-16	27	97
157	222	-65	27	98
170	222	-52	27	99
165	222	-57	27	100
208	222	-14	27	101
165	222	-57	27	102
118	222	-104	27	103
196	222	-26	27	104
205	222	-17	27	105
199	222	-23	27	106
135	222	-87	27	107
212	222	-10	27	108
214	222	-8	27	109
214	222	-8	27	110
197	222	-25	27	111
179	222	-43	27	112
193	222	-29	27	113
173	222	-49	27	114
181	222	-41	27	115
500	222	278	28	115
162	222	-60	28	116
132	222	-90	28	117
144	222	-78	28	118
170	157	13	29	118
165	157	8	30	118
208	157	51	31	118
165	157	8	32	118
118	157	-39	32	119
196	157	39	33	119
205	157	48	34	119



199	157	42	35	119
135	157	-22	35	120
212	157	55	36	120
214	157	57	37	120
214	157	57	38	120
197	157	40	39	120
179	157	22	40	120
193	157	36	41	120
173	157	16	42	120
181	157	24	43	120
500	157	343	44	120
162	157	5	45	120
132	157	-25	45	121
144	157	-13	45	122
165	170	-5	45	123
208	170	38	46	123
165	170	-5	46	124
118	170	-52	46	125
196	170	26	47	125
205	170	35	48	125
199	170	29	49	125
135	170	-35	49	126
212	170	42	50	126
214	170	44	51	126
214	170	44	52	126
197	170	27	53	126
179	170	9	54	126
193	170	23	55	126
173	170	3	56	126
181	170	11	57	126
500	170	330	58	126
162	170	-8	58	127
132	170	-38	58	128
144	170	-26	58	129
208	165	43	59	129
165	165	0	59	129
118	165	-47	59	130
196	165	31	60	130
205	165	40	61	130
199	165	34	62	130
135	165	-30	62	131
212	165	47	63	131
214	165	49	64	131
214	165	49	65	131
197	165	32	66	131
179	165	14	67	131
193	165	28	68	131
173	165	8	69	131
181	165	16	70	131
500	165	335	71	131
162	165	-3	71	132
132	165	-33	71	133
144	165	-21	71	134
165	208	-43	71	135

118	208	-90	71	136
196	208	-12	71	137
205	208	-3	71	138
199	208	-9	71	139
135	208	-73	71	140
212	208	4	72	140
214	208	6	73	140
214	208	6	74	140
197	208	-11	74	141
179	208	-29	74	142
193	208	-15	74	143
173	208	-35	74	144
181	208	-27	74	145
500	208	292	75	145
162	208	-46	75	146
132	208	-76	75	147
144	208	-64	75	148
118	165	-47	75	149
196	165	31	76	149
205	165	40	77	149
199	165	34	78	149
135	165	-30	78	150
212	165	47	79	150
214	165	49	80	150
214	165	49	81	150
197	165	32	82	150
179	165	14	83	150
193	165	28	84	150
173	165	8	85	150
181	165	16	86	150
500	165	335	87	150
162	165	-3	87	151
132	165	-33	87	152
144	165	-21	87	153
196	118	78	88	153
205	118	87	89	153
199	118	81	90	153
135	118	17	91	153
212	118	94	92	153
214	118	96	93	153
214	118	96	94	153
197	118	79	95	153
179	118	61	96	153
193	118	75	97	153
173	118	55	98	153
181	118	63	99	153
500	118	382	100	153
162	118	44	101	153
132	118	14	102	153
144	118	26	103	153
205	196	9	104	153
199	196	3	105	153
135	196	-61	105	154
212	196	16	106	154

214	196	18	107	154
214	196	18	108	154
197	196	1	109	154
179	196	-17	109	155
193	196	-3	109	156
173	196	-23	109	157
181	196	-15	109	158
500	196	304	110	158
162	196	-34	110	159
132	196	-64	110	160
144	196	-52	110	161
199	205	-6	110	162
135	205	-70	110	163
212	205	7	111	163
214	205	9	112	163
214	205	9	113	163
197	205	-8	113	164
179	205	-26	113	165
193	205	-12	113	166
173	205	-32	113	167
181	205	-24	113	168
500	205	295	114	168
162	205	-43	114	169
132	205	-73	114	170
144	205	-61	114	171
135	199	-64	114	172
212	199	13	115	172
214	199	15	116	172
214	199	15	117	172
197	199	-2	117	173
179	199	-20	117	174
193	199	-6	117	175
173	199	-26	117	176
181	199	-18	117	177
500	199	301	118	177
162	199	-37	118	178
132	199	-67	118	179
144	199	-55	118	180
212	135	77	119	180
214	135	79	120	180
214	135	79	121	180
197	135	62	122	180
179	135	44	123	180
193	135	58	124	180
173	135	38	125	180
181	135	46	126	180
500	135	365	127	180
162	135	27	128	180
132	135	-3	128	181
144	135	9	129	181
214	212	2	130	181
214	212	2	131	181
197	212	-15	131	182

179	212	-33	131	183
193	212	-19	131	184
173	212	-39	131	185
181	212	-31	131	186
500	212	288	132	186
162	212	-50	132	187
132	212	-80	132	188
144	212	-68	132	189
214	214	0	132	189
197	214	-17	132	190
179	214	-35	132	191
193	214	-21	132	192
173	214	-41	132	193
181	214	-33	132	194
500	214	286	133	194
162	214	-52	133	195
132	214	-82	133	196
144	214	-70	133	197
197	214	-17	133	198
179	214	-35	133	199
193	214	-21	133	200
173	214	-41	133	201
181	214	-33	133	202
500	214	286	134	202
162	214	-52	134	203
132	214	-82	134	204
144	214	-70	134	205
179	197	-18	134	206
193	197	-4	134	207
173	197	-24	134	208
181	197	-16	134	209
500	197	303	135	209
162	197	-35	135	210
132	197	-65	135	211
144	197	-53	135	212
193	179	14	136	212
173	179	-6	136	213
181	179	2	137	213
500	179	321	138	213
162	179	-17	138	214
132	179	-47	138	215
144	179	-35	138	216
173	193	-20	138	217
181	193	-12	138	218
500	193	307	139	218
162	193	-31	139	219
132	193	-61	139	220
144	193	-49	139	221
181	173	8	140	221
500	173	327	141	221
162	173	-11	141	222

132	173	-41	141	223
144	173	-29	141	224
500	181	319	142	224
162	181	-19	142	225
132	181	-49	142	226
144	181	-37	142	227
162	500	-338	142	228
132	500	-368	142	229
144	500	-356	142	230
132	162	-30	142	231
144	162	-18	142	232
144	132	12	143	232

S Statistic = 143 - 232 = -89

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<b>Tied Group Value</b>	<b>Members</b>
1	230
2	165
3	214

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/14/2010	1
8/12/2010	1
11/24/2010	1
3/8/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 54

B = 0  
C = 0  
D = 0  
E = 6  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2559  
Z-Score = -1.73959  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
**-1.73959 < -1.65463 indicating a downward trend**

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-02D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
220	230	-10	0	1
230	230	0	0	1
240	230	10	1	1
160	230	-70	1	2
222	230	-8	1	3
157	230	-73	1	4
170	230	-60	1	5
165	230	-65	1	6
208	230	-22	1	7
165	230	-65	1	8
118	230	-112	1	9
196	230	-34	1	10
205	230	-25	1	11
199	230	-31	1	12
135	230	-95	1	13
212	230	-18	1	14
214	230	-16	1	15
214	230	-16	1	16
197	230	-33	1	17
179	230	-51	1	18
193	230	-37	1	19
173	230	-57	1	20
181	230	-49	1	21
500	230	270	2	21
162	230	-68	2	22
132	230	-98	2	23
144	230	-86	2	24
230	220	10	3	24
240	220	20	4	24
160	220	-60	4	25
222	220	2	5	25
157	220	-63	5	26
170	220	-50	5	27
165	220	-55	5	28
208	220	-12	5	29
165	220	-55	5	30
118	220	-102	5	31
196	220	-24	5	32
205	220	-15	5	33
199	220	-21	5	34
135	220	-85	5	35
212	220	-8	5	36
214	220	-6	5	37
214	220	-6	5	38
197	220	-23	5	39

179	220	-41	5	40
193	220	-27	5	41
173	220	-47	5	42
181	220	-39	5	43
500	220	280	6	43
162	220	-58	6	44
132	220	-88	6	45
144	220	-76	6	46
240	230	10	7	46
160	230	-70	7	47
222	230	-8	7	48
157	230	-73	7	49
170	230	-60	7	50
165	230	-65	7	51
208	230	-22	7	52
165	230	-65	7	53
118	230	-112	7	54
196	230	-34	7	55
205	230	-25	7	56
199	230	-31	7	57
135	230	-95	7	58
212	230	-18	7	59
214	230	-16	7	60
214	230	-16	7	61
197	230	-33	7	62
179	230	-51	7	63
193	230	-37	7	64
173	230	-57	7	65
181	230	-49	7	66
500	230	270	8	66
162	230	-68	8	67
132	230	-98	8	68
144	230	-86	8	69
160	240	-80	8	70
222	240	-18	8	71
157	240	-83	8	72
170	240	-70	8	73
165	240	-75	8	74
208	240	-32	8	75
165	240	-75	8	76
118	240	-122	8	77
196	240	-44	8	78
205	240	-35	8	79
199	240	-41	8	80
135	240	-105	8	81
212	240	-28	8	82
214	240	-26	8	83
214	240	-26	8	84
197	240	-43	8	85
179	240	-61	8	86
193	240	-47	8	87
173	240	-67	8	88
181	240	-59	8	89
500	240	260	9	89
162	240	-78	9	90



132	240	-108	9	91
144	240	-96	9	92
222	160	62	10	92
157	160	-3	10	93
170	160	10	11	93
165	160	5	12	93
208	160	48	13	93
165	160	5	14	93
118	160	-42	14	94
196	160	36	15	94
205	160	45	16	94
199	160	39	17	94
135	160	-25	17	95
212	160	52	18	95
214	160	54	19	95
214	160	54	20	95
197	160	37	21	95
179	160	19	22	95
193	160	33	23	95
173	160	13	24	95
181	160	21	25	95
500	160	340	26	95
162	160	2	27	95
132	160	-28	27	96
144	160	-16	27	97
157	222	-65	27	98
170	222	-52	27	99
165	222	-57	27	100
208	222	-14	27	101
165	222	-57	27	102
118	222	-104	27	103
196	222	-26	27	104
205	222	-17	27	105
199	222	-23	27	106
135	222	-87	27	107
212	222	-10	27	108
214	222	-8	27	109
214	222	-8	27	110
197	222	-25	27	111
179	222	-43	27	112
193	222	-29	27	113
173	222	-49	27	114
181	222	-41	27	115
500	222	278	28	115
162	222	-60	28	116
132	222	-90	28	117
144	222	-78	28	118
170	157	13	29	118
165	157	8	30	118
208	157	51	31	118
165	157	8	32	118
118	157	-39	32	119
196	157	39	33	119
205	157	48	34	119

199	157	42	35	119
135	157	-22	35	120
212	157	55	36	120
214	157	57	37	120
214	157	57	38	120
197	157	40	39	120
179	157	22	40	120
193	157	36	41	120
173	157	16	42	120
181	157	24	43	120
500	157	343	44	120
162	157	5	45	120
132	157	-25	45	121
144	157	-13	45	122
165	170	-5	45	123
208	170	38	46	123
165	170	-5	46	124
118	170	-52	46	125
196	170	26	47	125
205	170	35	48	125
199	170	29	49	125
135	170	-35	49	126
212	170	42	50	126
214	170	44	51	126
214	170	44	52	126
197	170	27	53	126
179	170	9	54	126
193	170	23	55	126
173	170	3	56	126
181	170	11	57	126
500	170	330	58	126
162	170	-8	58	127
132	170	-38	58	128
144	170	-26	58	129
208	165	43	59	129
165	165	0	59	129
118	165	-47	59	130
196	165	31	60	130
205	165	40	61	130
199	165	34	62	130
135	165	-30	62	131
212	165	47	63	131
214	165	49	64	131
214	165	49	65	131
197	165	32	66	131
179	165	14	67	131
193	165	28	68	131
173	165	8	69	131
181	165	16	70	131
500	165	335	71	131
162	165	-3	71	132
132	165	-33	71	133
144	165	-21	71	134
165	208	-43	71	135

118	208	-90	71	136
196	208	-12	71	137
205	208	-3	71	138
199	208	-9	71	139
135	208	-73	71	140
212	208	4	72	140
214	208	6	73	140
214	208	6	74	140
197	208	-11	74	141
179	208	-29	74	142
193	208	-15	74	143
173	208	-35	74	144
181	208	-27	74	145
500	208	292	75	145
162	208	-46	75	146
132	208	-76	75	147
144	208	-64	75	148
118	165	-47	75	149
196	165	31	76	149
205	165	40	77	149
199	165	34	78	149
135	165	-30	78	150
212	165	47	79	150
214	165	49	80	150
214	165	49	81	150
197	165	32	82	150
179	165	14	83	150
193	165	28	84	150
173	165	8	85	150
181	165	16	86	150
500	165	335	87	150
162	165	-3	87	151
132	165	-33	87	152
144	165	-21	87	153
196	118	78	88	153
205	118	87	89	153
199	118	81	90	153
135	118	17	91	153
212	118	94	92	153
214	118	96	93	153
214	118	96	94	153
197	118	79	95	153
179	118	61	96	153
193	118	75	97	153
173	118	55	98	153
181	118	63	99	153
500	118	382	100	153
162	118	44	101	153
132	118	14	102	153
144	118	26	103	153
205	196	9	104	153
199	196	3	105	153
135	196	-61	105	154
212	196	16	106	154

214	196	18	107	154
214	196	18	108	154
197	196	1	109	154
179	196	-17	109	155
193	196	-3	109	156
173	196	-23	109	157
181	196	-15	109	158
500	196	304	110	158
162	196	-34	110	159
132	196	-64	110	160
144	196	-52	110	161
199	205	-6	110	162
135	205	-70	110	163
212	205	7	111	163
214	205	9	112	163
214	205	9	113	163
197	205	-8	113	164
179	205	-26	113	165
193	205	-12	113	166
173	205	-32	113	167
181	205	-24	113	168
500	205	295	114	168
162	205	-43	114	169
132	205	-73	114	170
144	205	-61	114	171
135	199	-64	114	172
212	199	13	115	172
214	199	15	116	172
214	199	15	117	172
197	199	-2	117	173
179	199	-20	117	174
193	199	-6	117	175
173	199	-26	117	176
181	199	-18	117	177
500	199	301	118	177
162	199	-37	118	178
132	199	-67	118	179
144	199	-55	118	180
212	135	77	119	180
214	135	79	120	180
214	135	79	121	180
197	135	62	122	180
179	135	44	123	180
193	135	58	124	180
173	135	38	125	180
181	135	46	126	180
500	135	365	127	180
162	135	27	128	180
132	135	-3	128	181
144	135	9	129	181
214	212	2	130	181
214	212	2	131	181
197	212	-15	131	182

179	212	-33	131	183
193	212	-19	131	184
173	212	-39	131	185
181	212	-31	131	186
500	212	288	132	186
162	212	-50	132	187
132	212	-80	132	188
144	212	-68	132	189
214	214	0	132	189
197	214	-17	132	190
179	214	-35	132	191
193	214	-21	132	192
173	214	-41	132	193
181	214	-33	132	194
500	214	286	133	194
162	214	-52	133	195
132	214	-82	133	196
144	214	-70	133	197
197	214	-17	133	198
179	214	-35	133	199
193	214	-21	133	200
173	214	-41	133	201
181	214	-33	133	202
500	214	286	134	202
162	214	-52	134	203
132	214	-82	134	204
144	214	-70	134	205
179	197	-18	134	206
193	197	-4	134	207
173	197	-24	134	208
181	197	-16	134	209
500	197	303	135	209
162	197	-35	135	210
132	197	-65	135	211
144	197	-53	135	212
193	179	14	136	212
173	179	-6	136	213
181	179	2	137	213
500	179	321	138	213
162	179	-17	138	214
132	179	-47	138	215
144	179	-35	138	216
173	193	-20	138	217
181	193	-12	138	218
500	193	307	139	218
162	193	-31	139	219
132	193	-61	139	220
144	193	-49	139	221
181	173	8	140	221
500	173	327	141	221
162	173	-11	141	222

132	173	-41	141	223
144	173	-29	141	224
500	181	319	142	224
162	181	-19	142	225
132	181	-49	142	226
144	181	-37	142	227
162	500	-338	142	228
132	500	-368	142	229
144	500	-356	142	230
132	162	-30	142	231
144	162	-18	142	232
144	132	12	143	232

S Statistic = 143 - 232 = -89

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<b>Tied Group Value</b>		<b>Members</b>
1	230	2
2	165	2
3	214	2

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/14/2010	1
8/12/2010	1
11/24/2010	1
3/8/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 54

B = 0  
C = 0  
D = 0  
E = 6  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2559  
Z-Score = -1.73959  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-1.73959 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-03D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
220	200	20	1	0
440	200	240	2	0
480	200	280	3	0
446	200	246	4	0
440	200	240	5	0
205	200	5	6	0
187	200	-13	6	1
204	200	4	7	1
390	200	190	8	1
205	200	5	9	1
340	200	140	10	1
350	200	150	11	1
343	200	143	12	1
363	200	163	13	1
340	200	140	14	1
385	200	185	15	1
331	200	131	16	1
361	200	161	17	1
333	200	133	18	1
312	200	112	19	1
298	200	98	20	1
294	200	94	21	1
300	200	100	22	1
314	200	114	23	1
319	200	119	24	1
288	200	88	25	1
287	200	87	26	1
440	220	220	27	1
480	220	260	28	1
446	220	226	29	1
440	220	220	30	1
205	220	-15	30	2
187	220	-33	30	3
204	220	-16	30	4
390	220	170	31	4
205	220	-15	31	5
340	220	120	32	5
350	220	130	33	5
343	220	123	34	5
363	220	143	35	5
340	220	120	36	5
385	220	165	37	5
331	220	111	38	5
361	220	141	39	5
333	220	113	40	5



312	220	92	41	5
298	220	78	42	5
294	220	74	43	5
300	220	80	44	5
314	220	94	45	5
319	220	99	46	5
288	220	68	47	5
287	220	67	48	5
480	440	40	49	5
446	440	6	50	5
440	440	0	50	5
205	440	-235	50	6
187	440	-253	50	7
204	440	-236	50	8
390	440	-50	50	9
205	440	-235	50	10
340	440	-100	50	11
350	440	-90	50	12
343	440	-97	50	13
363	440	-77	50	14
340	440	-100	50	15
385	440	-55	50	16
331	440	-109	50	17
361	440	-79	50	18
333	440	-107	50	19
312	440	-128	50	20
298	440	-142	50	21
294	440	-146	50	22
300	440	-140	50	23
314	440	-126	50	24
319	440	-121	50	25
288	440	-152	50	26
287	440	-153	50	27
446	480	-34	50	28
440	480	-40	50	29
205	480	-275	50	30
187	480	-293	50	31
204	480	-276	50	32
390	480	-90	50	33
205	480	-275	50	34
340	480	-140	50	35
350	480	-130	50	36
343	480	-137	50	37
363	480	-117	50	38
340	480	-140	50	39
385	480	-95	50	40
331	480	-149	50	41
361	480	-119	50	42
333	480	-147	50	43
312	480	-168	50	44
298	480	-182	50	45
294	480	-186	50	46
300	480	-180	50	47
314	480	-166	50	48
319	480	-161	50	49

288	480	-192	50	50
287	480	-193	50	51
440	446	-6	50	52
205	446	-241	50	53
187	446	-259	50	54
204	446	-242	50	55
390	446	-56	50	56
205	446	-241	50	57
340	446	-106	50	58
350	446	-96	50	59
343	446	-103	50	60
363	446	-83	50	61
340	446	-106	50	62
385	446	-61	50	63
331	446	-115	50	64
361	446	-85	50	65
333	446	-113	50	66
312	446	-134	50	67
298	446	-148	50	68
294	446	-152	50	69
300	446	-146	50	70
314	446	-132	50	71
319	446	-127	50	72
288	446	-158	50	73
287	446	-159	50	74
205	440	-235	50	75
187	440	-253	50	76
204	440	-236	50	77
390	440	-50	50	78
205	440	-235	50	79
340	440	-100	50	80
350	440	-90	50	81
343	440	-97	50	82
363	440	-77	50	83
340	440	-100	50	84
385	440	-55	50	85
331	440	-109	50	86
361	440	-79	50	87
333	440	-107	50	88
312	440	-128	50	89
298	440	-142	50	90
294	440	-146	50	91
300	440	-140	50	92
314	440	-126	50	93
319	440	-121	50	94
288	440	-152	50	95
287	440	-153	50	96
187	205	-18	50	97
204	205	-1	50	98
390	205	185	51	98
205	205	0	51	98
340	205	135	52	98
350	205	145	53	98
343	205	138	54	98

363	205	158	55	98
340	205	135	56	98
385	205	180	57	98
331	205	126	58	98
361	205	156	59	98
333	205	128	60	98
312	205	107	61	98
298	205	93	62	98
294	205	89	63	98
300	205	95	64	98
314	205	109	65	98
319	205	114	66	98
288	205	83	67	98
287	205	82	68	98
204	187	17	69	98
390	187	203	70	98
205	187	18	71	98
340	187	153	72	98
350	187	163	73	98
343	187	156	74	98
363	187	176	75	98
340	187	153	76	98
385	187	198	77	98
331	187	144	78	98
361	187	174	79	98
333	187	146	80	98
312	187	125	81	98
298	187	111	82	98
294	187	107	83	98
300	187	113	84	98
314	187	127	85	98
319	187	132	86	98
288	187	101	87	98
287	187	100	88	98
390	204	186	89	98
205	204	1	90	98
340	204	136	91	98
350	204	146	92	98
343	204	139	93	98
363	204	159	94	98
340	204	136	95	98
385	204	181	96	98
331	204	127	97	98
361	204	157	98	98
333	204	129	99	98
312	204	108	100	98
298	204	94	101	98
294	204	90	102	98
300	204	96	103	98
314	204	110	104	98
319	204	115	105	98
288	204	84	106	98
287	204	83	107	98
205	390	-185	107	99

340	390	-50	107	100
350	390	-40	107	101
343	390	-47	107	102
363	390	-27	107	103
340	390	-50	107	104
385	390	-5	107	105
331	390	-59	107	106
361	390	-29	107	107
333	390	-57	107	108
312	390	-78	107	109
298	390	-92	107	110
294	390	-96	107	111
300	390	-90	107	112
314	390	-76	107	113
319	390	-71	107	114
288	390	-102	107	115
287	390	-103	107	116

340	205	135	108	116
350	205	145	109	116
343	205	138	110	116
363	205	158	111	116
340	205	135	112	116
385	205	180	113	116
331	205	126	114	116
361	205	156	115	116
333	205	128	116	116
312	205	107	117	116
298	205	93	118	116
294	205	89	119	116
300	205	95	120	116
314	205	109	121	116
319	205	114	122	116
288	205	83	123	116
287	205	82	124	116

350	340	10	125	116
343	340	3	126	116
363	340	23	127	116
340	340	0	127	116
385	340	45	128	116
331	340	-9	128	117
361	340	21	129	117
333	340	-7	129	118
312	340	-28	129	119
298	340	-42	129	120
294	340	-46	129	121
300	340	-40	129	122
314	340	-26	129	123
319	340	-21	129	124
288	340	-52	129	125
287	340	-53	129	126

343	350	-7	129	127
363	350	13	130	127
340	350	-10	130	128
385	350	35	131	128

331	350	-19	131	129
361	350	11	132	129
333	350	-17	132	130
312	350	-38	132	131
298	350	-52	132	132
294	350	-56	132	133
300	350	-50	132	134
314	350	-36	132	135
319	350	-31	132	136
288	350	-62	132	137
287	350	-63	132	138

363	343	20	133	138
340	343	-3	133	139
385	343	42	134	139
331	343	-12	134	140
361	343	18	135	140
333	343	-10	135	141
312	343	-31	135	142
298	343	-45	135	143
294	343	-49	135	144
300	343	-43	135	145
314	343	-29	135	146
319	343	-24	135	147
288	343	-55	135	148
287	343	-56	135	149

340	363	-23	135	150
385	363	22	136	150
331	363	-32	136	151
361	363	-2	136	152
333	363	-30	136	153
312	363	-51	136	154
298	363	-65	136	155
294	363	-69	136	156
300	363	-63	136	157
314	363	-49	136	158
319	363	-44	136	159
288	363	-75	136	160
287	363	-76	136	161

385	340	45	137	161
331	340	-9	137	162
361	340	21	138	162
333	340	-7	138	163
312	340	-28	138	164
298	340	-42	138	165
294	340	-46	138	166
300	340	-40	138	167
314	340	-26	138	168
319	340	-21	138	169
288	340	-52	138	170
287	340	-53	138	171

331	385	-54	138	172
361	385	-24	138	173
333	385	-52	138	174

312	385	-73	138	175
298	385	-87	138	176
294	385	-91	138	177
300	385	-85	138	178
314	385	-71	138	179
319	385	-66	138	180
288	385	-97	138	181
287	385	-98	138	182
361	331	30	139	182
333	331	2	140	182
312	331	-19	140	183
298	331	-33	140	184
294	331	-37	140	185
300	331	-31	140	186
314	331	-17	140	187
319	331	-12	140	188
288	331	-43	140	189
287	331	-44	140	190
333	361	-28	140	191
312	361	-49	140	192
298	361	-63	140	193
294	361	-67	140	194
300	361	-61	140	195
314	361	-47	140	196
319	361	-42	140	197
288	361	-73	140	198
287	361	-74	140	199
312	333	-21	140	200
298	333	-35	140	201
294	333	-39	140	202
300	333	-33	140	203
314	333	-19	140	204
319	333	-14	140	205
288	333	-45	140	206
287	333	-46	140	207
298	312	-14	140	208
294	312	-18	140	209
300	312	-12	140	210
314	312	2	141	210
319	312	7	142	210
288	312	-24	142	211
287	312	-25	142	212
294	298	-4	142	213
300	298	2	143	213
314	298	16	144	213
319	298	21	145	213
288	298	-10	145	214
287	298	-11	145	215
300	294	6	146	215
314	294	20	147	215
319	294	25	148	215

288	294	-6	148	216
287	294	-7	148	217
314	300	14	149	217
319	300	19	150	217
288	300	-12	150	218
287	300	-13	150	219
319	314	5	151	219
288	314	-26	151	220
287	314	-27	151	221
288	319	-31	151	222
287	319	-32	151	223
287	288	-1	151	224

S Statistic = 151 - 224 = -73

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<b>Tied Group Value</b>		<b>Members</b>
1	440	2
2	205	2
3	340	2

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 54

B = 0  
C = 0  
D = 0  
E = 6  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2559  
Z-Score = -1.4233  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
-1.4233  $\geq$  -1.65463 indicating no evidence of a downward trend



# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-03D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
220	200	20	1	0
440	200	240	2	0
480	200	280	3	0
446	200	246	4	0
440	200	240	5	0
205	200	5	6	0
187	200	-13	6	1
204	200	4	7	1
390	200	190	8	1
205	200	5	9	1
340	200	140	10	1
350	200	150	11	1
343	200	143	12	1
363	200	163	13	1
340	200	140	14	1
385	200	185	15	1
331	200	131	16	1
361	200	161	17	1
333	200	133	18	1
312	200	112	19	1
298	200	98	20	1
294	200	94	21	1
300	200	100	22	1
314	200	114	23	1
319	200	119	24	1
288	200	88	25	1
287	200	87	26	1
440	220	220	27	1
480	220	260	28	1
446	220	226	29	1
440	220	220	30	1
205	220	-15	30	2
187	220	-33	30	3
204	220	-16	30	4
390	220	170	31	4
205	220	-15	31	5
340	220	120	32	5
350	220	130	33	5
343	220	123	34	5
363	220	143	35	5
340	220	120	36	5
385	220	165	37	5
331	220	111	38	5
361	220	141	39	5
333	220	113	40	5

312	220	92	41	5
298	220	78	42	5
294	220	74	43	5
300	220	80	44	5
314	220	94	45	5
319	220	99	46	5
288	220	68	47	5
287	220	67	48	5
480	440	40	49	5
446	440	6	50	5
440	440	0	50	5
205	440	-235	50	6
187	440	-253	50	7
204	440	-236	50	8
390	440	-50	50	9
205	440	-235	50	10
340	440	-100	50	11
350	440	-90	50	12
343	440	-97	50	13
363	440	-77	50	14
340	440	-100	50	15
385	440	-55	50	16
331	440	-109	50	17
361	440	-79	50	18
333	440	-107	50	19
312	440	-128	50	20
298	440	-142	50	21
294	440	-146	50	22
300	440	-140	50	23
314	440	-126	50	24
319	440	-121	50	25
288	440	-152	50	26
287	440	-153	50	27
446	480	-34	50	28
440	480	-40	50	29
205	480	-275	50	30
187	480	-293	50	31
204	480	-276	50	32
390	480	-90	50	33
205	480	-275	50	34
340	480	-140	50	35
350	480	-130	50	36
343	480	-137	50	37
363	480	-117	50	38
340	480	-140	50	39
385	480	-95	50	40
331	480	-149	50	41
361	480	-119	50	42
333	480	-147	50	43
312	480	-168	50	44
298	480	-182	50	45
294	480	-186	50	46
300	480	-180	50	47
314	480	-166	50	48
319	480	-161	50	49

288	480	-192	50	50
287	480	-193	50	51
440	446	-6	50	52
205	446	-241	50	53
187	446	-259	50	54
204	446	-242	50	55
390	446	-56	50	56
205	446	-241	50	57
340	446	-106	50	58
350	446	-96	50	59
343	446	-103	50	60
363	446	-83	50	61
340	446	-106	50	62
385	446	-61	50	63
331	446	-115	50	64
361	446	-85	50	65
333	446	-113	50	66
312	446	-134	50	67
298	446	-148	50	68
294	446	-152	50	69
300	446	-146	50	70
314	446	-132	50	71
319	446	-127	50	72
288	446	-158	50	73
287	446	-159	50	74
205	440	-235	50	75
187	440	-253	50	76
204	440	-236	50	77
390	440	-50	50	78
205	440	-235	50	79
340	440	-100	50	80
350	440	-90	50	81
343	440	-97	50	82
363	440	-77	50	83
340	440	-100	50	84
385	440	-55	50	85
331	440	-109	50	86
361	440	-79	50	87
333	440	-107	50	88
312	440	-128	50	89
298	440	-142	50	90
294	440	-146	50	91
300	440	-140	50	92
314	440	-126	50	93
319	440	-121	50	94
288	440	-152	50	95
287	440	-153	50	96
187	205	-18	50	97
204	205	-1	50	98
390	205	185	51	98
205	205	0	51	98
340	205	135	52	98
350	205	145	53	98
343	205	138	54	98

363	205	158	55	98
340	205	135	56	98
385	205	180	57	98
331	205	126	58	98
361	205	156	59	98
333	205	128	60	98
312	205	107	61	98
298	205	93	62	98
294	205	89	63	98
300	205	95	64	98
314	205	109	65	98
319	205	114	66	98
288	205	83	67	98
287	205	82	68	98
204	187	17	69	98
390	187	203	70	98
205	187	18	71	98
340	187	153	72	98
350	187	163	73	98
343	187	156	74	98
363	187	176	75	98
340	187	153	76	98
385	187	198	77	98
331	187	144	78	98
361	187	174	79	98
333	187	146	80	98
312	187	125	81	98
298	187	111	82	98
294	187	107	83	98
300	187	113	84	98
314	187	127	85	98
319	187	132	86	98
288	187	101	87	98
287	187	100	88	98
390	204	186	89	98
205	204	1	90	98
340	204	136	91	98
350	204	146	92	98
343	204	139	93	98
363	204	159	94	98
340	204	136	95	98
385	204	181	96	98
331	204	127	97	98
361	204	157	98	98
333	204	129	99	98
312	204	108	100	98
298	204	94	101	98
294	204	90	102	98
300	204	96	103	98
314	204	110	104	98
319	204	115	105	98
288	204	84	106	98
287	204	83	107	98
205	390	-185	107	99

340	390	-50	107	100
350	390	-40	107	101
343	390	-47	107	102
363	390	-27	107	103
340	390	-50	107	104
385	390	-5	107	105
331	390	-59	107	106
361	390	-29	107	107
333	390	-57	107	108
312	390	-78	107	109
298	390	-92	107	110
294	390	-96	107	111
300	390	-90	107	112
314	390	-76	107	113
319	390	-71	107	114
288	390	-102	107	115
287	390	-103	107	116

340	205	135	108	116
350	205	145	109	116
343	205	138	110	116
363	205	158	111	116
340	205	135	112	116
385	205	180	113	116
331	205	126	114	116
361	205	156	115	116
333	205	128	116	116
312	205	107	117	116
298	205	93	118	116
294	205	89	119	116
300	205	95	120	116
314	205	109	121	116
319	205	114	122	116
288	205	83	123	116
287	205	82	124	116

350	340	10	125	116
343	340	3	126	116
363	340	23	127	116
340	340	0	127	116
385	340	45	128	116
331	340	-9	128	117
361	340	21	129	117
333	340	-7	129	118
312	340	-28	129	119
298	340	-42	129	120
294	340	-46	129	121
300	340	-40	129	122
314	340	-26	129	123
319	340	-21	129	124
288	340	-52	129	125
287	340	-53	129	126

343	350	-7	129	127
363	350	13	130	127
340	350	-10	130	128
385	350	35	131	128

331	350	-19	131	129
361	350	11	132	129
333	350	-17	132	130
312	350	-38	132	131
298	350	-52	132	132
294	350	-56	132	133
300	350	-50	132	134
314	350	-36	132	135
319	350	-31	132	136
288	350	-62	132	137
287	350	-63	132	138

363	343	20	133	138
340	343	-3	133	139
385	343	42	134	139
331	343	-12	134	140
361	343	18	135	140
333	343	-10	135	141
312	343	-31	135	142
298	343	-45	135	143
294	343	-49	135	144
300	343	-43	135	145
314	343	-29	135	146
319	343	-24	135	147
288	343	-55	135	148
287	343	-56	135	149

340	363	-23	135	150
385	363	22	136	150
331	363	-32	136	151
361	363	-2	136	152
333	363	-30	136	153
312	363	-51	136	154
298	363	-65	136	155
294	363	-69	136	156
300	363	-63	136	157
314	363	-49	136	158
319	363	-44	136	159
288	363	-75	136	160
287	363	-76	136	161

385	340	45	137	161
331	340	-9	137	162
361	340	21	138	162
333	340	-7	138	163
312	340	-28	138	164
298	340	-42	138	165
294	340	-46	138	166
300	340	-40	138	167
314	340	-26	138	168
319	340	-21	138	169
288	340	-52	138	170
287	340	-53	138	171

331	385	-54	138	172
361	385	-24	138	173
333	385	-52	138	174

312	385	-73	138	175
298	385	-87	138	176
294	385	-91	138	177
300	385	-85	138	178
314	385	-71	138	179
319	385	-66	138	180
288	385	-97	138	181
287	385	-98	138	182
361	331	30	139	182
333	331	2	140	182
312	331	-19	140	183
298	331	-33	140	184
294	331	-37	140	185
300	331	-31	140	186
314	331	-17	140	187
319	331	-12	140	188
288	331	-43	140	189
287	331	-44	140	190
333	361	-28	140	191
312	361	-49	140	192
298	361	-63	140	193
294	361	-67	140	194
300	361	-61	140	195
314	361	-47	140	196
319	361	-42	140	197
288	361	-73	140	198
287	361	-74	140	199
312	333	-21	140	200
298	333	-35	140	201
294	333	-39	140	202
300	333	-33	140	203
314	333	-19	140	204
319	333	-14	140	205
288	333	-45	140	206
287	333	-46	140	207
298	312	-14	140	208
294	312	-18	140	209
300	312	-12	140	210
314	312	2	141	210
319	312	7	142	210
288	312	-24	142	211
287	312	-25	142	212
294	298	-4	142	213
300	298	2	143	213
314	298	16	144	213
319	298	21	145	213
288	298	-10	145	214
287	298	-11	145	215
300	294	6	146	215
314	294	20	147	215
319	294	25	148	215

288	294	-6	148	216
287	294	-7	148	217
314	300	14	149	217
319	300	19	150	217
288	300	-12	150	218
287	300	-13	150	219
319	314	5	151	219
288	314	-26	151	220
287	314	-27	151	221
288	319	-31	151	222
287	319	-32	151	223
287	288	-1	151	224

S Statistic = 151 - 224 = -73

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<b>Tied Group Value</b>		<b>Members</b>
1	440	2
2	205	2
3	340	2

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 54



B = 0  
C = 0  
D = 0  
E = 6  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2559  
Z-Score = -1.4233  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-1.4233 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-04D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
570	530	40	1	0
890	530	360	2	0
920	530	390	3	0
950	530	420	4	0
864	530	334	5	0
506	530	-24	5	1
456	530	-74	5	2
486	530	-44	5	3
723	530	193	6	3
464	530	-66	6	4
622	530	92	7	4
593	530	63	8	4
575	530	45	9	4
561	530	31	10	4
546	530	16	11	4
550	530	20	12	4
593	530	63	13	4
592	530	62	14	4
505	530	-25	14	5
333	530	-197	14	6
0.6	530	-529.4	14	7
0.9	530	-529.1	14	8
0.6	530	-529.4	14	9
419	530	-111	14	10
420	530	-110	14	11
412	530	-118	14	12
0.91	530	-529.09	14	13
890	570	320	15	13
920	570	350	16	13
950	570	380	17	13
864	570	294	18	13
506	570	-64	18	14
456	570	-114	18	15
486	570	-84	18	16
723	570	153	19	16
464	570	-106	19	17
622	570	52	20	17
593	570	23	21	17
575	570	5	22	17
561	570	-9	22	18
546	570	-24	22	19
550	570	-20	22	20
593	570	23	23	20
592	570	22	24	20
505	570	-65	24	21

333	570	-237	24	22
0.6	570	-569.4	24	23
0.9	570	-569.1	24	24
0.6	570	-569.4	24	25
419	570	-151	24	26
420	570	-150	24	27
412	570	-158	24	28
0.91	570	-569.09	24	29
920	890	30	25	29
950	890	60	26	29
864	890	-26	26	30
506	890	-384	26	31
456	890	-434	26	32
486	890	-404	26	33
723	890	-167	26	34
464	890	-426	26	35
622	890	-268	26	36
593	890	-297	26	37
575	890	-315	26	38
561	890	-329	26	39
546	890	-344	26	40
550	890	-340	26	41
593	890	-297	26	42
592	890	-298	26	43
505	890	-385	26	44
333	890	-557	26	45
0.6	890	-889.4	26	46
0.9	890	-889.1	26	47
0.6	890	-889.4	26	48
419	890	-471	26	49
420	890	-470	26	50
412	890	-478	26	51
0.91	890	-889.09	26	52
950	920	30	27	52
864	920	-56	27	53
506	920	-414	27	54
456	920	-464	27	55
486	920	-434	27	56
723	920	-197	27	57
464	920	-456	27	58
622	920	-298	27	59
593	920	-327	27	60
575	920	-345	27	61
561	920	-359	27	62
546	920	-374	27	63
550	920	-370	27	64
593	920	-327	27	65
592	920	-328	27	66
505	920	-415	27	67
333	920	-587	27	68
0.6	920	-919.4	27	69
0.9	920	-919.1	27	70
0.6	920	-919.4	27	71
419	920	-501	27	72
420	920	-500	27	73

412	920	-508	27	74
0.91	920	-919.09	27	75
864	950	-86	27	76
506	950	-444	27	77
456	950	-494	27	78
486	950	-464	27	79
723	950	-227	27	80
464	950	-486	27	81
622	950	-328	27	82
593	950	-357	27	83
575	950	-375	27	84
561	950	-389	27	85
546	950	-404	27	86
550	950	-400	27	87
593	950	-357	27	88
592	950	-358	27	89
505	950	-445	27	90
333	950	-617	27	91
0.6	950	-949.4	27	92
0.9	950	-949.1	27	93
0.6	950	-949.4	27	94
419	950	-531	27	95
420	950	-530	27	96
412	950	-538	27	97
0.91	950	-949.09	27	98
506	864	-358	27	99
456	864	-408	27	100
486	864	-378	27	101
723	864	-141	27	102
464	864	-400	27	103
622	864	-242	27	104
593	864	-271	27	105
575	864	-289	27	106
561	864	-303	27	107
546	864	-318	27	108
550	864	-314	27	109
593	864	-271	27	110
592	864	-272	27	111
505	864	-359	27	112
333	864	-531	27	113
0.6	864	-863.4	27	114
0.9	864	-863.1	27	115
0.6	864	-863.4	27	116
419	864	-445	27	117
420	864	-444	27	118
412	864	-452	27	119
0.91	864	-863.09	27	120
456	506	-50	27	121
486	506	-20	27	122
723	506	217	28	122
464	506	-42	28	123
622	506	116	29	123
593	506	87	30	123
575	506	69	31	123

561	506	55	32	123
546	506	40	33	123
550	506	44	34	123
593	506	87	35	123
592	506	86	36	123
505	506	-1	36	124
333	506	-173	36	125
0.6	506	-505.4	36	126
0.9	506	-505.1	36	127
0.6	506	-505.4	36	128
419	506	-87	36	129
420	506	-86	36	130
412	506	-94	36	131
0.91	506	-505.09	36	132
486	456	30	37	132
723	456	267	38	132
464	456	8	39	132
622	456	166	40	132
593	456	137	41	132
575	456	119	42	132
561	456	105	43	132
546	456	90	44	132
550	456	94	45	132
593	456	137	46	132
592	456	136	47	132
505	456	49	48	132
333	456	-123	48	133
0.6	456	-455.4	48	134
0.9	456	-455.1	48	135
0.6	456	-455.4	48	136
419	456	-37	48	137
420	456	-36	48	138
412	456	-44	48	139
0.91	456	-455.09	48	140
723	486	237	49	140
464	486	-22	49	141
622	486	136	50	141
593	486	107	51	141
575	486	89	52	141
561	486	75	53	141
546	486	60	54	141
550	486	64	55	141
593	486	107	56	141
592	486	106	57	141
505	486	19	58	141
333	486	-153	58	142
0.6	486	-485.4	58	143
0.9	486	-485.1	58	144
0.6	486	-485.4	58	145
419	486	-67	58	146
420	486	-66	58	147
412	486	-74	58	148
0.91	486	-485.09	58	149
464	723	-259	58	150

622	723	-101	58	151
593	723	-130	58	152
575	723	-148	58	153
561	723	-162	58	154
546	723	-177	58	155
550	723	-173	58	156
593	723	-130	58	157
592	723	-131	58	158
505	723	-218	58	159
333	723	-390	58	160
0.6	723	-722.4	58	161
0.9	723	-722.1	58	162
0.6	723	-722.4	58	163
419	723	-304	58	164
420	723	-303	58	165
412	723	-311	58	166
0.91	723	-722.09	58	167

622	464	158	59	167
593	464	129	60	167
575	464	111	61	167
561	464	97	62	167
546	464	82	63	167
550	464	86	64	167
593	464	129	65	167
592	464	128	66	167
505	464	41	67	167
333	464	-131	67	168
0.6	464	-463.4	67	169
0.9	464	-463.1	67	170
0.6	464	-463.4	67	171
419	464	-45	67	172
420	464	-44	67	173
412	464	-52	67	174
0.91	464	-463.09	67	175

593	622	-29	67	176
575	622	-47	67	177
561	622	-61	67	178
546	622	-76	67	179
550	622	-72	67	180
593	622	-29	67	181
592	622	-30	67	182
505	622	-117	67	183
333	622	-289	67	184
0.6	622	-621.4	67	185
0.9	622	-621.1	67	186
0.6	622	-621.4	67	187
419	622	-203	67	188
420	622	-202	67	189
412	622	-210	67	190
0.91	622	-621.09	67	191

575	593	-18	67	192
561	593	-32	67	193
546	593	-47	67	194
550	593	-43	67	195

593	593	0	67	195
592	593	-1	67	196
505	593	-88	67	197
333	593	-260	67	198
0.6	593	-592.4	67	199
0.9	593	-592.1	67	200
0.6	593	-592.4	67	201
419	593	-174	67	202
420	593	-173	67	203
412	593	-181	67	204
0.91	593	-592.09	67	205
561	575	-14	67	206
546	575	-29	67	207
550	575	-25	67	208
593	575	18	68	208
592	575	17	69	208
505	575	-70	69	209
333	575	-242	69	210
0.6	575	-574.4	69	211
0.9	575	-574.1	69	212
0.6	575	-574.4	69	213
419	575	-156	69	214
420	575	-155	69	215
412	575	-163	69	216
0.91	575	-574.09	69	217
546	561	-15	69	218
550	561	-11	69	219
593	561	32	70	219
592	561	31	71	219
505	561	-56	71	220
333	561	-228	71	221
0.6	561	-560.4	71	222
0.9	561	-560.1	71	223
0.6	561	-560.4	71	224
419	561	-142	71	225
420	561	-141	71	226
412	561	-149	71	227
0.91	561	-560.09	71	228
550	546	4	72	228
593	546	47	73	228
592	546	46	74	228
505	546	-41	74	229
333	546	-213	74	230
0.6	546	-545.4	74	231
0.9	546	-545.1	74	232
0.6	546	-545.4	74	233
419	546	-127	74	234
420	546	-126	74	235
412	546	-134	74	236
0.91	546	-545.09	74	237
593	550	43	75	237
592	550	42	76	237
505	550	-45	76	238

333	550	-217	76	239
0.6	550	-549.4	76	240
0.9	550	-549.1	76	241
0.6	550	-549.4	76	242
419	550	-131	76	243
420	550	-130	76	244
412	550	-138	76	245
0.91	550	-549.09	76	246
592	593	-1	76	247
505	593	-88	76	248
333	593	-260	76	249
0.6	593	-592.4	76	250
0.9	593	-592.1	76	251
0.6	593	-592.4	76	252
419	593	-174	76	253
420	593	-173	76	254
412	593	-181	76	255
0.91	593	-592.09	76	256
505	592	-87	76	257
333	592	-259	76	258
0.6	592	-591.4	76	259
0.9	592	-591.1	76	260
0.6	592	-591.4	76	261
419	592	-173	76	262
420	592	-172	76	263
412	592	-180	76	264
0.91	592	-591.09	76	265
333	505	-172	76	266
0.6	505	-504.4	76	267
0.9	505	-504.1	76	268
0.6	505	-504.4	76	269
419	505	-86	76	270
420	505	-85	76	271
412	505	-93	76	272
0.91	505	-504.09	76	273
0.6	333	-332.4	76	274
0.9	333	-332.1	76	275
0.6	333	-332.4	76	276
419	333	86	77	276
420	333	87	78	276
412	333	79	79	276
0.91	333	-332.09	79	277
0.9	0.6	0.3	80	277
0.6	0.6	0	80	277
419	0.6	418.4	81	277
420	0.6	419.4	82	277
412	0.6	411.4	83	277
0.91	0.6	0.31	84	277
0.6	0.9	-0.3	84	278
419	0.9	418.1	85	278
420	0.9	419.1	86	278



412	0.9	411.1	87	278
0.91	0.9	0.01	88	278
419	0.6	418.4	89	278
420	0.6	419.4	90	278
412	0.6	411.4	91	278
0.91	0.6	0.31	92	278
420	419	1	93	278
412	419	-7	93	279
0.91	419	-418.09	93	280
412	420	-8	93	281
0.91	420	-419.09	93	282
0.91	412	-411.09	93	283

S Statistic = 93 - 283 = -190

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<b>Tied Group Value</b>		<b>Members</b>
1	593	2
2	0.6	2

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<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/10/2008	1
9/22/2008	1
12/3/2008	1
4/28/2009	1
5/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/16/2010	1
8/11/2010	1
11/22/2010	1
3/8/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

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A = 36  
B = 0

C = 0  
D = 0  
E = 4  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2560  
Z-Score = -3.73544  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
**-3.73544 < -1.65463 indicating a downward trend**

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-04D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
570	530	40	1	0
890	530	360	2	0
920	530	390	3	0
950	530	420	4	0
864	530	334	5	0
506	530	-24	5	1
456	530	-74	5	2
486	530	-44	5	3
723	530	193	6	3
464	530	-66	6	4
622	530	92	7	4
593	530	63	8	4
575	530	45	9	4
561	530	31	10	4
546	530	16	11	4
550	530	20	12	4
593	530	63	13	4
592	530	62	14	4
505	530	-25	14	5
333	530	-197	14	6
0.6	530	-529.4	14	7
0.9	530	-529.1	14	8
0.6	530	-529.4	14	9
419	530	-111	14	10
420	530	-110	14	11
412	530	-118	14	12
0.91	530	-529.09	14	13
890	570	320	15	13
920	570	350	16	13
950	570	380	17	13
864	570	294	18	13
506	570	-64	18	14
456	570	-114	18	15
486	570	-84	18	16
723	570	153	19	16
464	570	-106	19	17
622	570	52	20	17
593	570	23	21	17
575	570	5	22	17
561	570	-9	22	18
546	570	-24	22	19
550	570	-20	22	20
593	570	23	23	20
592	570	22	24	20
505	570	-65	24	21

333	570	-237	24	22
0.6	570	-569.4	24	23
0.9	570	-569.1	24	24
0.6	570	-569.4	24	25
419	570	-151	24	26
420	570	-150	24	27
412	570	-158	24	28
0.91	570	-569.09	24	29
920	890	30	25	29
950	890	60	26	29
864	890	-26	26	30
506	890	-384	26	31
456	890	-434	26	32
486	890	-404	26	33
723	890	-167	26	34
464	890	-426	26	35
622	890	-268	26	36
593	890	-297	26	37
575	890	-315	26	38
561	890	-329	26	39
546	890	-344	26	40
550	890	-340	26	41
593	890	-297	26	42
592	890	-298	26	43
505	890	-385	26	44
333	890	-557	26	45
0.6	890	-889.4	26	46
0.9	890	-889.1	26	47
0.6	890	-889.4	26	48
419	890	-471	26	49
420	890	-470	26	50
412	890	-478	26	51
0.91	890	-889.09	26	52
950	920	30	27	52
864	920	-56	27	53
506	920	-414	27	54
456	920	-464	27	55
486	920	-434	27	56
723	920	-197	27	57
464	920	-456	27	58
622	920	-298	27	59
593	920	-327	27	60
575	920	-345	27	61
561	920	-359	27	62
546	920	-374	27	63
550	920	-370	27	64
593	920	-327	27	65
592	920	-328	27	66
505	920	-415	27	67
333	920	-587	27	68
0.6	920	-919.4	27	69
0.9	920	-919.1	27	70
0.6	920	-919.4	27	71
419	920	-501	27	72
420	920	-500	27	73

412	920	-508	27	74
0.91	920	-919.09	27	75
864	950	-86	27	76
506	950	-444	27	77
456	950	-494	27	78
486	950	-464	27	79
723	950	-227	27	80
464	950	-486	27	81
622	950	-328	27	82
593	950	-357	27	83
575	950	-375	27	84
561	950	-389	27	85
546	950	-404	27	86
550	950	-400	27	87
593	950	-357	27	88
592	950	-358	27	89
505	950	-445	27	90
333	950	-617	27	91
0.6	950	-949.4	27	92
0.9	950	-949.1	27	93
0.6	950	-949.4	27	94
419	950	-531	27	95
420	950	-530	27	96
412	950	-538	27	97
0.91	950	-949.09	27	98
506	864	-358	27	99
456	864	-408	27	100
486	864	-378	27	101
723	864	-141	27	102
464	864	-400	27	103
622	864	-242	27	104
593	864	-271	27	105
575	864	-289	27	106
561	864	-303	27	107
546	864	-318	27	108
550	864	-314	27	109
593	864	-271	27	110
592	864	-272	27	111
505	864	-359	27	112
333	864	-531	27	113
0.6	864	-863.4	27	114
0.9	864	-863.1	27	115
0.6	864	-863.4	27	116
419	864	-445	27	117
420	864	-444	27	118
412	864	-452	27	119
0.91	864	-863.09	27	120
456	506	-50	27	121
486	506	-20	27	122
723	506	217	28	122
464	506	-42	28	123
622	506	116	29	123
593	506	87	30	123
575	506	69	31	123

