Geochemical Evaluation Summary & 2013 Remedial Action Work Plan

Former Clariant Corporation Facility

Kalama, Washington
Facility No. 24634187
State of Washington
Department of Ecology
VCP Project No. SWO492

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1.0 Introduction

Hart & Hickman, PC (H&H) has prepared this Geochemical Evaluation Summary & 2013 Remedial Action Work Plan (RAWP) to summarize the results of a recently-completed ground water geochemical evaluation and to present proposed 2013 remedial action (RA) activities at the former Clariant Corporation (Clariant) facility located at 404 Hendrickson Drive in Kalama, Washington. A site location map is provided as Figure 1. The facility is currently owned and operated by Chemtrade Logistics, Inc. (Chemtrade). This RAWP has been prepared on behalf of Clariant under Washington State Department of Ecology's (Ecology) Voluntary Cleanup Program (VCP), VCP number SWO492, facility number 24634187.

Proposed 2013 RA activities include:

- Pilot-scale injection of ferrous sulfate and magnesium hydroxide into a limited number of existing injection wells in the former Settling Basin #2 (FSB2) area.

- Completion of up to three ground water monitoring events to evaluate the effectiveness of the pilot test injection and to continue monitoring of the previously completed RA activities.

A summary of previous RA activities completed at the site is presented in Section 2.0. A discussion of ground water monitoring completed to evaluate the performance of the RA activities is included in Section 3.0 and the results of the geochemical evaluation are presented in Section 4.0. Proposed 2013 RA activities are presented in Section 5.0.

2.0 Previous RA Activities

Previous RA activities were completed at the site during August and September 2010 in accordance with H&H's *Remedial Action Work Plan* (RAWP) dated August 6, 2010 (H&H, 2010). The 2010 RA activities were documented in H&H's *Remedial Action* Report (RAR) dated January 19, 2011 (H&H, 2011a). Site background information, including a discussion of cleanup levels (CULs), points of compliance (POCs), and on-site ground water maximum contaminant levels (MCLs) are described in the RAWP and the RAR.

As described in the RAWP, the objectives of the RA activities were to:

- Remove soils impacted with cadmium and/or zinc (Zn) above CULs that remained beneath and to the southeast of a truck access road in the FSB2 area to 1) eliminate potential future human health and ecological risks associated with this soil, and 2) minimize the potential for future ground water impact from this soil; and,

- Remediate ground water such that the ground water CULs based upon protection of surface water are met at the ground water POCs adjacent to the Columbia River. As detailed in the RAWP, Ecology has approved monitor wells AB1 and AB2 as alternative ground water POCs for the ground water remedial action. The primary goal of the RA is to remediate ground water such that Zn is at or below 74 micrograms per liter (µg/l) in POC wells AB1 and AB2. The Zn ground water remedial goal is based upon surface water protection in the Columbia River.

The RA activities conducted in August and September 2010 included excavation and off-site disposal of approximately 11,500 tons of soil from the FSB2 area, installation of 23 vertical injection wells and six horizontal injection wells, and injection of calcium polysulfide (CaSx) into the injection wells to address dissolved cadmium and/or Zn in ground water. CaSx is a lime-sulfur solution designed to be used in various treatment systems as a metal precipitating agent and has been used for in-situ treatment of ground water impacted with metals. A site map showing the vertical and horizontal injection well locations is included as Figure 2.

Based upon a review of ground water monitoring data collected after completion of the 2010 RA activities and the results of a pilot test performed during September 2011 (documented in a *Pilot Test Report* dated October 28, 2011 (H&H, 2011d)), additional RA activities were completed during November and December 2011 (in accordance with the July 5, 2011 *Post-Injection Monitoring Report & RAWP Addendum* (H&H, 2011b) and a *RAWP Addendum Deviation Request* dated November 10, 2011 (H&H, 2011e)).

The purposes of the additional RA activities were to further remediate dissolved phase ground water impacts and to remediate leachable Zn in soil below the depths of previous soil excavations. The additional RA activities included application of CaSx to the base of a 15 ft bgs soil excavation area in the FSB2 area, installation of seven extraction wells, and CaSx injection and ground water re-circulation in the FSB2 area and in the southern portion of the site (to the west of the manufacturing plant). The area to the west of the manufacturing plant is hereafter referred to as the manufacturing plant area (MPA). The additional RA activities were completed and documented in H&H's *Additional Remedial Action & Performance Monitoring Report* dated October 16, 2012 (H&H, 2012).

A summary of post-remedial performance monitoring is presented in the following section.

3.0 Performance Ground Water Monitoring

H&H conducted monitoring of ground water in the areas of the 2010 and 2011 RA activities to evaluate the performance of the RA activities. Each monitoring event has consisted of ground water sample collection from the following 12 injection performance monitor wells: PZ1, PZ3, PZ4, PZ5, PZ6, PZ12, PZ13, AB1, AB2, OW1, OW2, and OW3. Water level measurements were also collected from the performance monitor wells and additional selected peizometers located at the site during each event. Construction details for the site monitoring and remediation wells are summarized in Tables 1A and 1B, respectively. Well locations are shown in Figure 2.

3.1 Summary of 2011 Performance Monitoring

A summary of performance monitoring conducted after completion of the 2010 RA activities through March 2011 are presented in the *Post-Injection Monitoring Report & RAWP Addendum* (H&H, 2011b) and a summary of June and September 2011 performance monitoring is included in the *Pilot Test Report* (H&H, 2011d). Ground water elevation data is summarized in Table 2 and ground water analytical data is summarized in Table 3.

The results of the performance monitoring conducted after completion of the 2010 RA activities through September 2011 (prior to the additional 2011 RA activities) indicated that reductions in dissolved Zn concentrations were observed in the first post-injection ground water sampling event conducted in November 2010; however, concentrations of dissolved Zn detected in the FSB2 area increased in subsequent sampling events. In the MPA, dissolved cadmium and Zn concentrations more consistently decreased or remained similar to pre-2010 RA activities during this period. The increased dissolved Zn concentrations observed in the FSB2 area were attributed to a substantial increase in ground water elevations to historic highs soon after completion of the 2010 RA activities. During this period, the ground water table rose into impacted soil between the depth of previous excavations in the FSB2 area and the "normal" elevation of the ground water table, resulting in dissolution of Zn.

As noted previously, additional RA activities were conducted in 2011 in response to the results of monitoring conducted in 2010 after the initial RA activities. The results of monitoring conducted after the 2011 RA activities are discussed in the following section.

3.2 Summary of 2012 Performance Monitoring

3.2.1 January through June 2012 Sampling

A summary of performance monitoring conducted after completion of the 2011 additional RA activities through June 2012 are presented in the *Additional Remedial Action & Performance Monitoring Report* (H&H, 2012). Ground water quality data is summarized in Table 4. Note that pre-2010 data are not shown in the table. Results of the sampling events indicated that reductions in dissolved Zn and cadmium concentrations in the MPA were observed in the first post-additional RA ground water sampling event conducted in January 2012. However, since that sampling event, dissolved Zn and cadmium concentrations in the MPA returned to similar levels as were detected in the pre-additional RA (September 2011) sampling event. In the FSB2 area, dissolved Zn concentrations generally increased after the September 2011 sampling. Zn isoconcentration maps for the September 2011 and January, March, and June 2012 monitoring events conducted during the period are included as Figures 4A through 4D, respectively.

During the period from September 2011 to June 2012, ground water quality data indicated that oxidation-reduction potential (ORP) levels in performance monitor wells generally increased to levels that do not favor reduction of Zn and cadmium into insoluble cadmium and Zn sulfides. The ORP levels increased above pre-remedial levels that were present at the site. This was unexpected given that the ORP of CaSx is very low. This increase may be the result of a lowered redox capacity of the aquifer (ability of a chemical system to maintain a redox potential) due to the addition of CaSx causing complex changes to the geochemistry of the aquifer.

3.2.2 October/November 2012 Sampling

A ground water monitoring event was completed at the site on October 31 through November 1,

2012. During the event, samples were collected from performance monitor wells for analyses of dissolved cadmium and Zn and total sulfide (consistent with previous routine sampling completed at the site during 2010 through 2012). A brief summary of these "routine" results is presented below. In addition, samples were collected for additional analyses as part of a geochemical evaluation. A discussion of the geochemical evaluation, including results of the additional analyses which are not discussed in this section, is presented in Section 4.0.

Ground Water Elevations

A single round of water level gauging of performance monitor wells and PZ2, PZ8, PZ9, and PZ11 was conducted as part of the monitoring event on October 31, 2012. Ground water elevation data is summarized in Table 3. The elevations were similar to those considered to be "normal" at the site. Consistent with previous sampling events, the ground water elevation data indicate that shallow ground water flow at the site is influenced by the tidal elevation variations of the Columbia River. In the eastern portion of the site, there is a hydraulic gradient from east to west toward the river. In the western portion of the site, hydraulic communication between the river and shallow ground water results in a temporal mound in the ground water table near the river that creates a relatively weak hydraulic gradient from west to east in that area. The ground water mound near the river is temporal and its presence depends upon the timing and magnitude of the tides. The converging hydraulic gradients appear to cause ground water in the central portion of the site to be temporally stagnant. An inferred ground water elevation contour map for the October 31, 2012 data is included as Figure 3.

Ground Water Sampling Methods

The October/November 2012 ground water sampling included collection of ground water samples from permanent monitor wells PZ1, PZ3 through PZ6, PZ12, PZ13, AB1, AB2, and OW1 through OW3. During the monitoring event, ground water from each of the wells was purged and sampled using standard low-flow/low-stress techniques. Ground water parameters that included temperature, pH, conductivity, dissolved oxygen (DO), ORP, and turbidity were measured during the low-flow purging. A summary of the ground water field parameter data collected during each monitoring event is included in Table 4.

After ground water parameters stabilized during purging, samples were collected from each monitor well into laboratory-supplied sample containers, placed into laboratory-supplied sample coolers, and covered with ice. Samples collected for dissolved cadmium and Zn were field-filtered using a 0.45-micron filter prior to collection into sample containers. The samples were delivered under standard chain-of-custody protocols to Test America of Nashville, TN for analysis of dissolved cadmium and Zn and total sulfide. Sulfide is analyzed to monitor for potential residual CaSx in the aquifer after injection.

Ground Water Analytical Results

Dissolved cadmium and Zn analytical results are summarized along with historical data in Table 3. Sulfide analytical results are summarized in Table 4 along with the ground water field parameter data. A Zn isoconcentration map for the October/November 2012 sampling is included as Figure 4E. The analytical data report is included in Appendix A.

In the FSB2 area, the October/November 2012 ground water sample results indicated that concentrations of dissolved Zn decreased compared to the June 2012 sampling event in each sampled well. In several wells the decreases were significant (e.g., from 33,300 µg/l to 9,600 µg/l in compliance well AB2, from 84,500 µg/l to 29,900 µg/l in PZ1, from 352,000 µg/l to 68,500 µg/l in PZ12, and from 47,700 µg/l to 10,800 µg/l in OW3). In addition, dissolved Zn was not detected above laboratory minimum reporting limits (MRLs) in PZ13, whereas dissolved Zn was detected at a concentration of 89,000 µg/l in March 2012. The maximum dissolved Zn concentration detected in the FSB2 area monitor wells was 68,500 µg/l in PZ12.

In the MPA, the October/November 2012 ground water sample results indicated that concentrations of dissolved Zn decreased compared to the June 2012 sampling event in the majority of the sampled wells. The maximum dissolved Zn concentration detected in the MPA area monitor wells was 6,360 µg/l in PZ6, and a dissolved Zn concentration of 877 µg/l was detected in the MPA compliance well AB1. Dissolved cadmium was detected in PZ4, PZ5, and PZ6 at concentrations of 21.5 µg/l, 4.3 µg/l, and 2.2 µg/l, respectively. Dissolved cadmium was not detected in MPA compliance well AB1. Detections of cadmium (1.8 µg/l) and Zn (141 µg/l) in PZ5 represent the lowest concentrations of these compounds that have been detected in the

well, PZ5 has historically contained the highest cadmium (up to 1,150 µg/l) and Zn (up to 35,800 µg/l) detections in the MPA area.

The only detection of sulfide above laboratory MRLs was in monitor well PZ13 (3.11 mg/l).

4.0 Geochemical Evaluation

In an effort to relate post-RA increases in dissolved Zn concentrations in site ground water to geochemical processes, H&H contracted Geochemistry Services LLC of Port Townsend, WA to assist with a ground water geochemical evaluation. The geochemical evaluation included a detailed review of site background information, development of a sampling plan, evaluation of geochemical sample results, and development of conceptual geochemical system model. The geochemical evaluation sampling, conceptual geochemical system model, and recommendations based on the geochemical evaluation are discussed below.

4.1 Geochemical Sampling Methods

Based on a review of site background information, Geochemistry Services designed a sampling and analysis plan to evaluate geochemical parameters of site soil and ground water for use in development of the conceptual model. Sampling methods are discussed in the following sections.

4.1.1 Soil Sampling

Solids in the subsurface are the primary sources of Zn in ground water and may also serve as sinks for Zn during remediation. For this reason, soil samples were collected to assess the distribution of Zn among subsurface minerals and amorphous solid phases. Soil borings were installed by Cascade Drilling, L.P. of Clackamas, OR using a direct-push technology (DPT) drill rig on October 30, 2012. The borings were installed at three locations in and downgradient of the FSB2 area (adjacent to PZ1, PZ12, and PZ13) and at two locations in the MPA (adjacent to PZ3 and PZ5). Soil samples were collected from two discrete depth intervals in each of the borings (total of 10 soil samples). The upper depth interval samples were collected from the unsaturated zone above the water table (and, below the depth of previous excavations in the FSB2 area borings). The lower depth interval samples were collected from the zone that coincided with top of the water table to approximately 2 ft below the top of the water table (at

the time of sampling). These lower samples allowed for comparison of solid phase geochemical compositions with nearby ground water compositions.

Soil samples were collected by a macro-core sampler into acetate sleeves. The acetate sleeves were cut into two-foot lengths and the ends were sealed with caps and tape prior to being placed into laboratory-supplied sample coolers and covered with ice for shipment to Applied Speciation and Consulting, LLC of Bothell, WA. Each of the 10 soil samples was submitted for cationic metals sequential extraction using the European Community Bureau of Reference (BCR) sequential selective extraction method to identify the class of solid phases associated with metals in the system. In this extraction method, acetic acid is used as the first extraction step to dissolve soluble carbonate minerals (such as Zn carbonate) and also release exchangeable metals into solution. This is followed by a second extraction step using a reducing agent to release metals strongly adsorbed onto iron/manganese oxides. A third extraction step treats the sample with hydrogen peroxide and ammonium acetate to dissolve sulfide minerals (such as Zn sulfide) and organic compounds. In the fourth and final extraction step, the strong acid Aqua Regia releases Zn and other metals that are not mobile under typical aquifer conditions.

At each sequential step, the extract is analyzed for the metals of interest to quantify the amount associated with the solid phase dissolved during that stage of the process. The metals sequential extraction is described in greater detail in the Applied Speciation and Consulting report included in Appendix A.

4.1.2 Ground Water Sampling

Ground water samples were collected by H&H personnel from the performance monitor wells on October 31 and November 1, 2012 (at the time of the sampling discussed in Section 3.2.2) using standard low-flow/low-stress techniques. Ground water parameters that included temperature, pH, conductivity, DO, ORP, and turbidity were measured during low-flow purging. In addition, samples were submitted to Test America of Nashville, TN for laboratory analysis of the following:

- Major ions (cation metals and anions): calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), carbonate/bicarbonate (HCO_3/CO_3), sulfate (SO_4), chloride (Cl), nitrate + nitrite ($NO_3 + NO_2$)
- Dissolved metals: aluminum (Al), cadmium (Cd), iron (Fe), manganese (Mn), zinc (Zn)
- Trace/Minor constituents: sulfide, ortho-phosphate (ortho-PO_4), silicon (Si)

Samples were collected on October 31 and November 1, 2012. Ground water for metals analysis was field filtered with a 0.45-micron filter prior to collection into sample containers.

4.2 Geochemical Sampling Results

Results of the cationic metals sequential extraction for the soil samples are presented in tabular format in the Applied Speciation and Consulting report included in Appendix A. A summary of the ground water geochemical analytical data is presented in Table 5. The ground water analytical data report is included in Appendix A.

4.2.1 Soil Results

The primary purposes of the cationic metals sequential extraction were 1) to identify potential sources of Zn in the unsaturated zone and aquifer soils, and 2) to quantify the amount of iron oxide adsorbent present in the soil. Iron oxide adsorbent is known to exchange Zn and other metals with ground water, and therefore is a potential source and sink of Zn in this system. Zn is relatively exchangeable between the ground water and the solid phase if it is associated with clays or carbonate minerals (such as Zn carbonate), is on the surface of an iron adsorbent, or is present in an oxidizable organic or sulfide compound. This mobile Zn is extracted from the solid phase by one or more of the first three steps of the sequential selective extraction. The sequential extractions provide information on the potential amount of mobile Zn in the solid phase that can be transferred to ground water if the geochemical environment changes in the subsurface. This is discussed in greater detail in Section 4.3.

The majority of mobile Zn was associated with the first step of the sequential selective extraction. This indicates that most of the mobile Zn in site soil is either present as an exchangeable cation on a clay mineral or as a carbonate mineral. Because the site soil is relatively coarse grained and it is unlikely that clay minerals are abundant, the release of Zn to solution during the first extraction step is most likely due to the dissolution of residual Zn carbonate in the weak acid of the extracting solution. In the samples where the amount of Zn released during the first step of the selective extraction is very high (i.e., greater than 1,000 mg/kg-sediment), such as in the PZ12 and PZ13 samples from the FSB2 area, it appears that sufficient Zn carbonate remains in the sediment to produce very high dissolved Zn concentrations if the Zn carbonate becomes soluble. In the samples where the amount of Zn released during the first step is low (i.e., less than 10 mg/kg-sediment), such as in the PZ1 sample, there is very little Zn available in the solid phase to produce high dissolved Zn concentrations. Therefore, the primary source of elevated Zn in ground water at this location (PZ1) is likely from migration of Zn-impacted water from beneath the former settling basin(s) in the FSB2 area. The Zn concentrations released during the first step of the selective extraction in the PZ3 (71.5 mg/kg) and PZ5 (419 mg/kg) samples from the MPA indicate that the soils in this area are capable of producing elevated levels of dissolved Zn, but lower than those near PZ12 and PZ13 in the FSB2 area.

As was previously discussed, the second extraction step releases metals strongly adsorbed onto iron/manganese oxides. Concentrations of iron released from the samples in this step ranged from 101 mg/kg (PZ5 upper sample) to 320 mg/kg (PZ13 upper sample). Concentrations of Zn released during the second step were in the range of 2.52 mg/kg (PZ1 upper sample) to 469 mg/kg (PZ13 upper sample). These Zn concentrations are much lower than those associated with the first extraction step, indicating that Zn adsorption onto the iron adsorbent is not currently the primary sink of Zn in the subsurface.

Concentrations of Zn released from the samples in the third extraction step were in the range of 4.4 mg/kg (PZ1 upper) to 302 mg/kg (PZ13 upper), which is similar to the range for Zn released during the second step. Some of the Zn released in the third step is likely associated with Zn

sulfide produced by the RA activities, but it is not possible to differentiate organic-bound from sulfide-bound Zn using this extraction method.

4.2.2 Ground Water Results

The major cations detected in the FSB2 area ground water samples were Zn^{2+} and Ca^{2+}. In the MPA, Na^{+} is the dominant cation, except in PZ6 where the Ca^{2+} concentration exceeds the Na^{+} concentration. It is likely that the Ca^{2+} concentration is greater in the FSB2 area than in MPA because of the larger volume of CaSx that was applied to the subsurface in the FSB2 area during RA activities. Secondary cations in the ground water samples are Mg^{2+} and K^{+}. The dominant anion in both the FSB2 area and MPA is SO_4^{2-} (sulfate), which is present in the range of 17.8 mg/L (PZ5) to 4,720 mg/L (PZ6). The only exceptions are AB1 and AB2 where alkalinity (HCO_3^{-}/CO_3^{2-}) exceeds the sulfate concentration. Chloride (Cl^{-}) is a secondary anion in most of the ground water samples.

The high level of SO_4^{2-} in the treatment areas is likely due to oxidation of the sulfide in CaSx to SO_4^{2-}. As will be discussed in more detail below, this oxidation generally produces free hydrogen ions (H^{+}) that can lower the pH of the system. It is notable that the lowest measured pH of 4.02 in PZ6 correlates with the highest measured SO_4^{2-} concentration of 4,720 mg/L.

The cation/anion electrical balance of each water sample was calculated from the major ion concentrations to evaluate the quality of the data and the possibility that a major ion is missing from the analyte list. The calculated cation/anion balances for the October/November 2012 sampling event are shown in Table 5. Water is an electrically neutral solution meaning that the sum of the electrical equivalents of the positively charged dissolved species equals the sum of the electrical equivalents of the negatively charged dissolved species. Variability in routine chemical analysis can produce imbalances of plus or minus 5%, which are considered acceptable. Only three of the calculated cation/anion balances for the October/November 2012 sample are less than 5%. These include PZ5 (+2.29%), PZ13 (-3.31%), and AB2 (+3.07%). The balances for the remaining ground water samples are in the range of approximately 10% to 25%, with the exceptions of a high value of -76.9% for PZ6. Almost all of the high imbalances are

negative, which could be due to: 1) an anion being reported at a higher than true value, 2) a cation being reported at a lower than true value, and/or 3) a cation present in ground water that was not included in the analyte list. At this time, it is not possible to determine the source of the electrical imbalance.

The dissolved Zn concentrations in MPA monitor wells (PZ3 through PZ6 and AB1) sampled as part of the geochemical evaluation are similar to previous sampling rounds with the range of latest values being 140 µg/l to 6,360 µg/l. The dissolved Zn concentrations in FSB2 monitor wells PZ1, PZ12, PZ13, OW1 through OW3, and AB2 are generally lower than the previous sampling rounds in 2012, but remain elevated in the range of 9,600 µg/l to 71,800 µg/l, with the exception of PZ13, in which Zn was not detected. PZ13 has had variable Zn concentrations in 2012, with levels of 2,140 µg/l (January 2012), 89,000 µg/l (March 2012), and 210 µg/l (June 2012). It is also notable that during the October/November 2012 sampling round, PZ13 was the only monitor well that contained sulfide (3.11 mg/l) above detection limits. The ORP measurement of -141 mV in PZ13 also correlates with the presence of sulfide in this well. This is the lowest ORP measured during the latest sampling round and suggests that, if the ORP is low and sulfide is present in the ground water, Zn can be reduced to low dissolved concentrations in the aquifer. The ORP in PZ5 (-13 mV) was the only negative ORP measured during the October/November sampling, and PZ5 contained the second lowest Zn concentration (140 µg/l). The ORPs for all the other monitor wells were positive and generally greater than +100 mV. These high redox potentials are not conducive to the formation of Zn sulfide.

The pH of the CaSx solution used during the RA is 11.4. Because this strongly alkaline solution was injected into the ground water and has been applied to the unsaturated zone, it was expected that the pH of the ground water would be raised at least a few pH units from the initial value of about approximately 6. The majority of the pH values measured during the October/November 2012 sampling were in the range of 5.23 (PZ4) to 6.38 (PZ13). However, relatively acidic pH values were measured in PZ6 (4.02), PZ12 (4.19), and OW3 (4.28). These are the lowest pH values that have historically been measured in site ground water. The low pH measurements suggest that reactions have occurred in some areas of the subsurface to lower the pH of the ground water since completion of the RA activities. Acidic pH conditions increase the solubility

of Zn carbonate solids in the subsurface, which may account for some of the high dissolved Zn concentrations in ground water measured since completion of RA activities. Potential chemical reactions are discussed in more detail in Section 4.3 below.

4.3 Geochemical Data Review

The addition of CaSx during RA activities was expected to result in reduction of dissolved Zn in site ground water by stabilizing the Zn as insoluble Zn sulfide that would be remain insoluble in the subsurface. Assuming that CaSx can be represented by the calcium polysulfide CaS_4, one of the potential reactions that would occur when this compound is added to ground water is:

$$CaS_4 + H_2O \rightarrow Ca^{2+} + 3S^0 + HS^- + OH^- \quad (1)$$

Under reducing conditions, the bisulfide [HS^- and sulfide (S^{2-})] formed by reaction (1) would combine with dissolved Zn to form zinc sulfide (ZnS):

$$Zn^{2+} + HS^- \rightarrow ZnS + H^+ \quad (2)$$

However, reaction (2) will only occur if conditions are reducing and this condition is maintained in the subsurface. Under oxidizing conditions, the following sulfide oxidation reaction will occur:

$$CaS_4 + 6.5O_2 + 3H_2O \rightarrow Ca^{2+} + 4SO_4^{2-} + 6H^+ \quad (3)$$

Oxidation of CaS_4 by O_2 results in the formation of sulfate (SO_4) instead of sulfide, and ZnS does not form. Also, reaction (3) produces a significant amount of free hydrogen (H^+) that can make the system acidic if the geochemical system is not strongly pH buffered. It appears that this pH effect has occurred since completion of the RA activities. After application of the CaS_x to the subsurface, the pH increased because of the high pH (11.4) of the CaS_x solution; however, the pH has subsequently decreased, likely in response to sulfide oxidation as shown in reaction (3). As discussed in Section 4.2.2, relatively low pH values have been measured in multiple monitor wells (particularly PZ6, PZ12, and OW3) since completion of the RA activities.

The sequential selective extraction of the soil samples has shown that Zn is predominantly present as Zn carbonate in the site subsurface. The solubility of carbonate minerals are strongly influenced by pH. These minerals are soluble at low pH and less soluble as the pH increases to

more alkaline values. The calculated solubility of Zn carbonate in pure water is shown in the following table:

pH	$ZnCO_3$ Solubility, mg-Zn/l
4	36,600
5	2,603
6	221
7	38
8	6.3

The initial increase in dissolved Zn concentrations following the RA activities in some monitor wells is likely due to the generation of acidic pH conditions by the oxidation of CaSx (reaction (3)) and the higher solubility of Zn carbonate under the more acidic conditions. As noted previously, Zn concentrations have since decreased as indicated in the most recent sampling event.

The sequential selective extractions of the soil samples provide information on the reservoir of Zn in the solid phase that is potentially available for dissolution into ground water. The sum of the Zn released during the first three steps of the extractions is considered the potentially mobile portion of Zn in the solid phase. To estimate the maximum possible dissolved ground water concentrations if all of the solid phase Zn was released to ground water, the concentrations for the first three extraction steps can be added together and converted to concentrations in milligrams per liter of ground water.

As an example, the sum of the Zn concentrations for the first three extraction steps for the upper sample at PZ13, where the highest solid phase Zn concentration was measured, is 8,701 mg/kg-soil. The mass of soil in contact with one liter of ground water is related to the bulk density of the soil (ρ_β) and its porosity (η) by the relationship ρ_β/η. For example, if the bulk density is 2 g/cc (2 kg/l) and the porosity is 0.25, then each liter of ground water is in contact with 8 kg of soil (2 kg/l ÷ 0.25). Assuming these values of bulk density and porosity for the site soil, the potential dissolved concentration of Zn from a soil concentration of 8,701 mg/kg is 8,701 mg-

Zn/kg-soil x 8 kg-soil/liter-ground water, which equals 69,600 mg-Zn/liter-ground water. This indicates that there is a large reservoir of Zn in the solid phase in some locations at the site.

For CaSx to effectively immobilization dissolved metals as insoluble metal sulfides, reducing conditions must be established and maintained in the subsurface. It is apparent from the post-RA ground water monitoring data that these conditions are not currently present in the RA areas where dissolved Zn concentrations remain elevated. Pre-RA ORP measurements indicated that the site aquifer was generally reducing, particularly in FSB2 area wells. Therefore, the addition of the strongly-reducing CaSx solution was expected to further decrease the aquifer ORP. Initially, ORP levels decreased after each of the injection activities; however, it appears that subsequent aquifer elevation fluctuations and interactions with the Columbia River periodically introduced significant concentrations of dissolved oxygen to the site aquifer which increased the ORP and likely drove oxidation of sulfides to sulfate.

4.4 Geochemical Evaluation Recommendations

The geochemical evaluation indicates that application of CaSx to the subsurface has generally not produced the anticipated reduction of dissolved Zn concentrations in site ground water as a result of the oxidation of sulfide and metal sulfides, primarily because of the inability to maintain reducing conditions as a result of aquifer fluctuations and interactions with the Columbia River. In addition, it is likely that dissolution of zinc carbonate in areas where ground water pH has decreased has contributed to the increased dissolved zinc concentrations in site ground water.

H&H recommends that additional RA activities performed at the site to address dissolved zinc concentrations be compatible with or not affected by ORP conditions that have been measured in site ground water. Potential methods include enhanced adsorption of dissolved Zn onto iron adsorbents and precipitation of insoluble Zn minerals under oxidizing conditions. These objectives may be achieved by augmenting the iron adsorbent in the aquifer through introduction of iron hydroxide and also increasing the pH of the aquifer through injection of a neutralizing agent such as calcium carbonate or magnesium hydroxide to raise the ground water pH to a level that enhances precipitation of dissolved zinc as zinc carbonate and also enhanced adsorption of

dissolved Zn onto iron solids. This approach should produce a stable solution for removing Zn because the iron hydroxide adsorbent is insoluble under neutral to alkaline pH levels and oxidizing conditions.

5.0 Proposed 2013 RA Activities

Based on the geochemical evaluation results, H&H proposes that a pilot-scale injection of ferrous sulfate and magnesium hydroxide be conducted in the vicinity of PZ12 in the FSB2 area to evaluate the effectiveness of this approach on reducing dissolved zinc concentrations in ground water. The ferrous sulfate will be applied to the subsurface where it will be oxidized to ferric hydroxide by the current aquifer conditions and subsequent pH neutralization by application of the magnesium hydroxide. This approach is intended to decrease dissolved zinc concentrations through precipitation of zinc as insoluble zinc carbonate where the ground water pH has decreased while also enhancing adsorption of dissolved Zn to iron solids.

5.1 Injection Methods

Prior to conducting the injection, H&H will obtain a conditional rule authorization from Ecology (if necessary) for the injection activities under the site's current registration with the Underground Injection Control Program.

For the pilot-testing, ferrous sulfate and magnesium hydroxide will be delivered to the site in solid form. Prior to subsurface injection, the ferrous sulfate will be dissolved into solution and the magnesium hydroxide will be mixed into slurry with water from a municipal source. It is anticipated that the dissolution/mixing will be conducted in a single poly or frac tank staged on the access road in the northern portion of the site near the gate. The dissolved concentration of the ferrous sulfate and percent solids of the magnesium hydroxide slurry will be determined in the field and will be adjusted as necessary to optimize distribution into the aquifer from the injection wells. Injection wells IW-8, IW-11, and IW-12 will be used for the pilot test (Figure 2). The injection fluids will be pumped from the mixing tank(s) through hoses to the injection wells using in-line utility pumps. In-line totalizing flow meters will be used to monitor injection flow rates and volumes.

A Health and Safety Plan for the pilot test activities will be developed for use by injection personnel and will be submitted to Chemtrade prior to implementation of the injection activities.

Material safety data sheets (MSDSs) for ferrous sulfate and magnesium hydroxide are provided in Appendix B.

Ferrous iron concentrations and ground water quality parameters (including temperature, conductivity, pH, DO, ORP, and turbidity) will be measured in the monitor and extraction wells located near the injection areas during the in injection activities to assist in evaluating the effectiveness of the injection in distributing the slurry throughout the targeted area of the aquifer.

5.2 Ground Water Monitoring

Prior to and approximately three and six months after completion of the pilot test, ground water monitoring will be completed at the site to evaluate the effectiveness of the pilot test and to continue monitoring of the previous RA activities. Each monitoring event will include collection of samples from the 2010 and 2011 RA performance monitoring wells (PZ1, PZ3, PZ4, PZ5, PZ6, PZ12, PZ13, AB1, AB2, OW1, OW2, and OW3). Sampling methods will be the same as during the previous monitoring events (Section 3.0), and samples will be analyzed for dissolved cadmium and zinc only. In addition, samples collected from PZ1, PZ12, OW1, OW2, OW3, and AB2 will be analyzed for the major ions, dissolved metals, and trace/minor constituents which were analyzed for as part of the October/November 2012 sampling event (Section 4.1.2) in order to provide geochemical data from the area of the pilot-test injection that may aid in evaluation of the effectiveness of the pilot test.

5.3 Reporting

A 2013 RAWP implementation and monitoring report will be prepared to document the pilot test activities and the associated ground water monitoring discussed above. The report will include a summary of the injection activities and the results of the pre-injection and the three month, and six month post-injection monitoring events. In addition, the report will include recommendations for future activities at the site.

6.0 Schedule

The planned RA activities will be implemented in accordance with the following schedule:

Project Activity	Start Date
2013 RAWP Submittal to DOE	03/25/13
DOE UIC Rule Authorization Issuance	04/29/13
Pre-Injection (Baseline) Ground Water Monitoring Event	05/21/13
Pilot Testing	05/27/13
Three Month Post-Injection Ground Water Monitoring Event	08/27/13
Six Month Post-Injection Ground Water Monitoring Event	11/26/13
2013 RAWP Implementation & Monitoring Report	12/31/13

The schedule is based on Clariant's and H&H's experience with similar projects. As the 2013 RA activities progress, schedule updates will be provided as necessary.

7.0 References

H&H, 2010. *Removal Action Work Plan,* Former Clariant Corporation Facility, Kalama, Washington. Hart & Hickman, PC. August 6, 2010.

H&H, 2011a. *Remedial Action Report,* Former Clariant Corporation Facility, Kalama, Washington. Hart & Hickman, PC. January 19, 2011.

H&H, 2011b. *Post-Injection Monitoring Report & RAWP Addendum,* Former Clariant Corporation Facility, Kalama, Washington. Hart & Hickman, PC. July 5, 2011.

H&H, 2011c. *Pilot Test Plan,* Former Clariant Corporation Facility, Kalama, Washington. Hart & Hickman, PC. September 9, 2011.

H&H, 2011d. *Pilot Test Report,* Former Clariant Corporation Facility, Kalama, Washington. Hart & Hickman, PC. October 28, 2011.

H&H, 2011e. *RAWP Addendum Deviation Request,* Clariant Corporation Facility, Kalama, Washington. Hart & Hickman, PC. November 10, 2011.

H&H, 2012. *Additional Remedial Action & Performance Monitoring Report*, Clariant Corporation Facility, Kalama, Washington. Hart & Hickman, PC. October 16, 2012.

Table 1A
Summary of Site Monitor Well Construction Details
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Installation Date	Well Diameter (inches)	Total Depth (ft bgs)	Sceen Interval (ft bgs)	TOC Elevation (ft CRD)
PZ1	04/15/03	1	32	17-32	28.99
PZ2	04/15/03	1	32	17-32	30.16
PZ3	04/15/03	1	32	17-32	28.47
PZ4	04/15/03	1	32	17-32	26.78
PZ5	04/16/03	1	32	17-32	26.86
PZ6	04/16/03	1	32	17-32	27.58
PZ7	04/16/03	1	31	16-31	28.06
PZ8	04/16/03	1	31	15.5-30.5	28.17
PZ9	05/06/03	1	32	17-32	27.54
PZ10	07/26/05	0.75	32	17-32	26.94
PZ11	07/27/05	0.75	32	17-32	30.39
PZ12	07/27/05	0.75	32	17-32	30.53
PZ13	07/27/05	0.75	30	15-30	30.40
PZ14	02/06/07	0.75	32	17-32	29.09
PZ15	02/06/07	0.75	32	17-32	27.79
AB1	07/01/03	2	28	14.1-28.2	27.53
AB2	07/01/03	2	30	14.4-30.0	28.41
OW1	09/20/10	2	35	20-35	26.51
OW2	09/20/10	2	35	20-35	25.99
OW3	09/20/10	2	35	20-35	26.13

Notes:
ft bgs = feet below ground surface
ft CRD = elevation in ft relative to Columbia River Datum
TOC = Top of Casing
Survey of well elevations based on NAVD88 and adjusted to CRD by subtracting 3.8 ft
OW1 through OW3 TOC elevations have not been surveyed
Depth and screen interval of AB1 and AB2 account for 45^{o} and 35^{o} angles of installation relative to vertical, respectively.