561	506	55	32	123
546	506	40	33	123
550	506	44	34	123
593	506	87	35	123
592	506	86	36	123
505	506	-1	36	124
333	506	-173	36	125
0.6	506	-505.4	36	126
0.9	506	-505.1	36	127
0.6	506	-505.4	36	128
419	506	-87	36	129
420	506	-86	36	130
412	506	-94	36	131
0.91	506	-505.09	36	132
486	456	30	37	132
723	456	267	38	132
464	456	8	39	132
622	456	166	40	132
593	456	137	41	132
575	456	119	42	132
561	456	105	43	132
546	456	90	44	132
550	456	94	45	132
593	456	137	46	132
592	456	136	47	132
505	456	49	48	132
333	456	-123	48	133
0.6	456	-455.4	48	134
0.9	456	-455.1	48	135
0.6	456	-455.4	48	136
419	456	-37	48	137
420	456	-36	48	138
412	456	-44	48	139
0.91	456	-455.09	48	140
723	486	237	49	140
464	486	-22	49	141
622	486	136	50	141
593	486	107	51	141
575	486	89	52	141
561	486	75	53	141
546	486	60	54	141
550	486	64	55	141
593	486	107	56	141
592	486	106	57	141
505	486	19	58	141
333	486	-153	58	142
0.6	486	-485.4	58	143
0.9	486	-485.1	58	144
0.6	486	-485.4	58	145
419	486	-67	58	146
420	486	-66	58	147
412	486	-74	58	148
0.91	486	-485.09	58	149
464	723	-259	58	150

622	723	-101	58	151
593	723	-130	58	152
575	723	-148	58	153
561	723	-162	58	154
546	723	-177	58	155
550	723	-173	58	156
593	723	-130	58	157
592	723	-131	58	158
505	723	-218	58	159
333	723	-390	58	160
0.6	723	-722.4	58	161
0.9	723	-722.1	58	162
0.6	723	-722.4	58	163
419	723	-304	58	164
420	723	-303	58	165
412	723	-311	58	166
0.91	723	-722.09	58	167

622	464	158	59	167
593	464	129	60	167
575	464	111	61	167
561	464	97	62	167
546	464	82	63	167
550	464	86	64	167
593	464	129	65	167
592	464	128	66	167
505	464	41	67	167
333	464	-131	67	168
0.6	464	-463.4	67	169
0.9	464	-463.1	67	170
0.6	464	-463.4	67	171
419	464	-45	67	172
420	464	-44	67	173
412	464	-52	67	174
0.91	464	-463.09	67	175

593	622	-29	67	176
575	622	-47	67	177
561	622	-61	67	178
546	622	-76	67	179
550	622	-72	67	180
593	622	-29	67	181
592	622	-30	67	182
505	622	-117	67	183
333	622	-289	67	184
0.6	622	-621.4	67	185
0.9	622	-621.1	67	186
0.6	622	-621.4	67	187
419	622	-203	67	188
420	622	-202	67	189
412	622	-210	67	190
0.91	622	-621.09	67	191

575	593	-18	67	192
561	593	-32	67	193
546	593	-47	67	194
550	593	-43	67	195

593	593	0	67	195
592	593	-1	67	196
505	593	-88	67	197
333	593	-260	67	198
0.6	593	-592.4	67	199
0.9	593	-592.1	67	200
0.6	593	-592.4	67	201
419	593	-174	67	202
420	593	-173	67	203
412	593	-181	67	204
0.91	593	-592.09	67	205
561	575	-14	67	206
546	575	-29	67	207
550	575	-25	67	208
593	575	18	68	208
592	575	17	69	208
505	575	-70	69	209
333	575	-242	69	210
0.6	575	-574.4	69	211
0.9	575	-574.1	69	212
0.6	575	-574.4	69	213
419	575	-156	69	214
420	575	-155	69	215
412	575	-163	69	216
0.91	575	-574.09	69	217
546	561	-15	69	218
550	561	-11	69	219
593	561	32	70	219
592	561	31	71	219
505	561	-56	71	220
333	561	-228	71	221
0.6	561	-560.4	71	222
0.9	561	-560.1	71	223
0.6	561	-560.4	71	224
419	561	-142	71	225
420	561	-141	71	226
412	561	-149	71	227
0.91	561	-560.09	71	228
550	546	4	72	228
593	546	47	73	228
592	546	46	74	228
505	546	-41	74	229
333	546	-213	74	230
0.6	546	-545.4	74	231
0.9	546	-545.1	74	232
0.6	546	-545.4	74	233
419	546	-127	74	234
420	546	-126	74	235
412	546	-134	74	236
0.91	546	-545.09	74	237
593	550	43	75	237
592	550	42	76	237
505	550	-45	76	238



333	550	-217	76	239
0.6	550	-549.4	76	240
0.9	550	-549.1	76	241
0.6	550	-549.4	76	242
419	550	-131	76	243
420	550	-130	76	244
412	550	-138	76	245
0.91	550	-549.09	76	246
592	593	-1	76	247
505	593	-88	76	248
333	593	-260	76	249
0.6	593	-592.4	76	250
0.9	593	-592.1	76	251
0.6	593	-592.4	76	252
419	593	-174	76	253
420	593	-173	76	254
412	593	-181	76	255
0.91	593	-592.09	76	256
505	592	-87	76	257
333	592	-259	76	258
0.6	592	-591.4	76	259
0.9	592	-591.1	76	260
0.6	592	-591.4	76	261
419	592	-173	76	262
420	592	-172	76	263
412	592	-180	76	264
0.91	592	-591.09	76	265
333	505	-172	76	266
0.6	505	-504.4	76	267
0.9	505	-504.1	76	268
0.6	505	-504.4	76	269
419	505	-86	76	270
420	505	-85	76	271
412	505	-93	76	272
0.91	505	-504.09	76	273
0.6	333	-332.4	76	274
0.9	333	-332.1	76	275
0.6	333	-332.4	76	276
419	333	86	77	276
420	333	87	78	276
412	333	79	79	276
0.91	333	-332.09	79	277
0.9	0.6	0.3	80	277
0.6	0.6	0	80	277
419	0.6	418.4	81	277
420	0.6	419.4	82	277
412	0.6	411.4	83	277
0.91	0.6	0.31	84	277
0.6	0.9	-0.3	84	278
419	0.9	418.1	85	278
420	0.9	419.1	86	278

412	0.9	411.1	87	278
0.91	0.9	0.01	88	278
419	0.6	418.4	89	278
420	0.6	419.4	90	278
412	0.6	411.4	91	278
0.91	0.6	0.31	92	278
420	419	1	93	278
412	419	-7	93	279
0.91	419	-418.09	93	280
412	420	-8	93	281
0.91	420	-419.09	93	282
0.91	412	-411.09	93	283

S Statistic = 93 - 283 = -190

---

<b>Tied Group Value</b>		<b>Members</b>
1	593	2
2	0.6	2

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<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/10/2008	1
9/22/2008	1
12/3/2008	1
4/28/2009	1
5/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/16/2010	1
8/11/2010	1
11/22/2010	1
3/8/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 36  
B = 0

C = 0  
D = 0  
E = 4  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2560  
Z-Score = -3.73544  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-3.73544 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-05

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
2.03	0.883	1.147	1	0
ND<0	0.883	-0.883	1	1
ND<0	0.883	-0.883	1	2
ND<0	0.883	-0.883	1	3
ND<0	0.883	-0.883	1	4
ND<0	0.883	-0.883	1	5
ND<0	0.883	-0.883	1	6
0.4	0.883	-0.483	1	7
0.4	0.883	-0.483	1	8
ND<0	0.883	-0.883	1	9
1.1	0.883	0.217	2	9
0.4	0.883	-0.483	2	10
0.1	0.883	-0.783	2	11
ND<0	0.883	-0.883	2	12
ND<0	0.883	-0.883	2	13
ND<0	0.883	-0.883	2	14
ND<0	0.883	-0.883	2	15
ND<0	0.883	-0.883	2	16
ND<0	0.883	-0.883	2	17
ND<0	2.03	-2.03	2	18
ND<0	2.03	-2.03	2	19
ND<0	2.03	-2.03	2	20
ND<0	2.03	-2.03	2	21
ND<0	2.03	-2.03	2	22
ND<0	2.03	-2.03	2	23
0.4	2.03	-1.63	2	24
0.4	2.03	-1.63	2	25
ND<0	2.03	-2.03	2	26
1.1	2.03	-0.93	2	27
0.4	2.03	-1.63	2	28
0.1	2.03	-1.93	2	29
ND<0	2.03	-2.03	2	30
ND<0	2.03	-2.03	2	31
ND<0	2.03	-2.03	2	32
ND<0	2.03	-2.03	2	33
ND<0	2.03	-2.03	2	34
ND<0	2.03	-2.03	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
0.4	ND<0	0.4	3	35
0.4	ND<0	0.4	4	35



ND<0	ND<0	0	22	35
ND<0	ND<0	0	22	35
0.4	ND<0	0.4	23	35
0.4	ND<0	0.4	24	35
ND<0	ND<0	0	24	35
1.1	ND<0	1.1	25	35
0.4	ND<0	0.4	26	35
0.1	ND<0	0.1	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
0.4	ND<0	0.4	28	35
0.4	ND<0	0.4	29	35
ND<0	ND<0	0	29	35
1.1	ND<0	1.1	30	35
0.4	ND<0	0.4	31	35
0.1	ND<0	0.1	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
0.4	0.4	0	32	35
ND<0	0.4	-0.4	32	36
1.1	0.4	0.7	33	36
0.4	0.4	0	33	36
0.1	0.4	-0.3	33	37
ND<0	0.4	-0.4	33	38
ND<0	0.4	-0.4	33	39
ND<0	0.4	-0.4	33	40
ND<0	0.4	-0.4	33	41
ND<0	0.4	-0.4	33	42
ND<0	0.4	-0.4	33	43
ND<0	0.4	-0.4	33	44
1.1	0.4	0.7	34	44
0.4	0.4	0	34	44
0.1	0.4	-0.3	34	45
ND<0	0.4	-0.4	34	46
ND<0	0.4	-0.4	34	47
ND<0	0.4	-0.4	34	48
ND<0	0.4	-0.4	34	49
ND<0	0.4	-0.4	34	50
ND<0	0.4	-0.4	34	51
1.1	ND<0	1.1	35	51
0.4	ND<0	0.4	36	51
0.1	ND<0	0.1	37	51
ND<0	ND<0	0	37	51
ND<0	ND<0	0	37	51



2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 4902

B = 0

C = 1722

D = 0

E = 162

F = 0

a = 17100

b = 61560

c = 760

Group Variance = 677.667

Z-Score = -1.30608

Comparison Level at 95% confidence level = -1.65463 (downward trend)

-1.30608 >= -1.65463 indicating no evidence of a downward trend



# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: GCW-05

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
2.03	0.883	1.147	1	0
ND<0	0.883	-0.883	1	1
ND<0	0.883	-0.883	1	2
ND<0	0.883	-0.883	1	3
ND<0	0.883	-0.883	1	4
ND<0	0.883	-0.883	1	5
ND<0	0.883	-0.883	1	6
0.4	0.883	-0.483	1	7
0.4	0.883	-0.483	1	8
ND<0	0.883	-0.883	1	9
1.1	0.883	0.217	2	9
0.4	0.883	-0.483	2	10
0.1	0.883	-0.783	2	11
ND<0	0.883	-0.883	2	12
ND<0	0.883	-0.883	2	13
ND<0	0.883	-0.883	2	14
ND<0	0.883	-0.883	2	15
ND<0	0.883	-0.883	2	16
ND<0	0.883	-0.883	2	17
ND<0	2.03	-2.03	2	18
ND<0	2.03	-2.03	2	19
ND<0	2.03	-2.03	2	20
ND<0	2.03	-2.03	2	21
ND<0	2.03	-2.03	2	22
ND<0	2.03	-2.03	2	23
0.4	2.03	-1.63	2	24
0.4	2.03	-1.63	2	25
ND<0	2.03	-2.03	2	26
1.1	2.03	-0.93	2	27
0.4	2.03	-1.63	2	28
0.1	2.03	-1.93	2	29
ND<0	2.03	-2.03	2	30
ND<0	2.03	-2.03	2	31
ND<0	2.03	-2.03	2	32
ND<0	2.03	-2.03	2	33
ND<0	2.03	-2.03	2	34
ND<0	2.03	-2.03	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
ND<0	ND<0	0	2	35
0.4	ND<0	0.4	3	35
0.4	ND<0	0.4	4	35

ND<0	ND<0	0	4	35
1.1	ND<0	1.1	5	35
0.4	ND<0	0.4	6	35
0.1	ND<0	0.1	7	35
ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35

ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35
ND<0	ND<0	0	7	35
0.4	ND<0	0.4	8	35
0.4	ND<0	0.4	9	35
ND<0	ND<0	0	9	35
1.1	ND<0	1.1	10	35
0.4	ND<0	0.4	11	35
0.1	ND<0	0.1	12	35
ND<0	ND<0	0	12	35
ND<0	ND<0	0	12	35
ND<0	ND<0	0	12	35
ND<0	ND<0	0	12	35
ND<0	ND<0	0	12	35
ND<0	ND<0	0	12	35

ND<0	ND<0	0	12	35
ND<0	ND<0	0	12	35
ND<0	ND<0	0	12	35
0.4	ND<0	0.4	13	35
0.4	ND<0	0.4	14	35
ND<0	ND<0	0	14	35
1.1	ND<0	1.1	15	35
0.4	ND<0	0.4	16	35
0.1	ND<0	0.1	17	35
ND<0	ND<0	0	17	35
ND<0	ND<0	0	17	35
ND<0	ND<0	0	17	35
ND<0	ND<0	0	17	35
ND<0	ND<0	0	17	35
ND<0	ND<0	0	17	35

ND<0	ND<0	0	17	35
ND<0	ND<0	0	17	35
0.4	ND<0	0.4	18	35
0.4	ND<0	0.4	19	35
ND<0	ND<0	0	19	35
1.1	ND<0	1.1	20	35
0.4	ND<0	0.4	21	35
0.1	ND<0	0.1	22	35
ND<0	ND<0	0	22	35
ND<0	ND<0	0	22	35
ND<0	ND<0	0	22	35
ND<0	ND<0	0	22	35
ND<0	ND<0	0	22	35
ND<0	ND<0	0	22	35

ND<0	ND<0	0	22	35
ND<0	ND<0	0	22	35
0.4	ND<0	0.4	23	35
0.4	ND<0	0.4	24	35
ND<0	ND<0	0	24	35
1.1	ND<0	1.1	25	35
0.4	ND<0	0.4	26	35
0.1	ND<0	0.1	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
ND<0	ND<0	0	27	35
0.4	ND<0	0.4	28	35
0.4	ND<0	0.4	29	35
ND<0	ND<0	0	29	35
1.1	ND<0	1.1	30	35
0.4	ND<0	0.4	31	35
0.1	ND<0	0.1	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
ND<0	ND<0	0	32	35
0.4	0.4	0	32	35
ND<0	0.4	-0.4	32	36
1.1	0.4	0.7	33	36
0.4	0.4	0	33	36
0.1	0.4	-0.3	33	37
ND<0	0.4	-0.4	33	38
ND<0	0.4	-0.4	33	39
ND<0	0.4	-0.4	33	40
ND<0	0.4	-0.4	33	41
ND<0	0.4	-0.4	33	42
ND<0	0.4	-0.4	33	43
ND<0	0.4	-0.4	33	44
1.1	0.4	0.7	34	44
0.4	0.4	0	34	44
0.1	0.4	-0.3	34	45
ND<0	0.4	-0.4	34	46
ND<0	0.4	-0.4	34	47
ND<0	0.4	-0.4	34	48
ND<0	0.4	-0.4	34	49
ND<0	0.4	-0.4	34	50
ND<0	0.4	-0.4	34	51
1.1	ND<0	1.1	35	51
0.4	ND<0	0.4	36	51
0.1	ND<0	0.1	37	51
ND<0	ND<0	0	37	51
ND<0	ND<0	0	37	51

ND<0	ND<0	0	37	51
ND<0	ND<0	0	37	51
ND<0	ND<0	0	37	51
ND<0	ND<0	0	37	51
0.4	1.1	-0.7	37	52
0.1	1.1	-1	37	53
ND<0	1.1	-1.1	37	54
ND<0	1.1	-1.1	37	55
ND<0	1.1	-1.1	37	56
ND<0	1.1	-1.1	37	57
ND<0	1.1	-1.1	37	58
ND<0	1.1	-1.1	37	59
0.1	0.4	-0.3	37	60
ND<0	0.4	-0.4	37	61
ND<0	0.4	-0.4	37	62
ND<0	0.4	-0.4	37	63
ND<0	0.4	-0.4	37	64
ND<0	0.4	-0.4	37	65
ND<0	0.4	-0.4	37	66
ND<0	0.1	-0.1	37	67
ND<0	0.1	-0.1	37	68
ND<0	0.1	-0.1	37	69
ND<0	0.1	-0.1	37	70
ND<0	0.1	-0.1	37	71
ND<0	0.1	-0.1	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72
ND<0	ND<0	0	37	72

S Statistic = 37 - 72 = -35

---

Tied Group Value		Members
1	0	13
2	0.4	3

---

**Time Period**                      **Observations**

2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 4902

B = 0

C = 1722

D = 0

E = 162

F = 0

a = 17100

b = 61560

c = 760

Group Variance = 677.667

Z-Score = -1.30608

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-1.30608 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: OW-01A

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
1	1.8	-0.8	0	1
1.1	1.8	-0.7	0	2
0.9	1.8	-0.9	0	3
1	1.8	-0.8	0	4
0.9	1.8	-0.9	0	5
0.9	1.8	-0.9	0	6
0.9	1.8	-0.9	0	7
1	1.8	-0.8	0	8
1.1	1.8	-0.7	0	9
1	1.8	-0.8	0	10
0.8	1.8	-1	0	11
0.7	1.8	-1.1	0	12
0.7	1.8	-1.1	0	13
0.7	1.8	-1.1	0	14
0.6	1.8	-1.2	0	15
0.9	1.8	-0.9	0	16
0.8	1.8	-1	0	17
0.7	1.8	-1.1	0	18
0.7	1.8	-1.1	0	19
0.5	1.8	-1.3	0	20
0.8	1.8	-1	0	21
0.8	1.8	-1	0	22
0.7	1.8	-1.1	0	23
0.572	1.8	-1.228	0	24
0.587	1.8	-1.213	0	25
0.508	1.8	-1.292	0	26
0.75	1.8	-1.05	0	27
1.1	1	0.1	1	27
0.9	1	-0.1	1	28
1	1	0	1	28
0.9	1	-0.1	1	29
0.9	1	-0.1	1	30
0.9	1	-0.1	1	31
1	1	0	1	31
1.1	1	0.1	2	31
1	1	0	2	31
0.8	1	-0.2	2	32
0.7	1	-0.3	2	33
0.7	1	-0.3	2	34
0.7	1	-0.3	2	35
0.6	1	-0.4	2	36
0.9	1	-0.1	2	37
0.8	1	-0.2	2	38
0.7	1	-0.3	2	39
0.7	1	-0.3	2	40

0.5	1	-0.5	2	41
0.8	1	-0.2	2	42
0.8	1	-0.2	2	43
0.7	1	-0.3	2	44
0.572	1	-0.428	2	45
0.587	1	-0.413	2	46
0.508	1	-0.492	2	47
0.75	1	-0.25	2	48
0.9	1.1	-0.2	2	49
1	1.1	-0.1	2	50
0.9	1.1	-0.2	2	51
0.9	1.1	-0.2	2	52
0.9	1.1	-0.2	2	53
1	1.1	-0.1	2	54
1.1	1.1	0	2	54
1	1.1	-0.1	2	55
0.8	1.1	-0.3	2	56
0.7	1.1	-0.4	2	57
0.7	1.1	-0.4	2	58
0.7	1.1	-0.4	2	59
0.6	1.1	-0.5	2	60
0.9	1.1	-0.2	2	61
0.8	1.1	-0.3	2	62
0.7	1.1	-0.4	2	63
0.7	1.1	-0.4	2	64
0.5	1.1	-0.6	2	65
0.8	1.1	-0.3	2	66
0.8	1.1	-0.3	2	67
0.7	1.1	-0.4	2	68
0.572	1.1	-0.528	2	69
0.587	1.1	-0.513	2	70
0.508	1.1	-0.592	2	71
0.75	1.1	-0.35	2	72
1	0.9	0.1	3	72
0.9	0.9	0	3	72
0.9	0.9	0	3	72
0.9	0.9	0	3	72
1	0.9	0.1	4	72
1.1	0.9	0.2	5	72
1	0.9	0.1	6	72
0.8	0.9	-0.1	6	73
0.7	0.9	-0.2	6	74
0.7	0.9	-0.2	6	75
0.7	0.9	-0.2	6	76
0.6	0.9	-0.3	6	77
0.9	0.9	0	6	77
0.8	0.9	-0.1	6	78
0.7	0.9	-0.2	6	79
0.7	0.9	-0.2	6	80
0.5	0.9	-0.4	6	81
0.8	0.9	-0.1	6	82
0.8	0.9	-0.1	6	83
0.7	0.9	-0.2	6	84
0.572	0.9	-0.328	6	85
0.587	0.9	-0.313	6	86

0.508	0.9	-0.392	6	87
0.75	0.9	-0.15	6	88
0.9	1	-0.1	6	89
0.9	1	-0.1	6	90
0.9	1	-0.1	6	91
1	1	0	6	91
1.1	1	0.1	7	91
1	1	0	7	91
0.8	1	-0.2	7	92
0.7	1	-0.3	7	93
0.7	1	-0.3	7	94
0.7	1	-0.3	7	95
0.6	1	-0.4	7	96
0.9	1	-0.1	7	97
0.8	1	-0.2	7	98
0.7	1	-0.3	7	99
0.7	1	-0.3	7	100
0.5	1	-0.5	7	101
0.8	1	-0.2	7	102
0.8	1	-0.2	7	103
0.7	1	-0.3	7	104
0.572	1	-0.428	7	105
0.587	1	-0.413	7	106
0.508	1	-0.492	7	107
0.75	1	-0.25	7	108
0.9	0.9	0	7	108
0.9	0.9	0	7	108
1	0.9	0.1	8	108
1.1	0.9	0.2	9	108
1	0.9	0.1	10	108
0.8	0.9	-0.1	10	109
0.7	0.9	-0.2	10	110
0.7	0.9	-0.2	10	111
0.7	0.9	-0.2	10	112
0.6	0.9	-0.3	10	113
0.9	0.9	0	10	113
0.8	0.9	-0.1	10	114
0.7	0.9	-0.2	10	115
0.7	0.9	-0.2	10	116
0.5	0.9	-0.4	10	117
0.8	0.9	-0.1	10	118
0.8	0.9	-0.1	10	119
0.7	0.9	-0.2	10	120
0.572	0.9	-0.328	10	121
0.587	0.9	-0.313	10	122
0.508	0.9	-0.392	10	123
0.75	0.9	-0.15	10	124
0.9	0.9	0	10	124
1	0.9	0.1	11	124
1.1	0.9	0.2	12	124
1	0.9	0.1	13	124
0.8	0.9	-0.1	13	125
0.7	0.9	-0.2	13	126
0.7	0.9	-0.2	13	127



0.7	0.9	-0.2	13	128
0.6	0.9	-0.3	13	129
0.9	0.9	0	13	129
0.8	0.9	-0.1	13	130
0.7	0.9	-0.2	13	131
0.7	0.9	-0.2	13	132
0.5	0.9	-0.4	13	133
0.8	0.9	-0.1	13	134
0.8	0.9	-0.1	13	135
0.7	0.9	-0.2	13	136
0.572	0.9	-0.328	13	137
0.587	0.9	-0.313	13	138
0.508	0.9	-0.392	13	139
0.75	0.9	-0.15	13	140
1	0.9	0.1	14	140
1.1	0.9	0.2	15	140
1	0.9	0.1	16	140
0.8	0.9	-0.1	16	141
0.7	0.9	-0.2	16	142
0.7	0.9	-0.2	16	143
0.7	0.9	-0.2	16	144
0.6	0.9	-0.3	16	145
0.9	0.9	0	16	145
0.8	0.9	-0.1	16	146
0.7	0.9	-0.2	16	147
0.7	0.9	-0.2	16	148
0.5	0.9	-0.4	16	149
0.8	0.9	-0.1	16	150
0.8	0.9	-0.1	16	151
0.7	0.9	-0.2	16	152
0.572	0.9	-0.328	16	153
0.587	0.9	-0.313	16	154
0.508	0.9	-0.392	16	155
0.75	0.9	-0.15	16	156
1.1	1	0.1	17	156
1	1	0	17	156
0.8	1	-0.2	17	157
0.7	1	-0.3	17	158
0.7	1	-0.3	17	159
0.7	1	-0.3	17	160
0.6	1	-0.4	17	161
0.9	1	-0.1	17	162
0.8	1	-0.2	17	163
0.7	1	-0.3	17	164
0.7	1	-0.3	17	165
0.5	1	-0.5	17	166
0.8	1	-0.2	17	167
0.8	1	-0.2	17	168
0.7	1	-0.3	17	169
0.572	1	-0.428	17	170
0.587	1	-0.413	17	171
0.508	1	-0.492	17	172
0.75	1	-0.25	17	173
1	1.1	-0.1	17	174

0.8	1.1	-0.3	17	175
0.7	1.1	-0.4	17	176
0.7	1.1	-0.4	17	177
0.7	1.1	-0.4	17	178
0.6	1.1	-0.5	17	179
0.9	1.1	-0.2	17	180
0.8	1.1	-0.3	17	181
0.7	1.1	-0.4	17	182
0.7	1.1	-0.4	17	183
0.5	1.1	-0.6	17	184
0.8	1.1	-0.3	17	185
0.8	1.1	-0.3	17	186
0.7	1.1	-0.4	17	187
0.572	1.1	-0.528	17	188
0.587	1.1	-0.513	17	189
0.508	1.1	-0.592	17	190
0.75	1.1	-0.35	17	191
0.8	1	-0.2	17	192
0.7	1	-0.3	17	193
0.7	1	-0.3	17	194
0.7	1	-0.3	17	195
0.6	1	-0.4	17	196
0.9	1	-0.1	17	197
0.8	1	-0.2	17	198
0.7	1	-0.3	17	199
0.7	1	-0.3	17	200
0.5	1	-0.5	17	201
0.8	1	-0.2	17	202
0.8	1	-0.2	17	203
0.7	1	-0.3	17	204
0.572	1	-0.428	17	205
0.587	1	-0.413	17	206
0.508	1	-0.492	17	207
0.75	1	-0.25	17	208
0.7	0.8	-0.1	17	209
0.7	0.8	-0.1	17	210
0.7	0.8	-0.1	17	211
0.6	0.8	-0.2	17	212
0.9	0.8	0.1	18	212
0.8	0.8	0	18	212
0.7	0.8	-0.1	18	213
0.7	0.8	-0.1	18	214
0.5	0.8	-0.3	18	215
0.8	0.8	0	18	215
0.8	0.8	0	18	215
0.7	0.8	-0.1	18	216
0.572	0.8	-0.228	18	217
0.587	0.8	-0.213	18	218
0.508	0.8	-0.292	18	219
0.75	0.8	-0.05	18	220
0.7	0.7	0	18	220
0.7	0.7	0	18	220
0.6	0.7	-0.1	18	221
0.9	0.7	0.2	19	221

0.8	0.7	0.1	20	221
0.7	0.7	0	20	221
0.7	0.7	0	20	221
0.5	0.7	-0.2	20	222
0.8	0.7	0.1	21	222
0.8	0.7	0.1	22	222
0.7	0.7	0	22	222
0.572	0.7	-0.128	22	223
0.587	0.7	-0.113	22	224
0.508	0.7	-0.192	22	225
0.75	0.7	0.05	23	225
0.7	0.7	0	23	225
0.6	0.7	-0.1	23	226
0.9	0.7	0.2	24	226
0.8	0.7	0.1	25	226
0.7	0.7	0	25	226
0.7	0.7	0	25	226
0.5	0.7	-0.2	25	227
0.8	0.7	0.1	26	227
0.8	0.7	0.1	27	227
0.7	0.7	0	27	227
0.572	0.7	-0.128	27	228
0.587	0.7	-0.113	27	229
0.508	0.7	-0.192	27	230
0.75	0.7	0.05	28	230
0.6	0.7	-0.1	28	231
0.9	0.7	0.2	29	231
0.8	0.7	0.1	30	231
0.7	0.7	0	30	231
0.7	0.7	0	30	231
0.5	0.7	-0.2	30	232
0.8	0.7	0.1	31	232
0.8	0.7	0.1	32	232
0.7	0.7	0	32	232
0.572	0.7	-0.128	32	233
0.587	0.7	-0.113	32	234
0.508	0.7	-0.192	32	235
0.75	0.7	0.05	33	235
0.9	0.6	0.3	34	235
0.8	0.6	0.2	35	235
0.7	0.6	0.1	36	235
0.7	0.6	0.1	37	235
0.5	0.6	-0.1	37	236
0.8	0.6	0.2	38	236
0.8	0.6	0.2	39	236
0.7	0.6	0.1	40	236
0.572	0.6	-0.028	40	237
0.587	0.6	-0.013	40	238
0.508	0.6	-0.092	40	239
0.75	0.6	0.15	41	239
0.8	0.9	-0.1	41	240
0.7	0.9	-0.2	41	241
0.7	0.9	-0.2	41	242

0.5	0.9	-0.4	41	243
0.8	0.9	-0.1	41	244
0.8	0.9	-0.1	41	245
0.7	0.9	-0.2	41	246
0.572	0.9	-0.328	41	247
0.587	0.9	-0.313	41	248
0.508	0.9	-0.392	41	249
0.75	0.9	-0.15	41	250
0.7	0.8	-0.1	41	251
0.7	0.8	-0.1	41	252
0.5	0.8	-0.3	41	253
0.8	0.8	0	41	253
0.8	0.8	0	41	253
0.7	0.8	-0.1	41	254
0.572	0.8	-0.228	41	255
0.587	0.8	-0.213	41	256
0.508	0.8	-0.292	41	257
0.75	0.8	-0.05	41	258
0.7	0.7	0	41	258
0.5	0.7	-0.2	41	259
0.8	0.7	0.1	42	259
0.8	0.7	0.1	43	259
0.7	0.7	0	43	259
0.572	0.7	-0.128	43	260
0.587	0.7	-0.113	43	261
0.508	0.7	-0.192	43	262
0.75	0.7	0.05	44	262
0.5	0.7	-0.2	44	263
0.8	0.7	0.1	45	263
0.8	0.7	0.1	46	263
0.7	0.7	0	46	263
0.572	0.7	-0.128	46	264
0.587	0.7	-0.113	46	265
0.508	0.7	-0.192	46	266
0.75	0.7	0.05	47	266
0.8	0.5	0.3	48	266
0.8	0.5	0.3	49	266
0.7	0.5	0.2	50	266
0.572	0.5	0.072	51	266
0.587	0.5	0.087	52	266
0.508	0.5	0.008	53	266
0.75	0.5	0.25	54	266
0.8	0.8	0	54	266
0.7	0.8	-0.1	54	267
0.572	0.8	-0.228	54	268
0.587	0.8	-0.213	54	269
0.508	0.8	-0.292	54	270
0.75	0.8	-0.05	54	271
0.7	0.8	-0.1	54	272
0.572	0.8	-0.228	54	273
0.587	0.8	-0.213	54	274

0.508	0.8	-0.292	54	275
0.75	0.8	-0.05	54	276
0.572	0.7	-0.128	54	277
0.587	0.7	-0.113	54	278
0.508	0.7	-0.192	54	279
0.75	0.7	0.05	55	279
0.587	0.572	0.015	56	279
0.508	0.572	-0.064	56	280
0.75	0.572	0.178	57	280
0.508	0.587	-0.079	57	281
0.75	0.587	0.163	58	281
0.75	0.508	0.242	59	281

S Statistic = 59 - 281 = -222

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Tied Group Value	Members
1	1
2	1.1
3	0.9
4	0.8
5	0.7

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Time Period	Observations
3/12/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/8/2009	1
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/13/2012	1
11/9/2012	1
4/22/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 1140  
B = 0  
C = 228  
D = 0  
E = 76  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2498.67  
Z-Score = -4.42118  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
-4.42118 < -1.65463 indicating a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: OW-01A

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
1	1.8	-0.8	0	1
1.1	1.8	-0.7	0	2
0.9	1.8	-0.9	0	3
1	1.8	-0.8	0	4
0.9	1.8	-0.9	0	5
0.9	1.8	-0.9	0	6
0.9	1.8	-0.9	0	7
1	1.8	-0.8	0	8
1.1	1.8	-0.7	0	9
1	1.8	-0.8	0	10
0.8	1.8	-1	0	11
0.7	1.8	-1.1	0	12
0.7	1.8	-1.1	0	13
0.7	1.8	-1.1	0	14
0.6	1.8	-1.2	0	15
0.9	1.8	-0.9	0	16
0.8	1.8	-1	0	17
0.7	1.8	-1.1	0	18
0.7	1.8	-1.1	0	19
0.5	1.8	-1.3	0	20
0.8	1.8	-1	0	21
0.8	1.8	-1	0	22
0.7	1.8	-1.1	0	23
0.572	1.8	-1.228	0	24
0.587	1.8	-1.213	0	25
0.508	1.8	-1.292	0	26
0.75	1.8	-1.05	0	27
1.1	1	0.1	1	27
0.9	1	-0.1	1	28
1	1	0	1	28
0.9	1	-0.1	1	29
0.9	1	-0.1	1	30
0.9	1	-0.1	1	31
1	1	0	1	31
1.1	1	0.1	2	31
1	1	0	2	31
0.8	1	-0.2	2	32
0.7	1	-0.3	2	33
0.7	1	-0.3	2	34
0.7	1	-0.3	2	35
0.6	1	-0.4	2	36
0.9	1	-0.1	2	37
0.8	1	-0.2	2	38
0.7	1	-0.3	2	39
0.7	1	-0.3	2	40

0.5	1	-0.5	2	41
0.8	1	-0.2	2	42
0.8	1	-0.2	2	43
0.7	1	-0.3	2	44
0.572	1	-0.428	2	45
0.587	1	-0.413	2	46
0.508	1	-0.492	2	47
0.75	1	-0.25	2	48
0.9	1.1	-0.2	2	49
1	1.1	-0.1	2	50
0.9	1.1	-0.2	2	51
0.9	1.1	-0.2	2	52
0.9	1.1	-0.2	2	53
1	1.1	-0.1	2	54
1.1	1.1	0	2	54
1	1.1	-0.1	2	55
0.8	1.1	-0.3	2	56
0.7	1.1	-0.4	2	57
0.7	1.1	-0.4	2	58
0.7	1.1	-0.4	2	59
0.6	1.1	-0.5	2	60
0.9	1.1	-0.2	2	61
0.8	1.1	-0.3	2	62
0.7	1.1	-0.4	2	63
0.7	1.1	-0.4	2	64
0.5	1.1	-0.6	2	65
0.8	1.1	-0.3	2	66
0.8	1.1	-0.3	2	67
0.7	1.1	-0.4	2	68
0.572	1.1	-0.528	2	69
0.587	1.1	-0.513	2	70
0.508	1.1	-0.592	2	71
0.75	1.1	-0.35	2	72
1	0.9	0.1	3	72
0.9	0.9	0	3	72
0.9	0.9	0	3	72
0.9	0.9	0	3	72
1	0.9	0.1	4	72
1.1	0.9	0.2	5	72
1	0.9	0.1	6	72
0.8	0.9	-0.1	6	73
0.7	0.9	-0.2	6	74
0.7	0.9	-0.2	6	75
0.7	0.9	-0.2	6	76
0.6	0.9	-0.3	6	77
0.9	0.9	0	6	77
0.8	0.9	-0.1	6	78
0.7	0.9	-0.2	6	79
0.7	0.9	-0.2	6	80
0.5	0.9	-0.4	6	81
0.8	0.9	-0.1	6	82
0.8	0.9	-0.1	6	83
0.7	0.9	-0.2	6	84
0.572	0.9	-0.328	6	85
0.587	0.9	-0.313	6	86



0.508	0.9	-0.392	6	87
0.75	0.9	-0.15	6	88
0.9	1	-0.1	6	89
0.9	1	-0.1	6	90
0.9	1	-0.1	6	91
1	1	0	6	91
1.1	1	0.1	7	91
1	1	0	7	91
0.8	1	-0.2	7	92
0.7	1	-0.3	7	93
0.7	1	-0.3	7	94
0.7	1	-0.3	7	95
0.6	1	-0.4	7	96
0.9	1	-0.1	7	97
0.8	1	-0.2	7	98
0.7	1	-0.3	7	99
0.7	1	-0.3	7	100
0.5	1	-0.5	7	101
0.8	1	-0.2	7	102
0.8	1	-0.2	7	103
0.7	1	-0.3	7	104
0.572	1	-0.428	7	105
0.587	1	-0.413	7	106
0.508	1	-0.492	7	107
0.75	1	-0.25	7	108
0.9	0.9	0	7	108
0.9	0.9	0	7	108
1	0.9	0.1	8	108
1.1	0.9	0.2	9	108
1	0.9	0.1	10	108
0.8	0.9	-0.1	10	109
0.7	0.9	-0.2	10	110
0.7	0.9	-0.2	10	111
0.7	0.9	-0.2	10	112
0.6	0.9	-0.3	10	113
0.9	0.9	0	10	113
0.8	0.9	-0.1	10	114
0.7	0.9	-0.2	10	115
0.7	0.9	-0.2	10	116
0.5	0.9	-0.4	10	117
0.8	0.9	-0.1	10	118
0.8	0.9	-0.1	10	119
0.7	0.9	-0.2	10	120
0.572	0.9	-0.328	10	121
0.587	0.9	-0.313	10	122
0.508	0.9	-0.392	10	123
0.75	0.9	-0.15	10	124
0.9	0.9	0	10	124
1	0.9	0.1	11	124
1.1	0.9	0.2	12	124
1	0.9	0.1	13	124
0.8	0.9	-0.1	13	125
0.7	0.9	-0.2	13	126
0.7	0.9	-0.2	13	127

0.7	0.9	-0.2	13	128
0.6	0.9	-0.3	13	129
0.9	0.9	0	13	129
0.8	0.9	-0.1	13	130
0.7	0.9	-0.2	13	131
0.7	0.9	-0.2	13	132
0.5	0.9	-0.4	13	133
0.8	0.9	-0.1	13	134
0.8	0.9	-0.1	13	135
0.7	0.9	-0.2	13	136
0.572	0.9	-0.328	13	137
0.587	0.9	-0.313	13	138
0.508	0.9	-0.392	13	139
0.75	0.9	-0.15	13	140
1	0.9	0.1	14	140
1.1	0.9	0.2	15	140
1	0.9	0.1	16	140
0.8	0.9	-0.1	16	141
0.7	0.9	-0.2	16	142
0.7	0.9	-0.2	16	143
0.7	0.9	-0.2	16	144
0.6	0.9	-0.3	16	145
0.9	0.9	0	16	145
0.8	0.9	-0.1	16	146
0.7	0.9	-0.2	16	147
0.7	0.9	-0.2	16	148
0.5	0.9	-0.4	16	149
0.8	0.9	-0.1	16	150
0.8	0.9	-0.1	16	151
0.7	0.9	-0.2	16	152
0.572	0.9	-0.328	16	153
0.587	0.9	-0.313	16	154
0.508	0.9	-0.392	16	155
0.75	0.9	-0.15	16	156
1.1	1	0.1	17	156
1	1	0	17	156
0.8	1	-0.2	17	157
0.7	1	-0.3	17	158
0.7	1	-0.3	17	159
0.7	1	-0.3	17	160
0.6	1	-0.4	17	161
0.9	1	-0.1	17	162
0.8	1	-0.2	17	163
0.7	1	-0.3	17	164
0.7	1	-0.3	17	165
0.5	1	-0.5	17	166
0.8	1	-0.2	17	167
0.8	1	-0.2	17	168
0.7	1	-0.3	17	169
0.572	1	-0.428	17	170
0.587	1	-0.413	17	171
0.508	1	-0.492	17	172
0.75	1	-0.25	17	173
1	1.1	-0.1	17	174

0.8	1.1	-0.3	17	175
0.7	1.1	-0.4	17	176
0.7	1.1	-0.4	17	177
0.7	1.1	-0.4	17	178
0.6	1.1	-0.5	17	179
0.9	1.1	-0.2	17	180
0.8	1.1	-0.3	17	181
0.7	1.1	-0.4	17	182
0.7	1.1	-0.4	17	183
0.5	1.1	-0.6	17	184
0.8	1.1	-0.3	17	185
0.8	1.1	-0.3	17	186
0.7	1.1	-0.4	17	187
0.572	1.1	-0.528	17	188
0.587	1.1	-0.513	17	189
0.508	1.1	-0.592	17	190
0.75	1.1	-0.35	17	191
0.8	1	-0.2	17	192
0.7	1	-0.3	17	193
0.7	1	-0.3	17	194
0.7	1	-0.3	17	195
0.6	1	-0.4	17	196
0.9	1	-0.1	17	197
0.8	1	-0.2	17	198
0.7	1	-0.3	17	199
0.7	1	-0.3	17	200
0.5	1	-0.5	17	201
0.8	1	-0.2	17	202
0.8	1	-0.2	17	203
0.7	1	-0.3	17	204
0.572	1	-0.428	17	205
0.587	1	-0.413	17	206
0.508	1	-0.492	17	207
0.75	1	-0.25	17	208
0.7	0.8	-0.1	17	209
0.7	0.8	-0.1	17	210
0.7	0.8	-0.1	17	211
0.6	0.8	-0.2	17	212
0.9	0.8	0.1	18	212
0.8	0.8	0	18	212
0.7	0.8	-0.1	18	213
0.7	0.8	-0.1	18	214
0.5	0.8	-0.3	18	215
0.8	0.8	0	18	215
0.8	0.8	0	18	215
0.7	0.8	-0.1	18	216
0.572	0.8	-0.228	18	217
0.587	0.8	-0.213	18	218
0.508	0.8	-0.292	18	219
0.75	0.8	-0.05	18	220
0.7	0.7	0	18	220
0.7	0.7	0	18	220
0.6	0.7	-0.1	18	221
0.9	0.7	0.2	19	221

0.8	0.7	0.1	20	221
0.7	0.7	0	20	221
0.7	0.7	0	20	221
0.5	0.7	-0.2	20	222
0.8	0.7	0.1	21	222
0.8	0.7	0.1	22	222
0.7	0.7	0	22	222
0.572	0.7	-0.128	22	223
0.587	0.7	-0.113	22	224
0.508	0.7	-0.192	22	225
0.75	0.7	0.05	23	225
0.7	0.7	0	23	225
0.6	0.7	-0.1	23	226
0.9	0.7	0.2	24	226
0.8	0.7	0.1	25	226
0.7	0.7	0	25	226
0.7	0.7	0	25	226
0.5	0.7	-0.2	25	227
0.8	0.7	0.1	26	227
0.8	0.7	0.1	27	227
0.7	0.7	0	27	227
0.572	0.7	-0.128	27	228
0.587	0.7	-0.113	27	229
0.508	0.7	-0.192	27	230
0.75	0.7	0.05	28	230
0.6	0.7	-0.1	28	231
0.9	0.7	0.2	29	231
0.8	0.7	0.1	30	231
0.7	0.7	0	30	231
0.7	0.7	0	30	231
0.5	0.7	-0.2	30	232
0.8	0.7	0.1	31	232
0.8	0.7	0.1	32	232
0.7	0.7	0	32	232
0.572	0.7	-0.128	32	233
0.587	0.7	-0.113	32	234
0.508	0.7	-0.192	32	235
0.75	0.7	0.05	33	235
0.9	0.6	0.3	34	235
0.8	0.6	0.2	35	235
0.7	0.6	0.1	36	235
0.7	0.6	0.1	37	235
0.5	0.6	-0.1	37	236
0.8	0.6	0.2	38	236
0.8	0.6	0.2	39	236
0.7	0.6	0.1	40	236
0.572	0.6	-0.028	40	237
0.587	0.6	-0.013	40	238
0.508	0.6	-0.092	40	239
0.75	0.6	0.15	41	239
0.8	0.9	-0.1	41	240
0.7	0.9	-0.2	41	241
0.7	0.9	-0.2	41	242

0.5	0.9	-0.4	41	243
0.8	0.9	-0.1	41	244
0.8	0.9	-0.1	41	245
0.7	0.9	-0.2	41	246
0.572	0.9	-0.328	41	247
0.587	0.9	-0.313	41	248
0.508	0.9	-0.392	41	249
0.75	0.9	-0.15	41	250
0.7	0.8	-0.1	41	251
0.7	0.8	-0.1	41	252
0.5	0.8	-0.3	41	253
0.8	0.8	0	41	253
0.8	0.8	0	41	253
0.7	0.8	-0.1	41	254
0.572	0.8	-0.228	41	255
0.587	0.8	-0.213	41	256
0.508	0.8	-0.292	41	257
0.75	0.8	-0.05	41	258
0.7	0.7	0	41	258
0.5	0.7	-0.2	41	259
0.8	0.7	0.1	42	259
0.8	0.7	0.1	43	259
0.7	0.7	0	43	259
0.572	0.7	-0.128	43	260
0.587	0.7	-0.113	43	261
0.508	0.7	-0.192	43	262
0.75	0.7	0.05	44	262
0.5	0.7	-0.2	44	263
0.8	0.7	0.1	45	263
0.8	0.7	0.1	46	263
0.7	0.7	0	46	263
0.572	0.7	-0.128	46	264
0.587	0.7	-0.113	46	265
0.508	0.7	-0.192	46	266
0.75	0.7	0.05	47	266
0.8	0.5	0.3	48	266
0.8	0.5	0.3	49	266
0.7	0.5	0.2	50	266
0.572	0.5	0.072	51	266
0.587	0.5	0.087	52	266
0.508	0.5	0.008	53	266
0.75	0.5	0.25	54	266
0.8	0.8	0	54	266
0.7	0.8	-0.1	54	267
0.572	0.8	-0.228	54	268
0.587	0.8	-0.213	54	269
0.508	0.8	-0.292	54	270
0.75	0.8	-0.05	54	271
0.7	0.8	-0.1	54	272
0.572	0.8	-0.228	54	273
0.587	0.8	-0.213	54	274

0.508	0.8	-0.292	54	275
0.75	0.8	-0.05	54	276
0.572	0.7	-0.128	54	277
0.587	0.7	-0.113	54	278
0.508	0.7	-0.192	54	279
0.75	0.7	0.05	55	279
0.587	0.572	0.015	56	279
0.508	0.572	-0.064	56	280
0.75	0.572	0.178	57	280
0.508	0.587	-0.079	57	281
0.75	0.587	0.163	58	281
0.75	0.508	0.242	59	281

S Statistic = 59 - 281 = -222

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Tied Group Value	Members
1	1
2	1.1
3	0.9
4	0.8
5	0.7

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Time Period	Observations
3/12/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/8/2009	1
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/13/2012	1
11/9/2012	1
4/22/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 1140  
B = 0  
C = 228  
D = 0  
E = 76  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2498.67  
Z-Score = -4.42118  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-4.42118 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
95.6	60	35.6	1	0
60.2	60	0.2	2	0
47.7	60	-12.3	2	1
86	60	26	3	1
69.4	60	9.4	4	1
95.2	60	35.2	5	1
52.5	60	-7.5	5	2
97.8	60	37.8	6	2
124	60	64	7	2
110	60	50	8	2
383	60	323	9	2
99.4	60	39.4	10	2
112	60	52	11	2
593	60	533	12	2
94.8	60	34.8	13	2
87	60	27	14	2
99	60	39	15	2
89.7	60	29.7	16	2
132	60	72	17	2
80.8	60	20.8	18	2
89.5	60	29.5	19	2
66	60	6	20	2
60.2	95.6	-35.4	20	3
47.7	95.6	-47.9	20	4
86	95.6	-9.6	20	5
69.4	95.6	-26.2	20	6
95.2	95.6	-0.4	20	7
52.5	95.6	-43.1	20	8
97.8	95.6	2.2	21	8
124	95.6	28.4	22	8
110	95.6	14.4	23	8
383	95.6	287.4	24	8
99.4	95.6	3.8	25	8
112	95.6	16.4	26	8
593	95.6	497.4	27	8
94.8	95.6	-0.8	27	9
87	95.6	-8.6	27	10
99	95.6	3.4	28	10
89.7	95.6	-5.9	28	11
132	95.6	36.4	29	11
80.8	95.6	-14.8	29	12
89.5	95.6	-6.1	29	13
66	95.6	-29.6	29	14
47.7	60.2	-12.5	29	15



86	60.2	25.8	30	15
69.4	60.2	9.2	31	15
95.2	60.2	35	32	15
52.5	60.2	-7.7	32	16
97.8	60.2	37.6	33	16
124	60.2	63.8	34	16
110	60.2	49.8	35	16
383	60.2	322.8	36	16
99.4	60.2	39.2	37	16
112	60.2	51.8	38	16
593	60.2	532.8	39	16
94.8	60.2	34.6	40	16
87	60.2	26.8	41	16
99	60.2	38.8	42	16
89.7	60.2	29.5	43	16
132	60.2	71.8	44	16
80.8	60.2	20.6	45	16
89.5	60.2	29.3	46	16
66	60.2	5.8	47	16
86	47.7	38.3	48	16
69.4	47.7	21.7	49	16
95.2	47.7	47.5	50	16
52.5	47.7	4.8	51	16
97.8	47.7	50.1	52	16
124	47.7	76.3	53	16
110	47.7	62.3	54	16
383	47.7	335.3	55	16
99.4	47.7	51.7	56	16
112	47.7	64.3	57	16
593	47.7	545.3	58	16
94.8	47.7	47.1	59	16
87	47.7	39.3	60	16
99	47.7	51.3	61	16
89.7	47.7	42	62	16
132	47.7	84.3	63	16
80.8	47.7	33.1	64	16
89.5	47.7	41.8	65	16
66	47.7	18.3	66	16
69.4	86	-16.6	66	17
95.2	86	9.2	67	17
52.5	86	-33.5	67	18
97.8	86	11.8	68	18
124	86	38	69	18
110	86	24	70	18
383	86	297	71	18
99.4	86	13.4	72	18
112	86	26	73	18
593	86	507	74	18
94.8	86	8.8	75	18
87	86	1	76	18
99	86	13	77	18
89.7	86	3.7	78	18
132	86	46	79	18
80.8	86	-5.2	79	19
89.5	86	3.5	80	19

66	86	-20	80	20
95.2	69.4	25.8	81	20
52.5	69.4	-16.9	81	21
97.8	69.4	28.4	82	21
124	69.4	54.6	83	21
110	69.4	40.6	84	21
383	69.4	313.6	85	21
99.4	69.4	30	86	21
112	69.4	42.6	87	21
593	69.4	523.6	88	21
94.8	69.4	25.4	89	21
87	69.4	17.6	90	21
99	69.4	29.6	91	21
89.7	69.4	20.3	92	21
132	69.4	62.6	93	21
80.8	69.4	11.4	94	21
89.5	69.4	20.1	95	21
66	69.4	-3.4	95	22
52.5	95.2	-42.7	95	23
97.8	95.2	2.6	96	23
124	95.2	28.8	97	23
110	95.2	14.8	98	23
383	95.2	287.8	99	23
99.4	95.2	4.2	100	23
112	95.2	16.8	101	23
593	95.2	497.8	102	23
94.8	95.2	-0.4	102	24
87	95.2	-8.2	102	25
99	95.2	3.8	103	25
89.7	95.2	-5.5	103	26
132	95.2	36.8	104	26
80.8	95.2	-14.4	104	27
89.5	95.2	-5.7	104	28
66	95.2	-29.2	104	29
97.8	52.5	45.3	105	29
124	52.5	71.5	106	29
110	52.5	57.5	107	29
383	52.5	330.5	108	29
99.4	52.5	46.9	109	29
112	52.5	59.5	110	29
593	52.5	540.5	111	29
94.8	52.5	42.3	112	29
87	52.5	34.5	113	29
99	52.5	46.5	114	29
89.7	52.5	37.2	115	29
132	52.5	79.5	116	29
80.8	52.5	28.3	117	29
89.5	52.5	37	118	29
66	52.5	13.5	119	29
124	97.8	26.2	120	29
110	97.8	12.2	121	29
383	97.8	285.2	122	29
99.4	97.8	1.6	123	29

112	97.8	14.2	124	29
593	97.8	495.2	125	29
94.8	97.8	-3	125	30
87	97.8	-10.8	125	31
99	97.8	1.2	126	31
89.7	97.8	-8.1	126	32
132	97.8	34.2	127	32
80.8	97.8	-17	127	33
89.5	97.8	-8.3	127	34
66	97.8	-31.8	127	35
110	124	-14	127	36
383	124	259	128	36
99.4	124	-24.6	128	37
112	124	-12	128	38
593	124	469	129	38
94.8	124	-29.2	129	39
87	124	-37	129	40
99	124	-25	129	41
89.7	124	-34.3	129	42
132	124	8	130	42
80.8	124	-43.2	130	43
89.5	124	-34.5	130	44
66	124	-58	130	45
383	110	273	131	45
99.4	110	-10.6	131	46
112	110	2	132	46
593	110	483	133	46
94.8	110	-15.2	133	47
87	110	-23	133	48
99	110	-11	133	49
89.7	110	-20.3	133	50
132	110	22	134	50
80.8	110	-29.2	134	51
89.5	110	-20.5	134	52
66	110	-44	134	53
99.4	383	-283.6	134	54
112	383	-271	134	55
593	383	210	135	55
94.8	383	-288.2	135	56
87	383	-296	135	57
99	383	-284	135	58
89.7	383	-293.3	135	59
132	383	-251	135	60
80.8	383	-302.2	135	61
89.5	383	-293.5	135	62
66	383	-317	135	63
112	99.4	12.6	136	63
593	99.4	493.6	137	63
94.8	99.4	-4.6	137	64
87	99.4	-12.4	137	65
99	99.4	-0.4	137	66
89.7	99.4	-9.7	137	67
132	99.4	32.6	138	67