Table 1B
Summary of Injection & Extraction Well Construction Details
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Installation Date	Well Diameter (inches)	Total Depth (ft bgs)	Sceen Interval (ft bgs)
Injection Wells				
IW-1	09/22/10	2	30	20-30
IW-2	09/22/10	2	30	20-30
IW-3	09/24/10	2	30	20-30
IW-4	09/24/10	2	30	20-30
IW-5	09/21/10	2	35	25-35
IW-6	09/21/10	2	35	25-35
IW-7	09/22/10	2	35	23-35
IW-8	09/22/10	2	35	25-35
IW-9	09/24/10	2	35	25-35
IW-10	09/17/10	2	35	25-35
IW-11	09/21/10	2	35	25-35
IW-12	09/21/10	2	35	25-35
IW-13	09/15/10	2	30	20-30
IW-14	09/14/10	2	30	20-30
IW-15	09/13/10	2	30	20-30
IW-16	09/13/10	2	30	20-30
IW-17	09/14/10	2	30	20-30
IW-18	09/14/10	2	30	20-30
IW-19	09/14/10	2	30	20-30
IW-20	09/13/10	2	30	20-30
IW-21	09/15/10	2	35	25-35
IW-22	09/15/10	2	30	20-30
IW-23	09/17/10	2	35	25-35
Extraction Wells				
EW-1	09/26/11	8	35	10-35
EW-2	12/05/11	8	35	10-35
EW-3	12/06/11	8	35	10-35
EW-4	12/06/11	8	35	10-35
EW-5	12/07/11	8	35	10-35
EW-6	12/07/11	8	35	10-35
EW-7	12/05/11	8	35	10-35

Note:
ft bgs = feet below ground surface

Table 2
Summary of Ground Water Elevation Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
PZ1	02/04/10	28.99	23.65	5.34	8:29 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ1	09/01/10		26.84	2.15	9:54 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ1	11/02/10		25.50	3.49	11:19 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ1	12/20/10		22.68	6.31	11:13 a.m.	--	--	10:09 a.m.	4.25
PZ1	12/20/10		21.74	7.25	2:25 p.m.	2:27 p.m.	7.11	--	--
PZ1	03/21/11		21.64	7.35	3:52 p.m.	--	--	2:15 p.m.	4.77
PZ1	03/23/11		21.34	7.65	8:32 a.m.	7:18 a.m.	7.27	--	--
PZ1	06/21/11		18.43	10.56	3:17 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ1	06/22/11		18.49	10.50	8:20 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ1	09/23/11		26.97	2.02	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ1	09/28/11		25.31	3.68	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ1	01/12/12		24.59	4.40	8:26 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ1	03/20/12		20.72	8.27	9:30 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ1	06/26/12		19.87	9.12	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ1	10/31/12		24.11	4.88	1:20 a.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ2	02/04/10	30.16	24.74	5.42	9:05 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ2	09/01/10		28.04	2.12	9:51 a.m	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ2	12/20/10		23.86	6.30	11:28 a.m	--	--	10:09 a.m.	4.25
PZ2	12/20/10		22.80	7.36	2:34 p.m	2:27 p.m.	7.11	--	--
PZ2	03/21/11		22.86	7.30	4:06 p.m.	--	--	2:15 p.m.	4.77
PZ2	03/23/11		22.44	7.72	8:41 a.m.	7:18 a.m.	7.27	--	--
PZ2	06/21/11		19.67	10.49	3:33 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ2	06/22/11		19.72	10.44	8:06 a.m	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ2	09/23/11		28.24	1.92	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ2	09/28/11		26.52	3.64	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ2	01/12/12		25.78	4.38	8:42 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ2	03/20/12		21.92	8.24	9:28 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ2	06/26/12		21.02	9.14	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ2	10/31/12		23.61	4.86	2:18 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ3	02/04/10	28.47	22.99	5.48	9:19 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ3	09/01/10		26.30	2.17	09:45 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ3	11/02/10		24.55	3.92	11:59 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ3	12/20/10		22.08	6.39	11:32 a.m.	--	--	10:09 a.m.	4.25
PZ3	12/20/10		20.96	7.51	2:38 p.m.	2:27 p.m.	7.11	--	--
PZ3	03/21/11		20.98	7.49	4:34 p.m	--	--	2:15 p.m.	4.77
PZ3	03/23/11		20.70	7.77	9:07 a.m.	7:18 a.m.	7.27	--	--
PZ3	06/21/11		17.96	10.51	3:38 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ3	06/22/11		18.01	10.46	7:45 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ3	09/23/11		26.66	1.81	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ3	09/28/11		24.66	3.81	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ3	01/12/12		24.07	4.40	8:45 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ3	03/20/12		20.23	8.24	9:24 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92

Table 2
Summary of Ground Water Elevation Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
PZ3	06/26/12		19.29	9.18	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ3	10/31/12		23.61	4.86	1:47 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ4	02/04/10	26.78	NM	NM	NM	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ4	09/01/10		24.61	2.17	10:18 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ4	11/02/10		23.16	3.62	11:52 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
PZ4	12/20/10		20.41	6.37	10:30 a.m	--	--	10:09 a.m.	4.25
PZ4	12/20/10		19.60	7.18	2:44 p.m.	2:27 p.m.	7.11	--	--
PZ4	03/21/11		19.17	7.61	4:11 p.m	--	--	2:15 p.m.	4.77
PZ4	03/23/11		19.14	7.64	9:12 a.m	7:18 a.m.	7.27	--	--
PZ4	06/21/11		16.07	10.71	2:55 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ4	06/22/11		16.26	10.52	7:42 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ4	09/23/11		24.60	2.18	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ4	09/28/11		23.13	3.65	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ4	01/12/12		22.39	4.39	8:48 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ4	03/20/12		18.49	8.29	9:55 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ4	06/26/12		17.69	9.09	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ4	10/31/12		21.87	4.91	5:42 a.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ5	02/04/10	26.86	21.70	5.16	9:27 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ5	09/01/10		24.73	2.13	10:22 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ5	11/02/10		23.34	3.52	11:56 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ5	12/20/10		20.41	6.45	11:36 a.m.	--	--	10:09 a.m.	4.25
PZ5	12/20/10		19.83	7.03	2:42 p.m.	2:27 p.m.	7.11	--	--
PZ5	03/21/11		19.19	7.67	4:56 p.m	--	--	2:15 p.m.	4.77
PZ5	03/23/11		19.30	7.56	9:17 a.m.	7:18 a.m.	7.27	--	--
PZ5	06/21/11		16.06	10.80	2:53 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ5	06/22/11		16.29	10.57	7:39 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ5	09/23/11		24.47	2.39	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ5	09/28/11		23.22	3.64	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ5	01/12/12		22.51	4.35	8:50 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ5	03/20/12		18.51	8.35	10:00 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ5	06/26/12		17.85	9.01	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ5	10/31/12		21.91	4.95	1:50 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ6	02/04/10	27.58	22.54	5.04	9:23 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ6	09/01/10		25.46	2.12	10:10 a.m.				
PZ6	09/01/10		24.80	2.78	10:15 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ6	11/02/10		24.10	3.48	11:48 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ6	12/20/10		21.15	6.43	10:21 a.m.	--	--	10:09 a.m.	4.25
PZ6	12/20/10		20.65	6.93	2:52 p.m.	2:27 p.m.	7.11	--	--
PZ6	03/21/11		19.92	7.66	4:47 p.m.	--	--	2:15 p.m.	4.77
PZ6	03/23/11		20.16	7.42	8:50 a.m.	7:18 a.m.	7.27	--	--
PZ6	06/21/11		16.70	10.88	2:30 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ6	06/22/11		16.99	10.59	7:50 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71

Table 2
Summary of Ground Water Elevation Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
PZ6	09/23/11		25.11	2.47	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ6	09/28/11		23.96	3.62	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ6	01/12/12		NM	NM	NM	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ6	03/20/12		19.33	8.25	10:10 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ6	06/26/12		18.61	8.97	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ6	10/31/12		22.57	5.01	1:52 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ7	02/04/10	28.06	24.80	3.26	10:40 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ7	12/20/10		20.89	7.17	10:55 a.m.	--	--	10:09 a.m.	4.25
PZ7	12/20/10		20.84	7.22	3:03 p.m.	2:27 p.m.	7.11	--	--
PZ7	03/21/11		19.52	8.54	4:25 p.m.	--	--	2:15 p.m.	4.77
PZ7	03/23/11		19.17	8.89	9:00 a.m.	7:18 a.m.	7.27	--	--
PZ7	06/21/11		16.61	11.45	2:42 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ7	06/22/11		16.91	11.15	7:55 p.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ7	09/23/11		24.61	3.45	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ7	09/28/11		23.77	4.29	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ7	01/12/12		NM	NM	NM	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ7	03/20/12		19.40	8.66	9:15 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ7	06/26/12		18.20	9.86	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ8	02/04/10	28.17	21.02	7.15	9:35 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ8	09/01/10		21.54	6.63	10:10 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ8	12/20/10		20.39	7.78	11:05 a.m.	--	--	10:09 a.m.	4.25
PZ8	12/20/10		20.35	7.82	2:55 p.m.	2:27 p.m.	7.11	--	--
PZ8	03/21/11		19.35	8.82	4:15 p.m.	--	--	2:15 p.m.	4.77
PZ8	03/23/11		19.84	8.33	8:54 a.m.	7:18 a.m.	7.27	--	--
PZ8	06/21/11		16.59	11.58	2:38 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ8	06/22/11		16.89	11.28	7:58 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ8	09/23/11		21.83	6.34	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ8	09/28/11		21.68	6.49	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ8	01/12/12		21.09	7.08	9:04 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ8	03/20/12		19.31	8.86	9:10 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ8	06/26/12		17.52	10.65	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ8	10/31/12		20.31	8.16	2:30 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ9	02/04/10	27.54	22.04	5.50	9:42 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ9	09/01/10		25.34	2.20	9:47 a.m	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ9	12/20/10		21.06	6.48	11:40 a.m.	--	--	10:09 a.m.	4.25
PZ9	12/20/10		19.97	7.57	2:40 p.m.	2:27 p.m.	7.11	--	--
PZ9	03/21/11		19.98	7.56	4:39 p.m.	--	--	2:15 p.m.	4.77
PZ9	03/23/11		19.73	7.81	9:23 a.m.	7:18 a.m.	7.27	--	--
PZ9	06/21/11		16.98	10.56	3:40 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ9	06/22/11		17.06	10.48	7:36 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ9	09/23/11		25.67	1.87	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ9	09/28/11		23.68	3.86	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ9	01/12/12		23.07	4.47	8:53 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02

Table 2
Summary of Ground Water Elevation Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
PZ9	03/20/12		19.23	8.31	9:20 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ9	06/26/12		18.32	9.22	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ9	10/31/12		23.61	4.86	2:21 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ10	02/04/10	26.94	NM	NM	NM	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ10	09/01/10		24.62	2.32	10:05 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ10	12/20/10		20.26	6.68	11:51 p.m.	2:27 p.m.	7.11	10:09 a.m.	4.25
PZ10	12/20/10		19.73	7.21	3:10 p.m.	2:27 p.m.	7.11	10:09 a.m.	4.25
PZ10	03/21/11		19.02	7.92	4:57 p.m.	--	--	2:15 p.m.	4.77
PZ10	03/23/11		19.26	7.68	9:27 a.m.	7:18 a.m.	7.27	--	--
PZ10	06/21/11		15.79	11.15	3:04 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ10	06/22/11		16.06	10.88	7:33 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ10	09/23/11		24.00	2.94	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ10	09/28/11		23.08	3.86	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ10	01/12/12		22.45	4.49	8:59 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ10	03/20/12		18.26	8.68	9:05 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ10	06/26/12		17.82	9.12	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ11	02/04/10	30.39	25.26	5.13	9:10 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ11	09/01/10		28.39	2.00	10:02 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ11	12/20/10		24.11	6.28	11:26 a.m	--	--	10:09 a.m.	4.25
PZ11	12/20/10		23.50	6.89	2:31 p.m.	2:27 p.m.	7.11	--	--
PZ11	03/21/11		22.92	7.47	4:03 p.m	--	--	2:15 p.m.	4.77
PZ11	03/23/11		22.98	7.41	8:38 a.m.	7:18 a.m.	7.27	--	--
PZ11	06/21/11		19.73	10.66	3:10 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ11	06/22/11		19.92	10.47	8:08 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ11	09/23/11		28.17	2.22	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ11	09/28/11		26.86	3.53	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ11	01/12/12		26.17	4.22	8:40 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ11	03/20/12		22.14	8.25	9:50 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ11	06/26/12		21.42	8.97	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ11	10/31/12		23.70	4.77	2:24 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ12	02/04/10	30.53	25.42	5.11	8:34 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ12	09/01/10		NM	NM	NM	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ12	11/02/10		27.18	3.35	11:37 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ12	12/20/10		24.25	6.28	11:20 a.m.	--	--	10:09 a.m.	4.25
PZ12	12/20/10		23.50	7.03	3:12 p.m.	2:27 p.m.	7.11	--	--
PZ12	03/21/11		23.06	7.47	3:33 p.m.	--	--	2:15 p.m.	4.77
PZ12	03/23/11		23.21	7.32	8:08 a.m	7:18 a.m.	7.27	--	--
PZ12	06/21/11		19.91	10.62	3:12 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ12	06/22/11		20.11	10.42	8:11 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ12	09/23/11		28.27	2.26	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ12	09/28/11		NM	NM	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ12	01/12/12		26.32	4.21	8:38 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ12	03/20/12		22.27	8.26	9:45 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92

Table 2
Summary of Ground Water Elevation Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
PZ12	06/26/12		21.60	8.93	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ12	10/31/12		25.61	4.92	5:42 a.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ13	02/04/10	30.40	25.50	4.90	8:32 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ13	09/01/10		28.21	2.19	9:59 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ13	11/02/10		26.93	3.47	11:30 a.m.	1:15 p.m.	4.42	8:42 a.m.	0.75
PZ13	12/20/10		23.89	6.51	11:18 a.m.	--	--	10:09 a.m.	4.25
PZ13	12/20/10		23.56	6.84	2:22 p.m.	2:27 p.m.	7.11	--	--
PZ13	03/21/11		23.57	6.83	3:36 p.m.	--	--	2:15 p.m.	4.77
PZ13	03/23/11		23.11	7.29	8:05 a.m.	7:18 a.m.	7.27	--	--
PZ13	06/21/11		19.50	10.90	3:14 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ13	06/22/11		19.75	10.65	8:14 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ13	09/23/11		27.82	2.58	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ13	09/28/11		26.63	3.77	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ13	01/12/12		26.12	4.28	8:30 a.m	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ13	03/20/12		21.81	8.59	9:40 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ13	06/26/12		21.36	9.04	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ13	10/31/12		25.31	5.09	5:42 a.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
PZ14	02/04/10	29.09	23.74	5.35	8:20 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ14	09/01/10		26.94	2.15	9:57 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ14	06/21/11		18.55	10.54	3:17 p.m	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ14	06/22/11		18.62	10.47	8:16 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ14	09/23/11		27.15	1.94	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ14	09/28/11		25.44	3.65	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ14	01/12/12		24.72	4.37	8:35 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ14	03/20/12		21.02	8.07	9:35 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ14	06/26/12		19.57	9.52	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
PZ15	02/04/10	27.79	22.22	5.57	9:45 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
PZ15	09/01/10		25.58	2.21	9:50 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
PZ15	06/21/11		NM	NM	NM	8:48 a.m.	9.36	5:06 p.m.	8.39
PZ15	06/22/11		NM	NM	NM	9:48 a.m.	9.13	6:54 a.m.	8.71
PZ15	09/23/11		26.04	1.75	8:45 a.m.	--	--	9:06 a.m.	-0.73
PZ15	09/28/11		23.91	3.88	3.25 p.m.	5:27 p.m.	4.72	--	--
PZ15	01/12/12		23.31	4.48	8:56 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
PZ15	03/20/12		19.51	8.28	9:18 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
PZ15	06/26/12		18.30	9.49	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
AB1[3]	02/04/10	27.53	30.08	6.26	9:17 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
AB1[3]	09/01/10		34.71	2.99	10:27 a.m.	9:42 p.m.	2.62	5.33 a.m.	-0.93
AB1[3]	11/02/10		32.19	4.77	12:03 p.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
AB1[3]	12/20/10		29.08	6.97	11:30 a.m.	--	--	10:09 a.m.	4.25
AB1[3]	12/20/10		28.32	7.50	2:36 p.m.	2:27 p.m.	7.11	--	--
AB1[3]	03/21/11		27.65	7.98	4:32 p.m.	--	--	2:15 p.m.	4.77
AB1[3]	03/23/11		27.07	8.39	8:30 a.m.	7:18 a.m.	7.27	--	--