80.8	99.4	-18.6	138	68
89.5	99.4	-9.9	138	69
66	99.4	-33.4	138	70
593	112	481	139	70
94.8	112	-17.2	139	71
87	112	-25	139	72
99	112	-13	139	73
89.7	112	-22.3	139	74
132	112	20	140	74
80.8	112	-31.2	140	75
89.5	112	-22.5	140	76
66	112	-46	140	77
94.8	593	-498.2	140	78
87	593	-506	140	79
99	593	-494	140	80
89.7	593	-503.3	140	81
132	593	-461	140	82
80.8	593	-512.2	140	83
89.5	593	-503.5	140	84
66	593	-527	140	85
87	94.8	-7.8	140	86
99	94.8	4.2	141	86
89.7	94.8	-5.1	141	87
132	94.8	37.2	142	87
80.8	94.8	-14	142	88
89.5	94.8	-5.3	142	89
66	94.8	-28.8	142	90
99	87	12	143	90
89.7	87	2.7	144	90
132	87	45	145	90
80.8	87	-6.2	145	91
89.5	87	2.5	146	91
66	87	-21	146	92
89.7	99	-9.3	146	93
132	99	33	147	93
80.8	99	-18.2	147	94
89.5	99	-9.5	147	95
66	99	-33	147	96
132	89.7	42.3	148	96
80.8	89.7	-8.9	148	97
89.5	89.7	-0.2	148	98
66	89.7	-23.7	148	99
80.8	132	-51.2	148	100
89.5	132	-42.5	148	101
66	132	-66	148	102
89.5	80.8	8.7	149	102
66	80.8	-14.8	149	103
66	89.5	-23.5	149	104

S Statistic = 149 - 104 = 45

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<b>Tied Group Value</b>	<b>Members</b>
<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 0

B = 0

C = 0

D = 0

E = 0

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1433.67

Z-Score = 1.16206

Comparison Level at 95% confidence level = -1.65463 (downward trend)

1.16206 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
95.6	60	35.6	1	0
60.2	60	0.2	2	0
47.7	60	-12.3	2	1
86	60	26	3	1
69.4	60	9.4	4	1
95.2	60	35.2	5	1
52.5	60	-7.5	5	2
97.8	60	37.8	6	2
124	60	64	7	2
110	60	50	8	2
383	60	323	9	2
99.4	60	39.4	10	2
112	60	52	11	2
593	60	533	12	2
94.8	60	34.8	13	2
87	60	27	14	2
99	60	39	15	2
89.7	60	29.7	16	2
132	60	72	17	2
80.8	60	20.8	18	2
89.5	60	29.5	19	2
66	60	6	20	2
60.2	95.6	-35.4	20	3
47.7	95.6	-47.9	20	4
86	95.6	-9.6	20	5
69.4	95.6	-26.2	20	6
95.2	95.6	-0.4	20	7
52.5	95.6	-43.1	20	8
97.8	95.6	2.2	21	8
124	95.6	28.4	22	8
110	95.6	14.4	23	8
383	95.6	287.4	24	8
99.4	95.6	3.8	25	8
112	95.6	16.4	26	8
593	95.6	497.4	27	8
94.8	95.6	-0.8	27	9
87	95.6	-8.6	27	10
99	95.6	3.4	28	10
89.7	95.6	-5.9	28	11
132	95.6	36.4	29	11
80.8	95.6	-14.8	29	12
89.5	95.6	-6.1	29	13
66	95.6	-29.6	29	14
47.7	60.2	-12.5	29	15

86	60.2	25.8	30	15
69.4	60.2	9.2	31	15
95.2	60.2	35	32	15
52.5	60.2	-7.7	32	16
97.8	60.2	37.6	33	16
124	60.2	63.8	34	16
110	60.2	49.8	35	16
383	60.2	322.8	36	16
99.4	60.2	39.2	37	16
112	60.2	51.8	38	16
593	60.2	532.8	39	16
94.8	60.2	34.6	40	16
87	60.2	26.8	41	16
99	60.2	38.8	42	16
89.7	60.2	29.5	43	16
132	60.2	71.8	44	16
80.8	60.2	20.6	45	16
89.5	60.2	29.3	46	16
66	60.2	5.8	47	16
86	47.7	38.3	48	16
69.4	47.7	21.7	49	16
95.2	47.7	47.5	50	16
52.5	47.7	4.8	51	16
97.8	47.7	50.1	52	16
124	47.7	76.3	53	16
110	47.7	62.3	54	16
383	47.7	335.3	55	16
99.4	47.7	51.7	56	16
112	47.7	64.3	57	16
593	47.7	545.3	58	16
94.8	47.7	47.1	59	16
87	47.7	39.3	60	16
99	47.7	51.3	61	16
89.7	47.7	42	62	16
132	47.7	84.3	63	16
80.8	47.7	33.1	64	16
89.5	47.7	41.8	65	16
66	47.7	18.3	66	16
69.4	86	-16.6	66	17
95.2	86	9.2	67	17
52.5	86	-33.5	67	18
97.8	86	11.8	68	18
124	86	38	69	18
110	86	24	70	18
383	86	297	71	18
99.4	86	13.4	72	18
112	86	26	73	18
593	86	507	74	18
94.8	86	8.8	75	18
87	86	1	76	18
99	86	13	77	18
89.7	86	3.7	78	18
132	86	46	79	18
80.8	86	-5.2	79	19
89.5	86	3.5	80	19

66	86	-20	80	20
95.2	69.4	25.8	81	20
52.5	69.4	-16.9	81	21
97.8	69.4	28.4	82	21
124	69.4	54.6	83	21
110	69.4	40.6	84	21
383	69.4	313.6	85	21
99.4	69.4	30	86	21
112	69.4	42.6	87	21
593	69.4	523.6	88	21
94.8	69.4	25.4	89	21
87	69.4	17.6	90	21
99	69.4	29.6	91	21
89.7	69.4	20.3	92	21
132	69.4	62.6	93	21
80.8	69.4	11.4	94	21
89.5	69.4	20.1	95	21
66	69.4	-3.4	95	22
52.5	95.2	-42.7	95	23
97.8	95.2	2.6	96	23
124	95.2	28.8	97	23
110	95.2	14.8	98	23
383	95.2	287.8	99	23
99.4	95.2	4.2	100	23
112	95.2	16.8	101	23
593	95.2	497.8	102	23
94.8	95.2	-0.4	102	24
87	95.2	-8.2	102	25
99	95.2	3.8	103	25
89.7	95.2	-5.5	103	26
132	95.2	36.8	104	26
80.8	95.2	-14.4	104	27
89.5	95.2	-5.7	104	28
66	95.2	-29.2	104	29
97.8	52.5	45.3	105	29
124	52.5	71.5	106	29
110	52.5	57.5	107	29
383	52.5	330.5	108	29
99.4	52.5	46.9	109	29
112	52.5	59.5	110	29
593	52.5	540.5	111	29
94.8	52.5	42.3	112	29
87	52.5	34.5	113	29
99	52.5	46.5	114	29
89.7	52.5	37.2	115	29
132	52.5	79.5	116	29
80.8	52.5	28.3	117	29
89.5	52.5	37	118	29
66	52.5	13.5	119	29
124	97.8	26.2	120	29
110	97.8	12.2	121	29
383	97.8	285.2	122	29
99.4	97.8	1.6	123	29



112	97.8	14.2	124	29
593	97.8	495.2	125	29
94.8	97.8	-3	125	30
87	97.8	-10.8	125	31
99	97.8	1.2	126	31
89.7	97.8	-8.1	126	32
132	97.8	34.2	127	32
80.8	97.8	-17	127	33
89.5	97.8	-8.3	127	34
66	97.8	-31.8	127	35
110	124	-14	127	36
383	124	259	128	36
99.4	124	-24.6	128	37
112	124	-12	128	38
593	124	469	129	38
94.8	124	-29.2	129	39
87	124	-37	129	40
99	124	-25	129	41
89.7	124	-34.3	129	42
132	124	8	130	42
80.8	124	-43.2	130	43
89.5	124	-34.5	130	44
66	124	-58	130	45
383	110	273	131	45
99.4	110	-10.6	131	46
112	110	2	132	46
593	110	483	133	46
94.8	110	-15.2	133	47
87	110	-23	133	48
99	110	-11	133	49
89.7	110	-20.3	133	50
132	110	22	134	50
80.8	110	-29.2	134	51
89.5	110	-20.5	134	52
66	110	-44	134	53
99.4	383	-283.6	134	54
112	383	-271	134	55
593	383	210	135	55
94.8	383	-288.2	135	56
87	383	-296	135	57
99	383	-284	135	58
89.7	383	-293.3	135	59
132	383	-251	135	60
80.8	383	-302.2	135	61
89.5	383	-293.5	135	62
66	383	-317	135	63
112	99.4	12.6	136	63
593	99.4	493.6	137	63
94.8	99.4	-4.6	137	64
87	99.4	-12.4	137	65
99	99.4	-0.4	137	66
89.7	99.4	-9.7	137	67
132	99.4	32.6	138	67

80.8	99.4	-18.6	138	68
89.5	99.4	-9.9	138	69
66	99.4	-33.4	138	70
593	112	481	139	70
94.8	112	-17.2	139	71
87	112	-25	139	72
99	112	-13	139	73
89.7	112	-22.3	139	74
132	112	20	140	74
80.8	112	-31.2	140	75
89.5	112	-22.5	140	76
66	112	-46	140	77
94.8	593	-498.2	140	78
87	593	-506	140	79
99	593	-494	140	80
89.7	593	-503.3	140	81
132	593	-461	140	82
80.8	593	-512.2	140	83
89.5	593	-503.5	140	84
66	593	-527	140	85
87	94.8	-7.8	140	86
99	94.8	4.2	141	86
89.7	94.8	-5.1	141	87
132	94.8	37.2	142	87
80.8	94.8	-14	142	88
89.5	94.8	-5.3	142	89
66	94.8	-28.8	142	90
99	87	12	143	90
89.7	87	2.7	144	90
132	87	45	145	90
80.8	87	-6.2	145	91
89.5	87	2.5	146	91
66	87	-21	146	92
89.7	99	-9.3	146	93
132	99	33	147	93
80.8	99	-18.2	147	94
89.5	99	-9.5	147	95
66	99	-33	147	96
132	89.7	42.3	148	96
80.8	89.7	-8.9	148	97
89.5	89.7	-0.2	148	98
66	89.7	-23.7	148	99
80.8	132	-51.2	148	100
89.5	132	-42.5	148	101
66	132	-66	148	102
89.5	80.8	8.7	149	102
66	80.8	-14.8	149	103
66	89.5	-23.5	149	104

S Statistic = 149 - 104 = 45

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Tied Group Value	Members
<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 0

B = 0

C = 0

D = 0

E = 0

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1433.67

Z-Score = 1.16206

Comparison Level at 95% confidence level = 1.65463 (upward trend)

1.16206 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-06

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
66.6	79	-12.4	0	1
60	79	-19	0	2
33.8	79	-45.2	0	3
185	79	106	1	3
99.1	79	20.1	2	3
134	79	55	3	3
76.3	79	-2.7	3	4
192	79	113	4	4
210	79	131	5	4
170	79	91	6	4
218	79	139	7	4
158	79	79	8	4
197	79	118	9	4
145	79	66	10	4
130	79	51	11	4
172	79	93	12	4
143	79	64	13	4
16.1	79	-62.9	13	5
234	79	155	14	5
158	79	79	15	5
191	79	112	16	5
134	79	55	17	5
60	66.6	-6.6	17	6
33.8	66.6	-32.8	17	7
185	66.6	118.4	18	7
99.1	66.6	32.5	19	7
134	66.6	67.4	20	7
76.3	66.6	9.7	21	7
192	66.6	125.4	22	7
210	66.6	143.4	23	7
170	66.6	103.4	24	7
218	66.6	151.4	25	7
158	66.6	91.4	26	7
197	66.6	130.4	27	7
145	66.6	78.4	28	7
130	66.6	63.4	29	7
172	66.6	105.4	30	7
143	66.6	76.4	31	7
16.1	66.6	-50.5	31	8
234	66.6	167.4	32	8
158	66.6	91.4	33	8
191	66.6	124.4	34	8
134	66.6	67.4	35	8
33.8	60	-26.2	35	9

185	60	125	36	9
99.1	60	39.1	37	9
134	60	74	38	9
76.3	60	16.3	39	9
192	60	132	40	9
210	60	150	41	9
170	60	110	42	9
218	60	158	43	9
158	60	98	44	9
197	60	137	45	9
145	60	85	46	9
130	60	70	47	9
172	60	112	48	9
143	60	83	49	9
16.1	60	-43.9	49	10
234	60	174	50	10
158	60	98	51	10
191	60	131	52	10
134	60	74	53	10
185	33.8	151.2	54	10
99.1	33.8	65.3	55	10
134	33.8	100.2	56	10
76.3	33.8	42.5	57	10
192	33.8	158.2	58	10
210	33.8	176.2	59	10
170	33.8	136.2	60	10
218	33.8	184.2	61	10
158	33.8	124.2	62	10
197	33.8	163.2	63	10
145	33.8	111.2	64	10
130	33.8	96.2	65	10
172	33.8	138.2	66	10
143	33.8	109.2	67	10
16.1	33.8	-17.7	67	11
234	33.8	200.2	68	11
158	33.8	124.2	69	11
191	33.8	157.2	70	11
134	33.8	100.2	71	11
99.1	185	-85.9	71	12
134	185	-51	71	13
76.3	185	-108.7	71	14
192	185	7	72	14
210	185	25	73	14
170	185	-15	73	15
218	185	33	74	15
158	185	-27	74	16
197	185	12	75	16
145	185	-40	75	17
130	185	-55	75	18
172	185	-13	75	19
143	185	-42	75	20
16.1	185	-168.9	75	21
234	185	49	76	21
158	185	-27	76	22
191	185	6	77	22

134	185	-51	77	23
134	99.1	34.9	78	23
76.3	99.1	-22.8	78	24
192	99.1	92.9	79	24
210	99.1	110.9	80	24
170	99.1	70.9	81	24
218	99.1	118.9	82	24
158	99.1	58.9	83	24
197	99.1	97.9	84	24
145	99.1	45.9	85	24
130	99.1	30.9	86	24
172	99.1	72.9	87	24
143	99.1	43.9	88	24
16.1	99.1	-83	88	25
234	99.1	134.9	89	25
158	99.1	58.9	90	25
191	99.1	91.9	91	25
134	99.1	34.9	92	25
76.3	134	-57.7	92	26
192	134	58	93	26
210	134	76	94	26
170	134	36	95	26
218	134	84	96	26
158	134	24	97	26
197	134	63	98	26
145	134	11	99	26
130	134	-4	99	27
172	134	38	100	27
143	134	9	101	27
16.1	134	-117.9	101	28
234	134	100	102	28
158	134	24	103	28
191	134	57	104	28
134	134	0	104	28
192	76.3	115.7	105	28
210	76.3	133.7	106	28
170	76.3	93.7	107	28
218	76.3	141.7	108	28
158	76.3	81.7	109	28
197	76.3	120.7	110	28
145	76.3	68.7	111	28
130	76.3	53.7	112	28
172	76.3	95.7	113	28
143	76.3	66.7	114	28
16.1	76.3	-60.2	114	29
234	76.3	157.7	115	29
158	76.3	81.7	116	29
191	76.3	114.7	117	29
134	76.3	57.7	118	29
210	192	18	119	29
170	192	-22	119	30
218	192	26	120	30
158	192	-34	120	31

197	192	5	121	31
145	192	-47	121	32
130	192	-62	121	33
172	192	-20	121	34
143	192	-49	121	35
16.1	192	-175.9	121	36
234	192	42	122	36
158	192	-34	122	37
191	192	-1	122	38
134	192	-58	122	39
170	210	-40	122	40
218	210	8	123	40
158	210	-52	123	41
197	210	-13	123	42
145	210	-65	123	43
130	210	-80	123	44
172	210	-38	123	45
143	210	-67	123	46
16.1	210	-193.9	123	47
234	210	24	124	47
158	210	-52	124	48
191	210	-19	124	49
134	210	-76	124	50
218	170	48	125	50
158	170	-12	125	51
197	170	27	126	51
145	170	-25	126	52
130	170	-40	126	53
172	170	2	127	53
143	170	-27	127	54
16.1	170	-153.9	127	55
234	170	64	128	55
158	170	-12	128	56
191	170	21	129	56
134	170	-36	129	57
158	218	-60	129	58
197	218	-21	129	59
145	218	-73	129	60
130	218	-88	129	61
172	218	-46	129	62
143	218	-75	129	63
16.1	218	-201.9	129	64
234	218	16	130	64
158	218	-60	130	65
191	218	-27	130	66
134	218	-84	130	67
197	158	39	131	67
145	158	-13	131	68
130	158	-28	131	69
172	158	14	132	69
143	158	-15	132	70
16.1	158	-141.9	132	71
234	158	76	133	71

158	158	0	133	71
191	158	33	134	71
134	158	-24	134	72
145	197	-52	134	73
130	197	-67	134	74
172	197	-25	134	75
143	197	-54	134	76
16.1	197	-180.9	134	77
234	197	37	135	77
158	197	-39	135	78
191	197	-6	135	79
134	197	-63	135	80
130	145	-15	135	81
172	145	27	136	81
143	145	-2	136	82
16.1	145	-128.9	136	83
234	145	89	137	83
158	145	13	138	83
191	145	46	139	83
134	145	-11	139	84
172	130	42	140	84
143	130	13	141	84
16.1	130	-113.9	141	85
234	130	104	142	85
158	130	28	143	85
191	130	61	144	85
134	130	4	145	85
143	172	-29	145	86
16.1	172	-155.9	145	87
234	172	62	146	87
158	172	-14	146	88
191	172	19	147	88
134	172	-38	147	89
16.1	143	-126.9	147	90
234	143	91	148	90
158	143	15	149	90
191	143	48	150	90
134	143	-9	150	91
234	16.1	217.9	151	91
158	16.1	141.9	152	91
191	16.1	174.9	153	91
134	16.1	117.9	154	91
158	234	-76	154	92
191	234	-43	154	93
134	234	-100	154	94
191	158	33	155	94
134	158	-24	155	95
134	191	-57	155	96



S Statistic = 155 - 96 = 59

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<b>Tied Group Value</b>		<b>Members</b>
1	134	2
2	158	2

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/22/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 36

B = 0

C = 0

D = 0

E = 4

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1431.67

Z-Score = 1.53288

Comparison Level at 95% confidence level = -1.65463 (downward trend)

1.53288 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-06

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
66.6	79	-12.4	0	1
60	79	-19	0	2
33.8	79	-45.2	0	3
185	79	106	1	3
99.1	79	20.1	2	3
134	79	55	3	3
76.3	79	-2.7	3	4
192	79	113	4	4
210	79	131	5	4
170	79	91	6	4
218	79	139	7	4
158	79	79	8	4
197	79	118	9	4
145	79	66	10	4
130	79	51	11	4
172	79	93	12	4
143	79	64	13	4
16.1	79	-62.9	13	5
234	79	155	14	5
158	79	79	15	5
191	79	112	16	5
134	79	55	17	5
60	66.6	-6.6	17	6
33.8	66.6	-32.8	17	7
185	66.6	118.4	18	7
99.1	66.6	32.5	19	7
134	66.6	67.4	20	7
76.3	66.6	9.7	21	7
192	66.6	125.4	22	7
210	66.6	143.4	23	7
170	66.6	103.4	24	7
218	66.6	151.4	25	7
158	66.6	91.4	26	7
197	66.6	130.4	27	7
145	66.6	78.4	28	7
130	66.6	63.4	29	7
172	66.6	105.4	30	7
143	66.6	76.4	31	7
16.1	66.6	-50.5	31	8
234	66.6	167.4	32	8
158	66.6	91.4	33	8
191	66.6	124.4	34	8
134	66.6	67.4	35	8
33.8	60	-26.2	35	9

185	60	125	36	9
99.1	60	39.1	37	9
134	60	74	38	9
76.3	60	16.3	39	9
192	60	132	40	9
210	60	150	41	9
170	60	110	42	9
218	60	158	43	9
158	60	98	44	9
197	60	137	45	9
145	60	85	46	9
130	60	70	47	9
172	60	112	48	9
143	60	83	49	9
16.1	60	-43.9	49	10
234	60	174	50	10
158	60	98	51	10
191	60	131	52	10
134	60	74	53	10
185	33.8	151.2	54	10
99.1	33.8	65.3	55	10
134	33.8	100.2	56	10
76.3	33.8	42.5	57	10
192	33.8	158.2	58	10
210	33.8	176.2	59	10
170	33.8	136.2	60	10
218	33.8	184.2	61	10
158	33.8	124.2	62	10
197	33.8	163.2	63	10
145	33.8	111.2	64	10
130	33.8	96.2	65	10
172	33.8	138.2	66	10
143	33.8	109.2	67	10
16.1	33.8	-17.7	67	11
234	33.8	200.2	68	11
158	33.8	124.2	69	11
191	33.8	157.2	70	11
134	33.8	100.2	71	11
99.1	185	-85.9	71	12
134	185	-51	71	13
76.3	185	-108.7	71	14
192	185	7	72	14
210	185	25	73	14
170	185	-15	73	15
218	185	33	74	15
158	185	-27	74	16
197	185	12	75	16
145	185	-40	75	17
130	185	-55	75	18
172	185	-13	75	19
143	185	-42	75	20
16.1	185	-168.9	75	21
234	185	49	76	21
158	185	-27	76	22
191	185	6	77	22

134	185	-51	77	23
134	99.1	34.9	78	23
76.3	99.1	-22.8	78	24
192	99.1	92.9	79	24
210	99.1	110.9	80	24
170	99.1	70.9	81	24
218	99.1	118.9	82	24
158	99.1	58.9	83	24
197	99.1	97.9	84	24
145	99.1	45.9	85	24
130	99.1	30.9	86	24
172	99.1	72.9	87	24
143	99.1	43.9	88	24
16.1	99.1	-83	88	25
234	99.1	134.9	89	25
158	99.1	58.9	90	25
191	99.1	91.9	91	25
134	99.1	34.9	92	25
76.3	134	-57.7	92	26
192	134	58	93	26
210	134	76	94	26
170	134	36	95	26
218	134	84	96	26
158	134	24	97	26
197	134	63	98	26
145	134	11	99	26
130	134	-4	99	27
172	134	38	100	27
143	134	9	101	27
16.1	134	-117.9	101	28
234	134	100	102	28
158	134	24	103	28
191	134	57	104	28
134	134	0	104	28
192	76.3	115.7	105	28
210	76.3	133.7	106	28
170	76.3	93.7	107	28
218	76.3	141.7	108	28
158	76.3	81.7	109	28
197	76.3	120.7	110	28
145	76.3	68.7	111	28
130	76.3	53.7	112	28
172	76.3	95.7	113	28
143	76.3	66.7	114	28
16.1	76.3	-60.2	114	29
234	76.3	157.7	115	29
158	76.3	81.7	116	29
191	76.3	114.7	117	29
134	76.3	57.7	118	29
210	192	18	119	29
170	192	-22	119	30
218	192	26	120	30
158	192	-34	120	31

197	192	5	121	31
145	192	-47	121	32
130	192	-62	121	33
172	192	-20	121	34
143	192	-49	121	35
16.1	192	-175.9	121	36
234	192	42	122	36
158	192	-34	122	37
191	192	-1	122	38
134	192	-58	122	39
170	210	-40	122	40
218	210	8	123	40
158	210	-52	123	41
197	210	-13	123	42
145	210	-65	123	43
130	210	-80	123	44
172	210	-38	123	45
143	210	-67	123	46
16.1	210	-193.9	123	47
234	210	24	124	47
158	210	-52	124	48
191	210	-19	124	49
134	210	-76	124	50
218	170	48	125	50
158	170	-12	125	51
197	170	27	126	51
145	170	-25	126	52
130	170	-40	126	53
172	170	2	127	53
143	170	-27	127	54
16.1	170	-153.9	127	55
234	170	64	128	55
158	170	-12	128	56
191	170	21	129	56
134	170	-36	129	57
158	218	-60	129	58
197	218	-21	129	59
145	218	-73	129	60
130	218	-88	129	61
172	218	-46	129	62
143	218	-75	129	63
16.1	218	-201.9	129	64
234	218	16	130	64
158	218	-60	130	65
191	218	-27	130	66
134	218	-84	130	67
197	158	39	131	67
145	158	-13	131	68
130	158	-28	131	69
172	158	14	132	69
143	158	-15	132	70
16.1	158	-141.9	132	71
234	158	76	133	71

158	158	0	133	71
191	158	33	134	71
134	158	-24	134	72
145	197	-52	134	73
130	197	-67	134	74
172	197	-25	134	75
143	197	-54	134	76
16.1	197	-180.9	134	77
234	197	37	135	77
158	197	-39	135	78
191	197	-6	135	79
134	197	-63	135	80
130	145	-15	135	81
172	145	27	136	81
143	145	-2	136	82
16.1	145	-128.9	136	83
234	145	89	137	83
158	145	13	138	83
191	145	46	139	83
134	145	-11	139	84
172	130	42	140	84
143	130	13	141	84
16.1	130	-113.9	141	85
234	130	104	142	85
158	130	28	143	85
191	130	61	144	85
134	130	4	145	85
143	172	-29	145	86
16.1	172	-155.9	145	87
234	172	62	146	87
158	172	-14	146	88
191	172	19	147	88
134	172	-38	147	89
16.1	143	-126.9	147	90
234	143	91	148	90
158	143	15	149	90
191	143	48	150	90
134	143	-9	150	91
234	16.1	217.9	151	91
158	16.1	141.9	152	91
191	16.1	174.9	153	91
134	16.1	117.9	154	91
158	234	-76	154	92
191	234	-43	154	93
134	234	-100	154	94
191	158	33	155	94
134	158	-24	155	95
134	191	-57	155	96

S Statistic = 155 - 96 = 59

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<b>Tied Group Value</b>		<b>Members</b>
1	134	2
2	158	2

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/22/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 36

B = 0

C = 0

D = 0

E = 4

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1431.67

Z-Score = 1.53288

Comparison Level at 95% confidence level = 1.65463 (upward trend)

1.53288 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-07

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
42.5	35	7.5	1	0
46.1	35	11.1	2	0
65.2	35	30.2	3	0
41.1	35	6.1	4	0
42.2	35	7.2	5	0
45.8	35	10.8	6	0
17.9	35	-17.1	6	1
41.5	35	6.5	7	1
18.8	35	-16.2	7	2
47.1	35	12.1	8	2
55	35	20	9	2
38.9	35	3.9	10	2
40.8	35	5.8	11	2
35.8	35	0.8	12	2
1.8	35	-33.2	12	3
87	35	52	13	3
41.6	35	6.6	14	3
36	35	1	15	3
40	35	5	16	3
42.4	35	7.4	17	3
43.5	35	8.5	18	3
38	35	3	19	3
46.1	42.5	3.6	20	3
65.2	42.5	22.7	21	3
41.1	42.5	-1.4	21	4
42.2	42.5	-0.3	21	5
45.8	42.5	3.3	22	5
17.9	42.5	-24.6	22	6
41.5	42.5	-1	22	7
18.8	42.5	-23.7	22	8
47.1	42.5	4.6	23	8
55	42.5	12.5	24	8
38.9	42.5	-3.6	24	9
40.8	42.5	-1.7	24	10
35.8	42.5	-6.7	24	11
1.8	42.5	-40.7	24	12
87	42.5	44.5	25	12
41.6	42.5	-0.9	25	13
36	42.5	-6.5	25	14
40	42.5	-2.5	25	15
42.4	42.5	-0.1	25	16
43.5	42.5	1	26	16
38	42.5	-4.5	26	17
65.2	46.1	19.1	27	17



41.1	46.1	-5	27	18
42.2	46.1	-3.9	27	19
45.8	46.1	-0.3	27	20
17.9	46.1	-28.2	27	21
41.5	46.1	-4.6	27	22
18.8	46.1	-27.3	27	23
47.1	46.1	1	28	23
55	46.1	8.9	29	23
38.9	46.1	-7.2	29	24
40.8	46.1	-5.3	29	25
35.8	46.1	-10.3	29	26
1.8	46.1	-44.3	29	27
87	46.1	40.9	30	27
41.6	46.1	-4.5	30	28
36	46.1	-10.1	30	29
40	46.1	-6.1	30	30
42.4	46.1	-3.7	30	31
43.5	46.1	-2.6	30	32
38	46.1	-8.1	30	33
41.1	65.2	-24.1	30	34
42.2	65.2	-23	30	35
45.8	65.2	-19.4	30	36
17.9	65.2	-47.3	30	37
41.5	65.2	-23.7	30	38
18.8	65.2	-46.4	30	39
47.1	65.2	-18.1	30	40
55	65.2	-10.2	30	41
38.9	65.2	-26.3	30	42
40.8	65.2	-24.4	30	43
35.8	65.2	-29.4	30	44
1.8	65.2	-63.4	30	45
87	65.2	21.8	31	45
41.6	65.2	-23.6	31	46
36	65.2	-29.2	31	47
40	65.2	-25.2	31	48
42.4	65.2	-22.8	31	49
43.5	65.2	-21.7	31	50
38	65.2	-27.2	31	51
42.2	41.1	1.1	32	51
45.8	41.1	4.7	33	51
17.9	41.1	-23.2	33	52
41.5	41.1	0.4	34	52
18.8	41.1	-22.3	34	53
47.1	41.1	6	35	53
55	41.1	13.9	36	53
38.9	41.1	-2.2	36	54
40.8	41.1	-0.3	36	55
35.8	41.1	-5.3	36	56
1.8	41.1	-39.3	36	57
87	41.1	45.9	37	57
41.6	41.1	0.5	38	57
36	41.1	-5.1	38	58
40	41.1	-1.1	38	59
42.4	41.1	1.3	39	59
43.5	41.1	2.4	40	59

38	41.1	-3.1	40	60
45.8	42.2	3.6	41	60
17.9	42.2	-24.3	41	61
41.5	42.2	-0.7	41	62
18.8	42.2	-23.4	41	63
47.1	42.2	4.9	42	63
55	42.2	12.8	43	63
38.9	42.2	-3.3	43	64
40.8	42.2	-1.4	43	65
35.8	42.2	-6.4	43	66
1.8	42.2	-40.4	43	67
87	42.2	44.8	44	67
41.6	42.2	-0.6	44	68
36	42.2	-6.2	44	69
40	42.2	-2.2	44	70
42.4	42.2	0.2	45	70
43.5	42.2	1.3	46	70
38	42.2	-4.2	46	71
17.9	45.8	-27.9	46	72
41.5	45.8	-4.3	46	73
18.8	45.8	-27	46	74
47.1	45.8	1.3	47	74
55	45.8	9.2	48	74
38.9	45.8	-6.9	48	75
40.8	45.8	-5	48	76
35.8	45.8	-10	48	77
1.8	45.8	-44	48	78
87	45.8	41.2	49	78
41.6	45.8	-4.2	49	79
36	45.8	-9.8	49	80
40	45.8	-5.8	49	81
42.4	45.8	-3.4	49	82
43.5	45.8	-2.3	49	83
38	45.8	-7.8	49	84
41.5	17.9	23.6	50	84
18.8	17.9	0.9	51	84
47.1	17.9	29.2	52	84
55	17.9	37.1	53	84
38.9	17.9	21	54	84
40.8	17.9	22.9	55	84
35.8	17.9	17.9	56	84
1.8	17.9	-16.1	56	85
87	17.9	69.1	57	85
41.6	17.9	23.7	58	85
36	17.9	18.1	59	85
40	17.9	22.1	60	85
42.4	17.9	24.5	61	85
43.5	17.9	25.6	62	85
38	17.9	20.1	63	85
18.8	41.5	-22.7	63	86
47.1	41.5	5.6	64	86
55	41.5	13.5	65	86
38.9	41.5	-2.6	65	87

40.8	41.5	-0.7	65	88
35.8	41.5	-5.7	65	89
1.8	41.5	-39.7	65	90
87	41.5	45.5	66	90
41.6	41.5	0.1	67	90
36	41.5	-5.5	67	91
40	41.5	-1.5	67	92
42.4	41.5	0.9	68	92
43.5	41.5	2	69	92
38	41.5	-3.5	69	93
47.1	18.8	28.3	70	93
55	18.8	36.2	71	93
38.9	18.8	20.1	72	93
40.8	18.8	22	73	93
35.8	18.8	17	74	93
1.8	18.8	-17	74	94
87	18.8	68.2	75	94
41.6	18.8	22.8	76	94
36	18.8	17.2	77	94
40	18.8	21.2	78	94
42.4	18.8	23.6	79	94
43.5	18.8	24.7	80	94
38	18.8	19.2	81	94
55	47.1	7.9	82	94
38.9	47.1	-8.2	82	95
40.8	47.1	-6.3	82	96
35.8	47.1	-11.3	82	97
1.8	47.1	-45.3	82	98
87	47.1	39.9	83	98
41.6	47.1	-5.5	83	99
36	47.1	-11.1	83	100
40	47.1	-7.1	83	101
42.4	47.1	-4.7	83	102
43.5	47.1	-3.6	83	103
38	47.1	-9.1	83	104
38.9	55	-16.1	83	105
40.8	55	-14.2	83	106
35.8	55	-19.2	83	107
1.8	55	-53.2	83	108
87	55	32	84	108
41.6	55	-13.4	84	109
36	55	-19	84	110
40	55	-15	84	111
42.4	55	-12.6	84	112
43.5	55	-11.5	84	113
38	55	-17	84	114
40.8	38.9	1.9	85	114
35.8	38.9	-3.1	85	115
1.8	38.9	-37.1	85	116
87	38.9	48.1	86	116
41.6	38.9	2.7	87	116
36	38.9	-2.9	87	117
40	38.9	1.1	88	117

42.4	38.9	3.5	89	117
43.5	38.9	4.6	90	117
38	38.9	-0.9	90	118
35.8	40.8	-5	90	119
1.8	40.8	-39	90	120
87	40.8	46.2	91	120
41.6	40.8	0.8	92	120
36	40.8	-4.8	92	121
40	40.8	-0.8	92	122
42.4	40.8	1.6	93	122
43.5	40.8	2.7	94	122
38	40.8	-2.8	94	123
1.8	35.8	-34	94	124
87	35.8	51.2	95	124
41.6	35.8	5.8	96	124
36	35.8	0.2	97	124
40	35.8	4.2	98	124
42.4	35.8	6.6	99	124
43.5	35.8	7.7	100	124
38	35.8	2.2	101	124
87	1.8	85.2	102	124
41.6	1.8	39.8	103	124
36	1.8	34.2	104	124
40	1.8	38.2	105	124
42.4	1.8	40.6	106	124
43.5	1.8	41.7	107	124
38	1.8	36.2	108	124
41.6	87	-45.4	108	125
36	87	-51	108	126
40	87	-47	108	127
42.4	87	-44.6	108	128
43.5	87	-43.5	108	129
38	87	-49	108	130
36	41.6	-5.6	108	131
40	41.6	-1.6	108	132
42.4	41.6	0.8	109	132
43.5	41.6	1.9	110	132
38	41.6	-3.6	110	133
40	36	4	111	133
42.4	36	6.4	112	133
43.5	36	7.5	113	133
38	36	2	114	133
42.4	40	2.4	115	133
43.5	40	3.5	116	133
38	40	-2	116	134
43.5	42.4	1.1	117	134
38	42.4	-4.4	117	135
38	43.5	-5.5	117	136

S Statistic = 117 - 136 = -19

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Tied Group Value	Members
Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/12/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 0

B = 0

C = 0

D = 0

E = 0

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1433.67

Z-Score = -0.475388

Comparison Level at 95% confidence level = -1.65463 (downward trend)

-0.475388 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-07

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
42.5	35	7.5	1	0
46.1	35	11.1	2	0
65.2	35	30.2	3	0
41.1	35	6.1	4	0
42.2	35	7.2	5	0
45.8	35	10.8	6	0
17.9	35	-17.1	6	1
41.5	35	6.5	7	1
18.8	35	-16.2	7	2
47.1	35	12.1	8	2
55	35	20	9	2
38.9	35	3.9	10	2
40.8	35	5.8	11	2
35.8	35	0.8	12	2
1.8	35	-33.2	12	3
87	35	52	13	3
41.6	35	6.6	14	3
36	35	1	15	3
40	35	5	16	3
42.4	35	7.4	17	3
43.5	35	8.5	18	3
38	35	3	19	3
46.1	42.5	3.6	20	3
65.2	42.5	22.7	21	3
41.1	42.5	-1.4	21	4
42.2	42.5	-0.3	21	5
45.8	42.5	3.3	22	5
17.9	42.5	-24.6	22	6
41.5	42.5	-1	22	7
18.8	42.5	-23.7	22	8
47.1	42.5	4.6	23	8
55	42.5	12.5	24	8
38.9	42.5	-3.6	24	9
40.8	42.5	-1.7	24	10
35.8	42.5	-6.7	24	11
1.8	42.5	-40.7	24	12
87	42.5	44.5	25	12
41.6	42.5	-0.9	25	13
36	42.5	-6.5	25	14
40	42.5	-2.5	25	15
42.4	42.5	-0.1	25	16
43.5	42.5	1	26	16
38	42.5	-4.5	26	17
65.2	46.1	19.1	27	17

41.1	46.1	-5	27	18
42.2	46.1	-3.9	27	19
45.8	46.1	-0.3	27	20
17.9	46.1	-28.2	27	21
41.5	46.1	-4.6	27	22
18.8	46.1	-27.3	27	23
47.1	46.1	1	28	23
55	46.1	8.9	29	23
38.9	46.1	-7.2	29	24
40.8	46.1	-5.3	29	25
35.8	46.1	-10.3	29	26
1.8	46.1	-44.3	29	27
87	46.1	40.9	30	27
41.6	46.1	-4.5	30	28
36	46.1	-10.1	30	29
40	46.1	-6.1	30	30
42.4	46.1	-3.7	30	31
43.5	46.1	-2.6	30	32
38	46.1	-8.1	30	33
41.1	65.2	-24.1	30	34
42.2	65.2	-23	30	35
45.8	65.2	-19.4	30	36
17.9	65.2	-47.3	30	37
41.5	65.2	-23.7	30	38
18.8	65.2	-46.4	30	39
47.1	65.2	-18.1	30	40
55	65.2	-10.2	30	41
38.9	65.2	-26.3	30	42
40.8	65.2	-24.4	30	43
35.8	65.2	-29.4	30	44
1.8	65.2	-63.4	30	45
87	65.2	21.8	31	45
41.6	65.2	-23.6	31	46
36	65.2	-29.2	31	47
40	65.2	-25.2	31	48
42.4	65.2	-22.8	31	49
43.5	65.2	-21.7	31	50
38	65.2	-27.2	31	51
42.2	41.1	1.1	32	51
45.8	41.1	4.7	33	51
17.9	41.1	-23.2	33	52
41.5	41.1	0.4	34	52
18.8	41.1	-22.3	34	53
47.1	41.1	6	35	53
55	41.1	13.9	36	53
38.9	41.1	-2.2	36	54
40.8	41.1	-0.3	36	55
35.8	41.1	-5.3	36	56
1.8	41.1	-39.3	36	57
87	41.1	45.9	37	57
41.6	41.1	0.5	38	57
36	41.1	-5.1	38	58
40	41.1	-1.1	38	59
42.4	41.1	1.3	39	59
43.5	41.1	2.4	40	59

38	41.1	-3.1	40	60
45.8	42.2	3.6	41	60
17.9	42.2	-24.3	41	61
41.5	42.2	-0.7	41	62
18.8	42.2	-23.4	41	63
47.1	42.2	4.9	42	63
55	42.2	12.8	43	63
38.9	42.2	-3.3	43	64
40.8	42.2	-1.4	43	65
35.8	42.2	-6.4	43	66
1.8	42.2	-40.4	43	67
87	42.2	44.8	44	67
41.6	42.2	-0.6	44	68
36	42.2	-6.2	44	69
40	42.2	-2.2	44	70
42.4	42.2	0.2	45	70
43.5	42.2	1.3	46	70
38	42.2	-4.2	46	71
17.9	45.8	-27.9	46	72
41.5	45.8	-4.3	46	73
18.8	45.8	-27	46	74
47.1	45.8	1.3	47	74
55	45.8	9.2	48	74
38.9	45.8	-6.9	48	75
40.8	45.8	-5	48	76
35.8	45.8	-10	48	77
1.8	45.8	-44	48	78
87	45.8	41.2	49	78
41.6	45.8	-4.2	49	79
36	45.8	-9.8	49	80
40	45.8	-5.8	49	81
42.4	45.8	-3.4	49	82
43.5	45.8	-2.3	49	83
38	45.8	-7.8	49	84
41.5	17.9	23.6	50	84
18.8	17.9	0.9	51	84
47.1	17.9	29.2	52	84
55	17.9	37.1	53	84
38.9	17.9	21	54	84
40.8	17.9	22.9	55	84
35.8	17.9	17.9	56	84
1.8	17.9	-16.1	56	85
87	17.9	69.1	57	85
41.6	17.9	23.7	58	85
36	17.9	18.1	59	85
40	17.9	22.1	60	85
42.4	17.9	24.5	61	85
43.5	17.9	25.6	62	85
38	17.9	20.1	63	85
18.8	41.5	-22.7	63	86
47.1	41.5	5.6	64	86
55	41.5	13.5	65	86
38.9	41.5	-2.6	65	87



40.8	41.5	-0.7	65	88
35.8	41.5	-5.7	65	89
1.8	41.5	-39.7	65	90
87	41.5	45.5	66	90
41.6	41.5	0.1	67	90
36	41.5	-5.5	67	91
40	41.5	-1.5	67	92
42.4	41.5	0.9	68	92
43.5	41.5	2	69	92
38	41.5	-3.5	69	93
47.1	18.8	28.3	70	93
55	18.8	36.2	71	93
38.9	18.8	20.1	72	93
40.8	18.8	22	73	93
35.8	18.8	17	74	93
1.8	18.8	-17	74	94
87	18.8	68.2	75	94
41.6	18.8	22.8	76	94
36	18.8	17.2	77	94
40	18.8	21.2	78	94
42.4	18.8	23.6	79	94
43.5	18.8	24.7	80	94
38	18.8	19.2	81	94
55	47.1	7.9	82	94
38.9	47.1	-8.2	82	95
40.8	47.1	-6.3	82	96
35.8	47.1	-11.3	82	97
1.8	47.1	-45.3	82	98
87	47.1	39.9	83	98
41.6	47.1	-5.5	83	99
36	47.1	-11.1	83	100
40	47.1	-7.1	83	101
42.4	47.1	-4.7	83	102
43.5	47.1	-3.6	83	103
38	47.1	-9.1	83	104
38.9	55	-16.1	83	105
40.8	55	-14.2	83	106
35.8	55	-19.2	83	107
1.8	55	-53.2	83	108
87	55	32	84	108
41.6	55	-13.4	84	109
36	55	-19	84	110
40	55	-15	84	111
42.4	55	-12.6	84	112
43.5	55	-11.5	84	113
38	55	-17	84	114
40.8	38.9	1.9	85	114
35.8	38.9	-3.1	85	115
1.8	38.9	-37.1	85	116
87	38.9	48.1	86	116
41.6	38.9	2.7	87	116
36	38.9	-2.9	87	117
40	38.9	1.1	88	117

42.4	38.9	3.5	89	117
43.5	38.9	4.6	90	117
38	38.9	-0.9	90	118
35.8	40.8	-5	90	119
1.8	40.8	-39	90	120
87	40.8	46.2	91	120
41.6	40.8	0.8	92	120
36	40.8	-4.8	92	121
40	40.8	-0.8	92	122
42.4	40.8	1.6	93	122
43.5	40.8	2.7	94	122
38	40.8	-2.8	94	123
1.8	35.8	-34	94	124
87	35.8	51.2	95	124
41.6	35.8	5.8	96	124
36	35.8	0.2	97	124
40	35.8	4.2	98	124
42.4	35.8	6.6	99	124
43.5	35.8	7.7	100	124
38	35.8	2.2	101	124
87	1.8	85.2	102	124
41.6	1.8	39.8	103	124
36	1.8	34.2	104	124
40	1.8	38.2	105	124
42.4	1.8	40.6	106	124
43.5	1.8	41.7	107	124
38	1.8	36.2	108	124
41.6	87	-45.4	108	125
36	87	-51	108	126
40	87	-47	108	127
42.4	87	-44.6	108	128
43.5	87	-43.5	108	129
38	87	-49	108	130
36	41.6	-5.6	108	131
40	41.6	-1.6	108	132
42.4	41.6	0.8	109	132
43.5	41.6	1.9	110	132
38	41.6	-3.6	110	133
40	36	4	111	133
42.4	36	6.4	112	133
43.5	36	7.5	113	133
38	36	2	114	133
42.4	40	2.4	115	133
43.5	40	3.5	116	133
38	40	-2	116	134
43.5	42.4	1.1	117	134
38	42.4	-4.4	117	135
38	43.5	-5.5	117	136

S Statistic = 117 - 136 = -19

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Tied Group Value	Members
<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/12/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 0

B = 0

C = 0

D = 0

E = 0

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1433.67

Z-Score = -0.475388

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-0.475388 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-09

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
1.13	ND<0	1.13	1	0
0.212	ND<0	0.212	2	0
0.728	ND<0	0.728	3	0
ND<0	ND<0	0	3	0
0.1	ND<0	0.1	4	0
4.87	ND<0	4.87	5	0
ND<0	ND<0	0	5	0
2.24	ND<0	2.24	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
5.56	ND<0	5.56	7	0
ND<0	ND<0	0	7	0
ND<0	ND<0	0	7	0
0.16	ND<0	0.16	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
1.13	ND<0	1.13	9	0
0.212	ND<0	0.212	10	0
0.728	ND<0	0.728	11	0
ND<0	ND<0	0	11	0
0.1	ND<0	0.1	12	0
4.87	ND<0	4.87	13	0
ND<0	ND<0	0	13	0
2.24	ND<0	2.24	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
5.56	ND<0	5.56	15	0
ND<0	ND<0	0	15	0
ND<0	ND<0	0	15	0
0.16	ND<0	0.16	16	0
ND<0	ND<0	0	16	0

ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
1.13	ND<0	1.13	17	0
0.212	ND<0	0.212	18	0
0.728	ND<0	0.728	19	0
ND<0	ND<0	0	19	0
0.1	ND<0	0.1	20	0
4.87	ND<0	4.87	21	0
ND<0	ND<0	0	21	0
2.24	ND<0	2.24	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
5.56	ND<0	5.56	23	0
ND<0	ND<0	0	23	0
ND<0	ND<0	0	23	0
0.16	ND<0	0.16	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
1.13	ND<0	1.13	25	0
0.212	ND<0	0.212	26	0
0.728	ND<0	0.728	27	0
ND<0	ND<0	0	27	0
0.1	ND<0	0.1	28	0
4.87	ND<0	4.87	29	0
ND<0	ND<0	0	29	0
2.24	ND<0	2.24	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
5.56	ND<0	5.56	31	0
ND<0	ND<0	0	31	0
ND<0	ND<0	0	31	0
0.16	ND<0	0.16	32	0
ND<0	ND<0	0	32	0
ND<0	ND<0	0	32	0
1.13	ND<0	1.13	33	0
0.212	ND<0	0.212	34	0
0.728	ND<0	0.728	35	0
ND<0	ND<0	0	35	0
0.1	ND<0	0.1	36	0
4.87	ND<0	4.87	37	0
ND<0	ND<0	0	37	0
2.24	ND<0	2.24	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
5.56	ND<0	5.56	39	0
ND<0	ND<0	0	39	0
ND<0	ND<0	0	39	0

0.16	ND<0	0.16	40	0
ND<0	ND<0	0	40	0
1.13	ND<0	1.13	41	0
0.212	ND<0	0.212	42	0
0.728	ND<0	0.728	43	0
ND<0	ND<0	0	43	0
0.1	ND<0	0.1	44	0
4.87	ND<0	4.87	45	0
ND<0	ND<0	0	45	0
2.24	ND<0	2.24	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
5.56	ND<0	5.56	47	0
ND<0	ND<0	0	47	0
ND<0	ND<0	0	47	0
0.16	ND<0	0.16	48	0
1.13	ND<0	1.13	49	0
0.212	ND<0	0.212	50	0
0.728	ND<0	0.728	51	0
ND<0	ND<0	0	51	0
0.1	ND<0	0.1	52	0
4.87	ND<0	4.87	53	0
ND<0	ND<0	0	53	0
2.24	ND<0	2.24	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
5.56	ND<0	5.56	55	0
ND<0	ND<0	0	55	0
ND<0	ND<0	0	55	0
0.16	ND<0	0.16	56	0
0.212	1.13	-0.918	56	1
0.728	1.13	-0.402	56	2
ND<0	1.13	-1.13	56	3
0.1	1.13	-1.03	56	4
4.87	1.13	3.74	57	4
ND<0	1.13	-1.13	57	5
2.24	1.13	1.11	58	5
ND<0	1.13	-1.13	58	6
ND<0	1.13	-1.13	58	7
ND<0	1.13	-1.13	58	8
ND<0	1.13	-1.13	58	9
5.56	1.13	4.43	59	9
ND<0	1.13	-1.13	59	10
ND<0	1.13	-1.13	59	11
0.16	1.13	-0.97	59	12
0.728	0.212	0.516	60	12
ND<0	0.212	-0.212	60	13
0.1	0.212	-0.112	60	14
4.87	0.212	4.658	61	14

ND<0	0.212	-0.212	61	15
2.24	0.212	2.028	62	15
ND<0	0.212	-0.212	62	16
ND<0	0.212	-0.212	62	17
ND<0	0.212	-0.212	62	18
ND<0	0.212	-0.212	62	19
5.56	0.212	5.348	63	19
ND<0	0.212	-0.212	63	20
ND<0	0.212	-0.212	63	21
0.16	0.212	-0.052	63	22
ND<0	0.728	-0.728	63	23
0.1	0.728	-0.628	63	24
4.87	0.728	4.142	64	24
ND<0	0.728	-0.728	64	25
2.24	0.728	1.512	65	25
ND<0	0.728	-0.728	65	26
ND<0	0.728	-0.728	65	27
ND<0	0.728	-0.728	65	28
ND<0	0.728	-0.728	65	29
5.56	0.728	4.832	66	29
ND<0	0.728	-0.728	66	30
ND<0	0.728	-0.728	66	31
0.16	0.728	-0.568	66	32
0.1	ND<0	0.1	67	32
4.87	ND<0	4.87	68	32
ND<0	ND<0	0	68	32
2.24	ND<0	2.24	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
5.56	ND<0	5.56	70	32
ND<0	ND<0	0	70	32
ND<0	ND<0	0	70	32
0.16	ND<0	0.16	71	32
4.87	0.1	4.77	72	32
ND<0	0.1	-0.1	72	33
2.24	0.1	2.14	73	33
ND<0	0.1	-0.1	73	34
ND<0	0.1	-0.1	73	35
ND<0	0.1	-0.1	73	36
ND<0	0.1	-0.1	73	37
5.56	0.1	5.46	74	37
ND<0	0.1	-0.1	74	38
ND<0	0.1	-0.1	74	39
0.16	0.1	0.06	75	39
ND<0	4.87	-4.87	75	40
2.24	4.87	-2.63	75	41
ND<0	4.87	-4.87	75	42
ND<0	4.87	-4.87	75	43
ND<0	4.87	-4.87	75	44
ND<0	4.87	-4.87	75	45
5.56	4.87	0.69	76	45

ND<0	4.87	-4.87	76	46
ND<0	4.87	-4.87	76	47
0.16	4.87	-4.71	76	48
2.24	ND<0	2.24	77	48
ND<0	ND<0	0	77	48
ND<0	ND<0	0	77	48
ND<0	ND<0	0	77	48
ND<0	ND<0	0	77	48
5.56	ND<0	5.56	78	48
ND<0	ND<0	0	78	48
ND<0	ND<0	0	78	48
0.16	ND<0	0.16	79	48
ND<0	2.24	-2.24	79	49
ND<0	2.24	-2.24	79	50
ND<0	2.24	-2.24	79	51
ND<0	2.24	-2.24	79	52
5.56	2.24	3.32	80	52
ND<0	2.24	-2.24	80	53
ND<0	2.24	-2.24	80	54
0.16	2.24	-2.08	80	55
ND<0	ND<0	0	80	55
ND<0	ND<0	0	80	55
ND<0	ND<0	0	80	55
5.56	ND<0	5.56	81	55
ND<0	ND<0	0	81	55
ND<0	ND<0	0	81	55
0.16	ND<0	0.16	82	55
ND<0	ND<0	0	82	55
ND<0	ND<0	0	82	55
5.56	ND<0	5.56	83	55
ND<0	ND<0	0	83	55
ND<0	ND<0	0	83	55
0.16	ND<0	0.16	84	55
ND<0	ND<0	0	84	55
5.56	ND<0	5.56	85	55
ND<0	ND<0	0	85	55
ND<0	ND<0	0	85	55
0.16	ND<0	0.16	86	55
5.56	ND<0	5.56	87	55
ND<0	ND<0	0	87	55
ND<0	ND<0	0	87	55
0.16	ND<0	0.16	88	55
ND<0	5.56	-5.56	88	56
ND<0	5.56	-5.56	88	57
0.16	5.56	-5.4	88	58
ND<0	ND<0	0	88	58
0.16	ND<0	0.16	89	58
0.16	ND<0	0.16	90	58



S Statistic =  $90 - 58 = 32$

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Tied Group Value		Members
1	0	15

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Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 7350

B = 0

C = 2730

D = 0

E = 210

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1025.33

Z-Score = 0.96812

Comparison Level at 95% confidence level = -1.65463 (downward trend)

0.96812 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Aluminum

Location: SW-09

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
ND<0	ND<0	0	0	0
1.13	ND<0	1.13	1	0
0.212	ND<0	0.212	2	0
0.728	ND<0	0.728	3	0
ND<0	ND<0	0	3	0
0.1	ND<0	0.1	4	0
4.87	ND<0	4.87	5	0
ND<0	ND<0	0	5	0
2.24	ND<0	2.24	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
ND<0	ND<0	0	6	0
5.56	ND<0	5.56	7	0
ND<0	ND<0	0	7	0
ND<0	ND<0	0	7	0
0.16	ND<0	0.16	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
ND<0	ND<0	0	8	0
1.13	ND<0	1.13	9	0
0.212	ND<0	0.212	10	0
0.728	ND<0	0.728	11	0
ND<0	ND<0	0	11	0
0.1	ND<0	0.1	12	0
4.87	ND<0	4.87	13	0
ND<0	ND<0	0	13	0
2.24	ND<0	2.24	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
ND<0	ND<0	0	14	0
5.56	ND<0	5.56	15	0
ND<0	ND<0	0	15	0
ND<0	ND<0	0	15	0
0.16	ND<0	0.16	16	0
ND<0	ND<0	0	16	0

ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
ND<0	ND<0	0	16	0
1.13	ND<0	1.13	17	0
0.212	ND<0	0.212	18	0
0.728	ND<0	0.728	19	0
ND<0	ND<0	0	19	0
0.1	ND<0	0.1	20	0
4.87	ND<0	4.87	21	0
ND<0	ND<0	0	21	0
2.24	ND<0	2.24	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
ND<0	ND<0	0	22	0
5.56	ND<0	5.56	23	0
ND<0	ND<0	0	23	0
ND<0	ND<0	0	23	0
0.16	ND<0	0.16	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
ND<0	ND<0	0	24	0
1.13	ND<0	1.13	25	0
0.212	ND<0	0.212	26	0
0.728	ND<0	0.728	27	0
ND<0	ND<0	0	27	0
0.1	ND<0	0.1	28	0
4.87	ND<0	4.87	29	0
ND<0	ND<0	0	29	0
2.24	ND<0	2.24	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
ND<0	ND<0	0	30	0
5.56	ND<0	5.56	31	0
ND<0	ND<0	0	31	0
ND<0	ND<0	0	31	0
0.16	ND<0	0.16	32	0
ND<0	ND<0	0	32	0
ND<0	ND<0	0	32	0
1.13	ND<0	1.13	33	0
0.212	ND<0	0.212	34	0
0.728	ND<0	0.728	35	0
ND<0	ND<0	0	35	0
0.1	ND<0	0.1	36	0
4.87	ND<0	4.87	37	0
ND<0	ND<0	0	37	0
2.24	ND<0	2.24	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
ND<0	ND<0	0	38	0
5.56	ND<0	5.56	39	0
ND<0	ND<0	0	39	0
ND<0	ND<0	0	39	0

0.16	ND<0	0.16	40	0
ND<0	ND<0	0	40	0
1.13	ND<0	1.13	41	0
0.212	ND<0	0.212	42	0
0.728	ND<0	0.728	43	0
ND<0	ND<0	0	43	0
0.1	ND<0	0.1	44	0
4.87	ND<0	4.87	45	0
ND<0	ND<0	0	45	0
2.24	ND<0	2.24	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
ND<0	ND<0	0	46	0
5.56	ND<0	5.56	47	0
ND<0	ND<0	0	47	0
ND<0	ND<0	0	47	0
0.16	ND<0	0.16	48	0
1.13	ND<0	1.13	49	0
0.212	ND<0	0.212	50	0
0.728	ND<0	0.728	51	0
ND<0	ND<0	0	51	0
0.1	ND<0	0.1	52	0
4.87	ND<0	4.87	53	0
ND<0	ND<0	0	53	0
2.24	ND<0	2.24	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
ND<0	ND<0	0	54	0
5.56	ND<0	5.56	55	0
ND<0	ND<0	0	55	0
ND<0	ND<0	0	55	0
0.16	ND<0	0.16	56	0
0.212	1.13	-0.918	56	1
0.728	1.13	-0.402	56	2
ND<0	1.13	-1.13	56	3
0.1	1.13	-1.03	56	4
4.87	1.13	3.74	57	4
ND<0	1.13	-1.13	57	5
2.24	1.13	1.11	58	5
ND<0	1.13	-1.13	58	6
ND<0	1.13	-1.13	58	7
ND<0	1.13	-1.13	58	8
ND<0	1.13	-1.13	58	9
5.56	1.13	4.43	59	9
ND<0	1.13	-1.13	59	10
ND<0	1.13	-1.13	59	11
0.16	1.13	-0.97	59	12
0.728	0.212	0.516	60	12
ND<0	0.212	-0.212	60	13
0.1	0.212	-0.112	60	14
4.87	0.212	4.658	61	14

ND<0	0.212	-0.212	61	15
2.24	0.212	2.028	62	15
ND<0	0.212	-0.212	62	16
ND<0	0.212	-0.212	62	17
ND<0	0.212	-0.212	62	18
ND<0	0.212	-0.212	62	19
5.56	0.212	5.348	63	19
ND<0	0.212	-0.212	63	20
ND<0	0.212	-0.212	63	21
0.16	0.212	-0.052	63	22
ND<0	0.728	-0.728	63	23
0.1	0.728	-0.628	63	24
4.87	0.728	4.142	64	24
ND<0	0.728	-0.728	64	25
2.24	0.728	1.512	65	25
ND<0	0.728	-0.728	65	26
ND<0	0.728	-0.728	65	27
ND<0	0.728	-0.728	65	28
ND<0	0.728	-0.728	65	29
5.56	0.728	4.832	66	29
ND<0	0.728	-0.728	66	30
ND<0	0.728	-0.728	66	31
0.16	0.728	-0.568	66	32
0.1	ND<0	0.1	67	32
4.87	ND<0	4.87	68	32
ND<0	ND<0	0	68	32
2.24	ND<0	2.24	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
ND<0	ND<0	0	69	32
5.56	ND<0	5.56	70	32
ND<0	ND<0	0	70	32
ND<0	ND<0	0	70	32
0.16	ND<0	0.16	71	32
4.87	0.1	4.77	72	32
ND<0	0.1	-0.1	72	33
2.24	0.1	2.14	73	33
ND<0	0.1	-0.1	73	34
ND<0	0.1	-0.1	73	35
ND<0	0.1	-0.1	73	36
ND<0	0.1	-0.1	73	37
5.56	0.1	5.46	74	37
ND<0	0.1	-0.1	74	38
ND<0	0.1	-0.1	74	39
0.16	0.1	0.06	75	39
ND<0	4.87	-4.87	75	40
2.24	4.87	-2.63	75	41
ND<0	4.87	-4.87	75	42
ND<0	4.87	-4.87	75	43
ND<0	4.87	-4.87	75	44
ND<0	4.87	-4.87	75	45
5.56	4.87	0.69	76	45

ND<0	4.87	-4.87	76	46
ND<0	4.87	-4.87	76	47
0.16	4.87	-4.71	76	48
2.24	ND<0	2.24	77	48
ND<0	ND<0	0	77	48
ND<0	ND<0	0	77	48
ND<0	ND<0	0	77	48
ND<0	ND<0	0	77	48
5.56	ND<0	5.56	78	48
ND<0	ND<0	0	78	48
ND<0	ND<0	0	78	48
0.16	ND<0	0.16	79	48
ND<0	2.24	-2.24	79	49
ND<0	2.24	-2.24	79	50
ND<0	2.24	-2.24	79	51
ND<0	2.24	-2.24	79	52
5.56	2.24	3.32	80	52
ND<0	2.24	-2.24	80	53
ND<0	2.24	-2.24	80	54
0.16	2.24	-2.08	80	55
ND<0	ND<0	0	80	55
ND<0	ND<0	0	80	55
ND<0	ND<0	0	80	55
5.56	ND<0	5.56	81	55
ND<0	ND<0	0	81	55
ND<0	ND<0	0	81	55
0.16	ND<0	0.16	82	55
ND<0	ND<0	0	82	55
ND<0	ND<0	0	82	55
5.56	ND<0	5.56	83	55
ND<0	ND<0	0	83	55
ND<0	ND<0	0	83	55
0.16	ND<0	0.16	84	55
ND<0	ND<0	0	84	55
5.56	ND<0	5.56	85	55
ND<0	ND<0	0	85	55
ND<0	ND<0	0	85	55
0.16	ND<0	0.16	86	55
5.56	ND<0	5.56	87	55
ND<0	ND<0	0	87	55
ND<0	ND<0	0	87	55
0.16	ND<0	0.16	88	55
ND<0	5.56	-5.56	88	56
ND<0	5.56	-5.56	88	57
0.16	5.56	-5.4	88	58
ND<0	ND<0	0	88	58
0.16	ND<0	0.16	89	58
0.16	ND<0	0.16	90	58

S Statistic = 90 - 58 = 32

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Tied Group Value		Members
1	0	15

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Time Period	Observations
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 7350

B = 0

C = 2730

D = 0

E = 210

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1025.33

Z-Score = 0.96812

Comparison Level at 95% confidence level = 1.65463 (upward trend)

0.96812 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-01

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
87	112	-25	0	1
63	112	-49	0	2
77	112	-35	0	3
133	112	21	1	3
190	112	78	2	3
78	112	-34	2	4
96	112	-16	2	5
110	112	-2	2	6
93	112	-19	2	7
64	112	-48	2	8
94	112	-18	2	9
91	112	-21	2	10
98	112	-14	2	11
92	112	-20	2	12
96	112	-16	2	13
130	112	18	3	13
110	112	-2	3	14
130	112	18	4	14
46	112	-66	4	15
130	112	18	5	15
110	112	-2	5	16
130	112	18	6	16
130	112	18	7	16
130	112	18	8	16
120	112	8	9	16
140	112	28	10	16
93	112	-19	10	17
85	112	-27	10	18
69.4	112	-42.6	10	19
63	87	-24	10	20
77	87	-10	10	21
133	87	46	11	21
190	87	103	12	21
78	87	-9	12	22
96	87	9	13	22
110	87	23	14	22
93	87	6	15	22
64	87	-23	15	23
94	87	7	16	23
91	87	4	17	23
98	87	11	18	23
92	87	5	19	23
96	87	9	20	23
130	87	43	21	23
110	87	23	22	23



130	87	43	23	23
46	87	-41	23	24
130	87	43	24	24
110	87	23	25	24
130	87	43	26	24
130	87	43	27	24
130	87	43	28	24
120	87	33	29	24
140	87	53	30	24
93	87	6	31	24
85	87	-2	31	25
69.4	87	-17.6	31	26
77	63	14	32	26
133	63	70	33	26
190	63	127	34	26
78	63	15	35	26
96	63	33	36	26
110	63	47	37	26
93	63	30	38	26
64	63	1	39	26
94	63	31	40	26
91	63	28	41	26
98	63	35	42	26
92	63	29	43	26
96	63	33	44	26
130	63	67	45	26
110	63	47	46	26
130	63	67	47	26
46	63	-17	47	27
130	63	67	48	27
110	63	47	49	27
130	63	67	50	27
130	63	67	51	27
130	63	67	52	27
120	63	57	53	27
140	63	77	54	27
93	63	30	55	27
85	63	22	56	27
69.4	63	6.4	57	27
133	77	56	58	27
190	77	113	59	27
78	77	1	60	27
96	77	19	61	27
110	77	33	62	27
93	77	16	63	27
64	77	-13	63	28
94	77	17	64	28
91	77	14	65	28
98	77	21	66	28
92	77	15	67	28
96	77	19	68	28
130	77	53	69	28
110	77	33	70	28
130	77	53	71	28
46	77	-31	71	29

130	77	53	72	29
110	77	33	73	29
130	77	53	74	29
130	77	53	75	29
130	77	53	76	29
120	77	43	77	29
140	77	63	78	29
93	77	16	79	29
85	77	8	80	29
69.4	77	-7.6	80	30

190	133	57	81	30
78	133	-55	81	31
96	133	-37	81	32
110	133	-23	81	33
93	133	-40	81	34
64	133	-69	81	35
94	133	-39	81	36
91	133	-42	81	37
98	133	-35	81	38
92	133	-41	81	39
96	133	-37	81	40
130	133	-3	81	41
110	133	-23	81	42
130	133	-3	81	43
46	133	-87	81	44
130	133	-3	81	45
110	133	-23	81	46
130	133	-3	81	47
130	133	-3	81	48
130	133	-3	81	49
120	133	-13	81	50
140	133	7	82	50
93	133	-40	82	51
85	133	-48	82	52
69.4	133	-63.6	82	53

78	190	-112	82	54
96	190	-94	82	55
110	190	-80	82	56
93	190	-97	82	57
64	190	-126	82	58
94	190	-96	82	59
91	190	-99	82	60
98	190	-92	82	61
92	190	-98	82	62
96	190	-94	82	63
130	190	-60	82	64
110	190	-80	82	65
130	190	-60	82	66
46	190	-144	82	67
130	190	-60	82	68
110	190	-80	82	69
130	190	-60	82	70
130	190	-60	82	71
130	190	-60	82	72
120	190	-70	82	73

140	190	-50	82	74
93	190	-97	82	75
85	190	-105	82	76
69.4	190	-120.6	82	77
96	78	18	83	77
110	78	32	84	77
93	78	15	85	77
64	78	-14	85	78
94	78	16	86	78
91	78	13	87	78
98	78	20	88	78
92	78	14	89	78
96	78	18	90	78
130	78	52	91	78
110	78	32	92	78
130	78	52	93	78
46	78	-32	93	79
130	78	52	94	79
110	78	32	95	79
130	78	52	96	79
130	78	52	97	79
130	78	52	98	79
120	78	42	99	79
140	78	62	100	79
93	78	15	101	79
85	78	7	102	79
69.4	78	-8.6	102	80
110	96	14	103	80
93	96	-3	103	81
64	96	-32	103	82
94	96	-2	103	83
91	96	-5	103	84
98	96	2	104	84
92	96	-4	104	85
96	96	0	104	85
130	96	34	105	85
110	96	14	106	85
130	96	34	107	85
46	96	-50	107	86
130	96	34	108	86
110	96	14	109	86
130	96	34	110	86
130	96	34	111	86
130	96	34	112	86
120	96	24	113	86
140	96	44	114	86
93	96	-3	114	87
85	96	-11	114	88
69.4	96	-26.6	114	89
93	110	-17	114	90
64	110	-46	114	91
94	110	-16	114	92
91	110	-19	114	93
98	110	-12	114	94

92	110	-18	114	95
96	110	-14	114	96
130	110	20	115	96
110	110	0	115	96
130	110	20	116	96
46	110	-64	116	97
130	110	20	117	97
110	110	0	117	97
130	110	20	118	97
130	110	20	119	97
130	110	20	120	97
120	110	10	121	97
140	110	30	122	97
93	110	-17	122	98
85	110	-25	122	99
69.4	110	-40.6	122	100
64	93	-29	122	101
94	93	1	123	101
91	93	-2	123	102
98	93	5	124	102
92	93	-1	124	103
96	93	3	125	103
130	93	37	126	103
110	93	17	127	103
130	93	37	128	103
46	93	-47	128	104
130	93	37	129	104
110	93	17	130	104
130	93	37	131	104
130	93	37	132	104
130	93	37	133	104
120	93	27	134	104
140	93	47	135	104
93	93	0	135	104
85	93	-8	135	105
69.4	93	-23.6	135	106
94	64	30	136	106
91	64	27	137	106
98	64	34	138	106
92	64	28	139	106
96	64	32	140	106
130	64	66	141	106
110	64	46	142	106
130	64	66	143	106
46	64	-18	143	107
130	64	66	144	107
110	64	46	145	107
130	64	66	146	107
130	64	66	147	107
130	64	66	148	107
120	64	56	149	107
140	64	76	150	107
93	64	29	151	107
85	64	21	152	107
69.4	64	5.4	153	107

91	94	-3	153	108
98	94	4	154	108
92	94	-2	154	109
96	94	2	155	109
130	94	36	156	109
110	94	16	157	109
130	94	36	158	109
46	94	-48	158	110
130	94	36	159	110
110	94	16	160	110
130	94	36	161	110
130	94	36	162	110
130	94	36	163	110
120	94	26	164	110
140	94	46	165	110
93	94	-1	165	111
85	94	-9	165	112
69.4	94	-24.6	165	113
98	91	7	166	113
92	91	1	167	113
96	91	5	168	113
130	91	39	169	113
110	91	19	170	113
130	91	39	171	113
46	91	-45	171	114
130	91	39	172	114
110	91	19	173	114
130	91	39	174	114
130	91	39	175	114
130	91	39	176	114
120	91	29	177	114
140	91	49	178	114
93	91	2	179	114
85	91	-6	179	115
69.4	91	-21.6	179	116
92	98	-6	179	117
96	98	-2	179	118
130	98	32	180	118
110	98	12	181	118
130	98	32	182	118
46	98	-52	182	119
130	98	32	183	119
110	98	12	184	119
130	98	32	185	119
130	98	32	186	119
130	98	32	187	119
120	98	22	188	119
140	98	42	189	119
93	98	-5	189	120
85	98	-13	189	121
69.4	98	-28.6	189	122
96	92	4	190	122
130	92	38	191	122

110	92	18	192	122
130	92	38	193	122
46	92	-46	193	123
130	92	38	194	123
110	92	18	195	123
130	92	38	196	123
130	92	38	197	123
130	92	38	198	123
120	92	28	199	123
140	92	48	200	123
93	92	1	201	123
85	92	-7	201	124
69.4	92	-22.6	201	125
130	96	34	202	125
110	96	14	203	125
130	96	34	204	125
46	96	-50	204	126
130	96	34	205	126
110	96	14	206	126
130	96	34	207	126
130	96	34	208	126
130	96	34	209	126
120	96	24	210	126
140	96	44	211	126
93	96	-3	211	127
85	96	-11	211	128
69.4	96	-26.6	211	129
110	130	-20	211	130
130	130	0	211	130
46	130	-84	211	131
130	130	0	211	131
110	130	-20	211	132
130	130	0	211	132
130	130	0	211	132
130	130	0	211	132
120	130	-10	211	133
140	130	10	212	133
93	130	-37	212	134
85	130	-45	212	135
69.4	130	-60.6	212	136
130	110	20	213	136
46	110	-64	213	137
130	110	20	214	137
110	110	0	214	137
130	110	20	215	137
130	110	20	216	137
130	110	20	217	137
120	110	10	218	137
140	110	30	219	137
93	110	-17	219	138
85	110	-25	219	139
69.4	110	-40.6	219	140
46	130	-84	219	141

130	130	0	219	141
110	130	-20	219	142
130	130	0	219	142
130	130	0	219	142
130	130	0	219	142
120	130	-10	219	143
140	130	10	220	143
93	130	-37	220	144
85	130	-45	220	145
69.4	130	-60.6	220	146
130	46	84	221	146
110	46	64	222	146
130	46	84	223	146
130	46	84	224	146
130	46	84	225	146
120	46	74	226	146
140	46	94	227	146
93	46	47	228	146
85	46	39	229	146
69.4	46	23.4	230	146
110	130	-20	230	147
130	130	0	230	147
130	130	0	230	147
130	130	0	230	147
120	130	-10	230	148
140	130	10	231	148
93	130	-37	231	149
85	130	-45	231	150
69.4	130	-60.6	231	151
130	110	20	232	151
130	110	20	233	151
130	110	20	234	151
120	110	10	235	151
140	110	30	236	151
93	110	-17	236	152
85	110	-25	236	153
69.4	110	-40.6	236	154
130	130	0	236	154
130	130	0	236	154
120	130	-10	236	155
140	130	10	237	155
93	130	-37	237	156
85	130	-45	237	157
69.4	130	-60.6	237	158
130	130	0	237	158
120	130	-10	237	159
140	130	10	238	159
93	130	-37	238	160
85	130	-45	238	161
69.4	130	-60.6	238	162
120	130	-10	238	163

140	130	10	239	163
93	130	-37	239	164
85	130	-45	239	165
69.4	130	-60.6	239	166
140	120	20	240	166
93	120	-27	240	167
85	120	-35	240	168
69.4	120	-50.6	240	169
93	140	-47	240	170
85	140	-55	240	171
69.4	140	-70.6	240	172
85	93	-8	240	173
69.4	93	-23.6	240	174
69.4	85	-15.6	240	175

S Statistic = 240 - 175 = 65

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<b>Tied Group Value</b>		<b>Members</b>
1	96	2
2	110	3
3	93	2
4	130	6

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<b>Time Period</b>	<b>Observations</b>
6/1/2005	1
2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1



10/5/2017 1  
4/4/2018 1  
There are 0 time periods with multiple data

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A = 612  
B = 0  
C = 126  
D = 0  
E = 40  
F = 0  
a = 56550  
b = 219240  
c = 1740  
Group Variance = 3107.67  
Z-Score = 1.14806  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
1.14806 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-01

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
87	112	-25	0	1
63	112	-49	0	2
77	112	-35	0	3
133	112	21	1	3
190	112	78	2	3
78	112	-34	2	4
96	112	-16	2	5
110	112	-2	2	6
93	112	-19	2	7
64	112	-48	2	8
94	112	-18	2	9
91	112	-21	2	10
98	112	-14	2	11
92	112	-20	2	12
96	112	-16	2	13
130	112	18	3	13
110	112	-2	3	14
130	112	18	4	14
46	112	-66	4	15
130	112	18	5	15
110	112	-2	5	16
130	112	18	6	16
130	112	18	7	16
130	112	18	8	16
120	112	8	9	16
140	112	28	10	16
93	112	-19	10	17
85	112	-27	10	18
69.4	112	-42.6	10	19
63	87	-24	10	20
77	87	-10	10	21
133	87	46	11	21
190	87	103	12	21
78	87	-9	12	22
96	87	9	13	22
110	87	23	14	22
93	87	6	15	22
64	87	-23	15	23
94	87	7	16	23
91	87	4	17	23
98	87	11	18	23
92	87	5	19	23
96	87	9	20	23
130	87	43	21	23
110	87	23	22	23

130	87	43	23	23
46	87	-41	23	24
130	87	43	24	24
110	87	23	25	24
130	87	43	26	24
130	87	43	27	24
130	87	43	28	24
120	87	33	29	24
140	87	53	30	24
93	87	6	31	24
85	87	-2	31	25
69.4	87	-17.6	31	26
77	63	14	32	26
133	63	70	33	26
190	63	127	34	26
78	63	15	35	26
96	63	33	36	26
110	63	47	37	26
93	63	30	38	26
64	63	1	39	26
94	63	31	40	26
91	63	28	41	26
98	63	35	42	26
92	63	29	43	26
96	63	33	44	26
130	63	67	45	26
110	63	47	46	26
130	63	67	47	26
46	63	-17	47	27
130	63	67	48	27
110	63	47	49	27
130	63	67	50	27
130	63	67	51	27
130	63	67	52	27
120	63	57	53	27
140	63	77	54	27
93	63	30	55	27
85	63	22	56	27
69.4	63	6.4	57	27
133	77	56	58	27
190	77	113	59	27
78	77	1	60	27
96	77	19	61	27
110	77	33	62	27
93	77	16	63	27
64	77	-13	63	28
94	77	17	64	28
91	77	14	65	28
98	77	21	66	28
92	77	15	67	28
96	77	19	68	28
130	77	53	69	28
110	77	33	70	28
130	77	53	71	28
46	77	-31	71	29

130	77	53	72	29
110	77	33	73	29
130	77	53	74	29
130	77	53	75	29
130	77	53	76	29
120	77	43	77	29
140	77	63	78	29
93	77	16	79	29
85	77	8	80	29
69.4	77	-7.6	80	30

190	133	57	81	30
78	133	-55	81	31
96	133	-37	81	32
110	133	-23	81	33
93	133	-40	81	34
64	133	-69	81	35
94	133	-39	81	36
91	133	-42	81	37
98	133	-35	81	38
92	133	-41	81	39
96	133	-37	81	40
130	133	-3	81	41
110	133	-23	81	42
130	133	-3	81	43
46	133	-87	81	44
130	133	-3	81	45
110	133	-23	81	46
130	133	-3	81	47
130	133	-3	81	48
130	133	-3	81	49
120	133	-13	81	50
140	133	7	82	50
93	133	-40	82	51
85	133	-48	82	52
69.4	133	-63.6	82	53

78	190	-112	82	54
96	190	-94	82	55
110	190	-80	82	56
93	190	-97	82	57
64	190	-126	82	58
94	190	-96	82	59
91	190	-99	82	60
98	190	-92	82	61
92	190	-98	82	62
96	190	-94	82	63
130	190	-60	82	64
110	190	-80	82	65
130	190	-60	82	66
46	190	-144	82	67
130	190	-60	82	68
110	190	-80	82	69
130	190	-60	82	70
130	190	-60	82	71
130	190	-60	82	72
120	190	-70	82	73

140	190	-50	82	74
93	190	-97	82	75
85	190	-105	82	76
69.4	190	-120.6	82	77
96	78	18	83	77
110	78	32	84	77
93	78	15	85	77
64	78	-14	85	78
94	78	16	86	78
91	78	13	87	78
98	78	20	88	78
92	78	14	89	78
96	78	18	90	78
130	78	52	91	78
110	78	32	92	78
130	78	52	93	78
46	78	-32	93	79
130	78	52	94	79
110	78	32	95	79
130	78	52	96	79
130	78	52	97	79
130	78	52	98	79
120	78	42	99	79
140	78	62	100	79
93	78	15	101	79
85	78	7	102	79
69.4	78	-8.6	102	80
110	96	14	103	80
93	96	-3	103	81
64	96	-32	103	82
94	96	-2	103	83
91	96	-5	103	84
98	96	2	104	84
92	96	-4	104	85
96	96	0	104	85
130	96	34	105	85
110	96	14	106	85
130	96	34	107	85
46	96	-50	107	86
130	96	34	108	86
110	96	14	109	86
130	96	34	110	86
130	96	34	111	86
130	96	34	112	86
120	96	24	113	86
140	96	44	114	86
93	96	-3	114	87
85	96	-11	114	88
69.4	96	-26.6	114	89
93	110	-17	114	90
64	110	-46	114	91
94	110	-16	114	92
91	110	-19	114	93
98	110	-12	114	94

92	110	-18	114	95
96	110	-14	114	96
130	110	20	115	96
110	110	0	115	96
130	110	20	116	96
46	110	-64	116	97
130	110	20	117	97
110	110	0	117	97
130	110	20	118	97
130	110	20	119	97
130	110	20	120	97
120	110	10	121	97
140	110	30	122	97
93	110	-17	122	98
85	110	-25	122	99
69.4	110	-40.6	122	100
64	93	-29	122	101
94	93	1	123	101
91	93	-2	123	102
98	93	5	124	102
92	93	-1	124	103
96	93	3	125	103
130	93	37	126	103
110	93	17	127	103
130	93	37	128	103
46	93	-47	128	104
130	93	37	129	104
110	93	17	130	104
130	93	37	131	104
130	93	37	132	104
130	93	37	133	104
120	93	27	134	104
140	93	47	135	104
93	93	0	135	104
85	93	-8	135	105
69.4	93	-23.6	135	106
94	64	30	136	106
91	64	27	137	106
98	64	34	138	106
92	64	28	139	106
96	64	32	140	106
130	64	66	141	106
110	64	46	142	106
130	64	66	143	106
46	64	-18	143	107
130	64	66	144	107
110	64	46	145	107
130	64	66	146	107
130	64	66	147	107
130	64	66	148	107
120	64	56	149	107
140	64	76	150	107
93	64	29	151	107
85	64	21	152	107
69.4	64	5.4	153	107

91	94	-3	153	108
98	94	4	154	108
92	94	-2	154	109
96	94	2	155	109
130	94	36	156	109
110	94	16	157	109
130	94	36	158	109
46	94	-48	158	110
130	94	36	159	110
110	94	16	160	110
130	94	36	161	110
130	94	36	162	110
130	94	36	163	110
120	94	26	164	110
140	94	46	165	110
93	94	-1	165	111
85	94	-9	165	112
69.4	94	-24.6	165	113
98	91	7	166	113
92	91	1	167	113
96	91	5	168	113
130	91	39	169	113
110	91	19	170	113
130	91	39	171	113
46	91	-45	171	114
130	91	39	172	114
110	91	19	173	114
130	91	39	174	114
130	91	39	175	114
130	91	39	176	114
120	91	29	177	114
140	91	49	178	114
93	91	2	179	114
85	91	-6	179	115
69.4	91	-21.6	179	116
92	98	-6	179	117
96	98	-2	179	118
130	98	32	180	118
110	98	12	181	118
130	98	32	182	118
46	98	-52	182	119
130	98	32	183	119
110	98	12	184	119
130	98	32	185	119
130	98	32	186	119
130	98	32	187	119
120	98	22	188	119
140	98	42	189	119
93	98	-5	189	120
85	98	-13	189	121
69.4	98	-28.6	189	122
96	92	4	190	122
130	92	38	191	122

110	92	18	192	122
130	92	38	193	122
46	92	-46	193	123
130	92	38	194	123
110	92	18	195	123
130	92	38	196	123
130	92	38	197	123
130	92	38	198	123
120	92	28	199	123
140	92	48	200	123
93	92	1	201	123
85	92	-7	201	124
69.4	92	-22.6	201	125
130	96	34	202	125
110	96	14	203	125
130	96	34	204	125
46	96	-50	204	126
130	96	34	205	126
110	96	14	206	126
130	96	34	207	126
130	96	34	208	126
130	96	34	209	126
120	96	24	210	126
140	96	44	211	126
93	96	-3	211	127
85	96	-11	211	128
69.4	96	-26.6	211	129
110	130	-20	211	130
130	130	0	211	130
46	130	-84	211	131
130	130	0	211	131
110	130	-20	211	132
130	130	0	211	132
130	130	0	211	132
130	130	0	211	132
120	130	-10	211	133
140	130	10	212	133
93	130	-37	212	134
85	130	-45	212	135
69.4	130	-60.6	212	136
130	110	20	213	136
46	110	-64	213	137
130	110	20	214	137
110	110	0	214	137
130	110	20	215	137
130	110	20	216	137
130	110	20	217	137
120	110	10	218	137
140	110	30	219	137
93	110	-17	219	138
85	110	-25	219	139
69.4	110	-40.6	219	140
46	130	-84	219	141



130	130	0	219	141
110	130	-20	219	142
130	130	0	219	142
130	130	0	219	142
130	130	0	219	142
120	130	-10	219	143
140	130	10	220	143
93	130	-37	220	144
85	130	-45	220	145
69.4	130	-60.6	220	146
130	46	84	221	146
110	46	64	222	146
130	46	84	223	146
130	46	84	224	146
130	46	84	225	146
120	46	74	226	146
140	46	94	227	146
93	46	47	228	146
85	46	39	229	146
69.4	46	23.4	230	146
110	130	-20	230	147
130	130	0	230	147
130	130	0	230	147
130	130	0	230	147
120	130	-10	230	148
140	130	10	231	148
93	130	-37	231	149
85	130	-45	231	150
69.4	130	-60.6	231	151
130	110	20	232	151
130	110	20	233	151
130	110	20	234	151
120	110	10	235	151
140	110	30	236	151
93	110	-17	236	152
85	110	-25	236	153
69.4	110	-40.6	236	154
130	130	0	236	154
130	130	0	236	154
120	130	-10	236	155
140	130	10	237	155
93	130	-37	237	156
85	130	-45	237	157
69.4	130	-60.6	237	158
130	130	0	237	158
120	130	-10	237	159
140	130	10	238	159
93	130	-37	238	160
85	130	-45	238	161
69.4	130	-60.6	238	162
120	130	-10	238	163

140	130	10	239	163
93	130	-37	239	164
85	130	-45	239	165
69.4	130	-60.6	239	166
140	120	20	240	166
93	120	-27	240	167
85	120	-35	240	168
69.4	120	-50.6	240	169
93	140	-47	240	170
85	140	-55	240	171
69.4	140	-70.6	240	172
85	93	-8	240	173
69.4	93	-23.6	240	174
69.4	85	-15.6	240	175

S Statistic = 240 - 175 = 65

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<b>Tied Group Value</b>		<b>Members</b>
1	96	2
2	110	3
3	93	2
4	130	6

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<b>Time Period</b>	<b>Observations</b>
6/1/2005	1
2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/15/2009	1
9/23/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1

10/5/2017                            1  
4/4/2018                            1  
There are 0 time periods with multiple data

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A = 612  
B = 0  
C = 126  
D = 0  
E = 40  
F = 0  
a = 56550  
b = 219240  
c = 1740  
Group Variance = 3107.67  
Z-Score = 1.14806  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
1.14806 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
3	3	0	0	0
3	3	0	0	0
2	3	-1	0	1
2	3	-1	0	2
57	3	54	1	2
47	3	44	2	2
9	3	6	3	2
44	3	41	4	2
43	3	40	5	2
23	3	20	6	2
16	3	13	7	2
ND<0	3	-3	7	3
28	3	25	8	3
16	3	13	9	3
ND<0	3	-3	9	4
9.3	3	6.3	10	4
ND<0	3	-3	10	5
57	3	54	11	5
15	3	12	12	5
30	3	27	13	5
ND<0	3	-3	13	6
24	3	21	14	6
10	3	7	15	6
5.1	3	2.1	16	6
ND<0	3	-3	16	7
ND<0	3	-3	16	8
ND<0	3	-3	16	9
7.2	3	4.2	17	9
3	3	0	17	9
2	3	-1	17	10
2	3	-1	17	11
57	3	54	18	11
47	3	44	19	11
9	3	6	20	11
44	3	41	21	11
43	3	40	22	11
23	3	20	23	11
16	3	13	24	11
ND<0	3	-3	24	12
28	3	25	25	12
16	3	13	26	12
ND<0	3	-3	26	13
9.3	3	6.3	27	13
ND<0	3	-3	27	14
57	3	54	28	14

15	3	12	29	14
30	3	27	30	14
ND<0	3	-3	30	15
24	3	21	31	15
10	3	7	32	15
5.1	3	2.1	33	15
ND<0	3	-3	33	16
ND<0	3	-3	33	17
ND<0	3	-3	33	18
7.2	3	4.2	34	18

2	3	-1	34	19
2	3	-1	34	20
57	3	54	35	20
47	3	44	36	20
9	3	6	37	20
44	3	41	38	20
43	3	40	39	20
23	3	20	40	20
16	3	13	41	20
ND<0	3	-3	41	21
28	3	25	42	21
16	3	13	43	21
ND<0	3	-3	43	22
9.3	3	6.3	44	22
ND<0	3	-3	44	23
57	3	54	45	23
15	3	12	46	23
30	3	27	47	23
ND<0	3	-3	47	24
24	3	21	48	24
10	3	7	49	24
5.1	3	2.1	50	24
ND<0	3	-3	50	25
ND<0	3	-3	50	26
ND<0	3	-3	50	27
7.2	3	4.2	51	27

2	2	0	51	27
57	2	55	52	27
47	2	45	53	27
9	2	7	54	27
44	2	42	55	27
43	2	41	56	27
23	2	21	57	27
16	2	14	58	27
ND<0	2	-2	58	28
28	2	26	59	28
16	2	14	60	28
ND<0	2	-2	60	29
9.3	2	7.3	61	29
ND<0	2	-2	61	30
57	2	55	62	30
15	2	13	63	30
30	2	28	64	30
ND<0	2	-2	64	31
24	2	22	65	31

10	2	8	66	31
5.1	2	3.1	67	31
ND<0	2	-2	67	32
ND<0	2	-2	67	33
ND<0	2	-2	67	34
7.2	2	5.2	68	34
57	2	55	69	34
47	2	45	70	34
9	2	7	71	34
44	2	42	72	34
43	2	41	73	34
23	2	21	74	34
16	2	14	75	34
ND<0	2	-2	75	35
28	2	26	76	35
16	2	14	77	35
ND<0	2	-2	77	36
9.3	2	7.3	78	36
ND<0	2	-2	78	37
57	2	55	79	37
15	2	13	80	37
30	2	28	81	37
ND<0	2	-2	81	38
24	2	22	82	38
10	2	8	83	38
5.1	2	3.1	84	38
ND<0	2	-2	84	39
ND<0	2	-2	84	40
ND<0	2	-2	84	41
7.2	2	5.2	85	41
47	57	-10	85	42
9	57	-48	85	43
44	57	-13	85	44
43	57	-14	85	45
23	57	-34	85	46
16	57	-41	85	47
ND<0	57	-57	85	48
28	57	-29	85	49
16	57	-41	85	50
ND<0	57	-57	85	51
9.3	57	-47.7	85	52
ND<0	57	-57	85	53
57	57	0	85	53
15	57	-42	85	54
30	57	-27	85	55
ND<0	57	-57	85	56
24	57	-33	85	57
10	57	-47	85	58
5.1	57	-51.9	85	59
ND<0	57	-57	85	60
ND<0	57	-57	85	61
ND<0	57	-57	85	62
7.2	57	-49.8	85	63
9	47	-38	85	64

44	47	-3	85	65
43	47	-4	85	66
23	47	-24	85	67
16	47	-31	85	68
ND<0	47	-47	85	69
28	47	-19	85	70
16	47	-31	85	71
ND<0	47	-47	85	72
9.3	47	-37.7	85	73
ND<0	47	-47	85	74
57	47	10	86	74
15	47	-32	86	75
30	47	-17	86	76
ND<0	47	-47	86	77
24	47	-23	86	78
10	47	-37	86	79
5.1	47	-41.9	86	80
ND<0	47	-47	86	81
ND<0	47	-47	86	82
ND<0	47	-47	86	83
7.2	47	-39.8	86	84

44	9	35	87	84
43	9	34	88	84
23	9	14	89	84
16	9	7	90	84
ND<0	9	-9	90	85
28	9	19	91	85
16	9	7	92	85
ND<0	9	-9	92	86
9.3	9	0.3	93	86
ND<0	9	-9	93	87
57	9	48	94	87
15	9	6	95	87
30	9	21	96	87
ND<0	9	-9	96	88
24	9	15	97	88
10	9	1	98	88
5.1	9	-3.9	98	89
ND<0	9	-9	98	90
ND<0	9	-9	98	91
ND<0	9	-9	98	92
7.2	9	-1.8	98	93

43	44	-1	98	94
23	44	-21	98	95
16	44	-28	98	96
ND<0	44	-44	98	97
28	44	-16	98	98
16	44	-28	98	99
ND<0	44	-44	98	100
9.3	44	-34.7	98	101
ND<0	44	-44	98	102
57	44	13	99	102
15	44	-29	99	103
30	44	-14	99	104
ND<0	44	-44	99	105

24	44	-20	99	106
10	44	-34	99	107
5.1	44	-38.9	99	108
ND<0	44	-44	99	109
ND<0	44	-44	99	110
ND<0	44	-44	99	111
7.2	44	-36.8	99	112
23	43	-20	99	113
16	43	-27	99	114
ND<0	43	-43	99	115
28	43	-15	99	116
16	43	-27	99	117
ND<0	43	-43	99	118
9.3	43	-33.7	99	119
ND<0	43	-43	99	120
57	43	14	100	120
15	43	-28	100	121
30	43	-13	100	122
ND<0	43	-43	100	123
24	43	-19	100	124
10	43	-33	100	125
5.1	43	-37.9	100	126
ND<0	43	-43	100	127
ND<0	43	-43	100	128
ND<0	43	-43	100	129
7.2	43	-35.8	100	130
16	23	-7	100	131
ND<0	23	-23	100	132
28	23	5	101	132
16	23	-7	101	133
ND<0	23	-23	101	134
9.3	23	-13.7	101	135
ND<0	23	-23	101	136
57	23	34	102	136
15	23	-8	102	137
30	23	7	103	137
ND<0	23	-23	103	138
24	23	1	104	138
10	23	-13	104	139
5.1	23	-17.9	104	140
ND<0	23	-23	104	141
ND<0	23	-23	104	142
ND<0	23	-23	104	143
7.2	23	-15.8	104	144
ND<0	16	-16	104	145
28	16	12	105	145
16	16	0	105	145
ND<0	16	-16	105	146
9.3	16	-6.7	105	147
ND<0	16	-16	105	148
57	16	41	106	148
15	16	-1	106	149
30	16	14	107	149
ND<0	16	-16	107	150



24	16	8	108	150
10	16	-6	108	151
5.1	16	-10.9	108	152
ND<0	16	-16	108	153
ND<0	16	-16	108	154
ND<0	16	-16	108	155
7.2	16	-8.8	108	156
28	ND<0	28	109	156
16	ND<0	16	110	156
ND<0	ND<0	0	110	156
9.3	ND<0	9.3	111	156
ND<0	ND<0	0	111	156
57	ND<0	57	112	156
15	ND<0	15	113	156
30	ND<0	30	114	156
ND<0	ND<0	0	114	156
24	ND<0	24	115	156
10	ND<0	10	116	156
5.1	ND<0	5.1	117	156
ND<0	ND<0	0	117	156
ND<0	ND<0	0	117	156
ND<0	ND<0	0	117	156
7.2	ND<0	7.2	118	156
16	28	-12	118	157
ND<0	28	-28	118	158
9.3	28	-18.7	118	159
ND<0	28	-28	118	160
57	28	29	119	160
15	28	-13	119	161
30	28	2	120	161
ND<0	28	-28	120	162
24	28	-4	120	163
10	28	-18	120	164
5.1	28	-22.9	120	165
ND<0	28	-28	120	166
ND<0	28	-28	120	167
ND<0	28	-28	120	168
7.2	28	-20.8	120	169
ND<0	16	-16	120	170
9.3	16	-6.7	120	171
ND<0	16	-16	120	172
57	16	41	121	172
15	16	-1	121	173
30	16	14	122	173
ND<0	16	-16	122	174
24	16	8	123	174
10	16	-6	123	175
5.1	16	-10.9	123	176
ND<0	16	-16	123	177
ND<0	16	-16	123	178
ND<0	16	-16	123	179
7.2	16	-8.8	123	180
9.3	ND<0	9.3	124	180

ND<0	ND<0	0	124	180
57	ND<0	57	125	180
15	ND<0	15	126	180
30	ND<0	30	127	180
ND<0	ND<0	0	127	180
24	ND<0	24	128	180
10	ND<0	10	129	180
5.1	ND<0	5.1	130	180
ND<0	ND<0	0	130	180
ND<0	ND<0	0	130	180
ND<0	ND<0	0	130	180
7.2	ND<0	7.2	131	180
ND<0	9.3	-9.3	131	181
57	9.3	47.7	132	181
15	9.3	5.7	133	181
30	9.3	20.7	134	181
ND<0	9.3	-9.3	134	182
24	9.3	14.7	135	182
10	9.3	0.7	136	182
5.1	9.3	-4.2	136	183
ND<0	9.3	-9.3	136	184
ND<0	9.3	-9.3	136	185
ND<0	9.3	-9.3	136	186
7.2	9.3	-2.1	136	187
57	ND<0	57	137	187
15	ND<0	15	138	187
30	ND<0	30	139	187
ND<0	ND<0	0	139	187
24	ND<0	24	140	187
10	ND<0	10	141	187
5.1	ND<0	5.1	142	187
ND<0	ND<0	0	142	187
ND<0	ND<0	0	142	187
ND<0	ND<0	0	142	187
7.2	ND<0	7.2	143	187
15	57	-42	143	188
30	57	-27	143	189
ND<0	57	-57	143	190
24	57	-33	143	191
10	57	-47	143	192
5.1	57	-51.9	143	193
ND<0	57	-57	143	194
ND<0	57	-57	143	195
ND<0	57	-57	143	196
7.2	57	-49.8	143	197
30	15	15	144	197
ND<0	15	-15	144	198
24	15	9	145	198
10	15	-5	145	199
5.1	15	-9.9	145	200
ND<0	15	-15	145	201
ND<0	15	-15	145	202
ND<0	15	-15	145	203

7.2	15	-7.8	145	204
ND<0	30	-30	145	205
24	30	-6	145	206
10	30	-20	145	207
5.1	30	-24.9	145	208
ND<0	30	-30	145	209
ND<0	30	-30	145	210
ND<0	30	-30	145	211
7.2	30	-22.8	145	212
24	ND<0	24	146	212
10	ND<0	10	147	212
5.1	ND<0	5.1	148	212
ND<0	ND<0	0	148	212
ND<0	ND<0	0	148	212
ND<0	ND<0	0	148	212
7.2	ND<0	7.2	149	212
10	24	-14	149	213
5.1	24	-18.9	149	214
ND<0	24	-24	149	215
ND<0	24	-24	149	216
ND<0	24	-24	149	217
7.2	24	-16.8	149	218
5.1	10	-4.9	149	219
ND<0	10	-10	149	220
ND<0	10	-10	149	221
ND<0	10	-10	149	222
7.2	10	-2.8	149	223
ND<0	5.1	-5.1	149	224
ND<0	5.1	-5.1	149	225
ND<0	5.1	-5.1	149	226
7.2	5.1	2.1	150	226
ND<0	ND<0	0	150	226
ND<0	ND<0	0	150	226
7.2	ND<0	7.2	151	226
ND<0	ND<0	0	151	226
7.2	ND<0	7.2	152	226
7.2	ND<0	7.2	153	226

S Statistic = 153 - 226 = -73

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**Tied Group Value      Members**

1	3	3
2	2	2
3	57	2
4	16	2
5	0	7

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**Time Period      Observations**

2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/29/2009	1
5/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

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A = 918

B = 0

C = 216

D = 0

E = 54

F = 0

a = 51156

b = 197316

c = 1624

Group Variance = 2791

Z-Score = -1.36286

Comparison Level at 95% confidence level = -1.65463 (downward trend)

-1.36286 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
3	3	0	0	0
3	3	0	0	0
2	3	-1	0	1
2	3	-1	0	2
57	3	54	1	2
47	3	44	2	2
9	3	6	3	2
44	3	41	4	2
43	3	40	5	2
23	3	20	6	2
16	3	13	7	2
ND<0	3	-3	7	3
28	3	25	8	3
16	3	13	9	3
ND<0	3	-3	9	4
9.3	3	6.3	10	4
ND<0	3	-3	10	5
57	3	54	11	5
15	3	12	12	5
30	3	27	13	5
ND<0	3	-3	13	6
24	3	21	14	6
10	3	7	15	6
5.1	3	2.1	16	6
ND<0	3	-3	16	7
ND<0	3	-3	16	8
ND<0	3	-3	16	9
7.2	3	4.2	17	9
3	3	0	17	9
2	3	-1	17	10
2	3	-1	17	11
57	3	54	18	11
47	3	44	19	11
9	3	6	20	11
44	3	41	21	11
43	3	40	22	11
23	3	20	23	11
16	3	13	24	11
ND<0	3	-3	24	12
28	3	25	25	12
16	3	13	26	12
ND<0	3	-3	26	13
9.3	3	6.3	27	13
ND<0	3	-3	27	14
57	3	54	28	14

15	3	12	29	14
30	3	27	30	14
ND<0	3	-3	30	15
24	3	21	31	15
10	3	7	32	15
5.1	3	2.1	33	15
ND<0	3	-3	33	16
ND<0	3	-3	33	17
ND<0	3	-3	33	18
7.2	3	4.2	34	18

2	3	-1	34	19
2	3	-1	34	20
57	3	54	35	20
47	3	44	36	20
9	3	6	37	20
44	3	41	38	20
43	3	40	39	20
23	3	20	40	20
16	3	13	41	20
ND<0	3	-3	41	21
28	3	25	42	21
16	3	13	43	21
ND<0	3	-3	43	22
9.3	3	6.3	44	22
ND<0	3	-3	44	23
57	3	54	45	23
15	3	12	46	23
30	3	27	47	23
ND<0	3	-3	47	24
24	3	21	48	24
10	3	7	49	24
5.1	3	2.1	50	24
ND<0	3	-3	50	25
ND<0	3	-3	50	26
ND<0	3	-3	50	27
7.2	3	4.2	51	27

2	2	0	51	27
57	2	55	52	27
47	2	45	53	27
9	2	7	54	27
44	2	42	55	27
43	2	41	56	27
23	2	21	57	27
16	2	14	58	27
ND<0	2	-2	58	28
28	2	26	59	28
16	2	14	60	28
ND<0	2	-2	60	29
9.3	2	7.3	61	29
ND<0	2	-2	61	30
57	2	55	62	30
15	2	13	63	30
30	2	28	64	30
ND<0	2	-2	64	31
24	2	22	65	31

10	2	8	66	31
5.1	2	3.1	67	31
ND<0	2	-2	67	32
ND<0	2	-2	67	33
ND<0	2	-2	67	34
7.2	2	5.2	68	34
57	2	55	69	34
47	2	45	70	34
9	2	7	71	34
44	2	42	72	34
43	2	41	73	34
23	2	21	74	34
16	2	14	75	34
ND<0	2	-2	75	35
28	2	26	76	35
16	2	14	77	35
ND<0	2	-2	77	36
9.3	2	7.3	78	36
ND<0	2	-2	78	37
57	2	55	79	37
15	2	13	80	37
30	2	28	81	37
ND<0	2	-2	81	38
24	2	22	82	38
10	2	8	83	38
5.1	2	3.1	84	38
ND<0	2	-2	84	39
ND<0	2	-2	84	40
ND<0	2	-2	84	41
7.2	2	5.2	85	41
47	57	-10	85	42
9	57	-48	85	43
44	57	-13	85	44
43	57	-14	85	45
23	57	-34	85	46
16	57	-41	85	47
ND<0	57	-57	85	48
28	57	-29	85	49
16	57	-41	85	50
ND<0	57	-57	85	51
9.3	57	-47.7	85	52
ND<0	57	-57	85	53
57	57	0	85	53
15	57	-42	85	54
30	57	-27	85	55
ND<0	57	-57	85	56
24	57	-33	85	57
10	57	-47	85	58
5.1	57	-51.9	85	59
ND<0	57	-57	85	60
ND<0	57	-57	85	61
ND<0	57	-57	85	62
7.2	57	-49.8	85	63
9	47	-38	85	64

44	47	-3	85	65
43	47	-4	85	66
23	47	-24	85	67
16	47	-31	85	68
ND<0	47	-47	85	69
28	47	-19	85	70
16	47	-31	85	71
ND<0	47	-47	85	72
9.3	47	-37.7	85	73
ND<0	47	-47	85	74
57	47	10	86	74
15	47	-32	86	75
30	47	-17	86	76
ND<0	47	-47	86	77
24	47	-23	86	78
10	47	-37	86	79
5.1	47	-41.9	86	80
ND<0	47	-47	86	81
ND<0	47	-47	86	82
ND<0	47	-47	86	83
7.2	47	-39.8	86	84

44	9	35	87	84
43	9	34	88	84
23	9	14	89	84
16	9	7	90	84
ND<0	9	-9	90	85
28	9	19	91	85
16	9	7	92	85
ND<0	9	-9	92	86
9.3	9	0.3	93	86
ND<0	9	-9	93	87
57	9	48	94	87
15	9	6	95	87
30	9	21	96	87
ND<0	9	-9	96	88
24	9	15	97	88
10	9	1	98	88
5.1	9	-3.9	98	89
ND<0	9	-9	98	90
ND<0	9	-9	98	91
ND<0	9	-9	98	92
7.2	9	-1.8	98	93

43	44	-1	98	94
23	44	-21	98	95
16	44	-28	98	96
ND<0	44	-44	98	97
28	44	-16	98	98
16	44	-28	98	99
ND<0	44	-44	98	100
9.3	44	-34.7	98	101
ND<0	44	-44	98	102
57	44	13	99	102
15	44	-29	99	103
30	44	-14	99	104
ND<0	44	-44	99	105