Table 2
Summary of Ground Water Elevation Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
AB1[3]	06/21/11		23.48	10.93	3:36 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
AB1[3]	06/22/11		23.49	10.92	7:46 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
AB1[3]	09/23/11		35.19	2.65	8:45 a.m.	--	--	9:06 a.m.	-0.73
AB1[3]	09/28/11		32.64	4.45	3.25 p.m.	5:27 p.m.	4.72	--	--
AB1[3]	01/12/12		31.76	5.07	8:46 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
AB1[3]	03/20/12		26.52	8.78	9:23 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
AB1[3]	06/26/12		25.13	9.76	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
AB1[3]	10/31/12		31.11	5.53	1:45 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
AB2[3]	02/04/10	28.41	27.23	6.10	8:27 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
AB2[3]	09/01/10		31.21	2.84	10:30 a.m	9:42 p.m.	2.62	5.33 a.m.	-0.93
AB2[3]	11/02/10		29.56	4.19	11:21 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
AB2[3]	12/20/10		26.36	6.82	11:16 a.m.	--	--	10:09 a.m.	4.25
AB2[3]	12/20/10		24.97	7.95	2:26 p.m.	2:27 p.m.	7.11	--	--
AB2[3]	03/21/11		25.20	7.77	3:54 p.m.	--	--	2:15 p.m.	4.77
AB2[3]	03/23/11		24.63	8.23	8:30 a.m.	7:18 a.m.	7.27	--	--
AB2[3]	06/21/11		21.36	10.91	3:21 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
AB2[3]	06/22/11		21.35	10.92	8:19 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
AB2[3]	09/23/11		31.66	2.47	8:45 a.m.	--	--	9:06 a.m.	-0.73
AB2[3]	09/28/11		29.45	4.28	3.25 p.m.	5:27 p.m.	4.72	--	--
AB2[3]	01/12/12		28.60	4.98	8:25 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
AB2[3]	03/20/12		24.03	8.72	9:32 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
AB2[3]	06/26/12		22.93	9.63	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
AB2[3]	10/31/12		28.01	5.46	1:23 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
OW1	11/02/10	26.51	23.00	3.51	11:26 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
OW1	12/20/10		20.22	6.29	11:10 a.m.	--	--	10:09 a.m.	4.25
OW1	12/20/10		19.38	7.13	2:20 p.m.	2:27 p.m.	7.11	--	--
OW1	03/21/11		19.15	7.36	3:40 p.m.	--	--	2:15 p.m.	4.77
OW1	03/23/11		18.97	7.54	8:20 a.m.	7:18 a.m.	7.27	--	--
OW1	06/21/11		15.93	10.58	3:26 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
OW1	06/22/11		16.05	10.46	8:21 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
OW1	09/23/11		24.43	2.08	8:45 a.m.	--	--	9:06 a.m.	-0.73
OW1	09/28/11		22.79	3.72	3.25 p.m.	5:27 p.m.	4.72	--	--
OW1	01/12/12		22.16	4.35	8:26 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
OW1	03/20/12		18.25	8.26	10:20 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
OW1	06/26/12		17.41	9.10	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
OW1	10/31/12		21.62	4.89	1:26 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
OW2	11/02/10	25.99	22.45	3.54	11:24 p.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
OW2	12/20/10		19.71	6.28	11:08 a.m.	--	--	10:09 a.m.	4.25
OW2	12/20/10		18.56	7.43	3:14 p.m.	2:27 p.m.	7.11	--	--
OW2	03/21/11		18.64	7.35	3:58 p.m.	--	--	2:15 p.m.	4.77
OW2	03/23/11		18.37	7.62	8:27 a.m.	7:18 a.m.	7.27	--	--

Table 2
Summary of Ground Water Elevation Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Measured	TOC Elevation[1] (ft CRD)	Depth to Water (ft below TOC)	Water Elevation[1] (ft CRD)	Time Measured	High (CRD)[2]		Low (CRD)[2]	
						Time	Elevation (ft)	Time	Elevation (ft)
OW2	06/21/11		15.48	10.51	3:24 a.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
OW2	06/22/11		15.51	10.48	8:23 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
OW2	09/23/11		23.99	2.00	8:45 a.m.	--	--	9:06 a.m.	-0.73
OW2	09/28/11		22.85	3.14	3.25 p.m.	5:27 p.m.	4.72	--	--
OW2	01/12/12		21.62	4.37	8:28 a.m	5:57 a.m.	4.01	1:48 p.m.	1.02
OW2	03/20/12		17.81	8.18	10:25 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
OW2	06/26/12		16.87	9.12	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
OW2	10/31/12		21.14	4.85	1:30 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67
OW3	11/02/10	26.13	22.62	3.51	11:28 a.m.	13:15 p.m.	4.42	8:42 a.m.	0.75
OW3	12/20/10		19.83	6.30	11:13 a.m.	--	--	10:09 a.m.	4.25
OW3	12/20/10		19.98	6.15	2:28 p.m.	2:27 p.m.	7.11	--	--
OW3	03/21/11		18.76	7.37	3:42 p.m.	--	--	2:15 p.m.	4.77
OW3	03/23/11		18.60	7.53	8:14 a.m.	7:18 a.m.	7.27	--	--
OW3	06/21/11		15.55	10.58	3:30 p.m.	8:48 a.m.	9.36	5:06 p.m.	8.39
OW3	06/22/11		15.65	10.48	8:24 a.m.	9:48 a.m.	9.13	6:54 a.m.	8.71
OW3	09/23/11		24.05	2.08	8:45 a.m.	--	--	9:06 a.m.	-0.73
OW3	09/28/11		22.52	3.61	3.25 p.m.	5:27 p.m.	4.72	--	--
OW3	01/12/12		21.76	4.37	8:07 a.m.	5:57 a.m.	4.01	1:48 p.m.	1.02
OW3	03/20/12		17.90	8.23	10:30 a.m.	4:09 a.m.	7.83	11:24 a.m.	5.92
OW3	06/26/12		17.03	9.10	10:30 a.m.	10:27 p.m.	6.27	5:20 p.m.	3.35
OW3	10/31/12		21.22	4.91	1:33 p.m.	5:42 a.m.	5.17	12:45 p.m.	2.67

Notes:

Pre-2010 data not shown in table

1) Survey based on NAVD88 and adjusted to CRD by subtracting 3.8 feet. Control point was taken from the I-5 intersection at the Todd Road overpass located at the northeast corner of the interchange.
2) Tidal data are from NOAA Co-ops web site http://co-ops.nos.noaa.gov. Verified times and high/low water level data from the Longview and St. Helens stations were used. Tides for Kalama were estimated by using the difference between the times and water level data at these two stations (assuming Kalama is located approximately at the midpoint). These elevations are based on MLLW.
3) Water elevations in the angle monitoring wells are approximated by the following calculations (where WL = depth to water):
   AB1 (27.53 - WL COS 45^{o})
   AB2 (28.41 - WL COS 35^{o})

ft TOC = feet below top of casing.

CRD = Columbia River Datum.

NM = not measured.

TOC survey data and were obtained from CDM reports or electronic files provided to H&H by Clariant.

Table 3
Summary of Ground Water Analytical Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

			Zinc		Cadmium	
			Total	Dissolved	Total	Dissolved
Sample ID	Sample Date	Sample Time	µg/L			
PZ1	02/04/10	1415	--	8,440	--	0.5
PZ1	09/02/10	1400	5,630	--	<1.0	--
PZ1	11/02/10	1650	--	7,290	--	<1.0
PZ1	12/20/10	1640	--	6,720	--	<1.0
PZ1	03/22/11	1030	--	12,300	--	<10.0
PZ1	06/21/11	1140	--	14,700	--	<10.0
PZ1	09/22/11	1125	--	17,800	--	<1.0
PZ1	01/12/11	1010	--	40,000	--	<10.0
PZ1	03/21/12	1235	--	70,000	--	5.1 J
PZ1	06/26/12	1255	--	84,500	--	<100
PZ1	10/31/12	1255	--	29,900	--	3
PZ3	02/05/10	1170	--	3,690	--	0.5
PZ3	09/01/10	1436	2,670	--	<1.0	--
PZ3	11/03/10	1310	--	1,940	--	<1.0
PZ3	12/21/10	1445	--	2,280	--	<1.0
PZ3	03/22/11	1620	--	4,370	--	<10.0
PZ3	09/22/11	1625	--	2,930		<10.0
PZ3	06/21/11	0945	--	4,420	--	<1.0
PZ3	01/12/12	1420	--	4,530	--	<10.0
PZ3	03/21/12	1020	--	11,000	--	1.7 J
PZ3	06/27/12	900	--	6,480	--	1.0
PZ3	10/31/12	900	--	3,530	--	<1.0
PZ4	09/01/10	1244	2,210	--	16.6	--
PZ4	11/03/10	1120	--	1,890	--	15.6
PZ4	12/21/10	1515	--	896	--	6.61
PZ4	03/22/11	1445	--	3,980	--	36.9
PZ4	06/21/11	1515	--	5,310	--	38.3
PZ4	09/22/11	1620	--	2,810	--	26.1
PZ4	01/12/12	1510	--	437	--	<10.0
PZ4	03/21/12	1135	--	1,700	--	10.0
PZ4	06/26/12	1520	--	4,880	--	31.2
PZ4	10/31/12	1520	--	2,770	--	21.5
PZ5	02/05/10	1450	--	3,060	--	107
PZ5	09/01/10	1521	4,350	--	118	--
PZ5	11/03/10	1035	--	2,080	--	69.7
PZ5	12/21/10	1545	--	2,880	--	91.8
PZ5	03/22/11	1520	--	2,980	--	84.7
PZ5	06/21/11	1555	--	35,800	--	1,150
PZ5	09/22/11	1650	--	2,390	--	102
PZ5	01/12/12	1550	--	394	--	<10.0
PZ5	03/21/12	1200	--	2,100	--	43
PZ5	06/26/12	1600	--	1,680	--	4.3
PZ5	10/31/12	1600	--	141	--	1.8
PZ6	09/01/10	1133	1,310	--	<1.0	--
PZ6	11/03/10	1155	--	1,190	--	<1.0
PZ6	12/20/10	1715	--	553	--	<1.0
PZ6	03/22/11	1415	--	740	--	<10.0
PZ6	06/21/11	1550	--	1,660	--	<10.0

Table 3
Summary of Ground Water Analytical Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Sample ID	Sample Date	Sample Time	Zinc		Cadmium	
			Total	Dissolved	Total	Dissolved
			µg/L			
PZ6	09/22/11	1555	--	500	--	<1.0
PZ6	01/12/12	1450	--	26.3	--	<10.0
PZ6	03/21/12	1105	--	980	--	<10.0
PZ6	06/26/12	805	--	3,570	--	<1.0
PZ6	11/01/12	805	--	6,360	--	2.2
PZ12	02/04/10	1230	--	34,200	--	0.6
PZ12	09/02/10	1124	37,800	--	<1.0	--
PZ12	11/03/10	945	--	1,940	--	<1.0
PZ12	12/21/10	1230	--	87,100	--	<1.0
PZ12	03/22/11	945	--	112,000	--	<10.0
PZ12	06/21/11	1405	--	74,100	--	<10.0
PZ12	09/22/11	1520	--	88,100	--	<1.0
PZ12	01/12/12	1255	--	83,600	--	<200
PZ12	03/21/12	1505	--	300,000	--	6.7 J
PZ12	06/27/12	1025	--	352,000	--	<100
PZ12	11/01/12	1025	--	68,500	--	1.0
PZ13	09/02/10	1029	18,400	--	<1.0	--
PZ13	11/02/10	1420	--	151	--	<1.0
PZ13	12/21/10	1020	--	79,000	--	<1.0
PZ13	03/22/11	900	--	68,200	--	<10.0
PZ13	06/21/11	1340	--	21,100	--	<10.0
PZ13	09/22/11	1430	--	<10.0	--	<1.0
PZ13	01/12/12	1325	--	2,140	--	<10.0
PZ13	03/21/12	1555	--	89,000	--	2.4 J
PZ13	06/27/12	940	--	210	--	<1.0
PZ13	11/01/12	940	--	<50	--	<1.0
AB1	02/05/10	1045	--	980	--	0.3
AB1	09/01/10	1339	996	--	<1.0	--
AB1	11/03/10	1245	--	613	--	<1.0
AB1	12/21/10	1410	--	463	--	<1.0
AB1	03/22/11	1600	--	439	--	<10.0
AB1	06/21/11	1640	--	304	--	<10.0
AB1	09/22/11	1020	--	1090	--	<1.0
AB1	01/12/12	1350	--	923	--	<10.0
AB1	03/21/12	1035	--	950	--	<10.0
AB1	06/27/12	835	--	736	--	<1.0
AB1	10/31/12	835	--	877	--	<1.0
AB2	02/04/10	1330	--	5,840	--	0.4
AB2	09/02/10	1319	9,290	--	<1.0	--
AB2	11/02/10	1545	--	7,310	--	<1.0
AB2	12/20/10	1610	--	6,310	--	<1.0
AB2	03/22/11	1125	--	5,630	--	<10.0
AB2	06/21/11	935	--	4,210	--	<10.0
AB2	09/22/11	1155	--	14,300	--	<1.0
AB2	01/12/12	940	--	19,500	--	<10.0
AB2	03/21/12	1255	--	20,000	--	1.5 J
AB2	06/26/12	1230	--	33,300	--	<1.0
AB2	10/31/12	1230	--	9,600	--	<1.0

Table 3
Summary of Ground Water Analytical Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Sample ID	Sample Date	Sample Time	Zinc		Cadmium	
			Total	Dissolved	Total	Dissolved
			µg/L			
OW1	09/23/10	1000	--	15,200	--	<1.0
OW1	11/02/10	1845	--	14,800	--	<1.0
OW1	12/20/10	1545	--	14,600	--	<1.0
OW1	03/22/10	1340	--	12,500	--	<10.0
OW1	06/21/11	1040	--	21,100	--	<10.0
OW1	09/22/11	1305	--	28,600	--	1.18
OW1	01/12/12	1100	--	44,500	--	<100
OW1	03/21/12	1420	--	46,000	--	2.8 J
OW1	06/26/12	1435	--	23,900	--	<100
OW1	10/31/12	1435	--	22,200	--	<1.0
OW2	09/23/10	0920	--	11,700	--	<1.0
OW2	11/02/10	1645	--	9,790	--	<1.0
OW2	12/20/10	1355	--	7,750	--	<1.0
OW2	03/22/11	1055	--	19,900	--	<10.0
OW2	06/21/11	1015	--	28,600	--	<10.0
OW2	09/22/11	1235	--	31,100	--	1.62
OW2	01/12/12	1035	--	52,500	--	<100
OW2	03/21/12	1320	--	91,000	--	8.4 J
OW2	06/26/12	1400	--	91,400	--	<100
OW2	10/31/12	1400	--	71,800	--	<1.0
OW3	09/23/10	0830	--	13,200	--	<1.0
OW3	11/02/10	1845	--	16,700	--	<1.0
OW3	12/21/10	1110	--	22,400	--	<1.0
OW3	03/22/11	1150	--	35,100	--	<10.0
OW3	06/21/11	1120	--	22,400	--	<10.0
OW3	09/22/11	1330	--	41,600	--	1.72
OW3	01/12/12	1140	--	8,100	--	<10
OW3	03/21/12	1400	--	11,000	--	<10.0
OW3	06/26/12	1335	--	47,700	--	<100
OW3	10/31/12	1335	--	10,800	--	3.5

Notes:
Pre-2010 data not shown in table
Samples analyzed by EPA Method 6010B for total concentrations and by
EPA Method 200 or 6010B for dissolved concetrations
Only data for wells used for injection performance monitoring are shown
µg/L = micrograms per liter
-- indicates not analyzed; "J" indicates result is less than laboratory reporting limit, but greater than or equal to the minimum detection limit and the concentration is approximate.
HT - sample collected at high tide, LT - sample collected at low tide

Table 4
Summary of Ground Water Field Parameters and Sulfide Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Sampled	Temp (^{o}C)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
PZ1	04/15/03	14.6	155	5.23	6.27	64	70	--
PZ1	07/18/03	15.2	--	--	6.84	--	Clear	--
PZ1	08/13/03	15.9	600	--	7.79	--	4.3	--
PZ1	01/28/04	13.5	190	--	6.49	--	5.4	--
PZ1	04/28/04	13.3	192	--	6.37	--	1.1	--
PZ1	07/29/04	18.0	202	--	6.20	--	5.4	--
PZ1	10/27/04	11.5	189	--	5.44	--	0.4	--
PZ1	01/27/05	12.9	198	4.05	6.38	-43	0	--
PZ1	05/03/05	15.6	208	--	6.02	--	0.6	--
PZ1	07/26/05	15.0	167	3.38	7.25	213	1.2	--
PZ1	10/26/05	13.9	142	--	5.67	--	--	--
PZ1	07/12/06	14.9	159	--	5.90	--	2.8	--
PZ1	02/04/10	13.2	160	2.04	5.29	24	Clear	--
PZ1	09/02/10	15.8	69	8.44	5.66	-64	3.2	<0.20
PZ1	11/02/10	14.8	84	7.62	6.57	-28	4.1	<0.20
PZ1	12/20/10	11.2	69	6.45	6.77	43	3.2	<0.20
PZ1	03/22/11	12.4	121	6.29	6.52	-59	1.3	<0.20
PZ1	06/21/11	15.4	124	4.77	6.51	5.7	2.0	<0.20
PZ1	09/22/11	16.8	170	8.99	5.74	261	<1.0	<0.20
PZ1	01/12/12	11.0	238	--	6.13	203	0.0	<0.20
PZ1	03/21/12	11.6	318	1.16	5.88	196	0.0	<0.20
PZ1	06/26/12	15.6	446	0.16	6.14	186	4.2	<5.0
PZ1	10/31/12	13.4	212	3.60	5.93	190	2.1	<0.10
PZ3	04/15/03	14.6	689	0.25	5.85	43	40	--
PZ3	05/06/03	15.4	695	1.62	6.80	24	4	--
PZ3	05/21/03	15.7	710	--	7.15	--	Clear	--
PZ3	07/18/03	15.3	--	--	7.10	--	Clear	--
PZ3	08/13/03	15.5	740	--	6.72	--	1.8	--
PZ3	01/28/04	13.9	517	--	6.27	--	1.1	--
PZ3	04/28/04	21.6	551	--	6.27	--	1.5	--
PZ3	07/29/04	18.9	421	--	6.15	--	5.3	--
PZ3	10/27/04	12.9	340	--	5.95	--	1.6	--
PZ3	01/27/05	14.7	459	3.39	6.68	-48	0.6	--
PZ3	05/03/05	16.0	436	--	6.10	--	0.7	--
PZ3	07/25/05	17.7	306	2.15	6.19	80	4.0	--
PZ3	10/27/05	12.8	257	--	5.64	--	--	--
PZ3	07/13/06	14.2	471	--	5.84	--	2.0	--
PZ3	07/13/06	14.7	198	--	6.35	--	0.3	--
PZ3	02/05/10	14.0	603	1.55	6.02	23	Clear	--
PZ3	09/01/10	14.0	311	3.54	6.11	67	3.4	<0.20
PZ3	11/03/10	19.0	254	5.19	6.30	77	2.0	<0.20
PZ3	12/21/10	12.5	200	2.79	6.69	-10	3.1	<0.20
PZ3	03/22/11	12.6	342	2.64	5.96	-110	0.7	<0.20
PZ3	06/21/11	18.6	341	1.16	6.20	4.4	1.1	<0.20
PZ3	09/22/11	17.3	404	7.46	5.86	231	<1.0	<0.20
PZ3	01/12/12	12.7	396	4.63	5.74	17	0.0	<0.20
PZ3	03/21/12	11.9	607	2.66	5.70	186	0.0	<0.20

Table 4
Summary of Ground Water Field Parameters and Sulfide Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Sampled	Temp (^{o}C)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
PZ3	06/27/12	14.6	415	0.87	6.17	149	6.2	<5.0
PZ3	10/31/12	13.7	345	5.03	5.92	178	0.5	<0.10
PZ4	04/15/03	14.2	1,050	4.49	5.35	91	67	--
PZ4	05/21/03	14.8	380	--	7.16	--	Clear	--
PZ4	08/13/03	15.9	510	--	6.62	--	5.2	--
PZ4	01/28/04	14.1	767	--	5.53	--	0.2	--
PZ4	04/28/04	14.0	811	--	5.76	--	5.0	--
PZ4	07/29/04	17.2	884	--	5.46	--	4.4	--
PZ4	10/27/04	12.5	614	--	5.53	--	0.3	--
PZ4	01/27/05	13.6	1,770	1.99	5.58	-49	0	--
PZ4	05/03/05	14.6	957	--	5.58	--	0.9	--
PZ4	07/25/05	15.2	454	0.86	5.82	236	2.8	--
PZ4	10/26/05	13.3	692	--	5.35	--	--	--
PZ4	07/13/06	14.0	465	--	5.73	--	3.1	--
PZ4	07/13/06	16.5	405	--	6.18	--	8.4	--
PZ4	09/01/10	13.7	636	2.91	5.50	85	3.7	<0.20
PZ4	11/03/10	16.7	587	5.11	5.71	125	4.8	<0.20
PZ4	12/21/10	11.8	275	2.36	6.34	-31	4.9	<0.20
PZ4	03/22/11	12.7	668	5.72	5.94	-67	1.6	<0.20
PZ4	06/21/11	17.0	888	6.15	5.65	36	2.3	<0.20
PZ4	09/22/11	21.4	839	3.90	5.41	165	2.5	<0.20
PZ4	01/12/12	11.8	220	2.18	5.77	1.0	0.0	<0.20
PZ4	03/21/12	11.9	341	3.90	5.96	157	3.2	<0.20
PZ4	06/26/12	14.7	400	1.23	5.93	228	5.2	<5.0
PZ4	10/31/12	13.5	380	1.63	5.23	178	12.2	<0.10
PZ5	04/16/03	13.6	530	4.78	5.86	100	57	--
PZ5	05/21/03	14.2	170	--	7.10	--	Clear	--
PZ5	08/13/03	15.9	860	--	6.69	--	9.7	--
PZ5	01/28/04	13.6	210	--	6.19	--	1.6	--
PZ5	04/28/04	14.2	293	--	6.03	--	1.5	--
PZ5	07/29/04	16.6	479	--	5.92	--	2.6	--
PZ5	10/27/04	12.4	1,300	--	5.32	--	0.6	--
PZ5	01/27/05	13.3	460	3.8	6.34	-27	7.9	--
PZ5	05/03/05	14.1	281	--	5.77	--	1.1	--
PZ5	07/25/05	15.8	478	3.05	5.94	199	5.2	--
PZ5	10/26/05	14.0	770	--	5.45	--	--	--
PZ5	07/13/06	13.9	190	--	5.00	--	4.7	--
PZ5	07/13/06	12.0	186	--	5.80	--	4.5	--
PZ5	02/05/10	13.6	433	1.90	5.76	22	Clear	--
PZ5	09/01/10	15.8	212	4.13	5.50	87	5.4	<0.20
PZ5	11/03/10	14.2	142	5.43	6.20	79	1.9	<0.20
PZ5	12/21/10	10.4	142	7.21	6.22	35	2.3	<0.20
PZ5	03/22/11	12.0	425	6.81	6.28	-85	1.3	<0.20
PZ5	06/21/11	15.3	2,178	4.22	5.43	65	1.0	<0.20
PZ5	09/22/11	20.7	162	2.98	5.77	148	2.7	<0.20
PZ5	01/12/12	11.3	234	3.22	5.60	-25	0.0	<0.20
PZ5	03/21/12	10.8	322	4.88	5.78	105	27	<0.20

Table 4
Summary of Ground Water Field Parameters and Sulfide Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Sampled	Temp (^{o}C)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
PZ5	06/26/12	14.0	190	2.30	6.09	6	8.2	<5.0
PZ5	10/31/12	13.3	89	2.25	5.99	-13	23.0	<0.10
PZ6	04/16/03	13.8	345	7.07	4.74	162	17	--
PZ6	05/21/03	14.4	250	--	6.85	--	Clear	--
PZ6	08/13/03	16.1	880	--	6.76	--	6.9	--
PZ6	01/28/04	12.1	447	--	5.96	--	0.1	--
PZ6	04/28/04	19.1	293	--	5.90	--	24	--
PZ6	07/29/04	18.2	725	--	5.80	--	6.3	--
PZ6	10/27/04	12.2	747	--	5.63	--	0.4	--
PZ6	01/27/05	13.0	991	3.72	5.59	12	3.2	--
PZ6	05/03/05	14.9	1,370	--	5.28	--	0.9	--
PZ6	07/25/05	16.0	1,275	4.85	4.48	290	0.9	--
PZ6	10/26/05	11.5	916	--	4.15	--	--	--
PZ6	07/13/06	14.0	802	--	5.08	--	1.9	--
PZ6	09/01/10	12.9	728	7.60	5.68	118	4.4	<0.20
PZ6	11/03/10	15.4	671	6.38	5.69	133	1.5	<0.20
PZ6	12/20/10	11.8	217	6.80	6.32	56	3.3	<0.20
PZ6	03/22/11	11.8	357	7.19	5.76	-40	2.0	<0.20
PZ6	06/21/11	16.4	420	6.93	5.94	22	4.9	<0.20
PZ6	09/22/11	19.7	220	3.93	5.73	135	<1.0	<0.20
PZ6	01/12/12	12.1	119	1.03	7.38	-161	0.0	<0.20
PZ6	03/21/12	11.3	1,140	1.73	5.6	-79	3.0	0.37
PZ6	06/27/12	13.1	701	0.98	5.58	28	9.4	<5.0
PZ6	11/01/12	12.1	2,250	1.94	4.02	158	32.5	<0.10
PZ12	07/27/05	17.6	198	2.54	9.65	15	3.8	--
PZ12	10/26/05	13.7	164	--	5.66	--	--	--
PZ12	07/13/06	14.7	193	--	5.45	--	3.1	--
PZ12	02/04/10	13.2	290	2.86	5.71	25	Clear	--
PZ12	09/02/10	12.3	185	1.54	5.61	-2.2	3.5	<0.20
PZ12	11/03/10	11.9	269	1.93	6.70	-66	3.6	<0.20
PZ12	12/21/10	12.8	372	0.61	6.54	-33	1.8	<0.20
PZ12	03/22/11	12.1	641	0.22	6.03	-192	1.0	<0.20
PZ12	06/21/11	16.2	531	2.43	5.46	-7.1	2.6	<0.20
PZ12	09/22/11	19.7	1,000	2.22	4.02	182	2.1	3.55
PZ12	01/12/12	12.0	1,510	1.85	5.50	-141	525	1.01
PZ12	03/21/12	11.4	2,460	1.10	4.58	-28	21	0.37
PZ12	06/27/12	16.6	2,050	4.70	4.25	196	6.7	<5.0
PZ12	11/01/12	13.7	1,090	2.06	4.19	254	18.0	<0.10
PZ13	07/27/05	15.9	168	1.52	8.61	-122	2.3	--
PZ13	09/02/10	14.3	225	2.97	6.14	15	4.9	<0.20
PZ13	11/02/10	16.1	1,941	0.14	9.80	-450	776	36
PZ13	12/21/10	11.0	539	0.94	6.71	-101	444	<0.20
PZ13	03/22/11	10.5	349	4.48	6.61	-152	267	10.4
PZ13	06/21/11	15.0	366	5.22	6.31	-60	22	1.22
PZ13	09/22/11	20.8	651	3.85	6.59	-233	200	2.98
PZ13	01/12/12	NM	NM	NM	NM	NM	NM	61.0
PZ13	03/21/12	10.2	1,190	4.69	5.75	213	82	<0.20

Table 4
Summary of Ground Water Field Parameters and Sulfide Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Sampled	Temp (°C)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
PZ13	06/27/12	13.2	368	0.12	6.20	-100	272	11.7
PZ13	11/01/12	12.4	541	4.27	6.38	-141	360	3.11
AB1	07/07/03	17.3	397	--	6.73	--	9	--
AB1	07/18/03	15.2	--	--	6.94	--	Clear	--
AB1	08/13/03	15.8	720	--	6.80	--	1.1	--
AB1	01/28/04	13.6	253	--	6.82	--	3.2	--
AB1	04/28/04	19.0	373	--	7.04	--	25	--
AB1	07/29/04	20.6	334	--	6.54	--	12	--
AB1	10/27/04	14.7	195	--	6.25	--	1.0	--
AB1	01/27/05	14.2	209	2.38	7.12	-58	2.6	--
AB1	05/03/05	15.0	310	--	6.52	--	0.7	--
AB1	07/25/05	15.4	226	3.46	6.65	189	10	--
AB1	10/27/05	12.3	177	--	6.08	--	--	--
AB1	07/13/06	13.7	255	--	6.08	--	0.9	--
AB1	07/13/06	16.1	505	--	5.95	--	0.9	--
AB1	02/05/10	12.7	391	1.65	6.29	31	Clear	--
AB1	09/01/10	14.6	314	5.47	6.39	67	6.1	<0.20
AB1	11/03/10	19.3	186	6.34	6.67	63	1.1	<0.20
AB1	12/21/10	10.8	112	9.01	7.36	23	4.3	<0.20
AB1	03/22/11	11.5	158	8.95	6.54	-50	0.5	<0.20
AB1	06/21/11	16.2	212	8.63	7.17	-7.3	2.4	<0.20
AB1	09/22/11	16.9	310	4.20	6.14	233	<1.0	<0.20
AB1	01/12/12	11.8	271	3.02	6.22	-32	0.0	<0.20
AB1	03/21/12	10.3	291	6.04	6.32	207	0.0	<0.20
AB1	06/27/12	13.2	294	6.71	6.63	68	2.6	<5.0
AB1	10/31/12	13.7	319	2.80	6.32	130	3.2	<0.10
AB2	07/07/03	15.8	174	--	6.29	--	2.7	--
AB2	07/18/03	15.1	--	--	7.03	--	9	--
AB2	08/12/03	14.7	710	--	7.11	--	5.7	--
AB2	01/28/04	14.0	165	--	6.51	--	20	--
AB2	04/28/04	16.6	192	--	6.67	--	219	--
AB2	07/29/04	18.5	180	--	6.35	--	68	--
AB2	10/27/04	12.0	162	--	5.61	--	9.1	--
AB2	01/27/05	13.5	174	1.66	6.52	-68	37	--
AB2	05/03/05	14.5	213	--	6.18	--	95	--
AB2	07/26/05	14.5	140	1.89	7.14	190	1.2	--
AB2	01/26/05	14.4	137	--	5.88	--	--	--
AB2	07/13/06	14.0	190	--	5.63	--	0.3	--
AB2	07/13/06	14.4	136	--	5.94	--	0.3	--
AB2	02/04/10	13.1	135	6.62	5.34	28	Clear	--
AB2	09/02/10	15.5	79	2.42	5.42	-15	5.4	<0.20
AB2	11/02/10	16.5	111	4.18	6.99	-62	1.8	<0.20
AB2	12/20/10	11.2	80	2.39	6.70	22	0.9	<0.20
AB2	03/22/11	11.6	99	7.35	6.67	-66	0.5	<0.20
AB2	06/21/11	13.7	109	7.48	6.50	340	1.6	<0.20
AB2	09/22/11	17.0	168	2.61	5.61	261	<1.0	<0.20
AB2	01/12/12	9.5	204	2.81	6.13	199	0.0	<0.20

Table 4
Summary of Ground Water Field Parameters and Sulfide Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

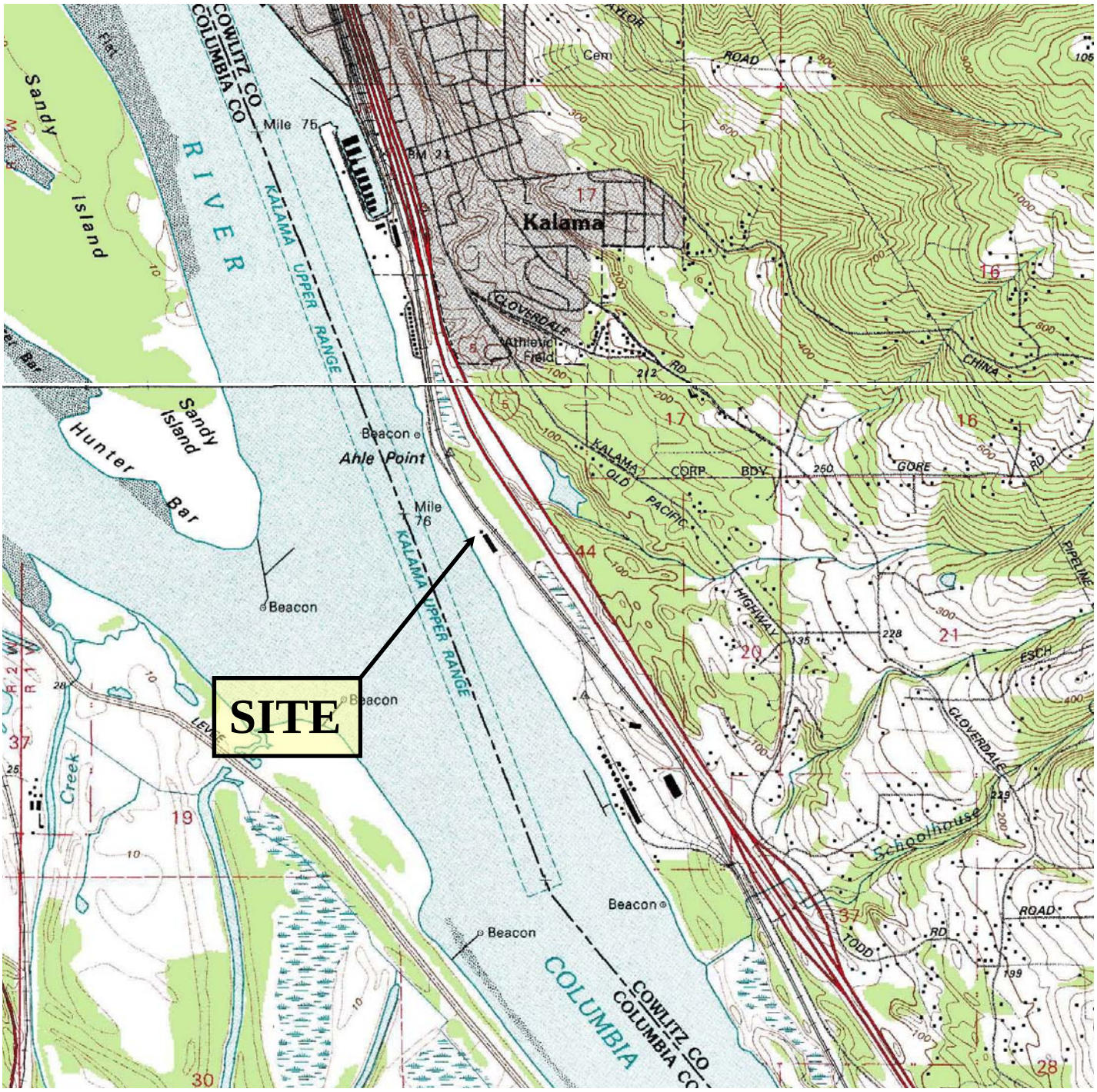
Well ID	Date Sampled	Temp (^{o}C)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
AB2	03/21/12	10.6	255	3.74	6.25	194	0.0	<0.20
AB2	06/26/12	15.7	316	2.52	6.33	202	0.0	<5.0
AB2	10/31/12	13.6	127	2.82	5.99	166	2.5	<0.10
OW1	09/23/10	12.7	162	10.6	6.47	-51	0.2	<0.20
OW1	11/02/10	14.2	104	7.28	6.63	-19	3.9	<0.20
OW1	12/20/10	11.2	91	6.02	6.84	39	1.1	<0.20
OW1	03/22/11	12.7	192	6.40	6.62	-59	0.5	<0.20
OW1	06/21/11	15.6	227	2.84	6.39	60	3.1	<0.20
OW1	09/22/11	17.0	270	4.66	5.99	229	0.3	<0.20
OW1	01/12/12	10.3	347	4.41	6.19	212	0.0	<0.20
OW1	03/21/12	11.1	557	0.48	6.05	28	0.0	<0.20
OW1	06/26/12	15.0	776	1.22	6.11	91	11	<5.0
OW1	10/31/12	13.3	706	3.82	6.28	95	9	<0.10
OW2	09/23/10	13.4	123	8.87	6.34	-43	1.6	<0.20
OW2	11/02/10	15.3	99	7.91	6.73	-41	4.5	<0.20
OW2	12/20/10	12.2	123	6.22	5.90	89	3.2	<0.20
OW2	03/22/11	11.2	172	5.70	6.60	-68	0.6	<0.20
OW2	06/21/11	14.3	224	3.58	6.25	171	4.6	<0.20
OW2	09/22/11	17.5	256	4.65	5.81	256	<1.0	<0.20
OW2	01/12/12	11.33	298	5.10	6.10	201	0.0	<0.20
OW2	03/21/12	11.25	417	1.65	5.99	173	0.0	<0.20
OW2	06/26/12	14.75	628	0.05	6.08	149	5.8	5.2
OW2	10/31/12	13.30	861	3.60	6.12	134	6.0	<0.10
OW3	09/23/10	13.3	104	10.46	6.43	-50	0.2	<0.20
OW3	11/02/10	13.9	104	5.85	6.46	-4.9	4.5	<0.20
OW3	12/21/10	12.9	153	2.92	6.67	13.5	2.2	<0.20
OW3	03/22/11	10.9	270	5.55	6.48	-74	0.6	<0.20
OW3	06/21/11	15.3	186	4.41	6.45	13.4	3.3	<0.20
OW3	09/22/11	17.0	355	5.60	5.82	242	0.3	<0.20
OW3	01/12/12	11.7	636	1.44	5.22	-52	0.0	0.597
OW3	03/21/12	14.2	1,004	1.49	5.74	-97	27	<0.20
OW3	06/26/12	15.7	967	0.05	4.70	209	10	<5.0
OW3	10/31/12	13.7	643	2.82	4.28	315	12	<0.10