24	44	-20	99	106
10	44	-34	99	107
5.1	44	-38.9	99	108
ND<0	44	-44	99	109
ND<0	44	-44	99	110
ND<0	44	-44	99	111
7.2	44	-36.8	99	112
23	43	-20	99	113
16	43	-27	99	114
ND<0	43	-43	99	115
28	43	-15	99	116
16	43	-27	99	117
ND<0	43	-43	99	118
9.3	43	-33.7	99	119
ND<0	43	-43	99	120
57	43	14	100	120
15	43	-28	100	121
30	43	-13	100	122
ND<0	43	-43	100	123
24	43	-19	100	124
10	43	-33	100	125
5.1	43	-37.9	100	126
ND<0	43	-43	100	127
ND<0	43	-43	100	128
ND<0	43	-43	100	129
7.2	43	-35.8	100	130
16	23	-7	100	131
ND<0	23	-23	100	132
28	23	5	101	132
16	23	-7	101	133
ND<0	23	-23	101	134
9.3	23	-13.7	101	135
ND<0	23	-23	101	136
57	23	34	102	136
15	23	-8	102	137
30	23	7	103	137
ND<0	23	-23	103	138
24	23	1	104	138
10	23	-13	104	139
5.1	23	-17.9	104	140
ND<0	23	-23	104	141
ND<0	23	-23	104	142
ND<0	23	-23	104	143
7.2	23	-15.8	104	144
ND<0	16	-16	104	145
28	16	12	105	145
16	16	0	105	145
ND<0	16	-16	105	146
9.3	16	-6.7	105	147
ND<0	16	-16	105	148
57	16	41	106	148
15	16	-1	106	149
30	16	14	107	149
ND<0	16	-16	107	150

24	16	8	108	150
10	16	-6	108	151
5.1	16	-10.9	108	152
ND<0	16	-16	108	153
ND<0	16	-16	108	154
ND<0	16	-16	108	155
7.2	16	-8.8	108	156
28	ND<0	28	109	156
16	ND<0	16	110	156
ND<0	ND<0	0	110	156
9.3	ND<0	9.3	111	156
ND<0	ND<0	0	111	156
57	ND<0	57	112	156
15	ND<0	15	113	156
30	ND<0	30	114	156
ND<0	ND<0	0	114	156
24	ND<0	24	115	156
10	ND<0	10	116	156
5.1	ND<0	5.1	117	156
ND<0	ND<0	0	117	156
ND<0	ND<0	0	117	156
ND<0	ND<0	0	117	156
7.2	ND<0	7.2	118	156
16	28	-12	118	157
ND<0	28	-28	118	158
9.3	28	-18.7	118	159
ND<0	28	-28	118	160
57	28	29	119	160
15	28	-13	119	161
30	28	2	120	161
ND<0	28	-28	120	162
24	28	-4	120	163
10	28	-18	120	164
5.1	28	-22.9	120	165
ND<0	28	-28	120	166
ND<0	28	-28	120	167
ND<0	28	-28	120	168
7.2	28	-20.8	120	169
ND<0	16	-16	120	170
9.3	16	-6.7	120	171
ND<0	16	-16	120	172
57	16	41	121	172
15	16	-1	121	173
30	16	14	122	173
ND<0	16	-16	122	174
24	16	8	123	174
10	16	-6	123	175
5.1	16	-10.9	123	176
ND<0	16	-16	123	177
ND<0	16	-16	123	178
ND<0	16	-16	123	179
7.2	16	-8.8	123	180
9.3	ND<0	9.3	124	180

ND<0	ND<0	0	124	180
57	ND<0	57	125	180
15	ND<0	15	126	180
30	ND<0	30	127	180
ND<0	ND<0	0	127	180
24	ND<0	24	128	180
10	ND<0	10	129	180
5.1	ND<0	5.1	130	180
ND<0	ND<0	0	130	180
ND<0	ND<0	0	130	180
ND<0	ND<0	0	130	180
7.2	ND<0	7.2	131	180
ND<0	9.3	-9.3	131	181
57	9.3	47.7	132	181
15	9.3	5.7	133	181
30	9.3	20.7	134	181
ND<0	9.3	-9.3	134	182
24	9.3	14.7	135	182
10	9.3	0.7	136	182
5.1	9.3	-4.2	136	183
ND<0	9.3	-9.3	136	184
ND<0	9.3	-9.3	136	185
ND<0	9.3	-9.3	136	186
7.2	9.3	-2.1	136	187
57	ND<0	57	137	187
15	ND<0	15	138	187
30	ND<0	30	139	187
ND<0	ND<0	0	139	187
24	ND<0	24	140	187
10	ND<0	10	141	187
5.1	ND<0	5.1	142	187
ND<0	ND<0	0	142	187
ND<0	ND<0	0	142	187
ND<0	ND<0	0	142	187
7.2	ND<0	7.2	143	187
15	57	-42	143	188
30	57	-27	143	189
ND<0	57	-57	143	190
24	57	-33	143	191
10	57	-47	143	192
5.1	57	-51.9	143	193
ND<0	57	-57	143	194
ND<0	57	-57	143	195
ND<0	57	-57	143	196
7.2	57	-49.8	143	197
30	15	15	144	197
ND<0	15	-15	144	198
24	15	9	145	198
10	15	-5	145	199
5.1	15	-9.9	145	200
ND<0	15	-15	145	201
ND<0	15	-15	145	202
ND<0	15	-15	145	203

7.2	15	-7.8	145	204
ND<0	30	-30	145	205
24	30	-6	145	206
10	30	-20	145	207
5.1	30	-24.9	145	208
ND<0	30	-30	145	209
ND<0	30	-30	145	210
ND<0	30	-30	145	211
7.2	30	-22.8	145	212
24	ND<0	24	146	212
10	ND<0	10	147	212
5.1	ND<0	5.1	148	212
ND<0	ND<0	0	148	212
ND<0	ND<0	0	148	212
ND<0	ND<0	0	148	212
7.2	ND<0	7.2	149	212
10	24	-14	149	213
5.1	24	-18.9	149	214
ND<0	24	-24	149	215
ND<0	24	-24	149	216
ND<0	24	-24	149	217
7.2	24	-16.8	149	218
5.1	10	-4.9	149	219
ND<0	10	-10	149	220
ND<0	10	-10	149	221
ND<0	10	-10	149	222
7.2	10	-2.8	149	223
ND<0	5.1	-5.1	149	224
ND<0	5.1	-5.1	149	225
ND<0	5.1	-5.1	149	226
7.2	5.1	2.1	150	226
ND<0	ND<0	0	150	226
ND<0	ND<0	0	150	226
7.2	ND<0	7.2	151	226
ND<0	ND<0	0	151	226
7.2	ND<0	7.2	152	226
7.2	ND<0	7.2	153	226

S Statistic = 153 - 226 = -73

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Tied Group Value		Members
1	3	3
2	2	2
3	57	2
4	16	2
5	0	7

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**Time Period**                      **Observations**

2/1/2006	1
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/29/2009	1
5/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 918

B = 0

C = 216

D = 0

E = 54

F = 0

a = 51156

b = 197316

c = 1624

Group Variance = 2791

Z-Score = -1.36286

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-1.36286 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-03D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
91	34	57	1	0
39	34	5	2	0
35	34	1	3	0
36	34	2	4	0
35	34	1	5	0
33	34	-1	5	1
32	34	-2	5	2
31	34	-3	5	3
37	34	3	6	3
34	34	0	6	3
39	34	5	7	3
30	34	-4	7	4
30	34	-4	7	5
28	34	-6	7	6
28	34	-6	7	7
26	34	-8	7	8
25	34	-9	7	9
26	34	-8	7	10
27	34	-7	7	11
20	34	-14	7	12
35	34	1	8	12
25	34	-9	8	13
23	34	-11	8	14
21.2	34	-12.8	8	15
39	91	-52	8	16
35	91	-56	8	17
36	91	-55	8	18
35	91	-56	8	19
33	91	-58	8	20
32	91	-59	8	21
31	91	-60	8	22
37	91	-54	8	23
34	91	-57	8	24
39	91	-52	8	25
30	91	-61	8	26
30	91	-61	8	27
28	91	-63	8	28
28	91	-63	8	29
26	91	-65	8	30
25	91	-66	8	31
26	91	-65	8	32
27	91	-64	8	33
20	91	-71	8	34
35	91	-56	8	35
25	91	-66	8	36

23	91	-68	8	37
21.2	91	-69.8	8	38
35	39	-4	8	39
36	39	-3	8	40
35	39	-4	8	41
33	39	-6	8	42
32	39	-7	8	43
31	39	-8	8	44
37	39	-2	8	45
34	39	-5	8	46
39	39	0	8	46
30	39	-9	8	47
30	39	-9	8	48
28	39	-11	8	49
28	39	-11	8	50
26	39	-13	8	51
25	39	-14	8	52
26	39	-13	8	53
27	39	-12	8	54
20	39	-19	8	55
35	39	-4	8	56
25	39	-14	8	57
23	39	-16	8	58
21.2	39	-17.8	8	59
36	35	1	9	59
35	35	0	9	59
33	35	-2	9	60
32	35	-3	9	61
31	35	-4	9	62
37	35	2	10	62
34	35	-1	10	63
39	35	4	11	63
30	35	-5	11	64
30	35	-5	11	65
28	35	-7	11	66
28	35	-7	11	67
26	35	-9	11	68
25	35	-10	11	69
26	35	-9	11	70
27	35	-8	11	71
20	35	-15	11	72
35	35	0	11	72
25	35	-10	11	73
23	35	-12	11	74
21.2	35	-13.8	11	75
35	36	-1	11	76
33	36	-3	11	77
32	36	-4	11	78
31	36	-5	11	79
37	36	1	12	79
34	36	-2	12	80
39	36	3	13	80
30	36	-6	13	81
30	36	-6	13	82

28	36	-8	13	83
28	36	-8	13	84
26	36	-10	13	85
25	36	-11	13	86
26	36	-10	13	87
27	36	-9	13	88
20	36	-16	13	89
35	36	-1	13	90
25	36	-11	13	91
23	36	-13	13	92
21.2	36	-14.8	13	93
33	35	-2	13	94
32	35	-3	13	95
31	35	-4	13	96
37	35	2	14	96
34	35	-1	14	97
39	35	4	15	97
30	35	-5	15	98
30	35	-5	15	99
28	35	-7	15	100
28	35	-7	15	101
26	35	-9	15	102
25	35	-10	15	103
26	35	-9	15	104
27	35	-8	15	105
20	35	-15	15	106
35	35	0	15	106
25	35	-10	15	107
23	35	-12	15	108
21.2	35	-13.8	15	109
32	33	-1	15	110
31	33	-2	15	111
37	33	4	16	111
34	33	1	17	111
39	33	6	18	111
30	33	-3	18	112
30	33	-3	18	113
28	33	-5	18	114
28	33	-5	18	115
26	33	-7	18	116
25	33	-8	18	117
26	33	-7	18	118
27	33	-6	18	119
20	33	-13	18	120
35	33	2	19	120
25	33	-8	19	121
23	33	-10	19	122
21.2	33	-11.8	19	123
31	32	-1	19	124
37	32	5	20	124
34	32	2	21	124
39	32	7	22	124
30	32	-2	22	125
30	32	-2	22	126



28	32	-4	22	127
28	32	-4	22	128
26	32	-6	22	129
25	32	-7	22	130
26	32	-6	22	131
27	32	-5	22	132
20	32	-12	22	133
35	32	3	23	133
25	32	-7	23	134
23	32	-9	23	135
21.2	32	-10.8	23	136

37	31	6	24	136
34	31	3	25	136
39	31	8	26	136
30	31	-1	26	137
30	31	-1	26	138
28	31	-3	26	139
28	31	-3	26	140
26	31	-5	26	141
25	31	-6	26	142
26	31	-5	26	143
27	31	-4	26	144
20	31	-11	26	145
35	31	4	27	145
25	31	-6	27	146
23	31	-8	27	147
21.2	31	-9.8	27	148

34	37	-3	27	149
39	37	2	28	149
30	37	-7	28	150
30	37	-7	28	151
28	37	-9	28	152
28	37	-9	28	153
26	37	-11	28	154
25	37	-12	28	155
26	37	-11	28	156
27	37	-10	28	157
20	37	-17	28	158
35	37	-2	28	159
25	37	-12	28	160
23	37	-14	28	161
21.2	37	-15.8	28	162

39	34	5	29	162
30	34	-4	29	163
30	34	-4	29	164
28	34	-6	29	165
28	34	-6	29	166
26	34	-8	29	167
25	34	-9	29	168
26	34	-8	29	169
27	34	-7	29	170
20	34	-14	29	171
35	34	1	30	171
25	34	-9	30	172

23	34	-11	30	173
21.2	34	-12.8	30	174
30	39	-9	30	175
30	39	-9	30	176
28	39	-11	30	177
28	39	-11	30	178
26	39	-13	30	179
25	39	-14	30	180
26	39	-13	30	181
27	39	-12	30	182
20	39	-19	30	183
35	39	-4	30	184
25	39	-14	30	185
23	39	-16	30	186
21.2	39	-17.8	30	187
30	30	0	30	187
28	30	-2	30	188
28	30	-2	30	189
26	30	-4	30	190
25	30	-5	30	191
26	30	-4	30	192
27	30	-3	30	193
20	30	-10	30	194
35	30	5	31	194
25	30	-5	31	195
23	30	-7	31	196
21.2	30	-8.8	31	197
28	30	-2	31	198
28	30	-2	31	199
26	30	-4	31	200
25	30	-5	31	201
26	30	-4	31	202
27	30	-3	31	203
20	30	-10	31	204
35	30	5	32	204
25	30	-5	32	205
23	30	-7	32	206
21.2	30	-8.8	32	207
28	28	0	32	207
26	28	-2	32	208
25	28	-3	32	209
26	28	-2	32	210
27	28	-1	32	211
20	28	-8	32	212
35	28	7	33	212
25	28	-3	33	213
23	28	-5	33	214
21.2	28	-6.8	33	215
26	28	-2	33	216
25	28	-3	33	217
26	28	-2	33	218
27	28	-1	33	219

20	28	-8	33	220
35	28	7	34	220
25	28	-3	34	221
23	28	-5	34	222
21.2	28	-6.8	34	223
25	26	-1	34	224
26	26	0	34	224
27	26	1	35	224
20	26	-6	35	225
35	26	9	36	225
25	26	-1	36	226
23	26	-3	36	227
21.2	26	-4.8	36	228
26	25	1	37	228
27	25	2	38	228
20	25	-5	38	229
35	25	10	39	229
25	25	0	39	229
23	25	-2	39	230
21.2	25	-3.8	39	231
27	26	1	40	231
20	26	-6	40	232
35	26	9	41	232
25	26	-1	41	233
23	26	-3	41	234
21.2	26	-4.8	41	235
20	27	-7	41	236
35	27	8	42	236
25	27	-2	42	237
23	27	-4	42	238
21.2	27	-5.8	42	239
35	20	15	43	239
25	20	5	44	239
23	20	3	45	239
21.2	20	1.2	46	239
25	35	-10	46	240
23	35	-12	46	241
21.2	35	-13.8	46	242
23	25	-2	46	243
21.2	25	-3.8	46	244
21.2	23	-1.8	46	245

S Statistic = 46 - 245 = -199

---

Tied Group Value	Members
1	34
2	39
3	35

4	30	2
5	28	2
6	26	2
7	25	2

---

Time Period	Observations
-------------	--------------

9/24/2008	1
10/29/2008	1
4/28/2009	1
5/15/2009	1
9/30/2009	1
12/9/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
3/8/2011	1
5/24/2011	1
8/31/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 174

B = 0

C = 6

D = 0

E = 18

F = 0

a = 33000

b = 124200

c = 1200

Group Variance = 1823.67

Z-Score = -4.63652

Comparison Level at 95% confidence level = -1.65463 (downward trend)

-4.63652 < -1.65463 indicating a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: EPW-03D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
91	34	57	1	0
39	34	5	2	0
35	34	1	3	0
36	34	2	4	0
35	34	1	5	0
33	34	-1	5	1
32	34	-2	5	2
31	34	-3	5	3
37	34	3	6	3
34	34	0	6	3
39	34	5	7	3
30	34	-4	7	4
30	34	-4	7	5
28	34	-6	7	6
28	34	-6	7	7
26	34	-8	7	8
25	34	-9	7	9
26	34	-8	7	10
27	34	-7	7	11
20	34	-14	7	12
35	34	1	8	12
25	34	-9	8	13
23	34	-11	8	14
21.2	34	-12.8	8	15
39	91	-52	8	16
35	91	-56	8	17
36	91	-55	8	18
35	91	-56	8	19
33	91	-58	8	20
32	91	-59	8	21
31	91	-60	8	22
37	91	-54	8	23
34	91	-57	8	24
39	91	-52	8	25
30	91	-61	8	26
30	91	-61	8	27
28	91	-63	8	28
28	91	-63	8	29
26	91	-65	8	30
25	91	-66	8	31
26	91	-65	8	32
27	91	-64	8	33
20	91	-71	8	34
35	91	-56	8	35
25	91	-66	8	36

23	91	-68	8	37
21.2	91	-69.8	8	38
35	39	-4	8	39
36	39	-3	8	40
35	39	-4	8	41
33	39	-6	8	42
32	39	-7	8	43
31	39	-8	8	44
37	39	-2	8	45
34	39	-5	8	46
39	39	0	8	46
30	39	-9	8	47
30	39	-9	8	48
28	39	-11	8	49
28	39	-11	8	50
26	39	-13	8	51
25	39	-14	8	52
26	39	-13	8	53
27	39	-12	8	54
20	39	-19	8	55
35	39	-4	8	56
25	39	-14	8	57
23	39	-16	8	58
21.2	39	-17.8	8	59
36	35	1	9	59
35	35	0	9	59
33	35	-2	9	60
32	35	-3	9	61
31	35	-4	9	62
37	35	2	10	62
34	35	-1	10	63
39	35	4	11	63
30	35	-5	11	64
30	35	-5	11	65
28	35	-7	11	66
28	35	-7	11	67
26	35	-9	11	68
25	35	-10	11	69
26	35	-9	11	70
27	35	-8	11	71
20	35	-15	11	72
35	35	0	11	72
25	35	-10	11	73
23	35	-12	11	74
21.2	35	-13.8	11	75
35	36	-1	11	76
33	36	-3	11	77
32	36	-4	11	78
31	36	-5	11	79
37	36	1	12	79
34	36	-2	12	80
39	36	3	13	80
30	36	-6	13	81
30	36	-6	13	82

28	36	-8	13	83
28	36	-8	13	84
26	36	-10	13	85
25	36	-11	13	86
26	36	-10	13	87
27	36	-9	13	88
20	36	-16	13	89
35	36	-1	13	90
25	36	-11	13	91
23	36	-13	13	92
21.2	36	-14.8	13	93
33	35	-2	13	94
32	35	-3	13	95
31	35	-4	13	96
37	35	2	14	96
34	35	-1	14	97
39	35	4	15	97
30	35	-5	15	98
30	35	-5	15	99
28	35	-7	15	100
28	35	-7	15	101
26	35	-9	15	102
25	35	-10	15	103
26	35	-9	15	104
27	35	-8	15	105
20	35	-15	15	106
35	35	0	15	106
25	35	-10	15	107
23	35	-12	15	108
21.2	35	-13.8	15	109
32	33	-1	15	110
31	33	-2	15	111
37	33	4	16	111
34	33	1	17	111
39	33	6	18	111
30	33	-3	18	112
30	33	-3	18	113
28	33	-5	18	114
28	33	-5	18	115
26	33	-7	18	116
25	33	-8	18	117
26	33	-7	18	118
27	33	-6	18	119
20	33	-13	18	120
35	33	2	19	120
25	33	-8	19	121
23	33	-10	19	122
21.2	33	-11.8	19	123
31	32	-1	19	124
37	32	5	20	124
34	32	2	21	124
39	32	7	22	124
30	32	-2	22	125
30	32	-2	22	126

28	32	-4	22	127
28	32	-4	22	128
26	32	-6	22	129
25	32	-7	22	130
26	32	-6	22	131
27	32	-5	22	132
20	32	-12	22	133
35	32	3	23	133
25	32	-7	23	134
23	32	-9	23	135
21.2	32	-10.8	23	136

37	31	6	24	136
34	31	3	25	136
39	31	8	26	136
30	31	-1	26	137
30	31	-1	26	138
28	31	-3	26	139
28	31	-3	26	140
26	31	-5	26	141
25	31	-6	26	142
26	31	-5	26	143
27	31	-4	26	144
20	31	-11	26	145
35	31	4	27	145
25	31	-6	27	146
23	31	-8	27	147
21.2	31	-9.8	27	148

34	37	-3	27	149
39	37	2	28	149
30	37	-7	28	150
30	37	-7	28	151
28	37	-9	28	152
28	37	-9	28	153
26	37	-11	28	154
25	37	-12	28	155
26	37	-11	28	156
27	37	-10	28	157
20	37	-17	28	158
35	37	-2	28	159
25	37	-12	28	160
23	37	-14	28	161
21.2	37	-15.8	28	162

39	34	5	29	162
30	34	-4	29	163
30	34	-4	29	164
28	34	-6	29	165
28	34	-6	29	166
26	34	-8	29	167
25	34	-9	29	168
26	34	-8	29	169
27	34	-7	29	170
20	34	-14	29	171
35	34	1	30	171
25	34	-9	30	172



23	34	-11	30	173
21.2	34	-12.8	30	174
30	39	-9	30	175
30	39	-9	30	176
28	39	-11	30	177
28	39	-11	30	178
26	39	-13	30	179
25	39	-14	30	180
26	39	-13	30	181
27	39	-12	30	182
20	39	-19	30	183
35	39	-4	30	184
25	39	-14	30	185
23	39	-16	30	186
21.2	39	-17.8	30	187
30	30	0	30	187
28	30	-2	30	188
28	30	-2	30	189
26	30	-4	30	190
25	30	-5	30	191
26	30	-4	30	192
27	30	-3	30	193
20	30	-10	30	194
35	30	5	31	194
25	30	-5	31	195
23	30	-7	31	196
21.2	30	-8.8	31	197
28	30	-2	31	198
28	30	-2	31	199
26	30	-4	31	200
25	30	-5	31	201
26	30	-4	31	202
27	30	-3	31	203
20	30	-10	31	204
35	30	5	32	204
25	30	-5	32	205
23	30	-7	32	206
21.2	30	-8.8	32	207
28	28	0	32	207
26	28	-2	32	208
25	28	-3	32	209
26	28	-2	32	210
27	28	-1	32	211
20	28	-8	32	212
35	28	7	33	212
25	28	-3	33	213
23	28	-5	33	214
21.2	28	-6.8	33	215
26	28	-2	33	216
25	28	-3	33	217
26	28	-2	33	218
27	28	-1	33	219

20	28	-8	33	220
35	28	7	34	220
25	28	-3	34	221
23	28	-5	34	222
21.2	28	-6.8	34	223
25	26	-1	34	224
26	26	0	34	224
27	26	1	35	224
20	26	-6	35	225
35	26	9	36	225
25	26	-1	36	226
23	26	-3	36	227
21.2	26	-4.8	36	228
26	25	1	37	228
27	25	2	38	228
20	25	-5	38	229
35	25	10	39	229
25	25	0	39	229
23	25	-2	39	230
21.2	25	-3.8	39	231
27	26	1	40	231
20	26	-6	40	232
35	26	9	41	232
25	26	-1	41	233
23	26	-3	41	234
21.2	26	-4.8	41	235
20	27	-7	41	236
35	27	8	42	236
25	27	-2	42	237
23	27	-4	42	238
21.2	27	-5.8	42	239
35	20	15	43	239
25	20	5	44	239
23	20	3	45	239
21.2	20	1.2	46	239
25	35	-10	46	240
23	35	-12	46	241
21.2	35	-13.8	46	242
23	25	-2	46	243
21.2	25	-3.8	46	244
21.2	23	-1.8	46	245

S Statistic = 46 - 245 = -199

---

Tied Group Value	Members
1	34
2	39
3	35

4	30	2
5	28	2
6	26	2
7	25	2

---

Time Period	Observations
-------------	--------------

9/24/2008	1
10/29/2008	1
4/28/2009	1
5/15/2009	1
9/30/2009	1
12/9/2009	1
2/25/2010	1
4/15/2010	1
8/11/2010	1
3/8/2011	1
5/24/2011	1
8/31/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 174

B = 0

C = 6

D = 0

E = 18

F = 0

a = 33000

b = 124200

c = 1200

Group Variance = 1823.67

Z-Score = -4.63652

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-4.63652 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-01D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
290	328	-38	0	1
358	328	30	1	1
699	328	371	2	1
480	328	152	3	1
350	328	22	4	1
300	328	-28	4	2
290	328	-38	4	3
260	328	-68	4	4
270	328	-58	4	5
260	328	-68	4	6
280	328	-48	4	7
280	328	-48	4	8
260	328	-68	4	9
260	328	-68	4	10
280	328	-48	4	11
290	328	-38	4	12
280	328	-48	4	13
250	328	-78	4	14
240	328	-88	4	15
230	328	-98	4	16
210	328	-118	4	17
220	328	-108	4	18
190	328	-138	4	19
190	328	-138	4	20
380	328	52	5	20
160	328	-168	5	21
167	328	-161	5	22
358	290	68	6	22
699	290	409	7	22
480	290	190	8	22
350	290	60	9	22
300	290	10	10	22
290	290	0	10	22
260	290	-30	10	23
270	290	-20	10	24
260	290	-30	10	25
280	290	-10	10	26
280	290	-10	10	27
260	290	-30	10	28
260	290	-30	10	29
280	290	-10	10	30
290	290	0	10	30
280	290	-10	10	31
250	290	-40	10	32
240	290	-50	10	33

230	290	-60	10	34
210	290	-80	10	35
220	290	-70	10	36
190	290	-100	10	37
190	290	-100	10	38
380	290	90	11	38
160	290	-130	11	39
167	290	-123	11	40
699	358	341	12	40
480	358	122	13	40
350	358	-8	13	41
300	358	-58	13	42
290	358	-68	13	43
260	358	-98	13	44
270	358	-88	13	45
260	358	-98	13	46
280	358	-78	13	47
280	358	-78	13	48
260	358	-98	13	49
260	358	-98	13	50
280	358	-78	13	51
290	358	-68	13	52
280	358	-78	13	53
250	358	-108	13	54
240	358	-118	13	55
230	358	-128	13	56
210	358	-148	13	57
220	358	-138	13	58
190	358	-168	13	59
190	358	-168	13	60
380	358	22	14	60
160	358	-198	14	61
167	358	-191	14	62
480	699	-219	14	63
350	699	-349	14	64
300	699	-399	14	65
290	699	-409	14	66
260	699	-439	14	67
270	699	-429	14	68
260	699	-439	14	69
280	699	-419	14	70
280	699	-419	14	71
260	699	-439	14	72
260	699	-439	14	73
280	699	-419	14	74
290	699	-409	14	75
280	699	-419	14	76
250	699	-449	14	77
240	699	-459	14	78
230	699	-469	14	79
210	699	-489	14	80
220	699	-479	14	81
190	699	-509	14	82
190	699	-509	14	83
380	699	-319	14	84

160	699	-539	14	85
167	699	-532	14	86
350	480	-130	14	87
300	480	-180	14	88
290	480	-190	14	89
260	480	-220	14	90
270	480	-210	14	91
260	480	-220	14	92
280	480	-200	14	93
280	480	-200	14	94
260	480	-220	14	95
260	480	-220	14	96
280	480	-200	14	97
290	480	-190	14	98
280	480	-200	14	99
250	480	-230	14	100
240	480	-240	14	101
230	480	-250	14	102
210	480	-270	14	103
220	480	-260	14	104
190	480	-290	14	105
190	480	-290	14	106
380	480	-100	14	107
160	480	-320	14	108
167	480	-313	14	109
300	350	-50	14	110
290	350	-60	14	111
260	350	-90	14	112
270	350	-80	14	113
260	350	-90	14	114
280	350	-70	14	115
280	350	-70	14	116
260	350	-90	14	117
260	350	-90	14	118
280	350	-70	14	119
290	350	-60	14	120
280	350	-70	14	121
250	350	-100	14	122
240	350	-110	14	123
230	350	-120	14	124
210	350	-140	14	125
220	350	-130	14	126
190	350	-160	14	127
190	350	-160	14	128
380	350	30	15	128
160	350	-190	15	129
167	350	-183	15	130
290	300	-10	15	131
260	300	-40	15	132
270	300	-30	15	133
260	300	-40	15	134
280	300	-20	15	135
280	300	-20	15	136
260	300	-40	15	137

260	300	-40	15	138
280	300	-20	15	139
290	300	-10	15	140
280	300	-20	15	141
250	300	-50	15	142
240	300	-60	15	143
230	300	-70	15	144
210	300	-90	15	145
220	300	-80	15	146
190	300	-110	15	147
190	300	-110	15	148
380	300	80	16	148
160	300	-140	16	149
167	300	-133	16	150
260	290	-30	16	151
270	290	-20	16	152
260	290	-30	16	153
280	290	-10	16	154
280	290	-10	16	155
260	290	-30	16	156
260	290	-30	16	157
280	290	-10	16	158
290	290	0	16	158
280	290	-10	16	159
250	290	-40	16	160
240	290	-50	16	161
230	290	-60	16	162
210	290	-80	16	163
220	290	-70	16	164
190	290	-100	16	165
190	290	-100	16	166
380	290	90	17	166
160	290	-130	17	167
167	290	-123	17	168
270	260	10	18	168
260	260	0	18	168
280	260	20	19	168
280	260	20	20	168
260	260	0	20	168
260	260	0	20	168
280	260	20	21	168
290	260	30	22	168
280	260	20	23	168
250	260	-10	23	169
240	260	-20	23	170
230	260	-30	23	171
210	260	-50	23	172
220	260	-40	23	173
190	260	-70	23	174
190	260	-70	23	175
380	260	120	24	175
160	260	-100	24	176
167	260	-93	24	177
260	270	-10	24	178

280	270	10	25	178
280	270	10	26	178
260	270	-10	26	179
260	270	-10	26	180
280	270	10	27	180
290	270	20	28	180
280	270	10	29	180
250	270	-20	29	181
240	270	-30	29	182
230	270	-40	29	183
210	270	-60	29	184
220	270	-50	29	185
190	270	-80	29	186
190	270	-80	29	187
380	270	110	30	187
160	270	-110	30	188
167	270	-103	30	189
280	260	20	31	189
280	260	20	32	189
260	260	0	32	189
260	260	0	32	189
280	260	20	33	189
290	260	30	34	189
280	260	20	35	189
250	260	-10	35	190
240	260	-20	35	191
230	260	-30	35	192
210	260	-50	35	193
220	260	-40	35	194
190	260	-70	35	195
190	260	-70	35	196
380	260	120	36	196
160	260	-100	36	197
167	260	-93	36	198
280	280	0	36	198
260	280	-20	36	199
260	280	-20	36	200
280	280	0	36	200
290	280	10	37	200
280	280	0	37	200
250	280	-30	37	201
240	280	-40	37	202
230	280	-50	37	203
210	280	-70	37	204
220	280	-60	37	205
190	280	-90	37	206
190	280	-90	37	207
380	280	100	38	207
160	280	-120	38	208
167	280	-113	38	209
260	280	-20	38	210
260	280	-20	38	211
280	280	0	38	211
290	280	10	39	211



280	280	0	39	211
250	280	-30	39	212
240	280	-40	39	213
230	280	-50	39	214
210	280	-70	39	215
220	280	-60	39	216
190	280	-90	39	217
190	280	-90	39	218
380	280	100	40	218
160	280	-120	40	219
167	280	-113	40	220
260	260	0	40	220
280	260	20	41	220
290	260	30	42	220
280	260	20	43	220
250	260	-10	43	221
240	260	-20	43	222
230	260	-30	43	223
210	260	-50	43	224
220	260	-40	43	225
190	260	-70	43	226
190	260	-70	43	227
380	260	120	44	227
160	260	-100	44	228
167	260	-93	44	229
280	260	20	45	229
290	260	30	46	229
280	260	20	47	229
250	260	-10	47	230
240	260	-20	47	231
230	260	-30	47	232
210	260	-50	47	233
220	260	-40	47	234
190	260	-70	47	235
190	260	-70	47	236
380	260	120	48	236
160	260	-100	48	237
167	260	-93	48	238
290	280	10	49	238
280	280	0	49	238
250	280	-30	49	239
240	280	-40	49	240
230	280	-50	49	241
210	280	-70	49	242
220	280	-60	49	243
190	280	-90	49	244
190	280	-90	49	245
380	280	100	50	245
160	280	-120	50	246
167	280	-113	50	247
280	290	-10	50	248
250	290	-40	50	249
240	290	-50	50	250

230	290	-60	50	251
210	290	-80	50	252
220	290	-70	50	253
190	290	-100	50	254
190	290	-100	50	255
380	290	90	51	255
160	290	-130	51	256
167	290	-123	51	257
250	280	-30	51	258
240	280	-40	51	259
230	280	-50	51	260
210	280	-70	51	261
220	280	-60	51	262
190	280	-90	51	263
190	280	-90	51	264
380	280	100	52	264
160	280	-120	52	265
167	280	-113	52	266
240	250	-10	52	267
230	250	-20	52	268
210	250	-40	52	269
220	250	-30	52	270
190	250	-60	52	271
190	250	-60	52	272
380	250	130	53	272
160	250	-90	53	273
167	250	-83	53	274
230	240	-10	53	275
210	240	-30	53	276
220	240	-20	53	277
190	240	-50	53	278
190	240	-50	53	279
380	240	140	54	279
160	240	-80	54	280
167	240	-73	54	281
210	230	-20	54	282
220	230	-10	54	283
190	230	-40	54	284
190	230	-40	54	285
380	230	150	55	285
160	230	-70	55	286
167	230	-63	55	287
220	210	10	56	287
190	210	-20	56	288
190	210	-20	56	289
380	210	170	57	289
160	210	-50	57	290
167	210	-43	57	291
190	220	-30	57	292
190	220	-30	57	293
380	220	160	58	293

160	220	-60	58	294
167	220	-53	58	295
190	190	0	58	295
380	190	190	59	295
160	190	-30	59	296
167	190	-23	59	297
380	190	190	60	297
160	190	-30	60	298
167	190	-23	60	299
160	380	-220	60	300
167	380	-213	60	301
167	160	7	61	301

S Statistic = 61 - 301 = -240

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<b>Tied Group Value</b>	<b>Members</b>
1	290
2	260
3	280
4	190

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<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/9/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 396  
B = 0  
C = 54  
D = 0  
E = 32  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2540  
Z-Score = -4.74221  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
**-4.74221 < -1.65463 indicating a downward trend**

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-01D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
290	328	-38	0	1
358	328	30	1	1
699	328	371	2	1
480	328	152	3	1
350	328	22	4	1
300	328	-28	4	2
290	328	-38	4	3
260	328	-68	4	4
270	328	-58	4	5
260	328	-68	4	6
280	328	-48	4	7
280	328	-48	4	8
260	328	-68	4	9
260	328	-68	4	10
280	328	-48	4	11
290	328	-38	4	12
280	328	-48	4	13
250	328	-78	4	14
240	328	-88	4	15
230	328	-98	4	16
210	328	-118	4	17
220	328	-108	4	18
190	328	-138	4	19
190	328	-138	4	20
380	328	52	5	20
160	328	-168	5	21
167	328	-161	5	22
358	290	68	6	22
699	290	409	7	22
480	290	190	8	22
350	290	60	9	22
300	290	10	10	22
290	290	0	10	22
260	290	-30	10	23
270	290	-20	10	24
260	290	-30	10	25
280	290	-10	10	26
280	290	-10	10	27
260	290	-30	10	28
260	290	-30	10	29
280	290	-10	10	30
290	290	0	10	30
280	290	-10	10	31
250	290	-40	10	32
240	290	-50	10	33

230	290	-60	10	34
210	290	-80	10	35
220	290	-70	10	36
190	290	-100	10	37
190	290	-100	10	38
380	290	90	11	38
160	290	-130	11	39
167	290	-123	11	40
699	358	341	12	40
480	358	122	13	40
350	358	-8	13	41
300	358	-58	13	42
290	358	-68	13	43
260	358	-98	13	44
270	358	-88	13	45
260	358	-98	13	46
280	358	-78	13	47
280	358	-78	13	48
260	358	-98	13	49
260	358	-98	13	50
280	358	-78	13	51
290	358	-68	13	52
280	358	-78	13	53
250	358	-108	13	54
240	358	-118	13	55
230	358	-128	13	56
210	358	-148	13	57
220	358	-138	13	58
190	358	-168	13	59
190	358	-168	13	60
380	358	22	14	60
160	358	-198	14	61
167	358	-191	14	62
480	699	-219	14	63
350	699	-349	14	64
300	699	-399	14	65
290	699	-409	14	66
260	699	-439	14	67
270	699	-429	14	68
260	699	-439	14	69
280	699	-419	14	70
280	699	-419	14	71
260	699	-439	14	72
260	699	-439	14	73
280	699	-419	14	74
290	699	-409	14	75
280	699	-419	14	76
250	699	-449	14	77
240	699	-459	14	78
230	699	-469	14	79
210	699	-489	14	80
220	699	-479	14	81
190	699	-509	14	82
190	699	-509	14	83
380	699	-319	14	84

160	699	-539	14	85
167	699	-532	14	86
350	480	-130	14	87
300	480	-180	14	88
290	480	-190	14	89
260	480	-220	14	90
270	480	-210	14	91
260	480	-220	14	92
280	480	-200	14	93
280	480	-200	14	94
260	480	-220	14	95
260	480	-220	14	96
280	480	-200	14	97
290	480	-190	14	98
280	480	-200	14	99
250	480	-230	14	100
240	480	-240	14	101
230	480	-250	14	102
210	480	-270	14	103
220	480	-260	14	104
190	480	-290	14	105
190	480	-290	14	106
380	480	-100	14	107
160	480	-320	14	108
167	480	-313	14	109
300	350	-50	14	110
290	350	-60	14	111
260	350	-90	14	112
270	350	-80	14	113
260	350	-90	14	114
280	350	-70	14	115
280	350	-70	14	116
260	350	-90	14	117
260	350	-90	14	118
280	350	-70	14	119
290	350	-60	14	120
280	350	-70	14	121
250	350	-100	14	122
240	350	-110	14	123
230	350	-120	14	124
210	350	-140	14	125
220	350	-130	14	126
190	350	-160	14	127
190	350	-160	14	128
380	350	30	15	128
160	350	-190	15	129
167	350	-183	15	130
290	300	-10	15	131
260	300	-40	15	132
270	300	-30	15	133
260	300	-40	15	134
280	300	-20	15	135
280	300	-20	15	136
260	300	-40	15	137

260	300	-40	15	138
280	300	-20	15	139
290	300	-10	15	140
280	300	-20	15	141
250	300	-50	15	142
240	300	-60	15	143
230	300	-70	15	144
210	300	-90	15	145
220	300	-80	15	146
190	300	-110	15	147
190	300	-110	15	148
380	300	80	16	148
160	300	-140	16	149
167	300	-133	16	150
260	290	-30	16	151
270	290	-20	16	152
260	290	-30	16	153
280	290	-10	16	154
280	290	-10	16	155
260	290	-30	16	156
260	290	-30	16	157
280	290	-10	16	158
290	290	0	16	158
280	290	-10	16	159
250	290	-40	16	160
240	290	-50	16	161
230	290	-60	16	162
210	290	-80	16	163
220	290	-70	16	164
190	290	-100	16	165
190	290	-100	16	166
380	290	90	17	166
160	290	-130	17	167
167	290	-123	17	168
270	260	10	18	168
260	260	0	18	168
280	260	20	19	168
280	260	20	20	168
260	260	0	20	168
260	260	0	20	168
280	260	20	21	168
290	260	30	22	168
280	260	20	23	168
250	260	-10	23	169
240	260	-20	23	170
230	260	-30	23	171
210	260	-50	23	172
220	260	-40	23	173
190	260	-70	23	174
190	260	-70	23	175
380	260	120	24	175
160	260	-100	24	176
167	260	-93	24	177
260	270	-10	24	178



280	270	10	25	178
280	270	10	26	178
260	270	-10	26	179
260	270	-10	26	180
280	270	10	27	180
290	270	20	28	180
280	270	10	29	180
250	270	-20	29	181
240	270	-30	29	182
230	270	-40	29	183
210	270	-60	29	184
220	270	-50	29	185
190	270	-80	29	186
190	270	-80	29	187
380	270	110	30	187
160	270	-110	30	188
167	270	-103	30	189
280	260	20	31	189
280	260	20	32	189
260	260	0	32	189
260	260	0	32	189
280	260	20	33	189
290	260	30	34	189
280	260	20	35	189
250	260	-10	35	190
240	260	-20	35	191
230	260	-30	35	192
210	260	-50	35	193
220	260	-40	35	194
190	260	-70	35	195
190	260	-70	35	196
380	260	120	36	196
160	260	-100	36	197
167	260	-93	36	198
280	280	0	36	198
260	280	-20	36	199
260	280	-20	36	200
280	280	0	36	200
290	280	10	37	200
280	280	0	37	200
250	280	-30	37	201
240	280	-40	37	202
230	280	-50	37	203
210	280	-70	37	204
220	280	-60	37	205
190	280	-90	37	206
190	280	-90	37	207
380	280	100	38	207
160	280	-120	38	208
167	280	-113	38	209
260	280	-20	38	210
260	280	-20	38	211
280	280	0	38	211
290	280	10	39	211

280	280	0	39	211
250	280	-30	39	212
240	280	-40	39	213
230	280	-50	39	214
210	280	-70	39	215
220	280	-60	39	216
190	280	-90	39	217
190	280	-90	39	218
380	280	100	40	218
160	280	-120	40	219
167	280	-113	40	220
260	260	0	40	220
280	260	20	41	220
290	260	30	42	220
280	260	20	43	220
250	260	-10	43	221
240	260	-20	43	222
230	260	-30	43	223
210	260	-50	43	224
220	260	-40	43	225
190	260	-70	43	226
190	260	-70	43	227
380	260	120	44	227
160	260	-100	44	228
167	260	-93	44	229
280	260	20	45	229
290	260	30	46	229
280	260	20	47	229
250	260	-10	47	230
240	260	-20	47	231
230	260	-30	47	232
210	260	-50	47	233
220	260	-40	47	234
190	260	-70	47	235
190	260	-70	47	236
380	260	120	48	236
160	260	-100	48	237
167	260	-93	48	238
290	280	10	49	238
280	280	0	49	238
250	280	-30	49	239
240	280	-40	49	240
230	280	-50	49	241
210	280	-70	49	242
220	280	-60	49	243
190	280	-90	49	244
190	280	-90	49	245
380	280	100	50	245
160	280	-120	50	246
167	280	-113	50	247
280	290	-10	50	248
250	290	-40	50	249
240	290	-50	50	250

230	290	-60	50	251
210	290	-80	50	252
220	290	-70	50	253
190	290	-100	50	254
190	290	-100	50	255
380	290	90	51	255
160	290	-130	51	256
167	290	-123	51	257
250	280	-30	51	258
240	280	-40	51	259
230	280	-50	51	260
210	280	-70	51	261
220	280	-60	51	262
190	280	-90	51	263
190	280	-90	51	264
380	280	100	52	264
160	280	-120	52	265
167	280	-113	52	266
240	250	-10	52	267
230	250	-20	52	268
210	250	-40	52	269
220	250	-30	52	270
190	250	-60	52	271
190	250	-60	52	272
380	250	130	53	272
160	250	-90	53	273
167	250	-83	53	274
230	240	-10	53	275
210	240	-30	53	276
220	240	-20	53	277
190	240	-50	53	278
190	240	-50	53	279
380	240	140	54	279
160	240	-80	54	280
167	240	-73	54	281
210	230	-20	54	282
220	230	-10	54	283
190	230	-40	54	284
190	230	-40	54	285
380	230	150	55	285
160	230	-70	55	286
167	230	-63	55	287
220	210	10	56	287
190	210	-20	56	288
190	210	-20	56	289
380	210	170	57	289
160	210	-50	57	290
167	210	-43	57	291
190	220	-30	57	292
190	220	-30	57	293
380	220	160	58	293

160	220	-60	58	294
167	220	-53	58	295
190	190	0	58	295
380	190	190	59	295
160	190	-30	59	296
167	190	-23	59	297
380	190	190	60	297
160	190	-30	60	298
167	190	-23	60	299
160	380	-220	60	300
167	380	-213	60	301
167	160	7	61	301

S Statistic = 61 - 301 = -240

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<b>Tied Group Value</b>	<b>Members</b>
1	290
2	260
3	280
4	190

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<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/9/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/12/2012	1
11/7/2012	1
4/23/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 396  
B = 0  
C = 54  
D = 0  
E = 32  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2540  
Z-Score = -4.74221  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-4.74221 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-02D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
2190	2980	-790	0	1
3140	2980	160	1	1
3030	2980	50	2	1
3000	2980	20	3	1
3600	2980	620	4	1
2200	2980	-780	4	2
4500	2980	1520	5	2
2100	2980	-880	5	3
2000	2980	-980	5	4
2100	2980	-880	5	5
1900	2980	-1080	5	6
2100	2980	-880	5	7
2200	2980	-780	5	8
2100	2980	-880	5	9
2300	2980	-680	5	10
2400	2980	-580	5	11
2500	2980	-480	5	12
2800	2980	-180	5	13
3000	2980	20	6	13
1900	2980	-1080	6	14
2000	2980	-980	6	15
2500	2980	-480	6	16
2400	2980	-580	6	17
3800	2980	820	7	17
1800	2980	-1180	7	18
1500	2980	-1480	7	19
1670	2980	-1310	7	20
3140	2190	950	8	20
3030	2190	840	9	20
3000	2190	810	10	20
3600	2190	1410	11	20
2200	2190	10	12	20
4500	2190	2310	13	20
2100	2190	-90	13	21
2000	2190	-190	13	22
2100	2190	-90	13	23
1900	2190	-290	13	24
2100	2190	-90	13	25
2200	2190	10	14	25
2100	2190	-90	14	26
2300	2190	110	15	26
2400	2190	210	16	26
2500	2190	310	17	26
2800	2190	610	18	26
3000	2190	810	19	26

1900	2190	-290	19	27
2000	2190	-190	19	28
2500	2190	310	20	28
2400	2190	210	21	28
3800	2190	1610	22	28
1800	2190	-390	22	29
1500	2190	-690	22	30
1670	2190	-520	22	31
3030	3140	-110	22	32
3000	3140	-140	22	33
3600	3140	460	23	33
2200	3140	-940	23	34
4500	3140	1360	24	34
2100	3140	-1040	24	35
2000	3140	-1140	24	36
2100	3140	-1040	24	37
1900	3140	-1240	24	38
2100	3140	-1040	24	39
2200	3140	-940	24	40
2100	3140	-1040	24	41
2300	3140	-840	24	42
2400	3140	-740	24	43
2500	3140	-640	24	44
2800	3140	-340	24	45
3000	3140	-140	24	46
1900	3140	-1240	24	47
2000	3140	-1140	24	48
2500	3140	-640	24	49
2400	3140	-740	24	50
3800	3140	660	25	50
1800	3140	-1340	25	51
1500	3140	-1640	25	52
1670	3140	-1470	25	53
3000	3030	-30	25	54
3600	3030	570	26	54
2200	3030	-830	26	55
4500	3030	1470	27	55
2100	3030	-930	27	56
2000	3030	-1030	27	57
2100	3030	-930	27	58
1900	3030	-1130	27	59
2100	3030	-930	27	60
2200	3030	-830	27	61
2100	3030	-930	27	62
2300	3030	-730	27	63
2400	3030	-630	27	64
2500	3030	-530	27	65
2800	3030	-230	27	66
3000	3030	-30	27	67
1900	3030	-1130	27	68
2000	3030	-1030	27	69
2500	3030	-530	27	70
2400	3030	-630	27	71
3800	3030	770	28	71
1800	3030	-1230	28	72

1500	3030	-1530	28	73
1670	3030	-1360	28	74
3600	3000	600	29	74
2200	3000	-800	29	75
4500	3000	1500	30	75
2100	3000	-900	30	76
2000	3000	-1000	30	77
2100	3000	-900	30	78
1900	3000	-1100	30	79
2100	3000	-900	30	80
2200	3000	-800	30	81
2100	3000	-900	30	82
2300	3000	-700	30	83
2400	3000	-600	30	84
2500	3000	-500	30	85
2800	3000	-200	30	86
3000	3000	0	30	86
1900	3000	-1100	30	87
2000	3000	-1000	30	88
2500	3000	-500	30	89
2400	3000	-600	30	90
3800	3000	800	31	90
1800	3000	-1200	31	91
1500	3000	-1500	31	92
1670	3000	-1330	31	93
2200	3600	-1400	31	94
4500	3600	900	32	94
2100	3600	-1500	32	95
2000	3600	-1600	32	96
2100	3600	-1500	32	97
1900	3600	-1700	32	98
2100	3600	-1500	32	99
2200	3600	-1400	32	100
2100	3600	-1500	32	101
2300	3600	-1300	32	102
2400	3600	-1200	32	103
2500	3600	-1100	32	104
2800	3600	-800	32	105
3000	3600	-600	32	106
1900	3600	-1700	32	107
2000	3600	-1600	32	108
2500	3600	-1100	32	109
2400	3600	-1200	32	110
3800	3600	200	33	110
1800	3600	-1800	33	111
1500	3600	-2100	33	112
1670	3600	-1930	33	113
4500	2200	2300	34	113
2100	2200	-100	34	114
2000	2200	-200	34	115
2100	2200	-100	34	116
1900	2200	-300	34	117
2100	2200	-100	34	118
2200	2200	0	34	118



2100	2200	-100	34	119
2300	2200	100	35	119
2400	2200	200	36	119
2500	2200	300	37	119
2800	2200	600	38	119
3000	2200	800	39	119
1900	2200	-300	39	120
2000	2200	-200	39	121
2500	2200	300	40	121
2400	2200	200	41	121
3800	2200	1600	42	121
1800	2200	-400	42	122
1500	2200	-700	42	123
1670	2200	-530	42	124
2100	4500	-2400	42	125
2000	4500	-2500	42	126
2100	4500	-2400	42	127
1900	4500	-2600	42	128
2100	4500	-2400	42	129
2200	4500	-2300	42	130
2100	4500	-2400	42	131
2300	4500	-2200	42	132
2400	4500	-2100	42	133
2500	4500	-2000	42	134
2800	4500	-1700	42	135
3000	4500	-1500	42	136
1900	4500	-2600	42	137
2000	4500	-2500	42	138
2500	4500	-2000	42	139
2400	4500	-2100	42	140
3800	4500	-700	42	141
1800	4500	-2700	42	142
1500	4500	-3000	42	143
1670	4500	-2830	42	144
2000	2100	-100	42	145
2100	2100	0	42	145
1900	2100	-200	42	146
2100	2100	0	42	146
2200	2100	100	43	146
2100	2100	0	43	146
2300	2100	200	44	146
2400	2100	300	45	146
2500	2100	400	46	146
2800	2100	700	47	146
3000	2100	900	48	146
1900	2100	-200	48	147
2000	2100	-100	48	148
2500	2100	400	49	148
2400	2100	300	50	148
3800	2100	1700	51	148
1800	2100	-300	51	149
1500	2100	-600	51	150
1670	2100	-430	51	151
2100	2000	100	52	151

1900	2000	-100	52	152
2100	2000	100	53	152
2200	2000	200	54	152
2100	2000	100	55	152
2300	2000	300	56	152
2400	2000	400	57	152
2500	2000	500	58	152
2800	2000	800	59	152
3000	2000	1000	60	152
1900	2000	-100	60	153
2000	2000	0	60	153
2500	2000	500	61	153
2400	2000	400	62	153
3800	2000	1800	63	153
1800	2000	-200	63	154
1500	2000	-500	63	155
1670	2000	-330	63	156
1900	2100	-200	63	157
2100	2100	0	63	157
2200	2100	100	64	157
2100	2100	0	64	157
2300	2100	200	65	157
2400	2100	300	66	157
2500	2100	400	67	157
2800	2100	700	68	157
3000	2100	900	69	157
1900	2100	-200	69	158
2000	2100	-100	69	159
2500	2100	400	70	159
2400	2100	300	71	159
3800	2100	1700	72	159
1800	2100	-300	72	160
1500	2100	-600	72	161
1670	2100	-430	72	162
2100	1900	200	73	162
2200	1900	300	74	162
2100	1900	200	75	162
2300	1900	400	76	162
2400	1900	500	77	162
2500	1900	600	78	162
2800	1900	900	79	162
3000	1900	1100	80	162
1900	1900	0	80	162
2000	1900	100	81	162
2500	1900	600	82	162
2400	1900	500	83	162
3800	1900	1900	84	162
1800	1900	-100	84	163
1500	1900	-400	84	164
1670	1900	-230	84	165
2200	2100	100	85	165
2100	2100	0	85	165
2300	2100	200	86	165
2400	2100	300	87	165