Notes:
Pre-2010 data not shown in table
Only data for wells used for injection performance monitoring are shown
* turbidity values were collected prior to field filtering
^{o}C - degrees Celsius, µs/cm - microsiemens per centimeter, mg/L - milligrams per liter, mV - millivolts
ORP - oxidation reduction potential, NTU - Nephelometric turbidity units
sulfides analysis performed by laboratory using SM 4500-S-2 D
-- indicates parameter not measured/analyzed or was not available from previous report

Table 5
Summary of Ground Water Geochemical Analytical Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Well ID	Date Sampled	Zinc	Aluminum	Cadmium	Calcium	Iron	Magnesium	Manganese	Potassium	Sodium	Chloride	Sulfate	Alkalinity as Calcium Carbonate	Nitrate + Nitrite as Nitrogen	Phosphate as Phosphorus	Sulfide	Silica as Silicon Dioxide	Cation/Anion Electrical Balance (%)	Conductivity (µs/cm)	DO (mg/L)	pH	ORP (mV)	Turbidity* (NTU)
		µg/L																					
PZ1	10/31/12	29,900	<100	3.0	4,780	<100	1,780	77.9	<100	10,500	2,010	73,100	18,200	2,260	207	<100	52,800	-9.6	212	3.60	5.93	190	2.1
PZ3	10/31/12	3,530	<100	<1	9,740	<100	2,650	<15	1,530	26,800	3,180	98,100	44,200	696	<100	<100	49,500	-21.7	345	5.03	5.92	178	0.5
PZ4	10/31/12	2,770	<100	21.5	7,300	<100	6,070	<15	<1,000	34,900	3,360	129,000	27,300	779	241	<100	57,200	-16.4	380	1.63	5.23	178	12.2
PZ5	10/31/12	141	<100	1.8	5,040	1,360	1,900	208	<1,000	4,440	1,140	17,800	11,500	<100	<100	<100	23,800	2.3	89	2.25	5.99	-13	23.0
PZ6	11/01/12	6,360	53,700	2.2	116,000	195,000	44,700	4,710	1,150	20,300	5,340	4,720,000	<10,000	<100	<2,000	<100	136,000	-76.9	2,250	1.94	4.02	158	32.5
PZ12	11/01/12	68,500	728	1.0	132,000	10,100	10,500	1,440	<1,000	16,400	2,140	687,000	<10,000	275	<100	<100	76,300	-18.2	1,090	2.06	4.19	254	18.0
PZ13	11/01/12	<50	<100	<1	82,600	1,640	8,650	192	<1,000	10,100	3,390	194,000	75,800	120	<2,000	3,110	45,200	-3.3	541	4.27	6.38	-141	360
AB1	10/31/12	877	<100	<1	10,100	<100	2,630	<15	2,000	34,900	2,830	42,400	47,900	557	<100	<100	45,200	13.2	319	2.80	6.32	130	3.2
AB2	10/31/12	9,600	<100	<1	4,760	<100	1,180	15.5	<1,000	8,990	1,940	12,400	29,800	725	<100	<100	48,700	-3.1	127	2.82	5.99	166	2.5
OW1	10/31/12	22,200	<100	<1	154,000	808	2,830	881	<1,000	13,300	2,080	525,000	32,800	<100	<100	<100	40,600	-14.6	706	3.82	6.28	95	9
OW2	10/31/12	71,800	<100	<1	104,000	<100	9,200	2,750	<1,000	12,100	2,770	508,000	14,900	<100	<100	<100	52,800	-13.9	861	3.60	6.12	134	6.0
OW3	10/31/12	10,800	498	3.5	87,000	804	6,030	1,680	1,480	14,200	1,880	426,000	<10,000	578	<100	<100	55,900	-23.6	643	2.82	4.28	315	12
River	11/01/12	<50	<100	<1	11,200	121	3,260	157	<1,000	4,480	2,550	6,980	41,800	220	<100	<100	12,000	5.9	105	9.5	6.56	80	10

Notes:
metals samples were field filtered using a 0.45 micron filter prior to collection, results are dissolved concentrations
µs/cm - microsiemens per centimeter
DO = dissolved oxygen; ORP - oxidation reduction potential, mV - millivolts
NTU - Nephelometric turbidity units, *turbidity values were collected prior to field filtering



N

APPROXIMATE

0 2,000 4,000

SCALE IN FEET

U.S.G.S. QUADRANGLE MAP

DEER ISLAND & KALAMA, WA 7.5 MIN. TOPOGRAPHIC QUADRANGLES

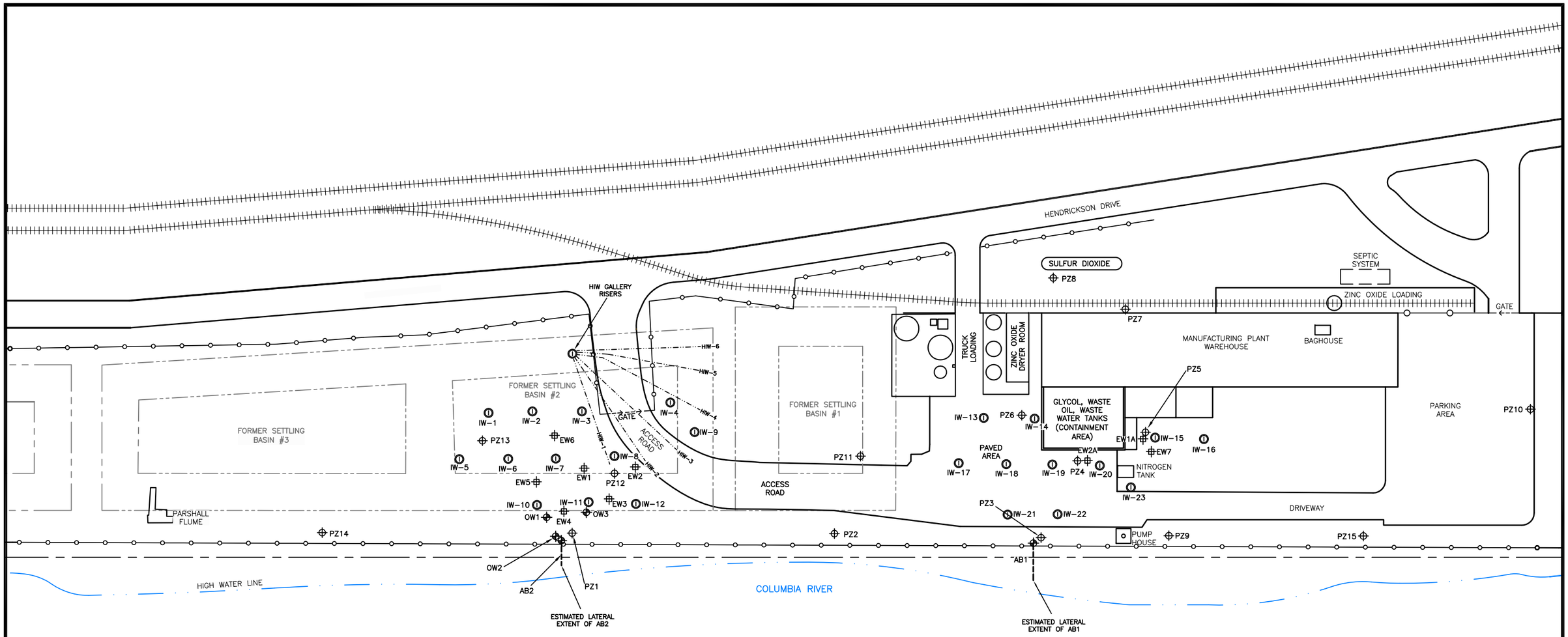
QUADRANGLE
7.5 MINUTE SERIES (TOPOGRAPHIC)

TITLE	SITE LOCATION MAP
PROJECT	CLARIANT CORPORATION KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

2923 South Tryon Street – Suite 100
Charlotte, North Carolina 28203
704-586-0007 (p) 704-586-0373 (f)

DATE:	09-18-12	REVISION NO:	0
JOB NO:	CLR-045	FIGURE NO:	1



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- SUBSURFACE EXTENT OF HORIZONTAL INJECTION WELL
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- EXTRACTION WELL

APPROXIMATE
0 80 160
SCALE IN FEET

NOTES
1. MAP BASED ON CDM SITE PLAN PROVIDED TO HART & HICKMAN BY CLARIANT CORPORATION.
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.
3. TEMPORARY OBSERVATION WELLS TW1 THROUGH TW3 WERE REMOVED FOLLOWING COMPLETION OF PILOT TESTING ACTIVITIES ON SEPTEMBER 29, 2011.

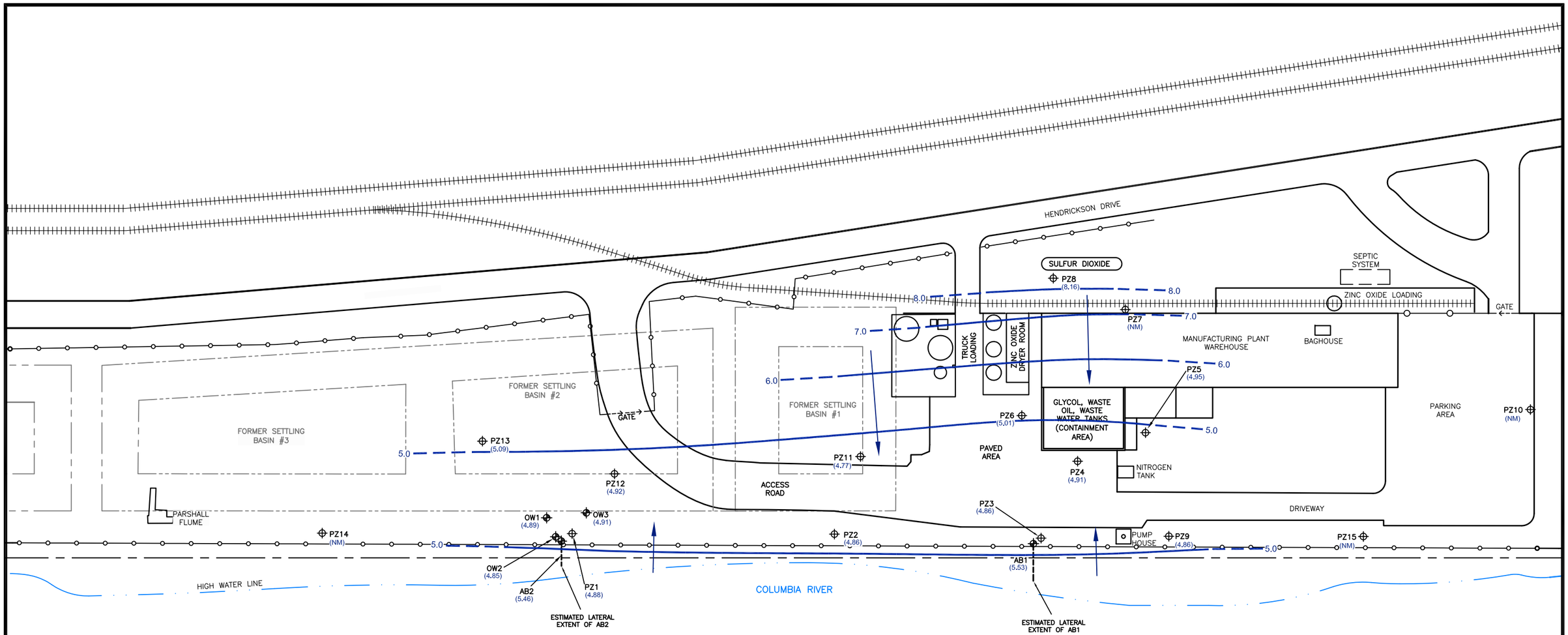
TITLE
SITE MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 08/16/12 | REVISION NO. 0
JOB NO. CLR-045 | FIGURE NO. 2

S:\AA-Master Projects\Clariant - CLR\CLR-045 Kalama, WA RA\2013 Work Plan\November GWM Update\Figures.dwg, FIG.2, 2/11/2013 4:37:16 PM, sdrury



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- (4.88) GROUND WATER ELEVATION (FT CRD)
- 5.0 GROUND WATER ELEVATION CONTOUR IN FT CRD (DASHING INDICATES EXTRAPOLATED CONTOUR)
- INFERRED GROUND WATER FLOW DIRECTION

APPROXIMATE
0 80 160
SCALE IN FEET

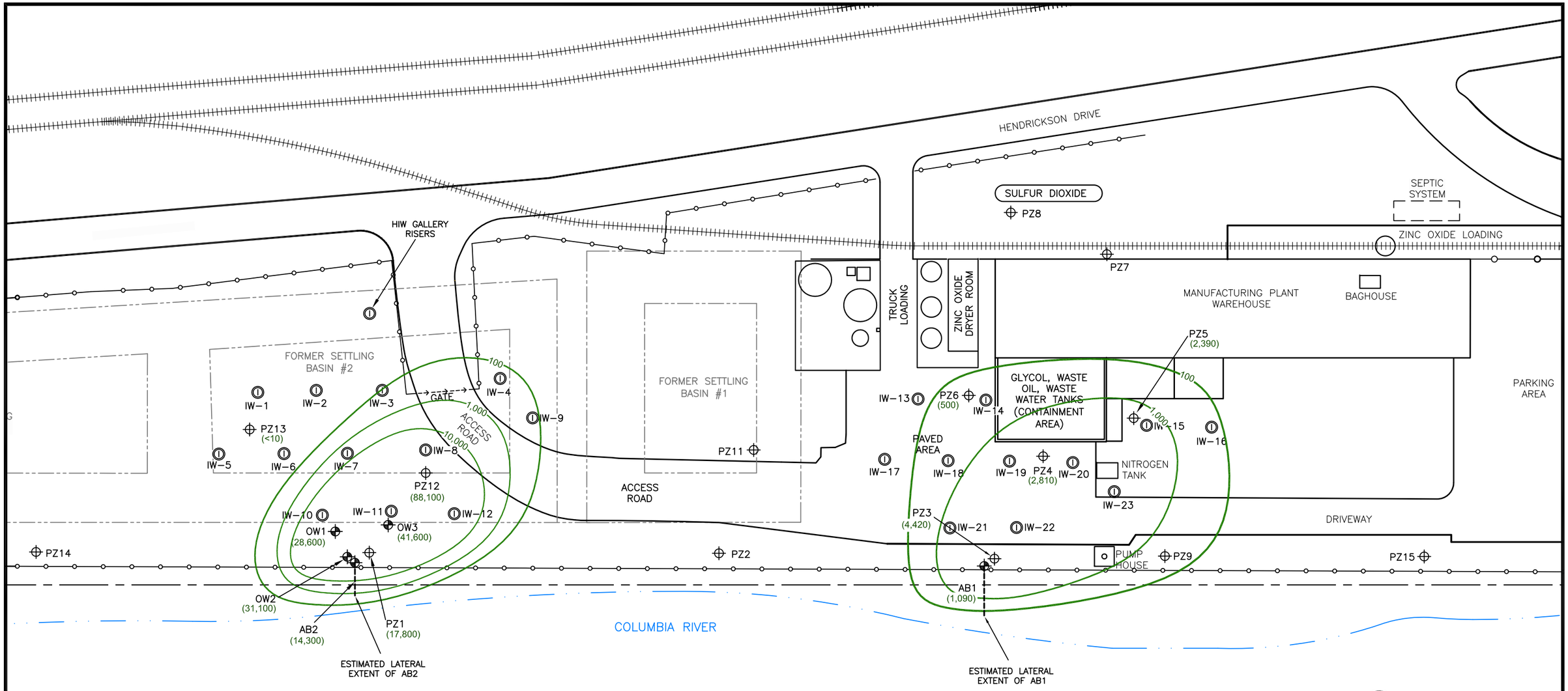
NOTES
1. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.

TITLE: GROUND WATER ELEVATION CONTOUR MAP
OCTOBER 31, 2012

PROJECT:
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 02/11/13	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 3



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- (1,090) SEPTEMBER 22, 2011 ZINC CONCENTRATION (µg/L)
- 1,000 ZINC ISOCONCENTRATION CONTOUR IN µg/L

APPROXIMATE
0 60 120
SCALE IN FEET

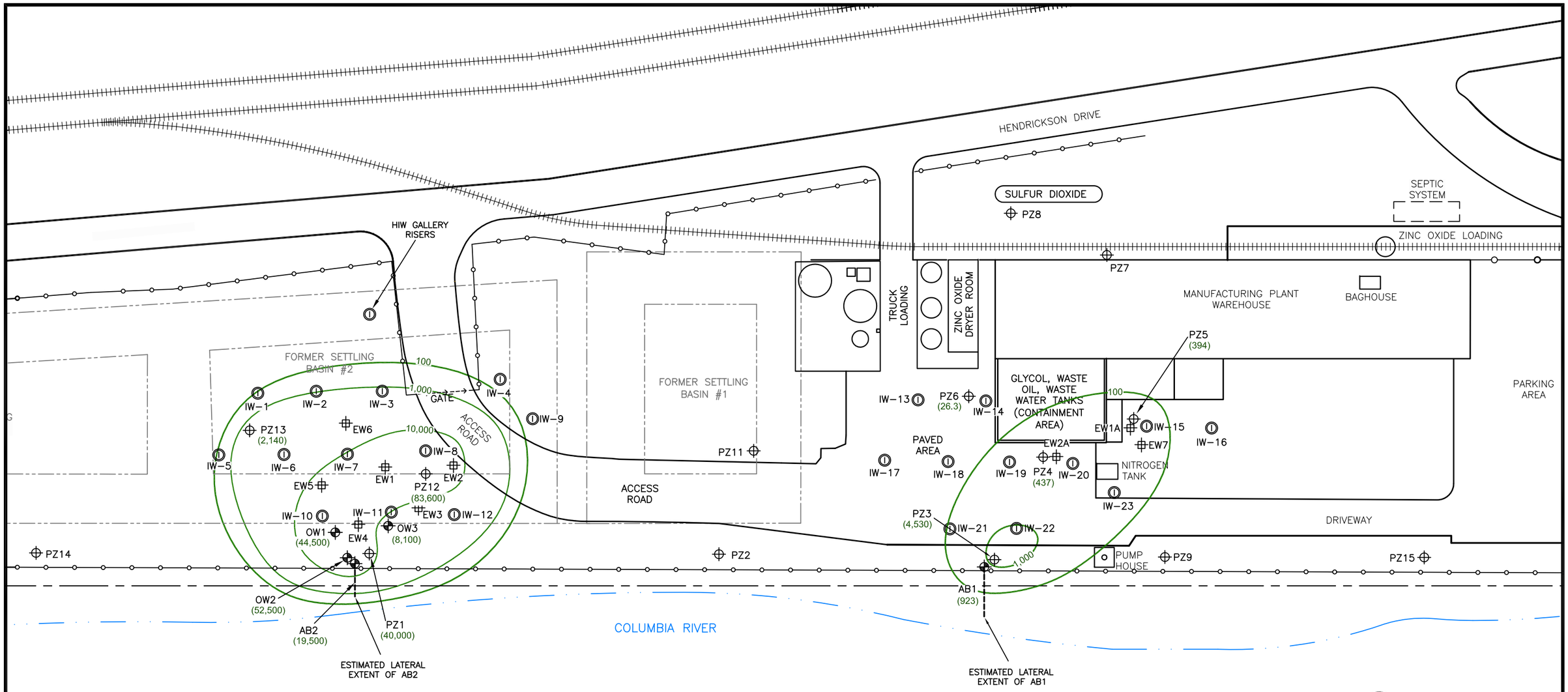
NOTES
1. HISTORICAL GROUND WATER SAMPLE DATA USED TO AID IN CONTOURING.
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATE THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.

TITLE
SEPTEMBER 22, 2011
ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 02/11/13	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4A



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- EXTRACTION WELL
- (923) JANUARY 12, 2012 ZINC CONCENTRATION (µg/L)
- 1,000 ZINC ISOCONCENTRATION CONTOUR IN µg/L

NOTES
1. HISTORICAL GROUND WATER SAMPLE DATA USED TO AID IN CONTOURING.
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATE THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.

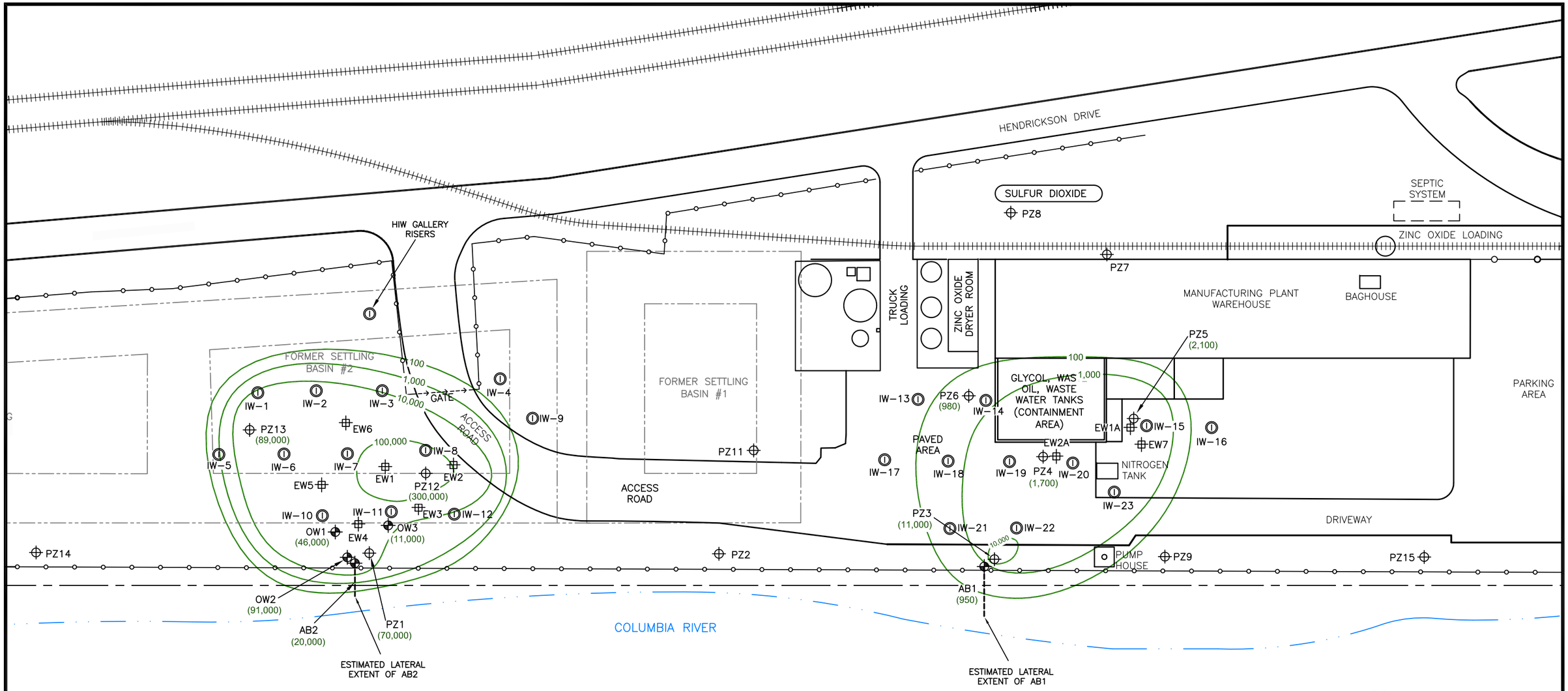
APPROXIMATE
0 60 120
SCALE IN FEET

TITLE
JANUARY 12, 2012
ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 02/11/13	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4B



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- EXTRACTION WELL
- (950) MARCH 21, 2012 ZINC CONCENTRATION (µg/L)
- 1,000 ZINC ISOCONCENTRATION CONTOUR IN µg/L

NOTES
1. HISTORICAL GROUND WATER SAMPLE DATA USED TO AID IN CONTOURING.
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATE THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.

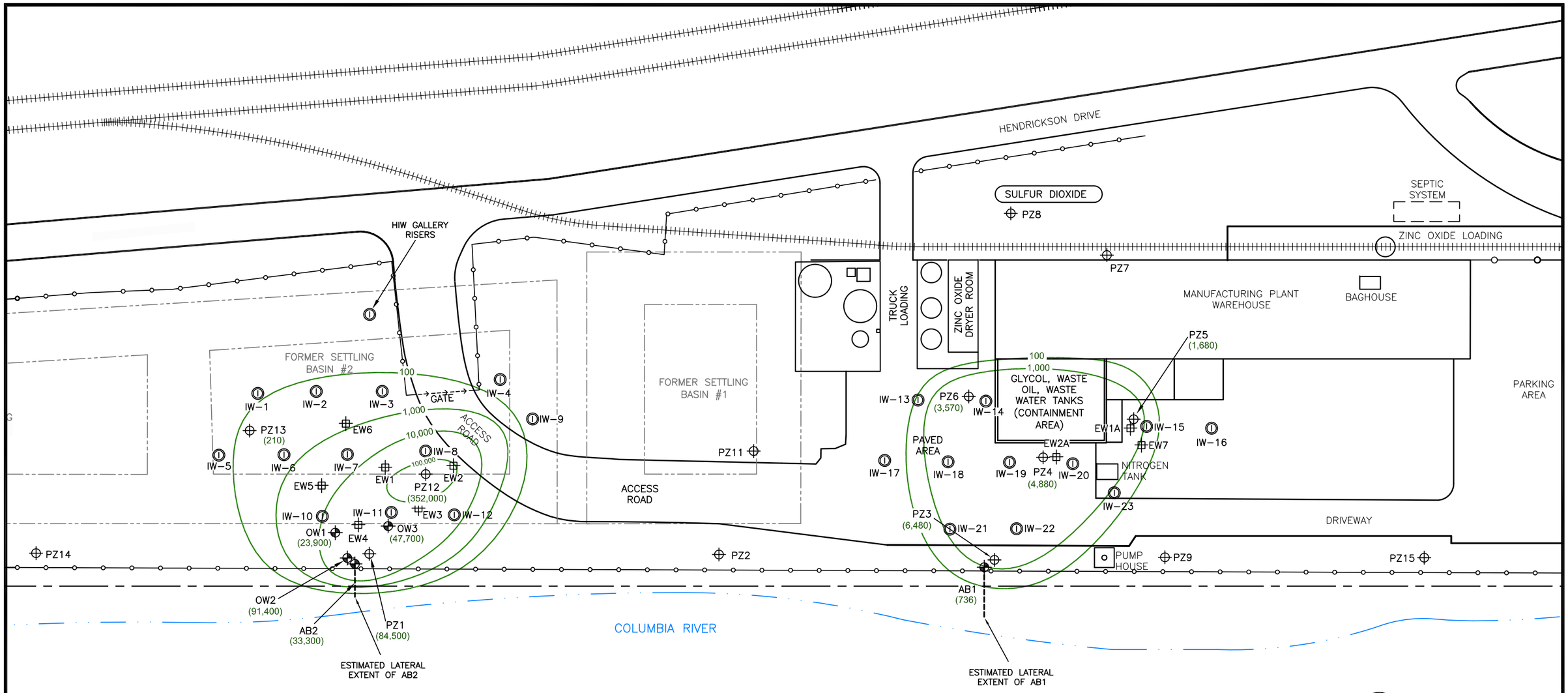
APPROXIMATE
0 60 120
SCALE IN FEET

TITLE
MARCH 21, 2012
ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 02/11/13	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4C



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- EXTRACTION WELL
- (736) JUNE 26, 2012 ZINC CONCENTRATION (µg/L)
- 1,000 ZINC ISOCONCENTRATION CONTOUR IN µg/L

NOTES
1. HISTORICAL GROUND WATER SAMPLE DATA USED TO AID IN CONTOURING.
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATE THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.

APPROXIMATE
0 60 120
SCALE IN FEET

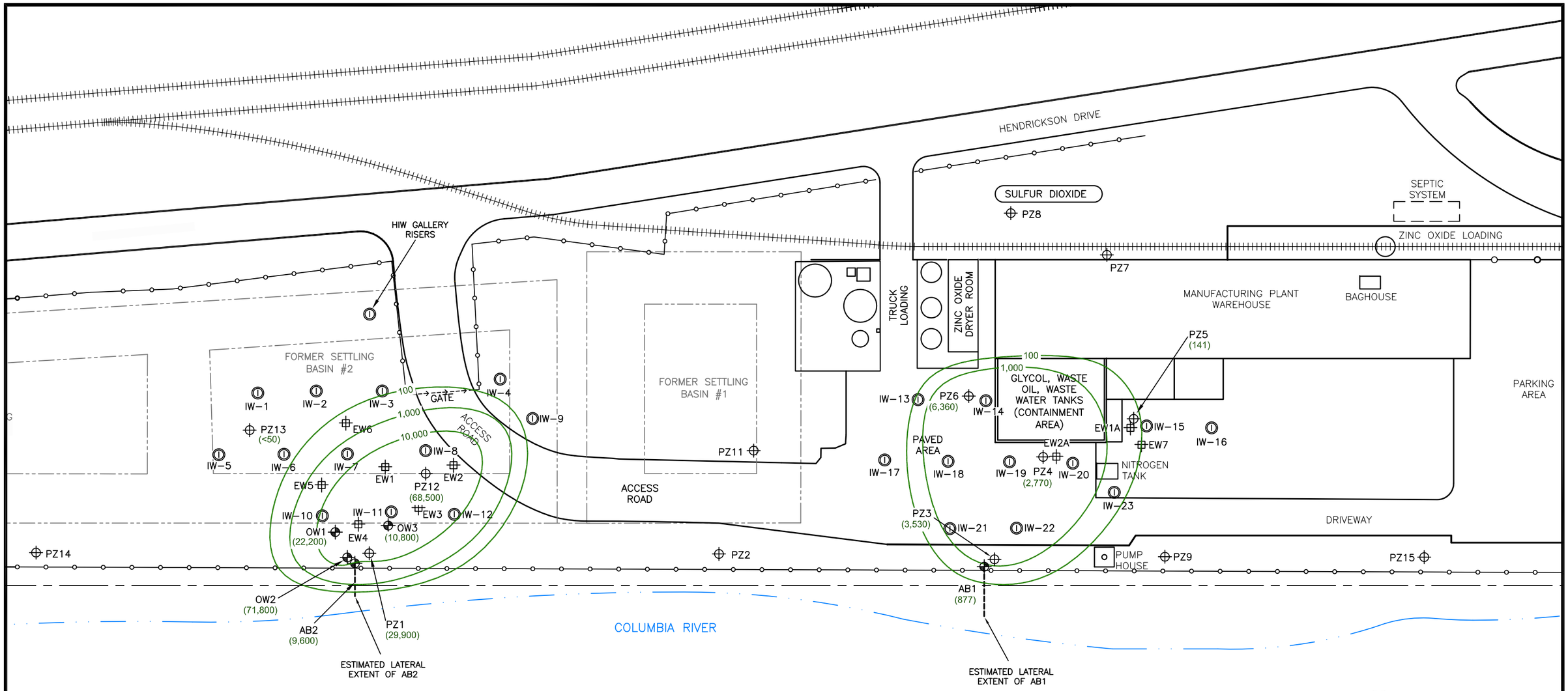
TITLE
JUNE 26, 2012
ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 02/11/13	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4D

S:\AAA-Master Projects\Clariant - CLR\CLR-045 Kalama, WA RA\2013 Work Plan\November GWM Update\Figures.dwg, FIG.4D, 2/13/2013 8:35:36 AM, sdrury



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- EXTRACTION WELL
- (877) OCTOBER 31 – NOVEMBER 1, 2012 ZINC CONCENTRATION (µg/L)
- 1,000 ZINC ISOCONCENTRATION CONTOUR IN µg/L

NOTES
1. HISTORICAL GROUND WATER SAMPLE DATA USED TO AID IN CONTOURING.
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATE THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION.

APPROXIMATE
0 60 120
SCALE IN FEET

TITLE
OCTOBER 31 - NOVEMBER 1, 2012
ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
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704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 02/11/13	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 4E

Appendix A
Laboratory Analytical Data Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Nashville
2960 Foster Creighton Drive
Nashville, TN 37204
Tel: (615)726-0177

TestAmerica Job ID: 490-10450-1
TestAmerica Sample Delivery Group: CLR.045
Client Project/Site: Clariant Kalama

For:
Hart & Hickman, PC
2923 S Tryon Street
Suite 100
Charlotte, North Carolina 28203

Attn: Mr. Scott Drury

Authorized for release by:
11/12/2012 10:42:11 AM

Ken Hayes
Project Manager I
ken.hayes@testamericainc.com

Table of Contents

Sample Summary

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
490-10450-1	PZ1	Water	10/31/12 13:40	11/02/12 08:00
490-10450-2	PZ3	Water	10/31/12 10:30	11/02/12 08:00
490-10450-3	PZ4	Water	10/31/12 09:45	11/02/12 08:00
490-10450-4	PZ5	Water	10/31/12 09:05	11/02/12 08:00
490-10450-5	PZ6	Water	11/01/12 09:20	11/02/12 08:00
490-10450-6	PZ12	Water	11/01/12 10:15	11/02/12 08:00
490-10450-7	PZ13	Water	11/01/12 11:45	11/02/12 08:00
490-10450-8	OW1	Water	10/31/12 14:55	11/02/12 08:00
490-10450-9	OW2	Water	10/31/12 15:40	11/02/12 08:00
490-10450-10	OW3	Water	10/31/12 14:15	11/02/12 08:00
490-10450-11	AB1	Water	10/31/12 11:05	11/02/12 08:00
490-10450-12	AB2	Water	10/31/12 12:55	11/02/12 08:00
490-10450-13	River	Water	11/01/12 10:30	11/02/12 08:00

Job ID: 490-10450-1

Laboratory: TestAmerica Nashville

Narrative

Job Narrative
490-10450-1

Comments
No additional comments.

Receipt
The samples were received on 11/2/2012 8:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperatures of the 3 coolers at receipt time were 2.7º C, 3.3º C and 4.9º C.

HPLC
Method(s) 9056A: The following samples were received and analyzed outside of analytical holding. AB1 (490-10450-11), AB2 (490-10450-12), PZ1 (490-10450-1), PZ3 (490-10450-2), PZ4 (490-10450-3), PZ5 (490-10450-4).

Method(s) 9056A: The following sample was received with insufficient time remaining to perform the analysis within holding time: OW3 (490-10450-10).

No other analytical or quality issues were noted.

Metals
Method(s) 6010B: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for batch 490-33242 were outside control limits for Na. The associated laboratory control sample (LCS) recovery met acceptance criteria.

No other analytical or quality issues were noted.

General Chemistry
Method(s) SM 4500 S2 D: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for batch 34849 were outside control limits low. The associated laboratory control sample (LCS) recovery met acceptance criteria.

No other analytical or quality issues were noted.