2500	2100	400	88	165
2800	2100	700	89	165
3000	2100	900	90	165
1900	2100	-200	90	166
2000	2100	-100	90	167
2500	2100	400	91	167
2400	2100	300	92	167
3800	2100	1700	93	167
1800	2100	-300	93	168
1500	2100	-600	93	169
1670	2100	-430	93	170

2100	2200	-100	93	171
2300	2200	100	94	171
2400	2200	200	95	171
2500	2200	300	96	171
2800	2200	600	97	171
3000	2200	800	98	171
1900	2200	-300	98	172
2000	2200	-200	98	173
2500	2200	300	99	173
2400	2200	200	100	173
3800	2200	1600	101	173
1800	2200	-400	101	174
1500	2200	-700	101	175
1670	2200	-530	101	176

2300	2100	200	102	176
2400	2100	300	103	176
2500	2100	400	104	176
2800	2100	700	105	176
3000	2100	900	106	176
1900	2100	-200	106	177
2000	2100	-100	106	178
2500	2100	400	107	178
2400	2100	300	108	178
3800	2100	1700	109	178
1800	2100	-300	109	179
1500	2100	-600	109	180
1670	2100	-430	109	181

2400	2300	100	110	181
2500	2300	200	111	181
2800	2300	500	112	181
3000	2300	700	113	181
1900	2300	-400	113	182
2000	2300	-300	113	183
2500	2300	200	114	183
2400	2300	100	115	183
3800	2300	1500	116	183
1800	2300	-500	116	184
1500	2300	-800	116	185
1670	2300	-630	116	186

2500	2400	100	117	186
2800	2400	400	118	186
3000	2400	600	119	186

1900	2400	-500	119	187
2000	2400	-400	119	188
2500	2400	100	120	188
2400	2400	0	120	188
3800	2400	1400	121	188
1800	2400	-600	121	189
1500	2400	-900	121	190
1670	2400	-730	121	191
2800	2500	300	122	191
3000	2500	500	123	191
1900	2500	-600	123	192
2000	2500	-500	123	193
2500	2500	0	123	193
2400	2500	-100	123	194
3800	2500	1300	124	194
1800	2500	-700	124	195
1500	2500	-1000	124	196
1670	2500	-830	124	197
3000	2800	200	125	197
1900	2800	-900	125	198
2000	2800	-800	125	199
2500	2800	-300	125	200
2400	2800	-400	125	201
3800	2800	1000	126	201
1800	2800	-1000	126	202
1500	2800	-1300	126	203
1670	2800	-1130	126	204
1900	3000	-1100	126	205
2000	3000	-1000	126	206
2500	3000	-500	126	207
2400	3000	-600	126	208
3800	3000	800	127	208
1800	3000	-1200	127	209
1500	3000	-1500	127	210
1670	3000	-1330	127	211
2000	1900	100	128	211
2500	1900	600	129	211
2400	1900	500	130	211
3800	1900	1900	131	211
1800	1900	-100	131	212
1500	1900	-400	131	213
1670	1900	-230	131	214
2500	2000	500	132	214
2400	2000	400	133	214
3800	2000	1800	134	214
1800	2000	-200	134	215
1500	2000	-500	134	216
1670	2000	-330	134	217
2400	2500	-100	134	218
3800	2500	1300	135	218
1800	2500	-700	135	219

1500	2500	-1000	135	220
1670	2500	-830	135	221
3800	2400	1400	136	221
1800	2400	-600	136	222
1500	2400	-900	136	223
1670	2400	-730	136	224
1800	3800	-2000	136	225
1500	3800	-2300	136	226
1670	3800	-2130	136	227
1500	1800	-300	136	228
1670	1800	-130	136	229
1670	1500	170	137	229

S Statistic = 137 - 229 = -92

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**Tied Group Value      Members**

1	3000	2
2	2200	2
3	2100	4
4	2000	2
5	1900	2
6	2400	2
7	2500	2

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**Time Period      Observations**

3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/14/2010	1
8/12/2010	1
11/24/2010	1
3/8/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1

4/4/2018

1

There are 0 time periods with multiple data

---

A = 264

B = 0

C = 24

D = 0

E = 24

F = 0

a = 46116

b = 176904

c = 1512

Group Variance = 2547.33

Z-Score = -1.80301

Comparison Level at 95% confidence level = -1.65463 (downward trend)

-1.80301 < -1.65463 indicating a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-02D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
2190	2980	-790	0	1
3140	2980	160	1	1
3030	2980	50	2	1
3000	2980	20	3	1
3600	2980	620	4	1
2200	2980	-780	4	2
4500	2980	1520	5	2
2100	2980	-880	5	3
2000	2980	-980	5	4
2100	2980	-880	5	5
1900	2980	-1080	5	6
2100	2980	-880	5	7
2200	2980	-780	5	8
2100	2980	-880	5	9
2300	2980	-680	5	10
2400	2980	-580	5	11
2500	2980	-480	5	12
2800	2980	-180	5	13
3000	2980	20	6	13
1900	2980	-1080	6	14
2000	2980	-980	6	15
2500	2980	-480	6	16
2400	2980	-580	6	17
3800	2980	820	7	17
1800	2980	-1180	7	18
1500	2980	-1480	7	19
1670	2980	-1310	7	20
3140	2190	950	8	20
3030	2190	840	9	20
3000	2190	810	10	20
3600	2190	1410	11	20
2200	2190	10	12	20
4500	2190	2310	13	20
2100	2190	-90	13	21
2000	2190	-190	13	22
2100	2190	-90	13	23
1900	2190	-290	13	24
2100	2190	-90	13	25
2200	2190	10	14	25
2100	2190	-90	14	26
2300	2190	110	15	26
2400	2190	210	16	26
2500	2190	310	17	26
2800	2190	610	18	26
3000	2190	810	19	26

1900	2190	-290	19	27
2000	2190	-190	19	28
2500	2190	310	20	28
2400	2190	210	21	28
3800	2190	1610	22	28
1800	2190	-390	22	29
1500	2190	-690	22	30
1670	2190	-520	22	31
3030	3140	-110	22	32
3000	3140	-140	22	33
3600	3140	460	23	33
2200	3140	-940	23	34
4500	3140	1360	24	34
2100	3140	-1040	24	35
2000	3140	-1140	24	36
2100	3140	-1040	24	37
1900	3140	-1240	24	38
2100	3140	-1040	24	39
2200	3140	-940	24	40
2100	3140	-1040	24	41
2300	3140	-840	24	42
2400	3140	-740	24	43
2500	3140	-640	24	44
2800	3140	-340	24	45
3000	3140	-140	24	46
1900	3140	-1240	24	47
2000	3140	-1140	24	48
2500	3140	-640	24	49
2400	3140	-740	24	50
3800	3140	660	25	50
1800	3140	-1340	25	51
1500	3140	-1640	25	52
1670	3140	-1470	25	53
3000	3030	-30	25	54
3600	3030	570	26	54
2200	3030	-830	26	55
4500	3030	1470	27	55
2100	3030	-930	27	56
2000	3030	-1030	27	57
2100	3030	-930	27	58
1900	3030	-1130	27	59
2100	3030	-930	27	60
2200	3030	-830	27	61
2100	3030	-930	27	62
2300	3030	-730	27	63
2400	3030	-630	27	64
2500	3030	-530	27	65
2800	3030	-230	27	66
3000	3030	-30	27	67
1900	3030	-1130	27	68
2000	3030	-1030	27	69
2500	3030	-530	27	70
2400	3030	-630	27	71
3800	3030	770	28	71
1800	3030	-1230	28	72



1500	3030	-1530	28	73
1670	3030	-1360	28	74
3600	3000	600	29	74
2200	3000	-800	29	75
4500	3000	1500	30	75
2100	3000	-900	30	76
2000	3000	-1000	30	77
2100	3000	-900	30	78
1900	3000	-1100	30	79
2100	3000	-900	30	80
2200	3000	-800	30	81
2100	3000	-900	30	82
2300	3000	-700	30	83
2400	3000	-600	30	84
2500	3000	-500	30	85
2800	3000	-200	30	86
3000	3000	0	30	86
1900	3000	-1100	30	87
2000	3000	-1000	30	88
2500	3000	-500	30	89
2400	3000	-600	30	90
3800	3000	800	31	90
1800	3000	-1200	31	91
1500	3000	-1500	31	92
1670	3000	-1330	31	93
2200	3600	-1400	31	94
4500	3600	900	32	94
2100	3600	-1500	32	95
2000	3600	-1600	32	96
2100	3600	-1500	32	97
1900	3600	-1700	32	98
2100	3600	-1500	32	99
2200	3600	-1400	32	100
2100	3600	-1500	32	101
2300	3600	-1300	32	102
2400	3600	-1200	32	103
2500	3600	-1100	32	104
2800	3600	-800	32	105
3000	3600	-600	32	106
1900	3600	-1700	32	107
2000	3600	-1600	32	108
2500	3600	-1100	32	109
2400	3600	-1200	32	110
3800	3600	200	33	110
1800	3600	-1800	33	111
1500	3600	-2100	33	112
1670	3600	-1930	33	113
4500	2200	2300	34	113
2100	2200	-100	34	114
2000	2200	-200	34	115
2100	2200	-100	34	116
1900	2200	-300	34	117
2100	2200	-100	34	118
2200	2200	0	34	118

2100	2200	-100	34	119
2300	2200	100	35	119
2400	2200	200	36	119
2500	2200	300	37	119
2800	2200	600	38	119
3000	2200	800	39	119
1900	2200	-300	39	120
2000	2200	-200	39	121
2500	2200	300	40	121
2400	2200	200	41	121
3800	2200	1600	42	121
1800	2200	-400	42	122
1500	2200	-700	42	123
1670	2200	-530	42	124
2100	4500	-2400	42	125
2000	4500	-2500	42	126
2100	4500	-2400	42	127
1900	4500	-2600	42	128
2100	4500	-2400	42	129
2200	4500	-2300	42	130
2100	4500	-2400	42	131
2300	4500	-2200	42	132
2400	4500	-2100	42	133
2500	4500	-2000	42	134
2800	4500	-1700	42	135
3000	4500	-1500	42	136
1900	4500	-2600	42	137
2000	4500	-2500	42	138
2500	4500	-2000	42	139
2400	4500	-2100	42	140
3800	4500	-700	42	141
1800	4500	-2700	42	142
1500	4500	-3000	42	143
1670	4500	-2830	42	144
2000	2100	-100	42	145
2100	2100	0	42	145
1900	2100	-200	42	146
2100	2100	0	42	146
2200	2100	100	43	146
2100	2100	0	43	146
2300	2100	200	44	146
2400	2100	300	45	146
2500	2100	400	46	146
2800	2100	700	47	146
3000	2100	900	48	146
1900	2100	-200	48	147
2000	2100	-100	48	148
2500	2100	400	49	148
2400	2100	300	50	148
3800	2100	1700	51	148
1800	2100	-300	51	149
1500	2100	-600	51	150
1670	2100	-430	51	151
2100	2000	100	52	151

1900	2000	-100	52	152
2100	2000	100	53	152
2200	2000	200	54	152
2100	2000	100	55	152
2300	2000	300	56	152
2400	2000	400	57	152
2500	2000	500	58	152
2800	2000	800	59	152
3000	2000	1000	60	152
1900	2000	-100	60	153
2000	2000	0	60	153
2500	2000	500	61	153
2400	2000	400	62	153
3800	2000	1800	63	153
1800	2000	-200	63	154
1500	2000	-500	63	155
1670	2000	-330	63	156
1900	2100	-200	63	157
2100	2100	0	63	157
2200	2100	100	64	157
2100	2100	0	64	157
2300	2100	200	65	157
2400	2100	300	66	157
2500	2100	400	67	157
2800	2100	700	68	157
3000	2100	900	69	157
1900	2100	-200	69	158
2000	2100	-100	69	159
2500	2100	400	70	159
2400	2100	300	71	159
3800	2100	1700	72	159
1800	2100	-300	72	160
1500	2100	-600	72	161
1670	2100	-430	72	162
2100	1900	200	73	162
2200	1900	300	74	162
2100	1900	200	75	162
2300	1900	400	76	162
2400	1900	500	77	162
2500	1900	600	78	162
2800	1900	900	79	162
3000	1900	1100	80	162
1900	1900	0	80	162
2000	1900	100	81	162
2500	1900	600	82	162
2400	1900	500	83	162
3800	1900	1900	84	162
1800	1900	-100	84	163
1500	1900	-400	84	164
1670	1900	-230	84	165
2200	2100	100	85	165
2100	2100	0	85	165
2300	2100	200	86	165
2400	2100	300	87	165

2500	2100	400	88	165
2800	2100	700	89	165
3000	2100	900	90	165
1900	2100	-200	90	166
2000	2100	-100	90	167
2500	2100	400	91	167
2400	2100	300	92	167
3800	2100	1700	93	167
1800	2100	-300	93	168
1500	2100	-600	93	169
1670	2100	-430	93	170

2100	2200	-100	93	171
2300	2200	100	94	171
2400	2200	200	95	171
2500	2200	300	96	171
2800	2200	600	97	171
3000	2200	800	98	171
1900	2200	-300	98	172
2000	2200	-200	98	173
2500	2200	300	99	173
2400	2200	200	100	173
3800	2200	1600	101	173
1800	2200	-400	101	174
1500	2200	-700	101	175
1670	2200	-530	101	176

2300	2100	200	102	176
2400	2100	300	103	176
2500	2100	400	104	176
2800	2100	700	105	176
3000	2100	900	106	176
1900	2100	-200	106	177
2000	2100	-100	106	178
2500	2100	400	107	178
2400	2100	300	108	178
3800	2100	1700	109	178
1800	2100	-300	109	179
1500	2100	-600	109	180
1670	2100	-430	109	181

2400	2300	100	110	181
2500	2300	200	111	181
2800	2300	500	112	181
3000	2300	700	113	181
1900	2300	-400	113	182
2000	2300	-300	113	183
2500	2300	200	114	183
2400	2300	100	115	183
3800	2300	1500	116	183
1800	2300	-500	116	184
1500	2300	-800	116	185
1670	2300	-630	116	186

2500	2400	100	117	186
2800	2400	400	118	186
3000	2400	600	119	186

1900	2400	-500	119	187
2000	2400	-400	119	188
2500	2400	100	120	188
2400	2400	0	120	188
3800	2400	1400	121	188
1800	2400	-600	121	189
1500	2400	-900	121	190
1670	2400	-730	121	191
2800	2500	300	122	191
3000	2500	500	123	191
1900	2500	-600	123	192
2000	2500	-500	123	193
2500	2500	0	123	193
2400	2500	-100	123	194
3800	2500	1300	124	194
1800	2500	-700	124	195
1500	2500	-1000	124	196
1670	2500	-830	124	197
3000	2800	200	125	197
1900	2800	-900	125	198
2000	2800	-800	125	199
2500	2800	-300	125	200
2400	2800	-400	125	201
3800	2800	1000	126	201
1800	2800	-1000	126	202
1500	2800	-1300	126	203
1670	2800	-1130	126	204
1900	3000	-1100	126	205
2000	3000	-1000	126	206
2500	3000	-500	126	207
2400	3000	-600	126	208
3800	3000	800	127	208
1800	3000	-1200	127	209
1500	3000	-1500	127	210
1670	3000	-1330	127	211
2000	1900	100	128	211
2500	1900	600	129	211
2400	1900	500	130	211
3800	1900	1900	131	211
1800	1900	-100	131	212
1500	1900	-400	131	213
1670	1900	-230	131	214
2500	2000	500	132	214
2400	2000	400	133	214
3800	2000	1800	134	214
1800	2000	-200	134	215
1500	2000	-500	134	216
1670	2000	-330	134	217
2400	2500	-100	134	218
3800	2500	1300	135	218
1800	2500	-700	135	219

1500	2500	-1000	135	220
1670	2500	-830	135	221
3800	2400	1400	136	221
1800	2400	-600	136	222
1500	2400	-900	136	223
1670	2400	-730	136	224
1800	3800	-2000	136	225
1500	3800	-2300	136	226
1670	3800	-2130	136	227
1500	1800	-300	136	228
1670	1800	-130	136	229
1670	1500	170	137	229

S Statistic = 137 - 229 = -92

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<b>Tied Group Value</b>	<b>Members</b>	
1	3000	2
2	2200	2
3	2100	4
4	2000	2
5	1900	2
6	2400	2
7	2500	2

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/12/2008	1
9/23/2008	1
12/3/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/14/2010	1
8/12/2010	1
11/24/2010	1
3/8/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1

4/4/2018

1

There are 0 time periods with multiple data

---

A = 264

B = 0

C = 24

D = 0

E = 24

F = 0

a = 46116

b = 176904

c = 1512

Group Variance = 2547.33

Z-Score = -1.80301

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-1.80301 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-03D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
3960	4960	-1000	0	1
5680	4960	720	1	1
6620	4960	1660	2	1
7900	4960	2940	3	1
8600	4960	3640	4	1
4300	4960	-660	4	2
5300	4960	340	5	2
4400	4960	-560	5	3
4600	4960	-360	5	4
3800	4960	-1160	5	5
3500	4960	-1460	5	6
3600	4960	-1360	5	7
3700	4960	-1260	5	8
3500	4960	-1460	5	9
3500	4960	-1460	5	10
4000	4960	-960	5	11
3600	4960	-1360	5	12
3900	4960	-1060	5	13
4500	4960	-460	5	14
3300	4960	-1660	5	15
3800	4960	-1160	5	16
4400	4960	-560	5	17
4000	4960	-960	5	18
7000	4960	2040	6	18
3400	4960	-1560	6	19
2900	4960	-2060	6	20
3130	4960	-1830	6	21
5680	3960	1720	7	21
6620	3960	2660	8	21
7900	3960	3940	9	21
8600	3960	4640	10	21
4300	3960	340	11	21
5300	3960	1340	12	21
4400	3960	440	13	21
4600	3960	640	14	21
3800	3960	-160	14	22
3500	3960	-460	14	23
3600	3960	-360	14	24
3700	3960	-260	14	25
3500	3960	-460	14	26
3500	3960	-460	14	27
4000	3960	40	15	27
3600	3960	-360	15	28
3900	3960	-60	15	29
4500	3960	540	16	29



3300	3960	-660	16	30
3800	3960	-160	16	31
4400	3960	440	17	31
4000	3960	40	18	31
7000	3960	3040	19	31
3400	3960	-560	19	32
2900	3960	-1060	19	33
3130	3960	-830	19	34
6620	5680	940	20	34
7900	5680	2220	21	34
8600	5680	2920	22	34
4300	5680	-1380	22	35
5300	5680	-380	22	36
4400	5680	-1280	22	37
4600	5680	-1080	22	38
3800	5680	-1880	22	39
3500	5680	-2180	22	40
3600	5680	-2080	22	41
3700	5680	-1980	22	42
3500	5680	-2180	22	43
3500	5680	-2180	22	44
4000	5680	-1680	22	45
3600	5680	-2080	22	46
3900	5680	-1780	22	47
4500	5680	-1180	22	48
3300	5680	-2380	22	49
3800	5680	-1880	22	50
4400	5680	-1280	22	51
4000	5680	-1680	22	52
7000	5680	1320	23	52
3400	5680	-2280	23	53
2900	5680	-2780	23	54
3130	5680	-2550	23	55
7900	6620	1280	24	55
8600	6620	1980	25	55
4300	6620	-2320	25	56
5300	6620	-1320	25	57
4400	6620	-2220	25	58
4600	6620	-2020	25	59
3800	6620	-2820	25	60
3500	6620	-3120	25	61
3600	6620	-3020	25	62
3700	6620	-2920	25	63
3500	6620	-3120	25	64
3500	6620	-3120	25	65
4000	6620	-2620	25	66
3600	6620	-3020	25	67
3900	6620	-2720	25	68
4500	6620	-2120	25	69
3300	6620	-3320	25	70
3800	6620	-2820	25	71
4400	6620	-2220	25	72
4000	6620	-2620	25	73
7000	6620	380	26	73
3400	6620	-3220	26	74

2900	6620	-3720	26	75
3130	6620	-3490	26	76
8600	7900	700	27	76
4300	7900	-3600	27	77
5300	7900	-2600	27	78
4400	7900	-3500	27	79
4600	7900	-3300	27	80
3800	7900	-4100	27	81
3500	7900	-4400	27	82
3600	7900	-4300	27	83
3700	7900	-4200	27	84
3500	7900	-4400	27	85
3500	7900	-4400	27	86
4000	7900	-3900	27	87
3600	7900	-4300	27	88
3900	7900	-4000	27	89
4500	7900	-3400	27	90
3300	7900	-4600	27	91
3800	7900	-4100	27	92
4400	7900	-3500	27	93
4000	7900	-3900	27	94
7000	7900	-900	27	95
3400	7900	-4500	27	96
2900	7900	-5000	27	97
3130	7900	-4770	27	98
4300	8600	-4300	27	99
5300	8600	-3300	27	100
4400	8600	-4200	27	101
4600	8600	-4000	27	102
3800	8600	-4800	27	103
3500	8600	-5100	27	104
3600	8600	-5000	27	105
3700	8600	-4900	27	106
3500	8600	-5100	27	107
3500	8600	-5100	27	108
4000	8600	-4600	27	109
3600	8600	-5000	27	110
3900	8600	-4700	27	111
4500	8600	-4100	27	112
3300	8600	-5300	27	113
3800	8600	-4800	27	114
4400	8600	-4200	27	115
4000	8600	-4600	27	116
7000	8600	-1600	27	117
3400	8600	-5200	27	118
2900	8600	-5700	27	119
3130	8600	-5470	27	120
5300	4300	1000	28	120
4400	4300	100	29	120
4600	4300	300	30	120
3800	4300	-500	30	121
3500	4300	-800	30	122
3600	4300	-700	30	123
3700	4300	-600	30	124

3500	4300	-800	30	125
3500	4300	-800	30	126
4000	4300	-300	30	127
3600	4300	-700	30	128
3900	4300	-400	30	129
4500	4300	200	31	129
3300	4300	-1000	31	130
3800	4300	-500	31	131
4400	4300	100	32	131
4000	4300	-300	32	132
7000	4300	2700	33	132
3400	4300	-900	33	133
2900	4300	-1400	33	134
3130	4300	-1170	33	135
4400	5300	-900	33	136
4600	5300	-700	33	137
3800	5300	-1500	33	138
3500	5300	-1800	33	139
3600	5300	-1700	33	140
3700	5300	-1600	33	141
3500	5300	-1800	33	142
3500	5300	-1800	33	143
4000	5300	-1300	33	144
3600	5300	-1700	33	145
3900	5300	-1400	33	146
4500	5300	-800	33	147
3300	5300	-2000	33	148
3800	5300	-1500	33	149
4400	5300	-900	33	150
4000	5300	-1300	33	151
7000	5300	1700	34	151
3400	5300	-1900	34	152
2900	5300	-2400	34	153
3130	5300	-2170	34	154
4600	4400	200	35	154
3800	4400	-600	35	155
3500	4400	-900	35	156
3600	4400	-800	35	157
3700	4400	-700	35	158
3500	4400	-900	35	159
3500	4400	-900	35	160
4000	4400	-400	35	161
3600	4400	-800	35	162
3900	4400	-500	35	163
4500	4400	100	36	163
3300	4400	-1100	36	164
3800	4400	-600	36	165
4400	4400	0	36	165
4000	4400	-400	36	166
7000	4400	2600	37	166
3400	4400	-1000	37	167
2900	4400	-1500	37	168
3130	4400	-1270	37	169
3800	4600	-800	37	170

3500	4600	-1100	37	171
3600	4600	-1000	37	172
3700	4600	-900	37	173
3500	4600	-1100	37	174
3500	4600	-1100	37	175
4000	4600	-600	37	176
3600	4600	-1000	37	177
3900	4600	-700	37	178
4500	4600	-100	37	179
3300	4600	-1300	37	180
3800	4600	-800	37	181
4400	4600	-200	37	182
4000	4600	-600	37	183
7000	4600	2400	38	183
3400	4600	-1200	38	184
2900	4600	-1700	38	185
3130	4600	-1470	38	186

3500	3800	-300	38	187
3600	3800	-200	38	188
3700	3800	-100	38	189
3500	3800	-300	38	190
3500	3800	-300	38	191
4000	3800	200	39	191
3600	3800	-200	39	192
3900	3800	100	40	192
4500	3800	700	41	192
3300	3800	-500	41	193
3800	3800	0	41	193
4400	3800	600	42	193
4000	3800	200	43	193
7000	3800	3200	44	193
3400	3800	-400	44	194
2900	3800	-900	44	195
3130	3800	-670	44	196

3600	3500	100	45	196
3700	3500	200	46	196
3500	3500	0	46	196
3500	3500	0	46	196
4000	3500	500	47	196
3600	3500	100	48	196
3900	3500	400	49	196
4500	3500	1000	50	196
3300	3500	-200	50	197
3800	3500	300	51	197
4400	3500	900	52	197
4000	3500	500	53	197
7000	3500	3500	54	197
3400	3500	-100	54	198
2900	3500	-600	54	199
3130	3500	-370	54	200

3700	3600	100	55	200
3500	3600	-100	55	201
3500	3600	-100	55	202
4000	3600	400	56	202

3600	3600	0	56	202
3900	3600	300	57	202
4500	3600	900	58	202
3300	3600	-300	58	203
3800	3600	200	59	203
4400	3600	800	60	203
4000	3600	400	61	203
7000	3600	3400	62	203
3400	3600	-200	62	204
2900	3600	-700	62	205
3130	3600	-470	62	206
3500	3700	-200	62	207
3500	3700	-200	62	208
4000	3700	300	63	208
3600	3700	-100	63	209
3900	3700	200	64	209
4500	3700	800	65	209
3300	3700	-400	65	210
3800	3700	100	66	210
4400	3700	700	67	210
4000	3700	300	68	210
7000	3700	3300	69	210
3400	3700	-300	69	211
2900	3700	-800	69	212
3130	3700	-570	69	213
3500	3500	0	69	213
4000	3500	500	70	213
3600	3500	100	71	213
3900	3500	400	72	213
4500	3500	1000	73	213
3300	3500	-200	73	214
3800	3500	300	74	214
4400	3500	900	75	214
4000	3500	500	76	214
7000	3500	3500	77	214
3400	3500	-100	77	215
2900	3500	-600	77	216
3130	3500	-370	77	217
4000	3500	500	78	217
3600	3500	100	79	217
3900	3500	400	80	217
4500	3500	1000	81	217
3300	3500	-200	81	218
3800	3500	300	82	218
4400	3500	900	83	218
4000	3500	500	84	218
7000	3500	3500	85	218
3400	3500	-100	85	219
2900	3500	-600	85	220
3130	3500	-370	85	221
3600	4000	-400	85	222
3900	4000	-100	85	223
4500	4000	500	86	223

3300	4000	-700	86	224
3800	4000	-200	86	225
4400	4000	400	87	225
4000	4000	0	87	225
7000	4000	3000	88	225
3400	4000	-600	88	226
2900	4000	-1100	88	227
3130	4000	-870	88	228
3900	3600	300	89	228
4500	3600	900	90	228
3300	3600	-300	90	229
3800	3600	200	91	229
4400	3600	800	92	229
4000	3600	400	93	229
7000	3600	3400	94	229
3400	3600	-200	94	230
2900	3600	-700	94	231
3130	3600	-470	94	232
4500	3900	600	95	232
3300	3900	-600	95	233
3800	3900	-100	95	234
4400	3900	500	96	234
4000	3900	100	97	234
7000	3900	3100	98	234
3400	3900	-500	98	235
2900	3900	-1000	98	236
3130	3900	-770	98	237
3300	4500	-1200	98	238
3800	4500	-700	98	239
4400	4500	-100	98	240
4000	4500	-500	98	241
7000	4500	2500	99	241
3400	4500	-1100	99	242
2900	4500	-1600	99	243
3130	4500	-1370	99	244
3800	3300	500	100	244
4400	3300	1100	101	244
4000	3300	700	102	244
7000	3300	3700	103	244
3400	3300	100	104	244
2900	3300	-400	104	245
3130	3300	-170	104	246
4400	3800	600	105	246
4000	3800	200	106	246
7000	3800	3200	107	246
3400	3800	-400	107	247
2900	3800	-900	107	248
3130	3800	-670	107	249
4000	4400	-400	107	250
7000	4400	2600	108	250
3400	4400	-1000	108	251

2900	4400	-1500	108	252
3130	4400	-1270	108	253
7000	4000	3000	109	253
3400	4000	-600	109	254
2900	4000	-1100	109	255
3130	4000	-870	109	256
3400	7000	-3600	109	257
2900	7000	-4100	109	258
3130	7000	-3870	109	259
2900	3400	-500	109	260
3130	3400	-270	109	261
3130	2900	230	110	261

S Statistic = 110 - 261 = -151

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Tied Group Value	Members	
1	4400	2
2	3800	2
3	3500	3
4	3600	2
5	4000	2

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Time Period	Observations
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 138  
B = 0  
C = 6  
D = 0  
E = 14  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2554.33  
Z-Score = -2.96792  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
-2.96792 < -1.65463 indicating a downward trend



# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-03D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
3960	4960	-1000	0	1
5680	4960	720	1	1
6620	4960	1660	2	1
7900	4960	2940	3	1
8600	4960	3640	4	1
4300	4960	-660	4	2
5300	4960	340	5	2
4400	4960	-560	5	3
4600	4960	-360	5	4
3800	4960	-1160	5	5
3500	4960	-1460	5	6
3600	4960	-1360	5	7
3700	4960	-1260	5	8
3500	4960	-1460	5	9
3500	4960	-1460	5	10
4000	4960	-960	5	11
3600	4960	-1360	5	12
3900	4960	-1060	5	13
4500	4960	-460	5	14
3300	4960	-1660	5	15
3800	4960	-1160	5	16
4400	4960	-560	5	17
4000	4960	-960	5	18
7000	4960	2040	6	18
3400	4960	-1560	6	19
2900	4960	-2060	6	20
3130	4960	-1830	6	21
5680	3960	1720	7	21
6620	3960	2660	8	21
7900	3960	3940	9	21
8600	3960	4640	10	21
4300	3960	340	11	21
5300	3960	1340	12	21
4400	3960	440	13	21
4600	3960	640	14	21
3800	3960	-160	14	22
3500	3960	-460	14	23
3600	3960	-360	14	24
3700	3960	-260	14	25
3500	3960	-460	14	26
3500	3960	-460	14	27
4000	3960	40	15	27
3600	3960	-360	15	28
3900	3960	-60	15	29
4500	3960	540	16	29

3300	3960	-660	16	30
3800	3960	-160	16	31
4400	3960	440	17	31
4000	3960	40	18	31
7000	3960	3040	19	31
3400	3960	-560	19	32
2900	3960	-1060	19	33
3130	3960	-830	19	34
6620	5680	940	20	34
7900	5680	2220	21	34
8600	5680	2920	22	34
4300	5680	-1380	22	35
5300	5680	-380	22	36
4400	5680	-1280	22	37
4600	5680	-1080	22	38
3800	5680	-1880	22	39
3500	5680	-2180	22	40
3600	5680	-2080	22	41
3700	5680	-1980	22	42
3500	5680	-2180	22	43
3500	5680	-2180	22	44
4000	5680	-1680	22	45
3600	5680	-2080	22	46
3900	5680	-1780	22	47
4500	5680	-1180	22	48
3300	5680	-2380	22	49
3800	5680	-1880	22	50
4400	5680	-1280	22	51
4000	5680	-1680	22	52
7000	5680	1320	23	52
3400	5680	-2280	23	53
2900	5680	-2780	23	54
3130	5680	-2550	23	55
7900	6620	1280	24	55
8600	6620	1980	25	55
4300	6620	-2320	25	56
5300	6620	-1320	25	57
4400	6620	-2220	25	58
4600	6620	-2020	25	59
3800	6620	-2820	25	60
3500	6620	-3120	25	61
3600	6620	-3020	25	62
3700	6620	-2920	25	63
3500	6620	-3120	25	64
3500	6620	-3120	25	65
4000	6620	-2620	25	66
3600	6620	-3020	25	67
3900	6620	-2720	25	68
4500	6620	-2120	25	69
3300	6620	-3320	25	70
3800	6620	-2820	25	71
4400	6620	-2220	25	72
4000	6620	-2620	25	73
7000	6620	380	26	73
3400	6620	-3220	26	74

2900	6620	-3720	26	75
3130	6620	-3490	26	76
8600	7900	700	27	76
4300	7900	-3600	27	77
5300	7900	-2600	27	78
4400	7900	-3500	27	79
4600	7900	-3300	27	80
3800	7900	-4100	27	81
3500	7900	-4400	27	82
3600	7900	-4300	27	83
3700	7900	-4200	27	84
3500	7900	-4400	27	85
3500	7900	-4400	27	86
4000	7900	-3900	27	87
3600	7900	-4300	27	88
3900	7900	-4000	27	89
4500	7900	-3400	27	90
3300	7900	-4600	27	91
3800	7900	-4100	27	92
4400	7900	-3500	27	93
4000	7900	-3900	27	94
7000	7900	-900	27	95
3400	7900	-4500	27	96
2900	7900	-5000	27	97
3130	7900	-4770	27	98
4300	8600	-4300	27	99
5300	8600	-3300	27	100
4400	8600	-4200	27	101
4600	8600	-4000	27	102
3800	8600	-4800	27	103
3500	8600	-5100	27	104
3600	8600	-5000	27	105
3700	8600	-4900	27	106
3500	8600	-5100	27	107
3500	8600	-5100	27	108
4000	8600	-4600	27	109
3600	8600	-5000	27	110
3900	8600	-4700	27	111
4500	8600	-4100	27	112
3300	8600	-5300	27	113
3800	8600	-4800	27	114
4400	8600	-4200	27	115
4000	8600	-4600	27	116
7000	8600	-1600	27	117
3400	8600	-5200	27	118
2900	8600	-5700	27	119
3130	8600	-5470	27	120
5300	4300	1000	28	120
4400	4300	100	29	120
4600	4300	300	30	120
3800	4300	-500	30	121
3500	4300	-800	30	122
3600	4300	-700	30	123
3700	4300	-600	30	124

3500	4300	-800	30	125
3500	4300	-800	30	126
4000	4300	-300	30	127
3600	4300	-700	30	128
3900	4300	-400	30	129
4500	4300	200	31	129
3300	4300	-1000	31	130
3800	4300	-500	31	131
4400	4300	100	32	131
4000	4300	-300	32	132
7000	4300	2700	33	132
3400	4300	-900	33	133
2900	4300	-1400	33	134
3130	4300	-1170	33	135
4400	5300	-900	33	136
4600	5300	-700	33	137
3800	5300	-1500	33	138
3500	5300	-1800	33	139
3600	5300	-1700	33	140
3700	5300	-1600	33	141
3500	5300	-1800	33	142
3500	5300	-1800	33	143
4000	5300	-1300	33	144
3600	5300	-1700	33	145
3900	5300	-1400	33	146
4500	5300	-800	33	147
3300	5300	-2000	33	148
3800	5300	-1500	33	149
4400	5300	-900	33	150
4000	5300	-1300	33	151
7000	5300	1700	34	151
3400	5300	-1900	34	152
2900	5300	-2400	34	153
3130	5300	-2170	34	154
4600	4400	200	35	154
3800	4400	-600	35	155
3500	4400	-900	35	156
3600	4400	-800	35	157
3700	4400	-700	35	158
3500	4400	-900	35	159
3500	4400	-900	35	160
4000	4400	-400	35	161
3600	4400	-800	35	162
3900	4400	-500	35	163
4500	4400	100	36	163
3300	4400	-1100	36	164
3800	4400	-600	36	165
4400	4400	0	36	165
4000	4400	-400	36	166
7000	4400	2600	37	166
3400	4400	-1000	37	167
2900	4400	-1500	37	168
3130	4400	-1270	37	169
3800	4600	-800	37	170

3500	4600	-1100	37	171
3600	4600	-1000	37	172
3700	4600	-900	37	173
3500	4600	-1100	37	174
3500	4600	-1100	37	175
4000	4600	-600	37	176
3600	4600	-1000	37	177
3900	4600	-700	37	178
4500	4600	-100	37	179
3300	4600	-1300	37	180
3800	4600	-800	37	181
4400	4600	-200	37	182
4000	4600	-600	37	183
7000	4600	2400	38	183
3400	4600	-1200	38	184
2900	4600	-1700	38	185
3130	4600	-1470	38	186

3500	3800	-300	38	187
3600	3800	-200	38	188
3700	3800	-100	38	189
3500	3800	-300	38	190
3500	3800	-300	38	191
4000	3800	200	39	191
3600	3800	-200	39	192
3900	3800	100	40	192
4500	3800	700	41	192
3300	3800	-500	41	193
3800	3800	0	41	193
4400	3800	600	42	193
4000	3800	200	43	193
7000	3800	3200	44	193
3400	3800	-400	44	194
2900	3800	-900	44	195
3130	3800	-670	44	196

3600	3500	100	45	196
3700	3500	200	46	196
3500	3500	0	46	196
3500	3500	0	46	196
4000	3500	500	47	196
3600	3500	100	48	196
3900	3500	400	49	196
4500	3500	1000	50	196
3300	3500	-200	50	197
3800	3500	300	51	197
4400	3500	900	52	197
4000	3500	500	53	197
7000	3500	3500	54	197
3400	3500	-100	54	198
2900	3500	-600	54	199
3130	3500	-370	54	200

3700	3600	100	55	200
3500	3600	-100	55	201
3500	3600	-100	55	202
4000	3600	400	56	202

3600	3600	0	56	202
3900	3600	300	57	202
4500	3600	900	58	202
3300	3600	-300	58	203
3800	3600	200	59	203
4400	3600	800	60	203
4000	3600	400	61	203
7000	3600	3400	62	203
3400	3600	-200	62	204
2900	3600	-700	62	205
3130	3600	-470	62	206
3500	3700	-200	62	207
3500	3700	-200	62	208
4000	3700	300	63	208
3600	3700	-100	63	209
3900	3700	200	64	209
4500	3700	800	65	209
3300	3700	-400	65	210
3800	3700	100	66	210
4400	3700	700	67	210
4000	3700	300	68	210
7000	3700	3300	69	210
3400	3700	-300	69	211
2900	3700	-800	69	212
3130	3700	-570	69	213
3500	3500	0	69	213
4000	3500	500	70	213
3600	3500	100	71	213
3900	3500	400	72	213
4500	3500	1000	73	213
3300	3500	-200	73	214
3800	3500	300	74	214
4400	3500	900	75	214
4000	3500	500	76	214
7000	3500	3500	77	214
3400	3500	-100	77	215
2900	3500	-600	77	216
3130	3500	-370	77	217
4000	3500	500	78	217
3600	3500	100	79	217
3900	3500	400	80	217
4500	3500	1000	81	217
3300	3500	-200	81	218
3800	3500	300	82	218
4400	3500	900	83	218
4000	3500	500	84	218
7000	3500	3500	85	218
3400	3500	-100	85	219
2900	3500	-600	85	220
3130	3500	-370	85	221
3600	4000	-400	85	222
3900	4000	-100	85	223
4500	4000	500	86	223

3300	4000	-700	86	224
3800	4000	-200	86	225
4400	4000	400	87	225
4000	4000	0	87	225
7000	4000	3000	88	225
3400	4000	-600	88	226
2900	4000	-1100	88	227
3130	4000	-870	88	228
3900	3600	300	89	228
4500	3600	900	90	228
3300	3600	-300	90	229
3800	3600	200	91	229
4400	3600	800	92	229
4000	3600	400	93	229
7000	3600	3400	94	229
3400	3600	-200	94	230
2900	3600	-700	94	231
3130	3600	-470	94	232
4500	3900	600	95	232
3300	3900	-600	95	233
3800	3900	-100	95	234
4400	3900	500	96	234
4000	3900	100	97	234
7000	3900	3100	98	234
3400	3900	-500	98	235
2900	3900	-1000	98	236
3130	3900	-770	98	237
3300	4500	-1200	98	238
3800	4500	-700	98	239
4400	4500	-100	98	240
4000	4500	-500	98	241
7000	4500	2500	99	241
3400	4500	-1100	99	242
2900	4500	-1600	99	243
3130	4500	-1370	99	244
3800	3300	500	100	244
4400	3300	1100	101	244
4000	3300	700	102	244
7000	3300	3700	103	244
3400	3300	100	104	244
2900	3300	-400	104	245
3130	3300	-170	104	246
4400	3800	600	105	246
4000	3800	200	106	246
7000	3800	3200	107	246
3400	3800	-400	107	247
2900	3800	-900	107	248
3130	3800	-670	107	249
4000	4400	-400	107	250
7000	4400	2600	108	250
3400	4400	-1000	108	251

2900	4400	-1500	108	252
3130	4400	-1270	108	253
7000	4000	3000	109	253
3400	4000	-600	109	254
2900	4000	-1100	109	255
3130	4000	-870	109	256
3400	7000	-3600	109	257
2900	7000	-4100	109	258
3130	7000	-3870	109	259
2900	3400	-500	109	260
3130	3400	-270	109	261
3130	2900	230	110	261

S Statistic = 110 - 261 = -151

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<b>Tied Group Value</b>	<b>Members</b>	
1	4400	2
2	3800	2
3	3500	3
4	3600	2
5	4000	2

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<b>Time Period</b>	<b>Observations</b>
3/12/2008	1
5/10/2008	1
9/22/2008	1
10/28/2008	1
4/28/2009	1
5/14/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/24/2011	1
9/1/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data



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A = 138  
B = 0  
C = 6  
D = 0  
E = 14  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2554.33  
Z-Score = -2.96792  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-2.96792 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-04D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
4700	5110	-410	0	1
8000	5110	2890	1	1
7470	5110	2360	2	1
12000	5110	6890	3	1
13000	5110	7890	4	1
6500	5110	1390	5	1
7200	5110	2090	6	1
5900	5110	790	7	1
5000	5110	-110	7	2
4800	5110	-310	7	3
4200	5110	-910	7	4
3900	5110	-1210	7	5
4000	5110	-1110	7	6
3900	5110	-1210	7	7
3700	5110	-1410	7	8
3900	5110	-1210	7	9
5000	5110	-110	7	10
5500	5110	390	8	10
5400	5110	290	9	10
3000	5110	-2110	9	11
9.8	5110	-5100.2	9	12
30	5110	-5080	9	13
12	5110	-5098	9	14
4600	5110	-510	9	15
2800	5110	-2310	9	16
2100	5110	-3010	9	17
26.2	5110	-5083.8	9	18
8000	4700	3300	10	18
7470	4700	2770	11	18
12000	4700	7300	12	18
13000	4700	8300	13	18
6500	4700	1800	14	18
7200	4700	2500	15	18
5900	4700	1200	16	18
5000	4700	300	17	18
4800	4700	100	18	18
4200	4700	-500	18	19
3900	4700	-800	18	20
4000	4700	-700	18	21
3900	4700	-800	18	22
3700	4700	-1000	18	23
3900	4700	-800	18	24
5000	4700	300	19	24
5500	4700	800	20	24
5400	4700	700	21	24

3000	4700	-1700	21	25
9.8	4700	-4690.2	21	26
30	4700	-4670	21	27
12	4700	-4688	21	28
4600	4700	-100	21	29
2800	4700	-1900	21	30
2100	4700	-2600	21	31
26.2	4700	-4673.8	21	32
7470	8000	-530	21	33
12000	8000	4000	22	33
13000	8000	5000	23	33
6500	8000	-1500	23	34
7200	8000	-800	23	35
5900	8000	-2100	23	36
5000	8000	-3000	23	37
4800	8000	-3200	23	38
4200	8000	-3800	23	39
3900	8000	-4100	23	40
4000	8000	-4000	23	41
3900	8000	-4100	23	42
3700	8000	-4300	23	43
3900	8000	-4100	23	44
5000	8000	-3000	23	45
5500	8000	-2500	23	46
5400	8000	-2600	23	47
3000	8000	-5000	23	48
9.8	8000	-7990.2	23	49
30	8000	-7970	23	50
12	8000	-7988	23	51
4600	8000	-3400	23	52
2800	8000	-5200	23	53
2100	8000	-5900	23	54
26.2	8000	-7973.8	23	55
12000	7470	4530	24	55
13000	7470	5530	25	55
6500	7470	-970	25	56
7200	7470	-270	25	57
5900	7470	-1570	25	58
5000	7470	-2470	25	59
4800	7470	-2670	25	60
4200	7470	-3270	25	61
3900	7470	-3570	25	62
4000	7470	-3470	25	63
3900	7470	-3570	25	64
3700	7470	-3770	25	65
3900	7470	-3570	25	66
5000	7470	-2470	25	67
5500	7470	-1970	25	68
5400	7470	-2070	25	69
3000	7470	-4470	25	70
9.8	7470	-7460.2	25	71
30	7470	-7440	25	72
12	7470	-7458	25	73
4600	7470	-2870	25	74
2800	7470	-4670	25	75

2100	7470	-5370	25	76
26.2	7470	-7443.8	25	77
13000	12000	1000	26	77
6500	12000	-5500	26	78
7200	12000	-4800	26	79
5900	12000	-6100	26	80
5000	12000	-7000	26	81
4800	12000	-7200	26	82
4200	12000	-7800	26	83
3900	12000	-8100	26	84
4000	12000	-8000	26	85
3900	12000	-8100	26	86
3700	12000	-8300	26	87
3900	12000	-8100	26	88
5000	12000	-7000	26	89
5500	12000	-6500	26	90
5400	12000	-6600	26	91
3000	12000	-9000	26	92
9.8	12000	-11990.2	26	93
30	12000	-11970	26	94
12	12000	-11988	26	95
4600	12000	-7400	26	96
2800	12000	-9200	26	97
2100	12000	-9900	26	98
26.2	12000	-11973.8	26	99
6500	13000	-6500	26	100
7200	13000	-5800	26	101
5900	13000	-7100	26	102
5000	13000	-8000	26	103
4800	13000	-8200	26	104
4200	13000	-8800	26	105
3900	13000	-9100	26	106
4000	13000	-9000	26	107
3900	13000	-9100	26	108
3700	13000	-9300	26	109
3900	13000	-9100	26	110
5000	13000	-8000	26	111
5500	13000	-7500	26	112
5400	13000	-7600	26	113
3000	13000	-10000	26	114
9.8	13000	-12990.2	26	115
30	13000	-12970	26	116
12	13000	-12988	26	117
4600	13000	-8400	26	118
2800	13000	-10200	26	119
2100	13000	-10900	26	120
26.2	13000	-12973.8	26	121
7200	6500	700	27	121
5900	6500	-600	27	122
5000	6500	-1500	27	123
4800	6500	-1700	27	124
4200	6500	-2300	27	125
3900	6500	-2600	27	126
4000	6500	-2500	27	127

3900	6500	-2600	27	128
3700	6500	-2800	27	129
3900	6500	-2600	27	130
5000	6500	-1500	27	131
5500	6500	-1000	27	132
5400	6500	-1100	27	133
3000	6500	-3500	27	134
9.8	6500	-6490.2	27	135
30	6500	-6470	27	136
12	6500	-6488	27	137
4600	6500	-1900	27	138
2800	6500	-3700	27	139
2100	6500	-4400	27	140
26.2	6500	-6473.8	27	141
5900	7200	-1300	27	142
5000	7200	-2200	27	143
4800	7200	-2400	27	144
4200	7200	-3000	27	145
3900	7200	-3300	27	146
4000	7200	-3200	27	147
3900	7200	-3300	27	148
3700	7200	-3500	27	149
3900	7200	-3300	27	150
5000	7200	-2200	27	151
5500	7200	-1700	27	152
5400	7200	-1800	27	153
3000	7200	-4200	27	154
9.8	7200	-7190.2	27	155
30	7200	-7170	27	156
12	7200	-7188	27	157
4600	7200	-2600	27	158
2800	7200	-4400	27	159
2100	7200	-5100	27	160
26.2	7200	-7173.8	27	161
5000	5900	-900	27	162
4800	5900	-1100	27	163
4200	5900	-1700	27	164
3900	5900	-2000	27	165
4000	5900	-1900	27	166
3900	5900	-2000	27	167
3700	5900	-2200	27	168
3900	5900	-2000	27	169
5000	5900	-900	27	170
5500	5900	-400	27	171
5400	5900	-500	27	172
3000	5900	-2900	27	173
9.8	5900	-5890.2	27	174
30	5900	-5870	27	175
12	5900	-5888	27	176
4600	5900	-1300	27	177
2800	5900	-3100	27	178
2100	5900	-3800	27	179
26.2	5900	-5873.8	27	180
4800	5000	-200	27	181

4200	5000	-800	27	182
3900	5000	-1100	27	183
4000	5000	-1000	27	184
3900	5000	-1100	27	185
3700	5000	-1300	27	186
3900	5000	-1100	27	187
5000	5000	0	27	187
5500	5000	500	28	187
5400	5000	400	29	187
3000	5000	-2000	29	188
9.8	5000	-4990.2	29	189
30	5000	-4970	29	190
12	5000	-4988	29	191
4600	5000	-400	29	192
2800	5000	-2200	29	193
2100	5000	-2900	29	194
26.2	5000	-4973.8	29	195
4200	4800	-600	29	196
3900	4800	-900	29	197
4000	4800	-800	29	198
3900	4800	-900	29	199
3700	4800	-1100	29	200
3900	4800	-900	29	201
5000	4800	200	30	201
5500	4800	700	31	201
5400	4800	600	32	201
3000	4800	-1800	32	202
9.8	4800	-4790.2	32	203
30	4800	-4770	32	204
12	4800	-4788	32	205
4600	4800	-200	32	206
2800	4800	-2000	32	207
2100	4800	-2700	32	208
26.2	4800	-4773.8	32	209
3900	4200	-300	32	210
4000	4200	-200	32	211
3900	4200	-300	32	212
3700	4200	-500	32	213
3900	4200	-300	32	214
5000	4200	800	33	214
5500	4200	1300	34	214
5400	4200	1200	35	214
3000	4200	-1200	35	215
9.8	4200	-4190.2	35	216
30	4200	-4170	35	217
12	4200	-4188	35	218
4600	4200	400	36	218
2800	4200	-1400	36	219
2100	4200	-2100	36	220
26.2	4200	-4173.8	36	221
4000	3900	100	37	221
3900	3900	0	37	221
3700	3900	-200	37	222
3900	3900	0	37	222

5000	3900	1100	38	222
5500	3900	1600	39	222
5400	3900	1500	40	222
3000	3900	-900	40	223
9.8	3900	-3890.2	40	224
30	3900	-3870	40	225
12	3900	-3888	40	226
4600	3900	700	41	226
2800	3900	-1100	41	227
2100	3900	-1800	41	228
26.2	3900	-3873.8	41	229
3900	4000	-100	41	230
3700	4000	-300	41	231
3900	4000	-100	41	232
5000	4000	1000	42	232
5500	4000	1500	43	232
5400	4000	1400	44	232
3000	4000	-1000	44	233
9.8	4000	-3990.2	44	234
30	4000	-3970	44	235
12	4000	-3988	44	236
4600	4000	600	45	236
2800	4000	-1200	45	237
2100	4000	-1900	45	238
26.2	4000	-3973.8	45	239
3700	3900	-200	45	240
3900	3900	0	45	240
5000	3900	1100	46	240
5500	3900	1600	47	240
5400	3900	1500	48	240
3000	3900	-900	48	241
9.8	3900	-3890.2	48	242
30	3900	-3870	48	243
12	3900	-3888	48	244
4600	3900	700	49	244
2800	3900	-1100	49	245
2100	3900	-1800	49	246
26.2	3900	-3873.8	49	247
3900	3700	200	50	247
5000	3700	1300	51	247
5500	3700	1800	52	247
5400	3700	1700	53	247
3000	3700	-700	53	248
9.8	3700	-3690.2	53	249
30	3700	-3670	53	250
12	3700	-3688	53	251
4600	3700	900	54	251
2800	3700	-900	54	252
2100	3700	-1600	54	253
26.2	3700	-3673.8	54	254
5000	3900	1100	55	254
5500	3900	1600	56	254
5400	3900	1500	57	254

3000	3900	-900	57	255
9.8	3900	-3890.2	57	256
30	3900	-3870	57	257
12	3900	-3888	57	258
4600	3900	700	58	258
2800	3900	-1100	58	259
2100	3900	-1800	58	260
26.2	3900	-3873.8	58	261
5500	5000	500	59	261
5400	5000	400	60	261
3000	5000	-2000	60	262
9.8	5000	-4990.2	60	263
30	5000	-4970	60	264
12	5000	-4988	60	265
4600	5000	-400	60	266
2800	5000	-2200	60	267
2100	5000	-2900	60	268
26.2	5000	-4973.8	60	269
5400	5500	-100	60	270
3000	5500	-2500	60	271
9.8	5500	-5490.2	60	272
30	5500	-5470	60	273
12	5500	-5488	60	274
4600	5500	-900	60	275
2800	5500	-2700	60	276
2100	5500	-3400	60	277
26.2	5500	-5473.8	60	278
3000	5400	-2400	60	279
9.8	5400	-5390.2	60	280
30	5400	-5370	60	281
12	5400	-5388	60	282
4600	5400	-800	60	283
2800	5400	-2600	60	284
2100	5400	-3300	60	285
26.2	5400	-5373.8	60	286
9.8	3000	-2990.2	60	287
30	3000	-2970	60	288
12	3000	-2988	60	289
4600	3000	1600	61	289
2800	3000	-200	61	290
2100	3000	-900	61	291
26.2	3000	-2973.8	61	292
30	9.8	20.2	62	292
12	9.8	2.2	63	292
4600	9.8	4590.2	64	292
2800	9.8	2790.2	65	292
2100	9.8	2090.2	66	292
26.2	9.8	16.4	67	292
12	30	-18	67	293
4600	30	4570	68	293
2800	30	2770	69	293



2100	30	2070	70	293
26.2	30	-3.8	70	294
4600	12	4588	71	294
2800	12	2788	72	294
2100	12	2088	73	294
26.2	12	14.2	74	294
2800	4600	-1800	74	295
2100	4600	-2500	74	296
26.2	4600	-4573.8	74	297
2100	2800	-700	74	298
26.2	2800	-2773.8	74	299
26.2	2100	-2073.8	74	300

S Statistic = 74 - 300 = -226

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<b>Tied Group Value</b>		<b>Members</b>
1	5000	2
2	3900	3

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<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/10/2008	1
9/22/2008	1
12/3/2008	1
4/28/2009	1
5/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/16/2010	1
8/11/2010	1
11/22/2010	1
3/8/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

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A = 84  
B = 0

C = 6  
D = 0  
E = 8  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2557.33  
Z-Score = -4.44927  
Comparison Level at 95% confidence level = -1.65463 (downward trend)  
**-4.44927 < -1.65463 indicating a downward trend**

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-04D

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
4700	5110	-410	0	1
8000	5110	2890	1	1
7470	5110	2360	2	1
12000	5110	6890	3	1
13000	5110	7890	4	1
6500	5110	1390	5	1
7200	5110	2090	6	1
5900	5110	790	7	1
5000	5110	-110	7	2
4800	5110	-310	7	3
4200	5110	-910	7	4
3900	5110	-1210	7	5
4000	5110	-1110	7	6
3900	5110	-1210	7	7
3700	5110	-1410	7	8
3900	5110	-1210	7	9
5000	5110	-110	7	10
5500	5110	390	8	10
5400	5110	290	9	10
3000	5110	-2110	9	11
9.8	5110	-5100.2	9	12
30	5110	-5080	9	13
12	5110	-5098	9	14
4600	5110	-510	9	15
2800	5110	-2310	9	16
2100	5110	-3010	9	17
26.2	5110	-5083.8	9	18
8000	4700	3300	10	18
7470	4700	2770	11	18
12000	4700	7300	12	18
13000	4700	8300	13	18
6500	4700	1800	14	18
7200	4700	2500	15	18
5900	4700	1200	16	18
5000	4700	300	17	18
4800	4700	100	18	18
4200	4700	-500	18	19
3900	4700	-800	18	20
4000	4700	-700	18	21
3900	4700	-800	18	22
3700	4700	-1000	18	23
3900	4700	-800	18	24
5000	4700	300	19	24
5500	4700	800	20	24
5400	4700	700	21	24

3000	4700	-1700	21	25
9.8	4700	-4690.2	21	26
30	4700	-4670	21	27
12	4700	-4688	21	28
4600	4700	-100	21	29
2800	4700	-1900	21	30
2100	4700	-2600	21	31
26.2	4700	-4673.8	21	32
7470	8000	-530	21	33
12000	8000	4000	22	33
13000	8000	5000	23	33
6500	8000	-1500	23	34
7200	8000	-800	23	35
5900	8000	-2100	23	36
5000	8000	-3000	23	37
4800	8000	-3200	23	38
4200	8000	-3800	23	39
3900	8000	-4100	23	40
4000	8000	-4000	23	41
3900	8000	-4100	23	42
3700	8000	-4300	23	43
3900	8000	-4100	23	44
5000	8000	-3000	23	45
5500	8000	-2500	23	46
5400	8000	-2600	23	47
3000	8000	-5000	23	48
9.8	8000	-7990.2	23	49
30	8000	-7970	23	50
12	8000	-7988	23	51
4600	8000	-3400	23	52
2800	8000	-5200	23	53
2100	8000	-5900	23	54
26.2	8000	-7973.8	23	55
12000	7470	4530	24	55
13000	7470	5530	25	55
6500	7470	-970	25	56
7200	7470	-270	25	57
5900	7470	-1570	25	58
5000	7470	-2470	25	59
4800	7470	-2670	25	60
4200	7470	-3270	25	61
3900	7470	-3570	25	62
4000	7470	-3470	25	63
3900	7470	-3570	25	64
3700	7470	-3770	25	65
3900	7470	-3570	25	66
5000	7470	-2470	25	67
5500	7470	-1970	25	68
5400	7470	-2070	25	69
3000	7470	-4470	25	70
9.8	7470	-7460.2	25	71
30	7470	-7440	25	72
12	7470	-7458	25	73
4600	7470	-2870	25	74
2800	7470	-4670	25	75

2100	7470	-5370	25	76
26.2	7470	-7443.8	25	77
13000	12000	1000	26	77
6500	12000	-5500	26	78
7200	12000	-4800	26	79
5900	12000	-6100	26	80
5000	12000	-7000	26	81
4800	12000	-7200	26	82
4200	12000	-7800	26	83
3900	12000	-8100	26	84
4000	12000	-8000	26	85
3900	12000	-8100	26	86
3700	12000	-8300	26	87
3900	12000	-8100	26	88
5000	12000	-7000	26	89
5500	12000	-6500	26	90
5400	12000	-6600	26	91
3000	12000	-9000	26	92
9.8	12000	-11990.2	26	93
30	12000	-11970	26	94
12	12000	-11988	26	95
4600	12000	-7400	26	96
2800	12000	-9200	26	97
2100	12000	-9900	26	98
26.2	12000	-11973.8	26	99
6500	13000	-6500	26	100
7200	13000	-5800	26	101
5900	13000	-7100	26	102
5000	13000	-8000	26	103
4800	13000	-8200	26	104
4200	13000	-8800	26	105
3900	13000	-9100	26	106
4000	13000	-9000	26	107
3900	13000	-9100	26	108
3700	13000	-9300	26	109
3900	13000	-9100	26	110
5000	13000	-8000	26	111
5500	13000	-7500	26	112
5400	13000	-7600	26	113
3000	13000	-10000	26	114
9.8	13000	-12990.2	26	115
30	13000	-12970	26	116
12	13000	-12988	26	117
4600	13000	-8400	26	118
2800	13000	-10200	26	119
2100	13000	-10900	26	120
26.2	13000	-12973.8	26	121
7200	6500	700	27	121
5900	6500	-600	27	122
5000	6500	-1500	27	123
4800	6500	-1700	27	124
4200	6500	-2300	27	125
3900	6500	-2600	27	126
4000	6500	-2500	27	127

3900	6500	-2600	27	128
3700	6500	-2800	27	129
3900	6500	-2600	27	130
5000	6500	-1500	27	131
5500	6500	-1000	27	132
5400	6500	-1100	27	133
3000	6500	-3500	27	134
9.8	6500	-6490.2	27	135
30	6500	-6470	27	136
12	6500	-6488	27	137
4600	6500	-1900	27	138
2800	6500	-3700	27	139
2100	6500	-4400	27	140
26.2	6500	-6473.8	27	141
5900	7200	-1300	27	142
5000	7200	-2200	27	143
4800	7200	-2400	27	144
4200	7200	-3000	27	145
3900	7200	-3300	27	146
4000	7200	-3200	27	147
3900	7200	-3300	27	148
3700	7200	-3500	27	149
3900	7200	-3300	27	150
5000	7200	-2200	27	151
5500	7200	-1700	27	152
5400	7200	-1800	27	153
3000	7200	-4200	27	154
9.8	7200	-7190.2	27	155
30	7200	-7170	27	156
12	7200	-7188	27	157
4600	7200	-2600	27	158
2800	7200	-4400	27	159
2100	7200	-5100	27	160
26.2	7200	-7173.8	27	161
5000	5900	-900	27	162
4800	5900	-1100	27	163
4200	5900	-1700	27	164
3900	5900	-2000	27	165
4000	5900	-1900	27	166
3900	5900	-2000	27	167
3700	5900	-2200	27	168
3900	5900	-2000	27	169
5000	5900	-900	27	170
5500	5900	-400	27	171
5400	5900	-500	27	172
3000	5900	-2900	27	173
9.8	5900	-5890.2	27	174
30	5900	-5870	27	175
12	5900	-5888	27	176
4600	5900	-1300	27	177
2800	5900	-3100	27	178
2100	5900	-3800	27	179
26.2	5900	-5873.8	27	180
4800	5000	-200	27	181

4200	5000	-800	27	182
3900	5000	-1100	27	183
4000	5000	-1000	27	184
3900	5000	-1100	27	185
3700	5000	-1300	27	186
3900	5000	-1100	27	187
5000	5000	0	27	187
5500	5000	500	28	187
5400	5000	400	29	187
3000	5000	-2000	29	188
9.8	5000	-4990.2	29	189
30	5000	-4970	29	190
12	5000	-4988	29	191
4600	5000	-400	29	192
2800	5000	-2200	29	193
2100	5000	-2900	29	194
26.2	5000	-4973.8	29	195
4200	4800	-600	29	196
3900	4800	-900	29	197
4000	4800	-800	29	198
3900	4800	-900	29	199
3700	4800	-1100	29	200
3900	4800	-900	29	201
5000	4800	200	30	201
5500	4800	700	31	201
5400	4800	600	32	201
3000	4800	-1800	32	202
9.8	4800	-4790.2	32	203
30	4800	-4770	32	204
12	4800	-4788	32	205
4600	4800	-200	32	206
2800	4800	-2000	32	207
2100	4800	-2700	32	208
26.2	4800	-4773.8	32	209
3900	4200	-300	32	210
4000	4200	-200	32	211
3900	4200	-300	32	212
3700	4200	-500	32	213
3900	4200	-300	32	214
5000	4200	800	33	214
5500	4200	1300	34	214
5400	4200	1200	35	214
3000	4200	-1200	35	215
9.8	4200	-4190.2	35	216
30	4200	-4170	35	217
12	4200	-4188	35	218
4600	4200	400	36	218
2800	4200	-1400	36	219
2100	4200	-2100	36	220
26.2	4200	-4173.8	36	221
4000	3900	100	37	221
3900	3900	0	37	221
3700	3900	-200	37	222
3900	3900	0	37	222

5000	3900	1100	38	222
5500	3900	1600	39	222
5400	3900	1500	40	222
3000	3900	-900	40	223
9.8	3900	-3890.2	40	224
30	3900	-3870	40	225
12	3900	-3888	40	226
4600	3900	700	41	226
2800	3900	-1100	41	227
2100	3900	-1800	41	228
26.2	3900	-3873.8	41	229
3900	4000	-100	41	230
3700	4000	-300	41	231
3900	4000	-100	41	232
5000	4000	1000	42	232
5500	4000	1500	43	232
5400	4000	1400	44	232
3000	4000	-1000	44	233
9.8	4000	-3990.2	44	234
30	4000	-3970	44	235
12	4000	-3988	44	236
4600	4000	600	45	236
2800	4000	-1200	45	237
2100	4000	-1900	45	238
26.2	4000	-3973.8	45	239
3700	3900	-200	45	240
3900	3900	0	45	240
5000	3900	1100	46	240
5500	3900	1600	47	240
5400	3900	1500	48	240
3000	3900	-900	48	241
9.8	3900	-3890.2	48	242
30	3900	-3870	48	243
12	3900	-3888	48	244
4600	3900	700	49	244
2800	3900	-1100	49	245
2100	3900	-1800	49	246
26.2	3900	-3873.8	49	247
3900	3700	200	50	247
5000	3700	1300	51	247
5500	3700	1800	52	247
5400	3700	1700	53	247
3000	3700	-700	53	248
9.8	3700	-3690.2	53	249
30	3700	-3670	53	250
12	3700	-3688	53	251
4600	3700	900	54	251
2800	3700	-900	54	252
2100	3700	-1600	54	253
26.2	3700	-3673.8	54	254
5000	3900	1100	55	254
5500	3900	1600	56	254
5400	3900	1500	57	254



3000	3900	-900	57	255
9.8	3900	-3890.2	57	256
30	3900	-3870	57	257
12	3900	-3888	57	258
4600	3900	700	58	258
2800	3900	-1100	58	259
2100	3900	-1800	58	260
26.2	3900	-3873.8	58	261
5500	5000	500	59	261
5400	5000	400	60	261
3000	5000	-2000	60	262
9.8	5000	-4990.2	60	263
30	5000	-4970	60	264
12	5000	-4988	60	265
4600	5000	-400	60	266
2800	5000	-2200	60	267
2100	5000	-2900	60	268
26.2	5000	-4973.8	60	269
5400	5500	-100	60	270
3000	5500	-2500	60	271
9.8	5500	-5490.2	60	272
30	5500	-5470	60	273
12	5500	-5488	60	274
4600	5500	-900	60	275
2800	5500	-2700	60	276
2100	5500	-3400	60	277
26.2	5500	-5473.8	60	278
3000	5400	-2400	60	279
9.8	5400	-5390.2	60	280
30	5400	-5370	60	281
12	5400	-5388	60	282
4600	5400	-800	60	283
2800	5400	-2600	60	284
2100	5400	-3300	60	285
26.2	5400	-5373.8	60	286
9.8	3000	-2990.2	60	287
30	3000	-2970	60	288
12	3000	-2988	60	289
4600	3000	1600	61	289
2800	3000	-200	61	290
2100	3000	-900	61	291
26.2	3000	-2973.8	61	292
30	9.8	20.2	62	292
12	9.8	2.2	63	292
4600	9.8	4590.2	64	292
2800	9.8	2790.2	65	292
2100	9.8	2090.2	66	292
26.2	9.8	16.4	67	292
12	30	-18	67	293
4600	30	4570	68	293
2800	30	2770	69	293

2100	30	2070	70	293
26.2	30	-3.8	70	294
4600	12	4588	71	294
2800	12	2788	72	294
2100	12	2088	73	294
26.2	12	14.2	74	294
2800	4600	-1800	74	295
2100	4600	-2500	74	296
26.2	4600	-4573.8	74	297
2100	2800	-700	74	298
26.2	2800	-2773.8	74	299
26.2	2100	-2073.8	74	300

S Statistic = 74 - 300 = -226

---

<b>Tied Group Value</b>	<b>Members</b>
1	5000
2	3900

---

<b>Time Period</b>	<b>Observations</b>
3/11/2008	1
5/10/2008	1
9/22/2008	1
12/3/2008	1
4/28/2009	1
5/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/16/2010	1
8/11/2010	1
11/22/2010	1
3/8/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 84  
B = 0

C = 6  
D = 0  
E = 8  
F = 0  
a = 46116  
b = 176904  
c = 1512  
Group Variance = 2557.33  
Z-Score = -4.44927  
Comparison Level at 95% confidence level = 1.65463 (upward trend)  
-4.44927 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-05

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
2600	2400	200	1	0
2600	2400	200	2	0
2500	2400	100	3	0
2500	2400	100	4	0
2500	2400	100	5	0
2600	2400	200	6	0
1400	2400	-1000	6	1
1700	2400	-700	6	2
1500	2400	-900	6	3
1100	2400	-1300	6	4
790	2400	-1610	6	5
640	2400	-1760	6	6
530	2400	-1870	6	7
460	2400	-1940	6	8
500	2400	-1900	6	9
500	2400	-1900	6	10
900	2400	-1500	6	11
1000	2400	-1400	6	12
350	2400	-2050	6	13
2600	2600	0	6	13
2500	2600	-100	6	14
2500	2600	-100	6	15
2500	2600	-100	6	16
2600	2600	0	6	16
1400	2600	-1200	6	17
1700	2600	-900	6	18
1500	2600	-1100	6	19
1100	2600	-1500	6	20
790	2600	-1810	6	21
640	2600	-1960	6	22
530	2600	-2070	6	23
460	2600	-2140	6	24
500	2600	-2100	6	25
500	2600	-2100	6	26
900	2600	-1700	6	27
1000	2600	-1600	6	28
350	2600	-2250	6	29
2500	2600	-100	6	30
2500	2600	-100	6	31
2500	2600	-100	6	32
2600	2600	0	6	32
1400	2600	-1200	6	33
1700	2600	-900	6	34
1500	2600	-1100	6	35

1100	2600	-1500	6	36
790	2600	-1810	6	37
640	2600	-1960	6	38
530	2600	-2070	6	39
460	2600	-2140	6	40
500	2600	-2100	6	41
500	2600	-2100	6	42
900	2600	-1700	6	43
1000	2600	-1600	6	44
350	2600	-2250	6	45
2500	2500	0	6	45
2500	2500	0	6	45
2600	2500	100	7	45
1400	2500	-1100	7	46
1700	2500	-800	7	47
1500	2500	-1000	7	48
1100	2500	-1400	7	49
790	2500	-1710	7	50
640	2500	-1860	7	51
530	2500	-1970	7	52
460	2500	-2040	7	53
500	2500	-2000	7	54
500	2500	-2000	7	55
900	2500	-1600	7	56
1000	2500	-1500	7	57
350	2500	-2150	7	58
2500	2500	0	7	58
2600	2500	100	8	58
1400	2500	-1100	8	59
1700	2500	-800	8	60
1500	2500	-1000	8	61
1100	2500	-1400	8	62
790	2500	-1710	8	63
640	2500	-1860	8	64
530	2500	-1970	8	65
460	2500	-2040	8	66
500	2500	-2000	8	67
500	2500	-2000	8	68
900	2500	-1600	8	69
1000	2500	-1500	8	70
350	2500	-2150	8	71
2600	2500	100	9	71
1400	2500	-1100	9	72
1700	2500	-800	9	73
1500	2500	-1000	9	74
1100	2500	-1400	9	75
790	2500	-1710	9	76
640	2500	-1860	9	77
530	2500	-1970	9	78
460	2500	-2040	9	79
500	2500	-2000	9	80
500	2500	-2000	9	81
900	2500	-1600	9	82
1000	2500	-1500	9	83

350	2500	-2150	9	84
1400	2600	-1200	9	85
1700	2600	-900	9	86
1500	2600	-1100	9	87
1100	2600	-1500	9	88
790	2600	-1810	9	89
640	2600	-1960	9	90
530	2600	-2070	9	91
460	2600	-2140	9	92
500	2600	-2100	9	93
500	2600	-2100	9	94
900	2600	-1700	9	95
1000	2600	-1600	9	96
350	2600	-2250	9	97
1700	1400	300	10	97
1500	1400	100	11	97
1100	1400	-300	11	98
790	1400	-610	11	99
640	1400	-760	11	100
530	1400	-870	11	101
460	1400	-940	11	102
500	1400	-900	11	103
500	1400	-900	11	104
900	1400	-500	11	105
1000	1400	-400	11	106
350	1400	-1050	11	107
1500	1700	-200	11	108
1100	1700	-600	11	109
790	1700	-910	11	110
640	1700	-1060	11	111
530	1700	-1170	11	112
460	1700	-1240	11	113
500	1700	-1200	11	114
500	1700	-1200	11	115
900	1700	-800	11	116
1000	1700	-700	11	117
350	1700	-1350	11	118
1100	1500	-400	11	119
790	1500	-710	11	120
640	1500	-860	11	121
530	1500	-970	11	122
460	1500	-1040	11	123
500	1500	-1000	11	124
500	1500	-1000	11	125
900	1500	-600	11	126
1000	1500	-500	11	127
350	1500	-1150	11	128
790	1100	-310	11	129
640	1100	-460	11	130
530	1100	-570	11	131
460	1100	-640	11	132
500	1100	-600	11	133

500	1100	-600	11	134
900	1100	-200	11	135
1000	1100	-100	11	136
350	1100	-750	11	137
640	790	-150	11	138
530	790	-260	11	139
460	790	-330	11	140
500	790	-290	11	141
500	790	-290	11	142
900	790	110	12	142
1000	790	210	13	142
350	790	-440	13	143
530	640	-110	13	144
460	640	-180	13	145
500	640	-140	13	146
500	640	-140	13	147
900	640	260	14	147
1000	640	360	15	147
350	640	-290	15	148
460	530	-70	15	149
500	530	-30	15	150
500	530	-30	15	151
900	530	370	16	151
1000	530	470	17	151
350	530	-180	17	152
500	460	40	18	152
500	460	40	19	152
900	460	440	20	152
1000	460	540	21	152
350	460	-110	21	153
500	500	0	21	153
900	500	400	22	153
1000	500	500	23	153
350	500	-150	23	154
900	500	400	24	154
1000	500	500	25	154
350	500	-150	25	155
1000	900	100	26	155
350	900	-550	26	156
350	1000	-650	26	157

S Statistic = 26 - 157 = -131

---

	<b>Tied Group Value</b>	<b>Members</b>
1	2600	3
2	2500	3
3	500	2

---

**Time Period**                      **Observations**

2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 150

B = 0

C = 12

D = 0

E = 14

F = 0

a = 17100

b = 61560

c = 760

Group Variance = 941.667

Z-Score = -4.23638

Comparison Level at 95% confidence level = -1.65463 (downward trend)

**-4.23638 < -1.65463 indicating a downward trend**



# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: GCW-05

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
2600	2400	200	1	0
2600	2400	200	2	0
2500	2400	100	3	0
2500	2400	100	4	0
2500	2400	100	5	0
2600	2400	200	6	0
1400	2400	-1000	6	1
1700	2400	-700	6	2
1500	2400	-900	6	3
1100	2400	-1300	6	4
790	2400	-1610	6	5
640	2400	-1760	6	6
530	2400	-1870	6	7
460	2400	-1940	6	8
500	2400	-1900	6	9
500	2400	-1900	6	10
900	2400	-1500	6	11
1000	2400	-1400	6	12
350	2400	-2050	6	13
2600	2600	0	6	13
2500	2600	-100	6	14
2500	2600	-100	6	15
2500	2600	-100	6	16
2600	2600	0	6	16
1400	2600	-1200	6	17
1700	2600	-900	6	18
1500	2600	-1100	6	19
1100	2600	-1500	6	20
790	2600	-1810	6	21
640	2600	-1960	6	22
530	2600	-2070	6	23
460	2600	-2140	6	24
500	2600	-2100	6	25
500	2600	-2100	6	26
900	2600	-1700	6	27
1000	2600	-1600	6	28
350	2600	-2250	6	29
2500	2600	-100	6	30
2500	2600	-100	6	31
2500	2600	-100	6	32
2600	2600	0	6	32
1400	2600	-1200	6	33
1700	2600	-900	6	34
1500	2600	-1100	6	35

1100	2600	-1500	6	36
790	2600	-1810	6	37
640	2600	-1960	6	38
530	2600	-2070	6	39
460	2600	-2140	6	40
500	2600	-2100	6	41
500	2600	-2100	6	42
900	2600	-1700	6	43
1000	2600	-1600	6	44
350	2600	-2250	6	45
2500	2500	0	6	45
2500	2500	0	6	45
2600	2500	100	7	45
1400	2500	-1100	7	46
1700	2500	-800	7	47
1500	2500	-1000	7	48
1100	2500	-1400	7	49
790	2500	-1710	7	50
640	2500	-1860	7	51
530	2500	-1970	7	52
460	2500	-2040	7	53
500	2500	-2000	7	54
500	2500	-2000	7	55
900	2500	-1600	7	56
1000	2500	-1500	7	57
350	2500	-2150	7	58
2500	2500	0	7	58
2600	2500	100	8	58
1400	2500	-1100	8	59
1700	2500	-800	8	60
1500	2500	-1000	8	61
1100	2500	-1400	8	62
790	2500	-1710	8	63
640	2500	-1860	8	64
530	2500	-1970	8	65
460	2500	-2040	8	66
500	2500	-2000	8	67
500	2500	-2000	8	68
900	2500	-1600	8	69
1000	2500	-1500	8	70
350	2500	-2150	8	71
2600	2500	100	9	71
1400	2500	-1100	9	72
1700	2500	-800	9	73
1500	2500	-1000	9	74
1100	2500	-1400	9	75
790	2500	-1710	9	76
640	2500	-1860	9	77
530	2500	-1970	9	78
460	2500	-2040	9	79
500	2500	-2000	9	80
500	2500	-2000	9	81
900	2500	-1600	9	82
1000	2500	-1500	9	83

350	2500	-2150	9	84
1400	2600	-1200	9	85
1700	2600	-900	9	86
1500	2600	-1100	9	87
1100	2600	-1500	9	88
790	2600	-1810	9	89
640	2600	-1960	9	90
530	2600	-2070	9	91
460	2600	-2140	9	92
500	2600	-2100	9	93
500	2600	-2100	9	94
900	2600	-1700	9	95
1000	2600	-1600	9	96
350	2600	-2250	9	97
1700	1400	300	10	97
1500	1400	100	11	97
1100	1400	-300	11	98
790	1400	-610	11	99
640	1400	-760	11	100
530	1400	-870	11	101
460	1400	-940	11	102
500	1400	-900	11	103
500	1400	-900	11	104
900	1400	-500	11	105
1000	1400	-400	11	106
350	1400	-1050	11	107
1500	1700	-200	11	108
1100	1700	-600	11	109
790	1700	-910	11	110
640	1700	-1060	11	111
530	1700	-1170	11	112
460	1700	-1240	11	113
500	1700	-1200	11	114
500	1700	-1200	11	115
900	1700	-800	11	116
1000	1700	-700	11	117
350	1700	-1350	11	118
1100	1500	-400	11	119
790	1500	-710	11	120
640	1500	-860	11	121
530	1500	-970	11	122
460	1500	-1040	11	123
500	1500	-1000	11	124
500	1500	-1000	11	125
900	1500	-600	11	126
1000	1500	-500	11	127
350	1500	-1150	11	128
790	1100	-310	11	129
640	1100	-460	11	130
530	1100	-570	11	131
460	1100	-640	11	132
500	1100	-600	11	133

500	1100	-600	11	134
900	1100	-200	11	135
1000	1100	-100	11	136
350	1100	-750	11	137
640	790	-150	11	138
530	790	-260	11	139
460	790	-330	11	140
500	790	-290	11	141
500	790	-290	11	142
900	790	110	12	142
1000	790	210	13	142
350	790	-440	13	143
530	640	-110	13	144
460	640	-180	13	145
500	640	-140	13	146
500	640	-140	13	147
900	640	260	14	147
1000	640	360	15	147
350	640	-290	15	148
460	530	-70	15	149
500	530	-30	15	150
500	530	-30	15	151
900	530	370	16	151
1000	530	470	17	151
350	530	-180	17	152
500	460	40	18	152
500	460	40	19	152
900	460	440	20	152
1000	460	540	21	152
350	460	-110	21	153
500	500	0	21	153
900	500	400	22	153
1000	500	500	23	153
350	500	-150	23	154
900	500	400	24	154
1000	500	500	25	154
350	500	-150	25	155
1000	900	100	26	155
350	900	-550	26	156
350	1000	-650	26	157

S Statistic = 26 - 157 = -131

---

<b>Tied Group Value</b>	<b>Members</b>
1	2600
2	2500
3	500

---

**Time Period**                      **Observations**

2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/23/2011	1
8/31/2011	1
4/11/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/19/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 150

B = 0

C = 12

D = 0

E = 14

F = 0

a = 17100

b = 61560

c = 760

Group Variance = 941.667

Z-Score = -4.23638

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-4.23638 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: OW-01A

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
91	240	-149	0	1
81	240	-159	0	2
61	240	-179	0	3
52	240	-188	0	4
60	240	-180	0	5
118	240	-122	0	6
85	240	-155	0	7
61	240	-179	0	8
51	240	-189	0	9
60	240	-180	0	10
53	240	-187	0	11
55	240	-185	0	12
56	240	-184	0	13
55	240	-185	0	14
53	240	-187	0	15
55	240	-185	0	16
56	240	-184	0	17
56	240	-184	0	18
53	240	-187	0	19
51	240	-189	0	20
54	240	-186	0	21
47	240	-193	0	22
45	240	-195	0	23
55	240	-185	0	24
57	240	-183	0	25
50	240	-190	0	26
48	240	-192	0	27
44	240	-196	0	28
39	240	-201	0	29
41	240	-199	0	30
81	91	-10	0	31
61	91	-30	0	32
52	91	-39	0	33
60	91	-31	0	34
118	91	27	1	34
85	91	-6	1	35
61	91	-30	1	36
51	91	-40	1	37
60	91	-31	1	38
53	91	-38	1	39
55	91	-36	1	40
56	91	-35	1	41
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45	91	-46	1	51
55	91	-36	1	52
57	91	-34	1	53
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48	91	-43	1	55
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39	91	-52	1	57
41	91	-50	1	58
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51	61	-10	5	98
54	61	-7	5	99
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44	61	-17	5	106
39	61	-22	5	107
41	61	-20	5	108
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118	52	66	7	108
85	52	33	8	108
61	52	9	9	108
51	52	-1	9	109
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39	118	-79	25	161
41	118	-77	25	162

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50	85	-35	25	181
48	85	-37	25	182
44	85	-41	25	183

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47	61	-14	25	199
45	61	-16	25	200
55	61	-6	25	201
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50	61	-11	25	203
48	61	-13	25	204
44	61	-17	25	205
39	61	-22	25	206
41	61	-20	25	207
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53	51	2	27	207
55	51	4	28	207
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55	51	4	30	207
53	51	2	31	207
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50	51	-1	38	210
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39	51	-12	38	213
41	51	-10	38	214
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55	60	-5	38	216
56	60	-4	38	217
55	60	-5	38	218
53	60	-7	38	219
55	60	-5	38	220
56	60	-4	38	221
56	60	-4	38	222
53	60	-7	38	223

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47	60	-13	38	226
45	60	-15	38	227
55	60	-5	38	228
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50	55	-5	51	249
48	55	-7	51	250
44	55	-11	51	251
39	55	-16	51	252
41	55	-14	51	253
55	56	-1	51	254
53	56	-3	51	255
55	56	-1	51	256
56	56	0	51	256
56	56	0	51	256
53	56	-3	51	257

51	56	-5	51	258
54	56	-2	51	259
47	56	-9	51	260
45	56	-11	51	261
55	56	-1	51	262
57	56	1	52	262
50	56	-6	52	263
48	56	-8	52	264
44	56	-12	52	265
39	56	-17	52	266
41	56	-15	52	267
53	55	-2	52	268
55	55	0	52	268
56	55	1	53	268
56	55	1	54	268
53	55	-2	54	269
51	55	-4	54	270
54	55	-1	54	271
47	55	-8	54	272
45	55	-10	54	273
55	55	0	54	273
57	55	2	55	273
50	55	-5	55	274
48	55	-7	55	275
44	55	-11	55	276
39	55	-16	55	277
41	55	-14	55	278
55	53	2	56	278
56	53	3	57	278
56	53	3	58	278
53	53	0	58	278
51	53	-2	58	279
54	53	1	59	279
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53	55	-2	63	287
51	55	-4	63	288
54	55	-1	63	289
47	55	-8	63	290
45	55	-10	63	291
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57	55	2	64	291
50	55	-5	64	292
48	55	-7	64	293
44	55	-11	64	294

39	55	-16	64	295
41	55	-14	64	296
56	56	0	64	296
53	56	-3	64	297
51	56	-5	64	298
54	56	-2	64	299
47	56	-9	64	300
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50	56	-6	65	303
48	56	-8	65	304
44	56	-12	65	305
39	56	-17	65	306
41	56	-15	65	307
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47	56	-9	65	311
45	56	-11	65	312
55	56	-1	65	313
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50	56	-6	66	314
48	56	-8	66	315
44	56	-12	66	316
39	56	-17	66	317
41	56	-15	66	318
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39	51	-12	72	332
41	51	-10	72	333
47	54	-7	72	334
45	54	-9	72	335
55	54	1	73	335
57	54	3	74	335

50	54	-4	74	336
48	54	-6	74	337
44	54	-10	74	338
39	54	-15	74	339
41	54	-13	74	340
45	47	-2	74	341
55	47	8	75	341
57	47	10	76	341
50	47	3	77	341
48	47	1	78	341
44	47	-3	78	342
39	47	-8	78	343
41	47	-6	78	344
55	45	10	79	344
57	45	12	80	344
50	45	5	81	344
48	45	3	82	344
44	45	-1	82	345
39	45	-6	82	346
41	45	-4	82	347
57	55	2	83	347
50	55	-5	83	348
48	55	-7	83	349
44	55	-11	83	350
39	55	-16	83	351
41	55	-14	83	352
50	57	-7	83	353
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39	50	-11	83	360
41	50	-9	83	361
44	48	-4	83	362
39	48	-9	83	363
41	48	-7	83	364
39	44	-5	83	365
41	44	-3	83	366
41	39	2	84	366

S Statistic = 84 - 366 = -282

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Tied Group Value	Members
1	61
2	60
3	51

4	53	3
5	55	4
6	56	3

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Time Period	Observations
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11/1/1998	1
6/1/2005	1
2/1/2006	1
3/12/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/8/2009	1
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/13/2012	1
11/9/2012	1
4/22/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 342

B = 0

C = 36

D = 0

E = 30

F = 0

a = 62310

b = 242730

c = 1860

Group Variance = 3442.67

Z-Score = -4.78915

Comparison Level at 95% confidence level = -1.65463 (downward trend)

**-4.78915 < -1.65463 indicating a downward trend**

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: OW-01A

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
91	240	-149	0	1
81	240	-159	0	2
61	240	-179	0	3
52	240	-188	0	4
60	240	-180	0	5
118	240	-122	0	6
85	240	-155	0	7
61	240	-179	0	8
51	240	-189	0	9
60	240	-180	0	10
53	240	-187	0	11
55	240	-185	0	12
56	240	-184	0	13
55	240	-185	0	14
53	240	-187	0	15
55	240	-185	0	16
56	240	-184	0	17
56	240	-184	0	18
53	240	-187	0	19
51	240	-189	0	20
54	240	-186	0	21
47	240	-193	0	22
45	240	-195	0	23
55	240	-185	0	24
57	240	-183	0	25
50	240	-190	0	26
48	240	-192	0	27
44	240	-196	0	28
39	240	-201	0	29
41	240	-199	0	30
81	91	-10	0	31
61	91	-30	0	32
52	91	-39	0	33
60	91	-31	0	34
118	91	27	1	34
85	91	-6	1	35
61	91	-30	1	36
51	91	-40	1	37
60	91	-31	1	38
53	91	-38	1	39
55	91	-36	1	40
56	91	-35	1	41
55	91	-36	1	42
53	91	-38	1	43
55	91	-36	1	44



56	91	-35	1	45
56	91	-35	1	46
53	91	-38	1	47
51	91	-40	1	48
54	91	-37	1	49
47	91	-44	1	50
45	91	-46	1	51
55	91	-36	1	52
57	91	-34	1	53
50	91	-41	1	54
48	91	-43	1	55
44	91	-47	1	56
39	91	-52	1	57
41	91	-50	1	58
61	81	-20	1	59
52	81	-29	1	60
60	81	-21	1	61
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54	81	-27	3	75
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45	81	-36	3	77
55	81	-26	3	78
57	81	-24	3	79
50	81	-31	3	80
48	81	-33	3	81
44	81	-37	3	82
39	81	-42	3	83
41	81	-40	3	84
52	61	-9	3	85
60	61	-1	3	86
118	61	57	4	86
85	61	24	5	86
61	61	0	5	86
51	61	-10	5	87
60	61	-1	5	88
53	61	-8	5	89
55	61	-6	5	90
56	61	-5	5	91
55	61	-6	5	92
53	61	-8	5	93
55	61	-6	5	94

56	61	-5	5	95
56	61	-5	5	96
53	61	-8	5	97
51	61	-10	5	98
54	61	-7	5	99
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57	61	-4	5	103
50	61	-11	5	104
48	61	-13	5	105
44	61	-17	5	106
39	61	-22	5	107
41	61	-20	5	108
60	52	8	6	108
118	52	66	7	108
85	52	33	8	108
61	52	9	9	108
51	52	-1	9	109
60	52	8	10	109
53	52	1	11	109
55	52	3	12	109
56	52	4	13	109
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56	52	4	18	109
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48	52	-4	22	114
44	52	-8	22	115
39	52	-13	22	116
41	52	-11	22	117
118	60	58	23	117
85	60	25	24	117
61	60	1	25	117
51	60	-9	25	118
60	60	0	25	118
53	60	-7	25	119
55	60	-5	25	120
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53	60	-7	25	123
55	60	-5	25	124
56	60	-4	25	125
56	60	-4	25	126
53	60	-7	25	127
51	60	-9	25	128

54	60	-6	25	129
47	60	-13	25	130
45	60	-15	25	131
55	60	-5	25	132
57	60	-3	25	133
50	60	-10	25	134
48	60	-12	25	135
44	60	-16	25	136
39	60	-21	25	137
41	60	-19	25	138

85	118	-33	25	139
61	118	-57	25	140
51	118	-67	25	141
60	118	-58	25	142
53	118	-65	25	143
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45	118	-73	25	155
55	118	-63	25	156
57	118	-61	25	157
50	118	-68	25	158
48	118	-70	25	159
44	118	-74	25	160
39	118	-79	25	161
41	118	-77	25	162

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60	85	-25	25	165
53	85	-32	25	166
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56	85	-29	25	173
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51	85	-34	25	175
54	85	-31	25	176
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55	85	-30	25	179
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48	85	-37	25	182
44	85	-41	25	183

39	85	-46	25	184
41	85	-44	25	185
51	61	-10	25	186
60	61	-1	25	187
53	61	-8	25	188
55	61	-6	25	189
56	61	-5	25	190
55	61	-6	25	191
53	61	-8	25	192
55	61	-6	25	193
56	61	-5	25	194
56	61	-5	25	195
53	61	-8	25	196
51	61	-10	25	197
54	61	-7	25	198
47	61	-14	25	199
45	61	-16	25	200
55	61	-6	25	201
57	61	-4	25	202
50	61	-11	25	203
48	61	-13	25	204
44	61	-17	25	205
39	61	-22	25	206
41	61	-20	25	207
60	51	9	26	207
53	51	2	27	207
55	51	4	28	207
56	51	5	29	207
55	51	4	30	207
53	51	2	31	207
55	51	4	32	207
56	51	5	33	207
56	51	5	34	207
53	51	2	35	207
51	51	0	35	207
54	51	3	36	207
47	51	-4	36	208
45	51	-6	36	209
55	51	4	37	209
57	51	6	38	209
50	51	-1	38	210
48	51	-3	38	211
44	51	-7	38	212
39	51	-12	38	213
41	51	-10	38	214
53	60	-7	38	215
55	60	-5	38	216
56	60	-4	38	217
55	60	-5	38	218
53	60	-7	38	219
55	60	-5	38	220
56	60	-4	38	221
56	60	-4	38	222
53	60	-7	38	223

51	60	-9	38	224
54	60	-6	38	225
47	60	-13	38	226
45	60	-15	38	227
55	60	-5	38	228
57	60	-3	38	229
50	60	-10	38	230
48	60	-12	38	231
44	60	-16	38	232
39	60	-21	38	233
41	60	-19	38	234
55	53	2	39	234
56	53	3	40	234
55	53	2	41	234
53	53	0	41	234
55	53	2	42	234
56	53	3	43	234
56	53	3	44	234
53	53	0	44	234
51	53	-2	44	235
54	53	1	45	235
47	53	-6	45	236
45	53	-8	45	237
55	53	2	46	237
57	53	4	47	237
50	53	-3	47	238
48	53	-5	47	239
44	53	-9	47	240
39	53	-14	47	241
41	53	-12	47	242
56	55	1	48	242
55	55	0	48	242
53	55	-2	48	243
55	55	0	48	243
56	55	1	49	243
56	55	1	50	243
53	55	-2	50	244
51	55	-4	50	245
54	55	-1	50	246
47	55	-8	50	247
45	55	-10	50	248
55	55	0	50	248
57	55	2	51	248
50	55	-5	51	249
48	55	-7	51	250
44	55	-11	51	251
39	55	-16	51	252
41	55	-14	51	253
55	56	-1	51	254
53	56	-3	51	255
55	56	-1	51	256
56	56	0	51	256
56	56	0	51	256
53	56	-3	51	257

51	56	-5	51	258
54	56	-2	51	259
47	56	-9	51	260
45	56	-11	51	261
55	56	-1	51	262
57	56	1	52	262
50	56	-6	52	263
48	56	-8	52	264
44	56	-12	52	265
39	56	-17	52	266
41	56	-15	52	267
53	55	-2	52	268
55	55	0	52	268
56	55	1	53	268
56	55	1	54	268
53	55	-2	54	269
51	55	-4	54	270
54	55	-1	54	271
47	55	-8	54	272
45	55	-10	54	273
55	55	0	54	273
57	55	2	55	273
50	55	-5	55	274
48	55	-7	55	275
44	55	-11	55	276
39	55	-16	55	277
41	55	-14	55	278
55	53	2	56	278
56	53	3	57	278
56	53	3	58	278
53	53	0	58	278
51	53	-2	58	279
54	53	1	59	279
47	53	-6	59	280
45	53	-8	59	281
55	53	2	60	281
57	53	4	61	281
50	53	-3	61	282
48	53	-5	61	283
44	53	-9	61	284
39	53	-14	61	285
41	53	-12	61	286
56	55	1	62	286
56	55	1	63	286
53	55	-2	63	287
51	55	-4	63	288
54	55	-1	63	289
47	55	-8	63	290
45	55	-10	63	291
55	55	0	63	291
57	55	2	64	291
50	55	-5	64	292
48	55	-7	64	293
44	55	-11	64	294

39	55	-16	64	295
41	55	-14	64	296
56	56	0	64	296
53	56	-3	64	297
51	56	-5	64	298
54	56	-2	64	299
47	56	-9	64	300
45	56	-11	64	301
55	56	-1	64	302
57	56	1	65	302
50	56	-6	65	303
48	56	-8	65	304
44	56	-12	65	305
39	56	-17	65	306
41	56	-15	65	307
53	56	-3	65	308
51	56	-5	65	309
54	56	-2	65	310
47	56	-9	65	311
45	56	-11	65	312
55	56	-1	65	313
57	56	1	66	313
50	56	-6	66	314
48	56	-8	66	315
44	56	-12	66	316
39	56	-17	66	317
41	56	-15	66	318
51	53	-2	66	319
54	53	1	67	319
47	53	-6	67	320
45	53	-8	67	321
55	53	2	68	321
57	53	4	69	321
50	53	-3	69	322
48	53	-5	69	323
44	53	-9	69	324
39	53	-14	69	325
41	53	-12	69	326
54	51	3	70	326
47	51	-4	70	327
45	51	-6	70	328
55	51	4	71	328
57	51	6	72	328
50	51	-1	72	329
48	51	-3	72	330
44	51	-7	72	331
39	51	-12	72	332
41	51	-10	72	333
47	54	-7	72	334
45	54	-9	72	335
55	54	1	73	335
57	54	3	74	335

50	54	-4	74	336
48	54	-6	74	337
44	54	-10	74	338
39	54	-15	74	339
41	54	-13	74	340
45	47	-2	74	341
55	47	8	75	341
57	47	10	76	341
50	47	3	77	341
48	47	1	78	341
44	47	-3	78	342
39	47	-8	78	343
41	47	-6	78	344
55	45	10	79	344
57	45	12	80	344
50	45	5	81	344
48	45	3	82	344
44	45	-1	82	345
39	45	-6	82	346
41	45	-4	82	347
57	55	2	83	347
50	55	-5	83	348
48	55	-7	83	349
44	55	-11	83	350
39	55	-16	83	351
41	55	-14	83	352
50	57	-7	83	353
48	57	-9	83	354
44	57	-13	83	355
39	57	-18	83	356
41	57	-16	83	357
48	50	-2	83	358
44	50	-6	83	359
39	50	-11	83	360
41	50	-9	83	361
44	48	-4	83	362
39	48	-9	83	363
41	48	-7	83	364
39	44	-5	83	365
41	44	-3	83	366
41	39	2	84	366

S Statistic = 84 - 366 = -282

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Tied Group Value	Members
1	61
2	60
3	51



4	53	3
5	55	4
6	56	3

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Time Period	Observations
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11/1/1998	1
6/1/2005	1
2/1/2006	1
3/12/2008	1
5/13/2008	1
9/23/2008	1
10/29/2008	1
4/29/2009	1
5/13/2009	1
9/29/2009	1
12/8/2009	1
2/26/2010	1
4/14/2010	1
8/12/2010	1
11/22/2010	1
3/10/2011	1
5/25/2011	1
9/2/2011	1
4/13/2012	1
11/9/2012	1
4/22/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 342

B = 0

C = 36

D = 0

E = 30

F = 0

a = 62310

b = 242730

c = 1860

Group Variance = 3442.67

Z-Score = -4.78915

Comparison Level at 95% confidence level = 1.65463 (upward trend)

-4.78915 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
1200	915	285	1	0
1000	915	85	2	0
930	915	15	3	0
900	915	-15	3	1
1100	915	185	4	1
1100	915	185	5	1
500	915	-415	5	2
1000	915	85	6	2
1300	915	385	7	2
1200	915	285	8	2
3100	915	2185	9	2
990	915	75	10	2
1500	915	585	11	2
7300	915	6385	12	2
1600	915	685	13	2
1400	915	485	14	2
1100	915	185	15	2
2200	915	1285	16	2
1100	915	185	17	2
840	915	-75	17	3
830	915	-85	17	4
737	915	-178	17	5
1000	1200	-200	17	6
930	1200	-270	17	7
900	1200	-300	17	8
1100	1200	-100	17	9
1100	1200	-100	17	10
500	1200	-700	17	11
1000	1200	-200	17	12
1300	1200	100	18	12
1200	1200	0	18	12
3100	1200	1900	19	12
990	1200	-210	19	13
1500	1200	300	20	13
7300	1200	6100	21	13
1600	1200	400	22	13
1400	1200	200	23	13
1100	1200	-100	23	14
2200	1200	1000	24	14
1100	1200	-100	24	15
840	1200	-360	24	16
830	1200	-370	24	17
737	1200	-463	24	18
930	1000	-70	24	19

900	1000	-100	24	20
1100	1000	100	25	20
1100	1000	100	26	20
500	1000	-500	26	21
1000	1000	0	26	21
1300	1000	300	27	21
1200	1000	200	28	21
3100	1000	2100	29	21
990	1000	-10	29	22
1500	1000	500	30	22
7300	1000	6300	31	22
1600	1000	600	32	22
1400	1000	400	33	22
1100	1000	100	34	22
2200	1000	1200	35	22
1100	1000	100	36	22
840	1000	-160	36	23
830	1000	-170	36	24
737	1000	-263	36	25

900	930	-30	36	26
1100	930	170	37	26
1100	930	170	38	26
500	930	-430	38	27
1000	930	70	39	27
1300	930	370	40	27
1200	930	270	41	27
3100	930	2170	42	27
990	930	60	43	27
1500	930	570	44	27
7300	930	6370	45	27
1600	930	670	46	27
1400	930	470	47	27
1100	930	170	48	27
2200	930	1270	49	27
1100	930	170	50	27
840	930	-90	50	28
830	930	-100	50	29
737	930	-193	50	30

1100	900	200	51	30
1100	900	200	52	30
500	900	-400	52	31
1000	900	100	53	31
1300	900	400	54	31
1200	900	300	55	31
3100	900	2200	56	31
990	900	90	57	31
1500	900	600	58	31
7300	900	6400	59	31
1600	900	700	60	31
1400	900	500	61	31
1100	900	200	62	31
2200	900	1300	63	31
1100	900	200	64	31
840	900	-60	64	32
830	900	-70	64	33

737	900	-163	64	34
1100	1100	0	64	34
500	1100	-600	64	35
1000	1100	-100	64	36
1300	1100	200	65	36
1200	1100	100	66	36
3100	1100	2000	67	36
990	1100	-110	67	37
1500	1100	400	68	37
7300	1100	6200	69	37
1600	1100	500	70	37
1400	1100	300	71	37
1100	1100	0	71	37
2200	1100	1100	72	37
1100	1100	0	72	37
840	1100	-260	72	38
830	1100	-270	72	39
737	1100	-363	72	40
500	1100	-600	72	41
1000	1100	-100	72	42
1300	1100	200	73	42
1200	1100	100	74	42
3100	1100	2000	75	42
990	1100	-110	75	43
1500	1100	400	76	43
7300	1100	6200	77	43
1600	1100	500	78	43
1400	1100	300	79	43
1100	1100	0	79	43
2200	1100	1100	80	43
1100	1100	0	80	43
840	1100	-260	80	44
830	1100	-270	80	45
737	1100	-363	80	46
1000	500	500	81	46
1300	500	800	82	46
1200	500	700	83	46
3100	500	2600	84	46
990	500	490	85	46
1500	500	1000	86	46
7300	500	6800	87	46
1600	500	1100	88	46
1400	500	900	89	46
1100	500	600	90	46
2200	500	1700	91	46
1100	500	600	92	46
840	500	340	93	46
830	500	330	94	46
737	500	237	95	46
1300	1000	300	96	46
1200	1000	200	97	46
3100	1000	2100	98	46
990	1000	-10	98	47

1500	1000	500	99	47
7300	1000	6300	100	47
1600	1000	600	101	47
1400	1000	400	102	47
1100	1000	100	103	47
2200	1000	1200	104	47
1100	1000	100	105	47
840	1000	-160	105	48
830	1000	-170	105	49
737	1000	-263	105	50
1200	1300	-100	105	51
3100	1300	1800	106	51
990	1300	-310	106	52
1500	1300	200	107	52
7300	1300	6000	108	52
1600	1300	300	109	52
1400	1300	100	110	52
1100	1300	-200	110	53
2200	1300	900	111	53
1100	1300	-200	111	54
840	1300	-460	111	55
830	1300	-470	111	56
737	1300	-563	111	57
3100	1200	1900	112	57
990	1200	-210	112	58
1500	1200	300	113	58
7300	1200	6100	114	58
1600	1200	400	115	58
1400	1200	200	116	58
1100	1200	-100	116	59
2200	1200	1000	117	59
1100	1200	-100	117	60
840	1200	-360	117	61
830	1200	-370	117	62
737	1200	-463	117	63
990	3100	-2110	117	64
1500	3100	-1600	117	65
7300	3100	4200	118	65
1600	3100	-1500	118	66
1400	3100	-1700	118	67
1100	3100	-2000	118	68
2200	3100	-900	118	69
1100	3100	-2000	118	70
840	3100	-2260	118	71
830	3100	-2270	118	72
737	3100	-2363	118	73
1500	990	510	119	73
7300	990	6310	120	73
1600	990	610	121	73
1400	990	410	122	73
1100	990	110	123	73
2200	990	1210	124	73
1100	990	110	125	73

840	990	-150	125	74
830	990	-160	125	75
737	990	-253	125	76
7300	1500	5800	126	76
1600	1500	100	127	76
1400	1500	-100	127	77
1100	1500	-400	127	78
2200	1500	700	128	78
1100	1500	-400	128	79
840	1500	-660	128	80
830	1500	-670	128	81
737	1500	-763	128	82
1600	7300	-5700	128	83
1400	7300	-5900	128	84
1100	7300	-6200	128	85
2200	7300	-5100	128	86
1100	7300	-6200	128	87
840	7300	-6460	128	88
830	7300	-6470	128	89
737	7300	-6563	128	90
1400	1600	-200	128	91
1100	1600	-500	128	92
2200	1600	600	129	92
1100	1600	-500	129	93
840	1600	-760	129	94
830	1600	-770	129	95
737	1600	-863	129	96
1100	1400	-300	129	97
2200	1400	800	130	97
1100	1400	-300	130	98
840	1400	-560	130	99
830	1400	-570	130	100
737	1400	-663	130	101
2200	1100	1100	131	101
1100	1100	0	131	101
840	1100	-260	131	102
830	1100	-270	131	103
737	1100	-363	131	104
1100	2200	-1100	131	105
840	2200	-1360	131	106
830	2200	-1370	131	107
737	2200	-1463	131	108
840	1100	Same Date	131	108
830	1100	-270	131	109
737	1100	-363	131	110
830	840	-10	131	111
737	840	-103	131	112
737	830	-93	131	113

S Statistic = 131 - 113 = 18

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<b>Tied Group Value</b>		<b>Members</b>
1	1200	2
2	1000	2
3	1100	4

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/17/2014	1
10/29/2014	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	2
10/5/2017	1
4/4/2018	1

There are 1 time periods with multiple data

---

A = 192

B = 18

C = 24

D = 0

E = 16

F = 2

a = 25806

b = 95634

c = 1012

Group Variance = 1422.03

Z-Score = 0.450811

Comparison Level at 95% confidence level = -1.65463 (downward trend)

0.450811 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-02

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
1200	915	285	1	0
1000	915	85	2	0
930	915	15	3	0
900	915	-15	3	1
1100	915	185	4	1
1100	915	185	5	1
500	915	-415	5	2
1000	915	85	6	2
1300	915	385	7	2
1200	915	285	8	2
3100	915	2185	9	2
990	915	75	10	2
1500	915	585	11	2
7300	915	6385	12	2
1600	915	685	13	2
1400	915	485	14	2
1100	915	185	15	2
2200	915	1285	16	2
1100	915	185	17	2
840	915	-75	17	3
830	915	-85	17	4
737	915	-178	17	5
1000	1200	-200	17	6
930	1200	-270	17	7
900	1200	-300	17	8
1100	1200	-100	17	9
1100	1200	-100	17	10
500	1200	-700	17	11
1000	1200	-200	17	12
1300	1200	100	18	12
1200	1200	0	18	12
3100	1200	1900	19	12
990	1200	-210	19	13
1500	1200	300	20	13
7300	1200	6100	21	13
1600	1200	400	22	13
1400	1200	200	23	13
1100	1200	-100	23	14
2200	1200	1000	24	14
1100	1200	-100	24	15
840	1200	-360	24	16
830	1200	-370	24	17
737	1200	-463	24	18
930	1000	-70	24	19



900	1000	-100	24	20
1100	1000	100	25	20
1100	1000	100	26	20
500	1000	-500	26	21
1000	1000	0	26	21
1300	1000	300	27	21
1200	1000	200	28	21
3100	1000	2100	29	21
990	1000	-10	29	22
1500	1000	500	30	22
7300	1000	6300	31	22
1600	1000	600	32	22
1400	1000	400	33	22
1100	1000	100	34	22
2200	1000	1200	35	22
1100	1000	100	36	22
840	1000	-160	36	23
830	1000	-170	36	24
737	1000	-263	36	25

900	930	-30	36	26
1100	930	170	37	26
1100	930	170	38	26
500	930	-430	38	27
1000	930	70	39	27
1300	930	370	40	27
1200	930	270	41	27
3100	930	2170	42	27
990	930	60	43	27
1500	930	570	44	27
7300	930	6370	45	27
1600	930	670	46	27
1400	930	470	47	27
1100	930	170	48	27
2200	930	1270	49	27
1100	930	170	50	27
840	930	-90	50	28
830	930	-100	50	29
737	930	-193	50	30

1100	900	200	51	30
1100	900	200	52	30
500	900	-400	52	31
1000	900	100	53	31
1300	900	400	54	31
1200	900	300	55	31
3100	900	2200	56	31
990	900	90	57	31
1500	900	600	58	31
7300	900	6400	59	31
1600	900	700	60	31
1400	900	500	61	31
1100	900	200	62	31
2200	900	1300	63	31
1100	900	200	64	31
840	900	-60	64	32
830	900	-70	64	33

737	900	-163	64	34
1100	1100	0	64	34
500	1100	-600	64	35
1000	1100	-100	64	36
1300	1100	200	65	36
1200	1100	100	66	36
3100	1100	2000	67	36
990	1100	-110	67	37
1500	1100	400	68	37
7300	1100	6200	69	37
1600	1100	500	70	37
1400	1100	300	71	37
1100	1100	0	71	37
2200	1100	1100	72	37
1100	1100	0	72	37
840	1100	-260	72	38
830	1100	-270	72	39
737	1100	-363	72	40
500	1100	-600	72	41
1000	1100	-100	72	42
1300	1100	200	73	42
1200	1100	100	74	42
3100	1100	2000	75	42
990	1100	-110	75	43
1500	1100	400	76	43
7300	1100	6200	77	43
1600	1100	500	78	43
1400	1100	300	79	43
1100	1100	0	79	43
2200	1100	1100	80	43
1100	1100	0	80	43
840	1100	-260	80	44
830	1100	-270	80	45
737	1100	-363	80	46
1000	500	500	81	46
1300	500	800	82	46
1200	500	700	83	46
3100	500	2600	84	46
990	500	490	85	46
1500	500	1000	86	46
7300	500	6800	87	46
1600	500	1100	88	46
1400	500	900	89	46
1100	500	600	90	46
2200	500	1700	91	46
1100	500	600	92	46
840	500	340	93	46
830	500	330	94	46
737	500	237	95	46
1300	1000	300	96	46
1200	1000	200	97	46
3100	1000	2100	98	46
990	1000	-10	98	47

1500	1000	500	99	47
7300	1000	6300	100	47
1600	1000	600	101	47
1400	1000	400	102	47
1100	1000	100	103	47
2200	1000	1200	104	47
1100	1000	100	105	47
840	1000	-160	105	48
830	1000	-170	105	49
737	1000	-263	105	50
1200	1300	-100	105	51
3100	1300	1800	106	51
990	1300	-310	106	52
1500	1300	200	107	52
7300	1300	6000	108	52
1600	1300	300	109	52
1400	1300	100	110	52
1100	1300	-200	110	53
2200	1300	900	111	53
1100	1300	-200	111	54
840	1300	-460	111	55
830	1300	-470	111	56
737	1300	-563	111	57
3100	1200	1900	112	57
990	1200	-210	112	58
1500	1200	300	113	58
7300	1200	6100	114	58
1600	1200	400	115	58
1400	1200	200	116	58
1100	1200	-100	116	59
2200	1200	1000	117	59
1100	1200	-100	117	60
840	1200	-360	117	61
830	1200	-370	117	62
737	1200	-463	117	63
990	3100	-2110	117	64
1500	3100	-1600	117	65
7300	3100	4200	118	65
1600	3100	-1500	118	66
1400	3100	-1700	118	67
1100	3100	-2000	118	68
2200	3100	-900	118	69
1100	3100	-2000	118	70
840	3100	-2260	118	71
830	3100	-2270	118	72
737	3100	-2363	118	73
1500	990	510	119	73
7300	990	6310	120	73
1600	990	610	121	73
1400	990	410	122	73
1100	990	110	123	73
2200	990	1210	124	73
1100	990	110	125	73

840	990	-150	125	74
830	990	-160	125	75
737	990	-253	125	76
7300	1500	5800	126	76
1600	1500	100	127	76
1400	1500	-100	127	77
1100	1500	-400	127	78
2200	1500	700	128	78
1100	1500	-400	128	79
840	1500	-660	128	80
830	1500	-670	128	81
737	1500	-763	128	82
1600	7300	-5700	128	83
1400	7300	-5900	128	84
1100	7300	-6200	128	85
2200	7300	-5100	128	86
1100	7300	-6200	128	87
840	7300	-6460	128	88
830	7300	-6470	128	89
737	7300	-6563	128	90
1400	1600	-200	128	91
1100	1600	-500	128	92
2200	1600	600	129	92
1100	1600	-500	129	93
840	1600	-760	129	94
830	1600	-770	129	95
737	1600	-863	129	96
1100	1400	-300	129	97
2200	1400	800	130	97
1100	1400	-300	130	98
840	1400	-560	130	99
830	1400	-570	130	100
737	1400	-663	130	101
2200	1100	1100	131	101
1100	1100	0	131	101
840	1100	-260	131	102
830	1100	-270	131	103
737	1100	-363	131	104
1100	2200	-1100	131	105
840	2200	-1360	131	106
830	2200	-1370	131	107
737	2200	-1463	131	108
840	1100	Same Date	131	108
830	1100	-270	131	109
737	1100	-363	131	110
830	840	-10	131	111
737	840	-103	131	112
737	830	-93	131	113

S Statistic = 131 - 113 = 18

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<b>Tied Group Value</b>		<b>Members</b>
1	1200	2
2	1000	2
3	1100	4

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/24/2010	1
4/15/2010	1
8/12/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/22/2013	1
11/13/2013	1
4/17/2014	1
10/29/2014	1
10/23/2015	1
5/4/2016	1
10/4/2016	1
4/13/2017	2
10/5/2017	1
4/4/2018	1

There are 1 time periods with multiple data

---

A = 192

B = 18

C = 24

D = 0

E = 16

F = 2

a = 25806

b = 95634

c = 1012

Group Variance = 1422.03

Z-Score = 0.450811

Comparison Level at 95% confidence level = 1.65463 (upward trend)

0.450811 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-06

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
1200	1490	-290	0	1
1600	1490	110	1	1
500	1490	-990	1	2
1600	1490	110	2	2
1800	1490	310	3	2
1600	1490	110	4	2
790	1490	-700	4	3
1700	1490	210	5	3
1800	1490	310	6	3
1700	1490	210	7	3
2100	1490	610	8	3
1700	1490	210	9	3
2200	1490	710	10	3
1900	1490	410	11	3
2200	1490	710	12	3
2000	1490	510	13	3
2000	1490	510	14	3
320	1490	-1170	14	4
4600	1490	3110	15	4
1500	1490	10	16	4
1900	1490	410	17	4
1370	1490	-120	17	5
1600	1200	400	18	5
500	1200	-700	18	6
1600	1200	400	19	6
1800	1200	600	20	6
1600	1200	400	21	6
790	1200	-410	21	7
1700	1200	500	22	7
1800	1200	600	23	7
1700	1200	500	24	7
2100	1200	900	25	7
1700	1200	500	26	7
2200	1200	1000	27	7
1900	1200	700	28	7
2200	1200	1000	29	7
2000	1200	800	30	7
2000	1200	800	31	7
320	1200	-880	31	8
4600	1200	3400	32	8
1500	1200	300	33	8
1900	1200	700	34	8
1370	1200	170	35	8
500	1600	-1100	35	9

1600	1600	0	35	9
1800	1600	200	36	9
1600	1600	0	36	9
790	1600	-810	36	10
1700	1600	100	37	10
1800	1600	200	38	10
1700	1600	100	39	10
2100	1600	500	40	10
1700	1600	100	41	10
2200	1600	600	42	10
1900	1600	300	43	10
2200	1600	600	44	10
2000	1600	400	45	10
2000	1600	400	46	10
320	1600	-1280	46	11
4600	1600	3000	47	11
1500	1600	-100	47	12
1900	1600	300	48	12
1370	1600	-230	48	13
1600	500	1100	49	13
1800	500	1300	50	13
1600	500	1100	51	13
790	500	290	52	13
1700	500	1200	53	13
1800	500	1300	54	13
1700	500	1200	55	13
2100	500	1600	56	13
1700	500	1200	57	13
2200	500	1700	58	13
1900	500	1400	59	13
2200	500	1700	60	13
2000	500	1500	61	13
2000	500	1500	62	13
320	500	-180	62	14
4600	500	4100	63	14
1500	500	1000	64	14
1900	500	1400	65	14
1370	500	870	66	14
1800	1600	200	67	14
1600	1600	0	67	14
790	1600	-810	67	15
1700	1600	100	68	15
1800	1600	200	69	15
1700	1600	100	70	15
2100	1600	500	71	15
1700	1600	100	72	15
2200	1600	600	73	15
1900	1600	300	74	15
2200	1600	600	75	15
2000	1600	400	76	15
2000	1600	400	77	15
320	1600	-1280	77	16
4600	1600	3000	78	16
1500	1600	-100	78	17
1900	1600	300	79	17

1370	1600	-230	79	18
1600	1800	-200	79	19
790	1800	-1010	79	20
1700	1800	-100	79	21
1800	1800	0	79	21
1700	1800	-100	79	22
2100	1800	300	80	22
1700	1800	-100	80	23
2200	1800	400	81	23
1900	1800	100	82	23
2200	1800	400	83	23
2000	1800	200	84	23
2000	1800	200	85	23
320	1800	-1480	85	24
4600	1800	2800	86	24
1500	1800	-300	86	25
1900	1800	100	87	25
1370	1800	-430	87	26
790	1600	-810	87	27
1700	1600	100	88	27
1800	1600	200	89	27
1700	1600	100	90	27
2100	1600	500	91	27
1700	1600	100	92	27
2200	1600	600	93	27
1900	1600	300	94	27
2200	1600	600	95	27
2000	1600	400	96	27
2000	1600	400	97	27
320	1600	-1280	97	28
4600	1600	3000	98	28
1500	1600	-100	98	29
1900	1600	300	99	29
1370	1600	-230	99	30
1700	790	910	100	30
1800	790	1010	101	30
1700	790	910	102	30
2100	790	1310	103	30
1700	790	910	104	30
2200	790	1410	105	30
1900	790	1110	106	30
2200	790	1410	107	30
2000	790	1210	108	30
2000	790	1210	109	30
320	790	-470	109	31
4600	790	3810	110	31
1500	790	710	111	31
1900	790	1110	112	31
1370	790	580	113	31
1800	1700	100	114	31
1700	1700	0	114	31
2100	1700	400	115	31
1700	1700	0	115	31



2200	1700	500	116	31
1900	1700	200	117	31
2200	1700	500	118	31
2000	1700	300	119	31
2000	1700	300	120	31
320	1700	-1380	120	32
4600	1700	2900	121	32
1500	1700	-200	121	33
1900	1700	200	122	33
1370	1700	-330	122	34
1700	1800	-100	122	35
2100	1800	300	123	35
1700	1800	-100	123	36
2200	1800	400	124	36
1900	1800	100	125	36
2200	1800	400	126	36
2000	1800	200	127	36
2000	1800	200	128	36
320	1800	-1480	128	37
4600	1800	2800	129	37
1500	1800	-300	129	38
1900	1800	100	130	38
1370	1800	-430	130	39
2100	1700	400	131	39
1700	1700	0	131	39
2200	1700	500	132	39
1900	1700	200	133	39
2200	1700	500	134	39
2000	1700	300	135	39
2000	1700	300	136	39
320	1700	-1380	136	40
4600	1700	2900	137	40
1500	1700	-200	137	41
1900	1700	200	138	41
1370	1700	-330	138	42
1700	2100	-400	138	43
2200	2100	100	139	43
1900	2100	-200	139	44
2200	2100	100	140	44
2000	2100	-100	140	45
2000	2100	-100	140	46
320	2100	-1780	140	47
4600	2100	2500	141	47
1500	2100	-600	141	48
1900	2100	-200	141	49
1370	2100	-730	141	50
2200	1700	500	142	50
1900	1700	200	143	50
2200	1700	500	144	50
2000	1700	300	145	50
2000	1700	300	146	50
320	1700	-1380	146	51
4600	1700	2900	147	51

1500	1700	-200	147	52
1900	1700	200	148	52
1370	1700	-330	148	53
1900	2200	-300	148	54
2200	2200	0	148	54
2000	2200	-200	148	55
2000	2200	-200	148	56
320	2200	-1880	148	57
4600	2200	2400	149	57
1500	2200	-700	149	58
1900	2200	-300	149	59
1370	2200	-830	149	60
2200	1900	300	150	60
2000	1900	100	151	60
2000	1900	100	152	60
320	1900	-1580	152	61
4600	1900	2700	153	61
1500	1900	-400	153	62
1900	1900	0	153	62
1370	1900	-530	153	63
2000	2200	-200	153	64
2000	2200	-200	153	65
320	2200	-1880	153	66
4600	2200	2400	154	66
1500	2200	-700	154	67
1900	2200	-300	154	68
1370	2200	-830	154	69
2000	2000	0	154	69
320	2000	-1680	154	70
4600	2000	2600	155	70
1500	2000	-500	155	71
1900	2000	-100	155	72
1370	2000	-630	155	73
320	2000	-1680	155	74
4600	2000	2600	156	74
1500	2000	-500	156	75
1900	2000	-100	156	76
1370	2000	-630	156	77
4600	320	4280	157	77
1500	320	1180	158	77
1900	320	1580	159	77
1370	320	1050	160	77
1500	4600	-3100	160	78
1900	4600	-2700	160	79
1370	4600	-3230	160	80
1900	1500	400	161	80
1370	1500	-130	161	81
1370	1900	-530	161	82

S Statistic = 161 - 82 = 79

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<b>Tied Group Value</b>		<b>Members</b>
1	1600	3
2	1800	2
3	1700	3
4	2200	2
5	1900	2
6	2000	2

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/22/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 204

B = 0

C = 12

D = 0

E = 20

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1422.33

Z-Score = 2.06821

Comparison Level at 95% confidence level = -1.65463 (downward trend)

2.06821 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-06

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
1200	1490	-290	0	1
1600	1490	110	1	1
500	1490	-990	1	2
1600	1490	110	2	2
1800	1490	310	3	2
1600	1490	110	4	2
790	1490	-700	4	3
1700	1490	210	5	3
1800	1490	310	6	3
1700	1490	210	7	3
2100	1490	610	8	3
1700	1490	210	9	3
2200	1490	710	10	3
1900	1490	410	11	3
2200	1490	710	12	3
2000	1490	510	13	3
2000	1490	510	14	3
320	1490	-1170	14	4
4600	1490	3110	15	4
1500	1490	10	16	4
1900	1490	410	17	4
1370	1490	-120	17	5
1600	1200	400	18	5
500	1200	-700	18	6
1600	1200	400	19	6
1800	1200	600	20	6
1600	1200	400	21	6
790	1200	-410	21	7
1700	1200	500	22	7
1800	1200	600	23	7
1700	1200	500	24	7
2100	1200	900	25	7
1700	1200	500	26	7
2200	1200	1000	27	7
1900	1200	700	28	7
2200	1200	1000	29	7
2000	1200	800	30	7
2000	1200	800	31	7
320	1200	-880	31	8
4600	1200	3400	32	8
1500	1200	300	33	8
1900	1200	700	34	8
1370	1200	170	35	8
500	1600	-1100	35	9

1600	1600	0	35	9
1800	1600	200	36	9
1600	1600	0	36	9
790	1600	-810	36	10
1700	1600	100	37	10
1800	1600	200	38	10
1700	1600	100	39	10
2100	1600	500	40	10
1700	1600	100	41	10
2200	1600	600	42	10
1900	1600	300	43	10
2200	1600	600	44	10
2000	1600	400	45	10
2000	1600	400	46	10
320	1600	-1280	46	11
4600	1600	3000	47	11
1500	1600	-100	47	12
1900	1600	300	48	12
1370	1600	-230	48	13
1600	500	1100	49	13
1800	500	1300	50	13
1600	500	1100	51	13
790	500	290	52	13
1700	500	1200	53	13
1800	500	1300	54	13
1700	500	1200	55	13
2100	500	1600	56	13
1700	500	1200	57	13
2200	500	1700	58	13
1900	500	1400	59	13
2200	500	1700	60	13
2000	500	1500	61	13
2000	500	1500	62	13
320	500	-180	62	14
4600	500	4100	63	14
1500	500	1000	64	14
1900	500	1400	65	14
1370	500	870	66	14
1800	1600	200	67	14
1600	1600	0	67	14
790	1600	-810	67	15
1700	1600	100	68	15
1800	1600	200	69	15
1700	1600	100	70	15
2100	1600	500	71	15
1700	1600	100	72	15
2200	1600	600	73	15
1900	1600	300	74	15
2200	1600	600	75	15
2000	1600	400	76	15
2000	1600	400	77	15
320	1600	-1280	77	16
4600	1600	3000	78	16
1500	1600	-100	78	17
1900	1600	300	79	17

1370	1600	-230	79	18
1600	1800	-200	79	19
790	1800	-1010	79	20
1700	1800	-100	79	21
1800	1800	0	79	21
1700	1800	-100	79	22
2100	1800	300	80	22
1700	1800	-100	80	23
2200	1800	400	81	23
1900	1800	100	82	23
2200	1800	400	83	23
2000	1800	200	84	23
2000	1800	200	85	23
320	1800	-1480	85	24
4600	1800	2800	86	24
1500	1800	-300	86	25
1900	1800	100	87	25
1370	1800	-430	87	26
790	1600	-810	87	27
1700	1600	100	88	27
1800	1600	200	89	27
1700	1600	100	90	27
2100	1600	500	91	27
1700	1600	100	92	27
2200	1600	600	93	27
1900	1600	300	94	27
2200	1600	600	95	27
2000	1600	400	96	27
2000	1600	400	97	27
320	1600	-1280	97	28
4600	1600	3000	98	28
1500	1600	-100	98	29
1900	1600	300	99	29
1370	1600	-230	99	30
1700	790	910	100	30
1800	790	1010	101	30
1700	790	910	102	30
2100	790	1310	103	30
1700	790	910	104	30
2200	790	1410	105	30
1900	790	1110	106	30
2200	790	1410	107	30
2000	790	1210	108	30
2000	790	1210	109	30
320	790	-470	109	31
4600	790	3810	110	31
1500	790	710	111	31
1900	790	1110	112	31
1370	790	580	113	31
1800	1700	100	114	31
1700	1700	0	114	31
2100	1700	400	115	31
1700	1700	0	115	31

2200	1700	500	116	31
1900	1700	200	117	31
2200	1700	500	118	31
2000	1700	300	119	31
2000	1700	300	120	31
320	1700	-1380	120	32
4600	1700	2900	121	32
1500	1700	-200	121	33
1900	1700	200	122	33
1370	1700	-330	122	34
1700	1800	-100	122	35
2100	1800	300	123	35
1700	1800	-100	123	36
2200	1800	400	124	36
1900	1800	100	125	36
2200	1800	400	126	36
2000	1800	200	127	36
2000	1800	200	128	36
320	1800	-1480	128	37
4600	1800	2800	129	37
1500	1800	-300	129	38
1900	1800	100	130	38
1370	1800	-430	130	39
2100	1700	400	131	39
1700	1700	0	131	39
2200	1700	500	132	39
1900	1700	200	133	39
2200	1700	500	134	39
2000	1700	300	135	39
2000	1700	300	136	39
320	1700	-1380	136	40
4600	1700	2900	137	40
1500	1700	-200	137	41
1900	1700	200	138	41
1370	1700	-330	138	42
1700	2100	-400	138	43
2200	2100	100	139	43
1900	2100	-200	139	44
2200	2100	100	140	44
2000	2100	-100	140	45
2000	2100	-100	140	46
320	2100	-1780	140	47
4600	2100	2500	141	47
1500	2100	-600	141	48
1900	2100	-200	141	49
1370	2100	-730	141	50
2200	1700	500	142	50
1900	1700	200	143	50
2200	1700	500	144	50
2000	1700	300	145	50
2000	1700	300	146	50
320	1700	-1380	146	51
4600	1700	2900	147	51

1500	1700	-200	147	52
1900	1700	200	148	52
1370	1700	-330	148	53
1900	2200	-300	148	54
2200	2200	0	148	54
2000	2200	-200	148	55
2000	2200	-200	148	56
320	2200	-1880	148	57
4600	2200	2400	149	57
1500	2200	-700	149	58
1900	2200	-300	149	59
1370	2200	-830	149	60
2200	1900	300	150	60
2000	1900	100	151	60
2000	1900	100	152	60
320	1900	-1580	152	61
4600	1900	2700	153	61
1500	1900	-400	153	62
1900	1900	0	153	62
1370	1900	-530	153	63
2000	2200	-200	153	64
2000	2200	-200	153	65
320	2200	-1880	153	66
4600	2200	2400	154	66
1500	2200	-700	154	67
1900	2200	-300	154	68
1370	2200	-830	154	69
2000	2000	0	154	69
320	2000	-1680	154	70
4600	2000	2600	155	70
1500	2000	-500	155	71
1900	2000	-100	155	72
1370	2000	-630	155	73
320	2000	-1680	155	74
4600	2000	2600	156	74
1500	2000	-500	156	75
1900	2000	-100	156	76
1370	2000	-630	156	77
4600	320	4280	157	77
1500	320	1180	158	77
1900	320	1580	159	77
1370	320	1050	160	77
1500	4600	-3100	160	78
1900	4600	-2700	160	79
1370	4600	-3230	160	80
1900	1500	400	161	80
1370	1500	-130	161	81
1370	1900	-530	161	82



S Statistic = 161 - 82 = 79

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<b>Tied Group Value</b>		<b>Members</b>
1	1600	3
2	1800	2
3	1700	3
4	2200	2
5	1900	2
6	2000	2

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/26/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/13/2013	1
4/16/2014	1
10/29/2014	1
3/16/2015	1
10/22/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 204

B = 0

C = 12

D = 0

E = 20

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1422.33

Z-Score = 2.06821

Comparison Level at 95% confidence level = 1.65463 (upward trend)

**2.06821 > 1.65463 indicating an upward trend**

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-07

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
490	436	54	1	0
590	436	154	2	0
200	436	-236	2	1
410	436	-26	2	2
490	436	54	3	2
480	436	44	4	2
190	436	-246	4	3
500	436	64	5	3
390	436	-46	5	4
570	436	134	6	4
590	436	154	7	4
510	436	74	8	4
540	436	104	9	4
440	436	4	10	4
98	436	-338	10	5
500	436	64	11	5
630	436	194	12	5
520	436	84	13	5
410	436	-26	13	6
450	436	14	14	6
450	436	14	15	6
434	436	-2	15	7
590	490	100	16	7
200	490	-290	16	8
410	490	-80	16	9
490	490	0	16	9
480	490	-10	16	10
190	490	-300	16	11
500	490	10	17	11
390	490	-100	17	12
570	490	80	18	12
590	490	100	19	12
510	490	20	20	12
540	490	50	21	12
440	490	-50	21	13
98	490	-392	21	14
500	490	10	22	14
630	490	140	23	14
520	490	30	24	14
410	490	-80	24	15
450	490	-40	24	16
450	490	-40	24	17
434	490	-56	24	18
200	590	-390	24	19

410	590	-180	24	20
490	590	-100	24	21
480	590	-110	24	22
190	590	-400	24	23
500	590	-90	24	24
390	590	-200	24	25
570	590	-20	24	26
590	590	0	24	26
510	590	-80	24	27
540	590	-50	24	28
440	590	-150	24	29
98	590	-492	24	30
500	590	-90	24	31
630	590	40	25	31
520	590	-70	25	32
410	590	-180	25	33
450	590	-140	25	34
450	590	-140	25	35
434	590	-156	25	36
410	200	210	26	36
490	200	290	27	36
480	200	280	28	36
190	200	-10	28	37
500	200	300	29	37
390	200	190	30	37
570	200	370	31	37
590	200	390	32	37
510	200	310	33	37
540	200	340	34	37
440	200	240	35	37
98	200	-102	35	38
500	200	300	36	38
630	200	430	37	38
520	200	320	38	38
410	200	210	39	38
450	200	250	40	38
450	200	250	41	38
434	200	234	42	38
490	410	80	43	38
480	410	70	44	38
190	410	-220	44	39
500	410	90	45	39
390	410	-20	45	40
570	410	160	46	40
590	410	180	47	40
510	410	100	48	40
540	410	130	49	40
440	410	30	50	40
98	410	-312	50	41
500	410	90	51	41
630	410	220	52	41
520	410	110	53	41
410	410	0	53	41
450	410	40	54	41
450	410	40	55	41

434	410	24	56	41
480	490	-10	56	42
190	490	-300	56	43
500	490	10	57	43
390	490	-100	57	44
570	490	80	58	44
590	490	100	59	44
510	490	20	60	44
540	490	50	61	44
440	490	-50	61	45
98	490	-392	61	46
500	490	10	62	46
630	490	140	63	46
520	490	30	64	46
410	490	-80	64	47
450	490	-40	64	48
450	490	-40	64	49
434	490	-56	64	50
190	480	-290	64	51
500	480	20	65	51
390	480	-90	65	52
570	480	90	66	52
590	480	110	67	52
510	480	30	68	52
540	480	60	69	52
440	480	-40	69	53
98	480	-382	69	54
500	480	20	70	54
630	480	150	71	54
520	480	40	72	54
410	480	-70	72	55
450	480	-30	72	56
450	480	-30	72	57
434	480	-46	72	58
500	190	310	73	58
390	190	200	74	58
570	190	380	75	58
590	190	400	76	58
510	190	320	77	58
540	190	350	78	58
440	190	250	79	58
98	190	-92	79	59
500	190	310	80	59
630	190	440	81	59
520	190	330	82	59
410	190	220	83	59
450	190	260	84	59
450	190	260	85	59
434	190	244	86	59
390	500	-110	86	60
570	500	70	87	60
590	500	90	88	60
510	500	10	89	60

540	500	40	90	60
440	500	-60	90	61
98	500	-402	90	62
500	500	0	90	62
630	500	130	91	62
520	500	20	92	62
410	500	-90	92	63
450	500	-50	92	64
450	500	-50	92	65
434	500	-66	92	66
570	390	180	93	66
590	390	200	94	66
510	390	120	95	66
540	390	150	96	66
440	390	50	97	66
98	390	-292	97	67
500	390	110	98	67
630	390	240	99	67
520	390	130	100	67
410	390	20	101	67
450	390	60	102	67
450	390	60	103	67
434	390	44	104	67
590	570	20	105	67
510	570	-60	105	68
540	570	-30	105	69
440	570	-130	105	70
98	570	-472	105	71
500	570	-70	105	72
630	570	60	106	72
520	570	-50	106	73
410	570	-160	106	74
450	570	-120	106	75
450	570	-120	106	76
434	570	-136	106	77
510	590	-80	106	78
540	590	-50	106	79
440	590	-150	106	80
98	590	-492	106	81
500	590	-90	106	82
630	590	40	107	82
520	590	-70	107	83
410	590	-180	107	84
450	590	-140	107	85
450	590	-140	107	86
434	590	-156	107	87
540	510	30	108	87
440	510	-70	108	88
98	510	-412	108	89
500	510	-10	108	90
630	510	120	109	90
520	510	10	110	90
410	510	-100	110	91

450	510	-60	110	92
450	510	-60	110	93
434	510	-76	110	94
440	540	-100	110	95
98	540	-442	110	96
500	540	-40	110	97
630	540	90	111	97
520	540	-20	111	98
410	540	-130	111	99
450	540	-90	111	100
450	540	-90	111	101
434	540	-106	111	102
98	440	-342	111	103
500	440	60	112	103
630	440	190	113	103
520	440	80	114	103
410	440	-30	114	104
450	440	10	115	104
450	440	10	116	104
434	440	-6	116	105
500	98	402	117	105
630	98	532	118	105
520	98	422	119	105
410	98	312	120	105
450	98	352	121	105
450	98	352	122	105
434	98	336	123	105
630	500	130	124	105
520	500	20	125	105
410	500	-90	125	106
450	500	-50	125	107
450	500	-50	125	108
434	500	-66	125	109
520	630	-110	125	110
410	630	-220	125	111
450	630	-180	125	112
450	630	-180	125	113
434	630	-196	125	114
410	520	-110	125	115
450	520	-70	125	116
450	520	-70	125	117
434	520	-86	125	118
450	410	40	126	118
450	410	40	127	118
434	410	24	128	118
450	450	0	128	118
434	450	-16	128	119
434	450	-16	128	120

S Statistic = 128 - 120 = 8

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<b>Tied Group Value</b>		<b>Members</b>
1	490	2
2	590	2
3	410	2
4	500	2
5	450	2

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 90

B = 0

C = 0

D = 0

E = 10

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1428.67

Z-Score = 0.185196

Comparison Level at 95% confidence level = -1.65463 (downward trend)

0.185196 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-07

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

---

<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
490	436	54	1	0
590	436	154	2	0
200	436	-236	2	1
410	436	-26	2	2
490	436	54	3	2
480	436	44	4	2
190	436	-246	4	3
500	436	64	5	3
390	436	-46	5	4
570	436	134	6	4
590	436	154	7	4
510	436	74	8	4
540	436	104	9	4
440	436	4	10	4
98	436	-338	10	5
500	436	64	11	5
630	436	194	12	5
520	436	84	13	5
410	436	-26	13	6
450	436	14	14	6
450	436	14	15	6
434	436	-2	15	7
590	490	100	16	7
200	490	-290	16	8
410	490	-80	16	9
490	490	0	16	9
480	490	-10	16	10
190	490	-300	16	11
500	490	10	17	11
390	490	-100	17	12
570	490	80	18	12
590	490	100	19	12
510	490	20	20	12
540	490	50	21	12
440	490	-50	21	13
98	490	-392	21	14
500	490	10	22	14
630	490	140	23	14
520	490	30	24	14
410	490	-80	24	15
450	490	-40	24	16
450	490	-40	24	17
434	490	-56	24	18
200	590	-390	24	19



410	590	-180	24	20
490	590	-100	24	21
480	590	-110	24	22
190	590	-400	24	23
500	590	-90	24	24
390	590	-200	24	25
570	590	-20	24	26
590	590	0	24	26
510	590	-80	24	27
540	590	-50	24	28
440	590	-150	24	29
98	590	-492	24	30
500	590	-90	24	31
630	590	40	25	31
520	590	-70	25	32
410	590	-180	25	33
450	590	-140	25	34
450	590	-140	25	35
434	590	-156	25	36
410	200	210	26	36
490	200	290	27	36
480	200	280	28	36
190	200	-10	28	37
500	200	300	29	37
390	200	190	30	37
570	200	370	31	37
590	200	390	32	37
510	200	310	33	37
540	200	340	34	37
440	200	240	35	37
98	200	-102	35	38
500	200	300	36	38
630	200	430	37	38
520	200	320	38	38
410	200	210	39	38
450	200	250	40	38
450	200	250	41	38
434	200	234	42	38
490	410	80	43	38
480	410	70	44	38
190	410	-220	44	39
500	410	90	45	39
390	410	-20	45	40
570	410	160	46	40
590	410	180	47	40
510	410	100	48	40
540	410	130	49	40
440	410	30	50	40
98	410	-312	50	41
500	410	90	51	41
630	410	220	52	41
520	410	110	53	41
410	410	0	53	41
450	410	40	54	41
450	410	40	55	41

434	410	24	56	41
480	490	-10	56	42
190	490	-300	56	43
500	490	10	57	43
390	490	-100	57	44
570	490	80	58	44
590	490	100	59	44
510	490	20	60	44
540	490	50	61	44
440	490	-50	61	45
98	490	-392	61	46
500	490	10	62	46
630	490	140	63	46
520	490	30	64	46
410	490	-80	64	47
450	490	-40	64	48
450	490	-40	64	49
434	490	-56	64	50
190	480	-290	64	51
500	480	20	65	51
390	480	-90	65	52
570	480	90	66	52
590	480	110	67	52
510	480	30	68	52
540	480	60	69	52
440	480	-40	69	53
98	480	-382	69	54
500	480	20	70	54
630	480	150	71	54
520	480	40	72	54
410	480	-70	72	55
450	480	-30	72	56
450	480	-30	72	57
434	480	-46	72	58
500	190	310	73	58
390	190	200	74	58
570	190	380	75	58
590	190	400	76	58
510	190	320	77	58
540	190	350	78	58
440	190	250	79	58
98	190	-92	79	59
500	190	310	80	59
630	190	440	81	59
520	190	330	82	59
410	190	220	83	59
450	190	260	84	59
450	190	260	85	59
434	190	244	86	59
390	500	-110	86	60
570	500	70	87	60
590	500	90	88	60
510	500	10	89	60

540	500	40	90	60
440	500	-60	90	61
98	500	-402	90	62
500	500	0	90	62
630	500	130	91	62
520	500	20	92	62
410	500	-90	92	63
450	500	-50	92	64
450	500	-50	92	65
434	500	-66	92	66
570	390	180	93	66
590	390	200	94	66
510	390	120	95	66
540	390	150	96	66
440	390	50	97	66
98	390	-292	97	67
500	390	110	98	67
630	390	240	99	67
520	390	130	100	67
410	390	20	101	67
450	390	60	102	67
450	390	60	103	67
434	390	44	104	67
590	570	20	105	67
510	570	-60	105	68
540	570	-30	105	69
440	570	-130	105	70
98	570	-472	105	71
500	570	-70	105	72
630	570	60	106	72
520	570	-50	106	73
410	570	-160	106	74
450	570	-120	106	75
450	570	-120	106	76
434	570	-136	106	77
510	590	-80	106	78
540	590	-50	106	79
440	590	-150	106	80
98	590	-492	106	81
500	590	-90	106	82
630	590	40	107	82
520	590	-70	107	83
410	590	-180	107	84
450	590	-140	107	85
450	590	-140	107	86
434	590	-156	107	87
540	510	30	108	87
440	510	-70	108	88
98	510	-412	108	89
500	510	-10	108	90
630	510	120	109	90
520	510	10	110	90
410	510	-100	110	91

450	510	-60	110	92
450	510	-60	110	93
434	510	-76	110	94
440	540	-100	110	95
98	540	-442	110	96
500	540	-40	110	97
630	540	90	111	97
520	540	-20	111	98
410	540	-130	111	99
450	540	-90	111	100
450	540	-90	111	101
434	540	-106	111	102
98	440	-342	111	103
500	440	60	112	103
630	440	190	113	103
520	440	80	114	103
410	440	-30	114	104
450	440	10	115	104
450	440	10	116	104
434	440	-6	116	105
500	98	402	117	105
630	98	532	118	105
520	98	422	119	105
410	98	312	120	105
450	98	352	121	105
450	98	352	122	105
434	98	336	123	105
630	500	130	124	105
520	500	20	125	105
410	500	-90	125	106
450	500	-50	125	107
450	500	-50	125	108
434	500	-66	125	109
520	630	-110	125	110
410	630	-220	125	111
450	630	-180	125	112
450	630	-180	125	113
434	630	-196	125	114
410	520	-110	125	115
450	520	-70	125	116
450	520	-70	125	117
434	520	-86	125	118
450	410	40	126	118
450	410	40	127	118
434	410	24	128	118
450	450	0	128	118
434	450	-16	128	119
434	450	-16	128	120

S Statistic = 128 - 120 = 8

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<b>Tied Group Value</b>		<b>Members</b>
1	490	2
2	590	2
3	410	2
4	500	2
5	450	2

---

<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/23/2009	1
12/7/2009	1
2/24/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/12/2013	1
4/14/2014	1
10/29/2014	1
3/16/2015	1
10/20/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/3/2018	1

There are 0 time periods with multiple data

---

A = 90

B = 0

C = 0

D = 0

E = 10

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1428.67

Z-Score = 0.185196

Comparison Level at 95% confidence level = 1.65463 (upward trend)

0.185196 <= 1.65463 indicating no evidence of an upward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-09

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

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<b>Xj</b>	<b>Xk</b>	<b>Xj - Xk</b>	<b>Positives</b>	<b>Negatives</b>
140	21	119	1	0
81	21	60	2	0
64	21	43	3	0
72	21	51	4	0
83	21	62	5	0
96	21	75	6	0
ND<0	21	-21	6	1
97	21	76	7	1
170	21	149	8	1
130	21	109	9	1
62	21	41	10	1
17	21	-4	10	2
92	21	71	11	2
ND<0	21	-21	11	3
110	21	89	12	3
67	21	46	13	3
74	21	53	14	3
64	21	43	15	3
180	21	159	16	3
81	21	60	17	3
77	21	56	18	3
105	21	84	19	3
81	140	-59	19	4
64	140	-76	19	5
72	140	-68	19	6
83	140	-57	19	7
96	140	-44	19	8
ND<0	140	-140	19	9
97	140	-43	19	10
170	140	30	20	10
130	140	-10	20	11
62	140	-78	20	12
17	140	-123	20	13
92	140	-48	20	14
ND<0	140	-140	20	15
110	140	-30	20	16
67	140	-73	20	17
74	140	-66	20	18
64	140	-76	20	19
180	140	40	21	19
81	140	-59	21	20
77	140	-63	21	21
105	140	-35	21	22
64	81	-17	21	23

72	81	-9	21	24
83	81	2	22	24
96	81	15	23	24
ND<0	81	-81	23	25
97	81	16	24	25
170	81	89	25	25
130	81	49	26	25
62	81	-19	26	26
17	81	-64	26	27
92	81	11	27	27
ND<0	81	-81	27	28
110	81	29	28	28
67	81	-14	28	29
74	81	-7	28	30
64	81	-17	28	31
180	81	99	29	31
81	81	0	29	31
77	81	-4	29	32
105	81	24	30	32

72	64	8	31	32
83	64	19	32	32
96	64	32	33	32
ND<0	64	-64	33	33
97	64	33	34	33
170	64	106	35	33
130	64	66	36	33
62	64	-2	36	34
17	64	-47	36	35
92	64	28	37	35
ND<0	64	-64	37	36
110	64	46	38	36
67	64	3	39	36
74	64	10	40	36
64	64	0	40	36
180	64	116	41	36
81	64	17	42	36
77	64	13	43	36
105	64	41	44	36

83	72	11	45	36
96	72	24	46	36
ND<0	72	-72	46	37
97	72	25	47	37
170	72	98	48	37
130	72	58	49	37
62	72	-10	49	38
17	72	-55	49	39
92	72	20	50	39
ND<0	72	-72	50	40
110	72	38	51	40
67	72	-5	51	41
74	72	2	52	41
64	72	-8	52	42
180	72	108	53	42
81	72	9	54	42
77	72	5	55	42

105	72	33	56	42
96	83	13	57	42
ND<0	83	-83	57	43
97	83	14	58	43
170	83	87	59	43
130	83	47	60	43
62	83	-21	60	44
17	83	-66	60	45
92	83	9	61	45
ND<0	83	-83	61	46
110	83	27	62	46
67	83	-16	62	47
74	83	-9	62	48
64	83	-19	62	49
180	83	97	63	49
81	83	-2	63	50
77	83	-6	63	51
105	83	22	64	51
ND<0	96	-96	64	52
97	96	1	65	52
170	96	74	66	52
130	96	34	67	52
62	96	-34	67	53
17	96	-79	67	54
92	96	-4	67	55
ND<0	96	-96	67	56
110	96	14	68	56
67	96	-29	68	57
74	96	-22	68	58
64	96	-32	68	59
180	96	84	69	59
81	96	-15	69	60
77	96	-19	69	61
105	96	9	70	61
97	ND<0	97	71	61
170	ND<0	170	72	61
130	ND<0	130	73	61
62	ND<0	62	74	61
17	ND<0	17	75	61
92	ND<0	92	76	61
ND<0	ND<0	0	76	61
110	ND<0	110	77	61
67	ND<0	67	78	61
74	ND<0	74	79	61
64	ND<0	64	80	61
180	ND<0	180	81	61
81	ND<0	81	82	61
77	ND<0	77	83	61
105	ND<0	105	84	61
170	97	73	85	61
130	97	33	86	61
62	97	-35	86	62
17	97	-80	86	63



92	97	-5	86	64
ND<0	97	-97	86	65
110	97	13	87	65
67	97	-30	87	66
74	97	-23	87	67
64	97	-33	87	68
180	97	83	88	68
81	97	-16	88	69
77	97	-20	88	70
105	97	8	89	70
130	170	-40	89	71
62	170	-108	89	72
17	170	-153	89	73
92	170	-78	89	74
ND<0	170	-170	89	75
110	170	-60	89	76
67	170	-103	89	77
74	170	-96	89	78
64	170	-106	89	79
180	170	10	90	79
81	170	-89	90	80
77	170	-93	90	81
105	170	-65	90	82
62	130	-68	90	83
17	130	-113	90	84
92	130	-38	90	85
ND<0	130	-130	90	86
110	130	-20	90	87
67	130	-63	90	88
74	130	-56	90	89
64	130	-66	90	90
180	130	50	91	90
81	130	-49	91	91
77	130	-53	91	92
105	130	-25	91	93
17	62	-45	91	94
92	62	30	92	94
ND<0	62	-62	92	95
110	62	48	93	95
67	62	5	94	95
74	62	12	95	95
64	62	2	96	95
180	62	118	97	95
81	62	19	98	95
77	62	15	99	95
105	62	43	100	95
92	17	75	101	95
ND<0	17	-17	101	96
110	17	93	102	96
67	17	50	103	96
74	17	57	104	96
64	17	47	105	96
180	17	163	106	96

81	17	64	107	96
77	17	60	108	96
105	17	88	109	96
ND<0	92	-92	109	97
110	92	18	110	97
67	92	-25	110	98
74	92	-18	110	99
64	92	-28	110	100
180	92	88	111	100
81	92	-11	111	101
77	92	-15	111	102
105	92	13	112	102
110	ND<0	110	113	102
67	ND<0	67	114	102
74	ND<0	74	115	102
64	ND<0	64	116	102
180	ND<0	180	117	102
81	ND<0	81	118	102
77	ND<0	77	119	102
105	ND<0	105	120	102
67	110	-43	120	103
74	110	-36	120	104
64	110	-46	120	105
180	110	70	121	105
81	110	-29	121	106
77	110	-33	121	107
105	110	-5	121	108
74	67	7	122	108
64	67	-3	122	109
180	67	113	123	109
81	67	14	124	109
77	67	10	125	109
105	67	38	126	109
64	74	-10	126	110
180	74	106	127	110
81	74	7	128	110
77	74	3	129	110
105	74	31	130	110
180	64	116	131	110
81	64	17	132	110
77	64	13	133	110
105	64	41	134	110
81	180	-99	134	111
77	180	-103	134	112
105	180	-75	134	113
77	81	-4	134	114
105	81	24	135	114
105	77	28	136	114

S Statistic = 136 - 114 = 22

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<b>Tied Group Value</b>		<b>Members</b>
1	81	2
2	64	2
3	0	2

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/13/2013	1
4/15/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

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A = 54

B = 0

C = 0

D = 0

E = 6

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1430.67

Z-Score = 0.555201

Comparison Level at 95% confidence level = -1.65463 (downward trend)

0.555201 >= -1.65463 indicating no evidence of a downward trend

# Mann-Kendall Trend Analysis

Parameter: Sulfate

Location: SW-09

Original Data (Not Transformed)

Non-Detects Replaced with 0

95% Confidence Level

Xj	Xk	Xj - Xk	Positives	Negatives
140	21	119	1	0
81	21	60	2	0
64	21	43	3	0
72	21	51	4	0
83	21	62	5	0
96	21	75	6	0
ND<0	21	-21	6	1
97	21	76	7	1
170	21	149	8	1
130	21	109	9	1
62	21	41	10	1
17	21	-4	10	2
92	21	71	11	2
ND<0	21	-21	11	3
110	21	89	12	3
67	21	46	13	3
74	21	53	14	3
64	21	43	15	3
180	21	159	16	3
81	21	60	17	3
77	21	56	18	3
105	21	84	19	3
81	140	-59	19	4
64	140	-76	19	5
72	140	-68	19	6
83	140	-57	19	7
96	140	-44	19	8
ND<0	140	-140	19	9
97	140	-43	19	10
170	140	30	20	10
130	140	-10	20	11
62	140	-78	20	12
17	140	-123	20	13
92	140	-48	20	14
ND<0	140	-140	20	15
110	140	-30	20	16
67	140	-73	20	17
74	140	-66	20	18
64	140	-76	20	19
180	140	40	21	19
81	140	-59	21	20
77	140	-63	21	21
105	140	-35	21	22
64	81	-17	21	23

72	81	-9	21	24
83	81	2	22	24
96	81	15	23	24
ND<0	81	-81	23	25
97	81	16	24	25
170	81	89	25	25
130	81	49	26	25
62	81	-19	26	26
17	81	-64	26	27
92	81	11	27	27
ND<0	81	-81	27	28
110	81	29	28	28
67	81	-14	28	29
74	81	-7	28	30
64	81	-17	28	31
180	81	99	29	31
81	81	0	29	31
77	81	-4	29	32
105	81	24	30	32

72	64	8	31	32
83	64	19	32	32
96	64	32	33	32
ND<0	64	-64	33	33
97	64	33	34	33
170	64	106	35	33
130	64	66	36	33
62	64	-2	36	34
17	64	-47	36	35
92	64	28	37	35
ND<0	64	-64	37	36
110	64	46	38	36
67	64	3	39	36
74	64	10	40	36
64	64	0	40	36
180	64	116	41	36
81	64	17	42	36
77	64	13	43	36
105	64	41	44	36

83	72	11	45	36
96	72	24	46	36
ND<0	72	-72	46	37
97	72	25	47	37
170	72	98	48	37
130	72	58	49	37
62	72	-10	49	38
17	72	-55	49	39
92	72	20	50	39
ND<0	72	-72	50	40
110	72	38	51	40
67	72	-5	51	41
74	72	2	52	41
64	72	-8	52	42
180	72	108	53	42
81	72	9	54	42
77	72	5	55	42

105	72	33	56	42
96	83	13	57	42
ND<0	83	-83	57	43
97	83	14	58	43
170	83	87	59	43
130	83	47	60	43
62	83	-21	60	44
17	83	-66	60	45
92	83	9	61	45
ND<0	83	-83	61	46
110	83	27	62	46
67	83	-16	62	47
74	83	-9	62	48
64	83	-19	62	49
180	83	97	63	49
81	83	-2	63	50
77	83	-6	63	51
105	83	22	64	51
ND<0	96	-96	64	52
97	96	1	65	52
170	96	74	66	52
130	96	34	67	52
62	96	-34	67	53
17	96	-79	67	54
92	96	-4	67	55
ND<0	96	-96	67	56
110	96	14	68	56
67	96	-29	68	57
74	96	-22	68	58
64	96	-32	68	59
180	96	84	69	59
81	96	-15	69	60
77	96	-19	69	61
105	96	9	70	61
97	ND<0	97	71	61
170	ND<0	170	72	61
130	ND<0	130	73	61
62	ND<0	62	74	61
17	ND<0	17	75	61
92	ND<0	92	76	61
ND<0	ND<0	0	76	61
110	ND<0	110	77	61
67	ND<0	67	78	61
74	ND<0	74	79	61
64	ND<0	64	80	61
180	ND<0	180	81	61
81	ND<0	81	82	61
77	ND<0	77	83	61
105	ND<0	105	84	61
170	97	73	85	61
130	97	33	86	61
62	97	-35	86	62
17	97	-80	86	63

92	97	-5	86	64
ND<0	97	-97	86	65
110	97	13	87	65
67	97	-30	87	66
74	97	-23	87	67
64	97	-33	87	68
180	97	83	88	68
81	97	-16	88	69
77	97	-20	88	70
105	97	8	89	70
130	170	-40	89	71
62	170	-108	89	72
17	170	-153	89	73
92	170	-78	89	74
ND<0	170	-170	89	75
110	170	-60	89	76
67	170	-103	89	77
74	170	-96	89	78
64	170	-106	89	79
180	170	10	90	79
81	170	-89	90	80
77	170	-93	90	81
105	170	-65	90	82
62	130	-68	90	83
17	130	-113	90	84
92	130	-38	90	85
ND<0	130	-130	90	86
110	130	-20	90	87
67	130	-63	90	88
74	130	-56	90	89
64	130	-66	90	90
180	130	50	91	90
81	130	-49	91	91
77	130	-53	91	92
105	130	-25	91	93
17	62	-45	91	94
92	62	30	92	94
ND<0	62	-62	92	95
110	62	48	93	95
67	62	5	94	95
74	62	12	95	95
64	62	2	96	95
180	62	118	97	95
81	62	19	98	95
77	62	15	99	95
105	62	43	100	95
92	17	75	101	95
ND<0	17	-17	101	96
110	17	93	102	96
67	17	50	103	96
74	17	57	104	96
64	17	47	105	96
180	17	163	106	96

81	17	64	107	96
77	17	60	108	96
105	17	88	109	96
ND<0	92	-92	109	97
110	92	18	110	97
67	92	-25	110	98
74	92	-18	110	99
64	92	-28	110	100
180	92	88	111	100
81	92	-11	111	101
77	92	-15	111	102
105	92	13	112	102
110	ND<0	110	113	102
67	ND<0	67	114	102
74	ND<0	74	115	102
64	ND<0	64	116	102
180	ND<0	180	117	102
81	ND<0	81	118	102
77	ND<0	77	119	102
105	ND<0	105	120	102
67	110	-43	120	103
74	110	-36	120	104
64	110	-46	120	105
180	110	70	121	105
81	110	-29	121	106
77	110	-33	121	107
105	110	-5	121	108
74	67	7	122	108
64	67	-3	122	109
180	67	113	123	109
81	67	14	124	109
77	67	10	125	109
105	67	38	126	109
64	74	-10	126	110
180	74	106	127	110
81	74	7	128	110
77	74	3	129	110
105	74	31	130	110
180	64	116	131	110
81	64	17	132	110
77	64	13	133	110
105	64	41	134	110
81	180	-99	134	111
77	180	-103	134	112
105	180	-75	134	113
77	81	-4	134	114
105	81	24	135	114
105	77	28	136	114



S Statistic = 136 - 114 = 22

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<b>Tied Group Value</b>		<b>Members</b>
1	81	2
2	64	2
3	0	2

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<b>Time Period</b>	<b>Observations</b>
2/15/2009	1
9/24/2009	1
12/8/2009	1
2/25/2010	1
4/15/2010	1
8/10/2010	1
11/23/2010	1
3/10/2011	1
5/25/2011	1
9/1/2011	1
4/13/2012	1
11/8/2012	1
4/24/2013	1
11/13/2013	1
4/15/2014	1
10/29/2014	1
3/16/2015	1
10/21/2015	1
5/5/2016	1
10/4/2016	1
4/13/2017	1
10/5/2017	1
4/4/2018	1

There are 0 time periods with multiple data

---

A = 54

B = 0

C = 0

D = 0

E = 6

F = 0

a = 25806

b = 95634

c = 1012

Group Variance = 1430.67

Z-Score = 0.555201

Comparison Level at 95% confidence level = 1.65463 (upward trend)

0.555201 <= 1.65463 indicating no evidence of an upward trend