Qualifiers

Metals

Qualifier	Qualifier Description
F	MS or MSD exceeds the control limits

General Chemistry

Qualifier	Qualifier Description
F	MS or MSD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
RER	Relative error ratio
DER	Duplicate error ratio (normalized absolute difference)
DLC	Decision level concentration
RL	Reporting Limit or Requested Limit (Radiochemistry only)

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ1
Date Collected: 10/31/12 13:40
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-1
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**2.01**		1.00		mg/L			11/03/12 12:45	1
Sulfate	**73.1**		1.00		mg/L			11/03/12 12:45	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 10:40	1
Cadmium	**0.00300**		0.00100		mg/L		11/03/12 07:22	11/05/12 10:40	1
Calcium	**4.78**		1.00		mg/L		11/03/12 07:22	11/05/12 10:40	1
Iron	ND		0.100		mg/L		11/03/12 07:22	11/05/12 10:40	1
Magnesium	**1.78**		1.00		mg/L		11/03/12 07:22	11/05/12 10:40	1
Manganese	**0.0779**		0.0150		mg/L		11/03/12 07:22	11/05/12 10:40	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 10:40	1
Sodium	**10.5**		1.00		mg/L		11/03/12 07:22	11/05/12 10:40	1
Zinc	**29.9**		5.00		mg/L		11/03/12 07:22	11/05/12 11:54	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**18.2**		10.0		mg/L			11/02/12 21:52	1
Bicarbonate Alkalinity as CaCO3	**18.2**		10.0		mg/L			11/02/12 21:52	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 21:52	1
Nitrate Nitrite as N	**2.26**		0.100		mg/L			11/06/12 13:04	1
Orthophosphate as P	**0.207**		0.100		mg/L			11/02/12 15:21	1
Sulfide	ND		0.100		mg/L			11/07/12 12:05	1
Silica	**52.8**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ3
Date Collected: 10/31/12 10:30
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-2
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**3.18**		1.00		mg/L			11/03/12 13:04	1
Sulfate	**98.1**		5.00		mg/L			11/03/12 13:23	5

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 10:43	1
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 10:43	1
Calcium	**9.74**		1.00		mg/L		11/03/12 07:22	11/05/12 10:43	1
Iron	ND		0.100		mg/L		11/03/12 07:22	11/05/12 10:43	1
Magnesium	**2.65**		1.00		mg/L		11/03/12 07:22	11/05/12 10:43	1
Manganese	ND		0.0150		mg/L		11/03/12 07:22	11/05/12 10:43	1
Potassium	**1.53**		1.00		mg/L		11/03/12 07:22	11/05/12 10:43	1
Sodium	**26.8**		1.00		mg/L		11/03/12 07:22	11/05/12 10:43	1
Zinc	**3.53**		0.500		mg/L		11/03/12 07:22	11/05/12 11:58	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**44.2**		10.0		mg/L			11/02/12 22:07	1
Bicarbonate Alkalinity as CaCO3	**44.2**		10.0		mg/L			11/02/12 22:07	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:07	1
Nitrate Nitrite as N	**0.696**		0.100		mg/L			11/06/12 13:05	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:21	1
Sulfide	ND		0.100		mg/L			11/07/12 12:06	1
Silica	**49.5**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ4
Date Collected: 10/31/12 09:45
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-3
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**3.36**		1.00		mg/L			11/03/12 13:42	1
Sulfate	**129**		5.00		mg/L			11/03/12 14:02	5

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 10:47	1
Cadmium	**0.0215**		0.00100		mg/L		11/03/12 07:22	11/05/12 10:47	1
Calcium	**7.30**		1.00		mg/L		11/03/12 07:22	11/05/12 10:47	1
Iron	ND		0.100		mg/L		11/03/12 07:22	11/05/12 10:47	1
Magnesium	**6.07**		1.00		mg/L		11/03/12 07:22	11/05/12 10:47	1
Manganese	ND		0.0150		mg/L		11/03/12 07:22	11/05/12 10:47	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 10:47	1
Sodium	**34.9**		1.00		mg/L		11/03/12 07:22	11/05/12 10:47	1
Zinc	**2.77**		0.250		mg/L		11/03/12 07:22	11/05/12 12:01	5

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**27.3**		10.0		mg/L			11/02/12 22:11	1
Bicarbonate Alkalinity as CaCO3	**27.3**		10.0		mg/L			11/02/12 22:11	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:11	1
Nitrate Nitrite as N	**0.779**		0.100		mg/L			11/06/12 13:06	1
Orthophosphate as P	**0.241**		0.100		mg/L			11/02/12 15:21	1
Sulfide	ND		0.100		mg/L			11/07/12 12:07	1
Silica	**57.2**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ5
Date Collected: 10/31/12 09:05
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-4
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**1.14**		1.00		mg/L			11/03/12 14:21	1
Sulfate	**17.8**		1.00		mg/L			11/03/12 14:21	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 10:50	1
Cadmium	**0.00180**		0.00100		mg/L		11/03/12 07:22	11/05/12 10:50	1
Calcium	**5.04**		1.00		mg/L		11/03/12 07:22	11/05/12 10:50	1
Iron	**1.36**		0.100		mg/L		11/03/12 07:22	11/05/12 10:50	1
Magnesium	**1.90**		1.00		mg/L		11/03/12 07:22	11/05/12 10:50	1
Manganese	**0.208**		0.0150		mg/L		11/03/12 07:22	11/05/12 10:50	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 10:50	1
Sodium	**4.44**		1.00		mg/L		11/03/12 07:22	11/05/12 10:50	1
Zinc	**0.141**		0.0500		mg/L		11/03/12 07:22	11/05/12 10:50	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**11.5**		10.0		mg/L			11/02/12 22:17	1
Bicarbonate Alkalinity as CaCO3	**11.5**		10.0		mg/L			11/02/12 22:17	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:17	1
Nitrate Nitrite as N	ND		0.100		mg/L			11/06/12 13:07	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:21	1
Sulfide	ND		0.100		mg/L			11/07/12 12:08	1
Silica	**23.8**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ6
Date Collected: 11/01/12 09:20
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-5
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	5.34		1.00		mg/L			11/03/12 14:40	1
Sulfate	4720		50.0		mg/L			11/03/12 14:59	50

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	53.7		0.100		mg/L		11/03/12 07:22	11/05/12 10:53	1
Cadmium	0.00220		0.00100		mg/L		11/03/12 07:22	11/05/12 10:53	1
Calcium	116		1.00		mg/L		11/03/12 07:22	11/05/12 10:53	1
Iron	195		0.100		mg/L		11/03/12 07:22	11/05/12 10:53	1
Magnesium	44.7		1.00		mg/L		11/03/12 07:22	11/05/12 10:53	1
Manganese	4.71		0.0150		mg/L		11/03/12 07:22	11/05/12 10:53	1
Potassium	1.15		1.00		mg/L		11/03/12 07:22	11/05/12 10:53	1
Sodium	20.3		1.00		mg/L		11/03/12 07:22	11/05/12 10:53	1
Zinc	6.36		0.500		mg/L		11/03/12 07:22	11/05/12 12:04	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	ND		10.0		mg/L			11/02/12 22:19	1
Bicarbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:19	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:19	1
Nitrate Nitrite as N	ND		0.100		mg/L			11/07/12 13:42	1
Orthophosphate as P	ND		2.00		mg/L			11/02/12 15:21	20
Sulfide	ND		0.100		mg/L			11/07/12 12:09	1
Silica	136		5.00		mg/L			11/08/12 14:21	5

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ12
Date Collected: 11/01/12 10:15
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-6
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**2.14**		1.00		mg/L			11/03/12 15:18	1
Sulfate	**687**		20.0		mg/L			11/03/12 15:38	20

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**0.728**		0.100		mg/L		11/03/12 07:22	11/05/12 11:08	1
Cadmium	**0.00100**		0.00100		mg/L		11/03/12 07:22	11/05/12 11:08	1
Calcium	**132**		1.00		mg/L		11/03/12 07:22	11/05/12 11:08	1
Iron	**10.1**		0.100		mg/L		11/03/12 07:22	11/05/12 11:08	1
Magnesium	**10.5**		1.00		mg/L		11/03/12 07:22	11/05/12 11:08	1
Manganese	**1.44**		0.0150		mg/L		11/03/12 07:22	11/05/12 11:08	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 11:08	1
Sodium	**16.4**		1.00		mg/L		11/03/12 07:22	11/05/12 11:08	1
Zinc	**68.5**		5.00		mg/L		11/03/12 07:22	11/05/12 12:08	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	ND		10.0		mg/L			11/02/12 22:22	1
Bicarbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:22	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:22	1
Nitrate Nitrite as N	**0.275**		0.100		mg/L			11/07/12 13:44	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:22	1
Sulfide	ND		0.100		mg/L			11/07/12 12:09	1
Silica	**76.3**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ13
Date Collected: 11/01/12 11:45
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-7
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**3.39**		1.00		mg/L			11/03/12 16:35	1
Sulfate	**194**		5.00		mg/L			11/03/12 16:54	5

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:11	1
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 11:11	1
Calcium	**82.6**		1.00		mg/L		11/03/12 07:22	11/05/12 11:11	1
Iron	**1.64**		0.100		mg/L		11/03/12 07:22	11/05/12 11:11	1
Magnesium	**8.65**		1.00		mg/L		11/03/12 07:22	11/05/12 11:11	1
Manganese	**0.192**		0.0150		mg/L		11/03/12 07:22	11/05/12 11:11	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 11:11	1
Sodium	**10.1**		1.00		mg/L		11/03/12 07:22	11/05/12 11:11	1
Zinc	ND		0.0500		mg/L		11/03/12 07:22	11/05/12 11:11	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**75.8**		10.0		mg/L			11/02/12 22:27	1
Bicarbonate Alkalinity as CaCO3	**75.8**		10.0		mg/L			11/02/12 22:27	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:27	1
Nitrate Nitrite as N	**0.120**		0.100		mg/L			11/07/12 13:45	1
Orthophosphate as P	ND		2.00		mg/L			11/02/12 15:22	20
Sulfide	**3.11**		0.100		mg/L			11/07/12 12:10	1
Silica	**45.2**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: OW1
Date Collected: 10/31/12 14:55
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-8
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**2.08**		1.00		mg/L			11/03/12 17:14	1
Sulfate	**525**		20.0		mg/L			11/03/12 17:33	20

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:15	1
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 11:15	1
Calcium	**154**		1.00		mg/L		11/03/12 07:22	11/05/12 11:15	1
Iron	**0.808**		0.100		mg/L		11/03/12 07:22	11/05/12 11:15	1
Magnesium	**2.83**		1.00		mg/L		11/03/12 07:22	11/05/12 11:15	1
Manganese	**0.881**		0.0150		mg/L		11/03/12 07:22	11/05/12 11:15	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 11:15	1
Sodium	**13.3**		1.00		mg/L		11/03/12 07:22	11/05/12 11:15	1
Zinc	**22.2**		5.00		mg/L		11/03/12 07:22	11/05/12 12:11	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**32.8**		10.0		mg/L			11/02/12 22:32	1
Bicarbonate Alkalinity as CaCO3	**32.8**		10.0		mg/L			11/02/12 22:32	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:32	1
Nitrate Nitrite as N	ND		0.100		mg/L			11/06/12 13:10	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:33	1
Sulfide	ND		0.100		mg/L			11/07/12 12:10	1
Silica	**40.6**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: OW2
Date Collected: 10/31/12 15:40
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-9
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**2.77**		1.00		mg/L			11/03/12 13:39	1
Sulfate	**508**		20.0		mg/L			11/03/12 13:59	20

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:18	1
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 11:18	1
Calcium	**104**		1.00		mg/L		11/03/12 07:22	11/05/12 11:18	1
Iron	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:18	1
Magnesium	**9.20**		1.00		mg/L		11/03/12 07:22	11/05/12 11:18	1
Manganese	**2.75**		0.0150		mg/L		11/03/12 07:22	11/05/12 11:18	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 11:18	1
Sodium	**12.1**		1.00		mg/L		11/03/12 07:22	11/05/12 11:18	1
Zinc	**71.8**		5.00		mg/L		11/03/12 07:22	11/05/12 12:15	100

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**14.9**		10.0		mg/L			11/02/12 22:48	1
Bicarbonate Alkalinity as CaCO3	**14.9**		10.0		mg/L			11/02/12 22:48	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:48	1
Nitrate Nitrite as N	ND		0.100		mg/L			11/06/12 13:11	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:33	1
Sulfide	ND		0.100		mg/L			11/07/12 12:11	1
Silica	**52.8**		1.00		mg/L			11/08/12 13:19	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: OW3
Date Collected: 10/31/12 14:15
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-10
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	1.88		1.00		mg/L			11/03/12 14:19	1
Sulfate	426		10.0		mg/L			11/03/12 14:40	10

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	0.498		0.100		mg/L		11/03/12 07:22	11/05/12 11:22	1
Cadmium	0.00350		0.00100		mg/L		11/03/12 07:22	11/05/12 11:22	1
Calcium	87.0		1.00		mg/L		11/03/12 07:22	11/05/12 11:22	1
Iron	0.804		0.100		mg/L		11/03/12 07:22	11/05/12 11:22	1
Magnesium	6.03		1.00		mg/L		11/03/12 07:22	11/05/12 11:22	1
Manganese	1.68		0.0150		mg/L		11/03/12 07:22	11/05/12 11:22	1
Potassium	1.48		1.00		mg/L		11/03/12 07:22	11/05/12 11:22	1
Sodium	14.2		1.00		mg/L		11/03/12 07:22	11/05/12 11:22	1
Zinc	10.8		0.500		mg/L		11/03/12 07:22	11/05/12 12:18	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	ND		10.0		mg/L			11/02/12 22:52	1
Bicarbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:52	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:52	1
Nitrate Nitrite as N	0.578		0.100		mg/L			11/06/12 13:12	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:33	1
Sulfide	ND		0.100		mg/L			11/07/12 12:12	1
Silica	55.9		1.00		mg/L			11/08/12 13:26	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: AB1
Date Collected: 10/31/12 11:05
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-11
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**2.83**		1.00		mg/L			11/03/12 15:00	1
Sulfate	**42.4**		1.00		mg/L			11/03/12 15:00	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:25	1
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 11:25	1
Calcium	**10.1**		1.00		mg/L		11/03/12 07:22	11/05/12 11:25	1
Iron	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:25	1
Magnesium	**2.63**		1.00		mg/L		11/03/12 07:22	11/05/12 11:25	1
Manganese	ND		0.0150		mg/L		11/03/12 07:22	11/05/12 11:25	1
Potassium	**2.00**		1.00		mg/L		11/03/12 07:22	11/05/12 11:25	1
Sodium	**34.9**		1.00		mg/L		11/03/12 07:22	11/05/12 11:25	1
Zinc	**0.877**		0.0500		mg/L		11/03/12 07:22	11/05/12 11:25	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**47.9**		10.0		mg/L			11/02/12 22:57	1
Bicarbonate Alkalinity as CaCO3	**47.9**		10.0		mg/L			11/02/12 22:57	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 22:57	1
Nitrate Nitrite as N	**0.557**		0.100		mg/L			11/06/12 13:13	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:33	1
Sulfide	ND		0.100		mg/L			11/07/12 12:12	1
Silica	**45.2**		1.00		mg/L			11/08/12 13:26	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: AB2
Date Collected: 10/31/12 12:55
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-12
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**1.94**		1.00		mg/L			11/03/12 15:20	1
Sulfate	**12.4**		1.00		mg/L			11/03/12 15:20	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:28	1
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 11:28	1
Calcium	**4.76**		1.00		mg/L		11/03/12 07:22	11/05/12 11:28	1
Iron	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:28	1
Magnesium	**1.18**		1.00		mg/L		11/03/12 07:22	11/05/12 11:28	1
Manganese	**0.0155**		0.0150		mg/L		11/03/12 07:22	11/05/12 11:28	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 11:28	1
Sodium	**8.99**		1.00		mg/L		11/03/12 07:22	11/05/12 11:28	1
Zinc	**9.60**		0.500		mg/L		11/03/12 07:22	11/05/12 12:22	10

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**29.8**		10.0		mg/L			11/02/12 23:02	1
Bicarbonate Alkalinity as CaCO3	**29.8**		10.0		mg/L			11/02/12 23:02	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 23:02	1
Nitrate Nitrite as N	**0.725**		0.100		mg/L			11/06/12 13:13	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:33	1
Sulfide	ND		0.100		mg/L			11/07/12 12:14	1
Silica	**48.7**		1.00		mg/L			11/08/12 13:26	1

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: River
Date Collected: 11/01/12 10:30
Date Received: 11/02/12 08:00

Lab Sample ID: 490-10450-13
Matrix: Water

Method: 9056A - Anions, Ion Chromatography

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**2.55**		1.00		mg/L			11/03/12 15:40	1
Sulfate	**6.98**		1.00		mg/L			11/03/12 15:40	1

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 11:32	1
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 11:32	1
Calcium	**11.2**		1.00		mg/L		11/03/12 07:22	11/05/12 11:32	1
Iron	**0.121**		0.100		mg/L		11/03/12 07:22	11/05/12 11:32	1
Magnesium	**3.26**		1.00		mg/L		11/03/12 07:22	11/05/12 11:32	1
Manganese	**0.0157**		0.0150		mg/L		11/03/12 07:22	11/05/12 11:32	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 11:32	1
Sodium	**4.48**		1.00		mg/L		11/03/12 07:22	11/05/12 11:32	1
Zinc	ND		0.0500		mg/L		11/03/12 07:22	11/05/12 11:32	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	**41.8**		10.0		mg/L			11/02/12 23:08	1
Bicarbonate Alkalinity as CaCO3	**41.8**		10.0		mg/L			11/02/12 23:08	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 23:08	1
Nitrate Nitrite as N	**0.220**		0.100		mg/L			11/07/12 13:48	1
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:33	1
Sulfide	ND		0.100		mg/L			11/07/12 12:15	1
Silica	**12.0**		1.00		mg/L			11/08/12 13:26	1

Method: 9056A - Anions, Ion Chromatography

Lab Sample ID: MB 490-33293/2
Matrix: Water
Analysis Batch: 33293

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		1.00		mg/L			11/03/12 10:07	1
Sulfate	ND		1.00		mg/L			11/03/12 10:07	1

Lab Sample ID: LCS 490-33293/3
Matrix: Water
Analysis Batch: 33293

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	50.0	48.16		mg/L		96	90 - 110
Sulfate	50.0	51.82		mg/L		104	90 - 110

Lab Sample ID: LCSD 490-33293/4
Matrix: Water
Analysis Batch: 33293

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	50.0	49.06		mg/L		98	90 - 110	2	20
Sulfate	50.0	51.61		mg/L		103	90 - 110	0	20

Lab Sample ID: MB 490-33305/2
Matrix: Water
Analysis Batch: 33305

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	ND		1.00		mg/L			11/03/12 10:08	1
Sulfate	ND		1.00		mg/L			11/03/12 10:08	1

Lab Sample ID: LCS 490-33305/3
Matrix: Water
Analysis Batch: 33305

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	50.0	50.24		mg/L		100	90 - 110
Sulfate	50.0	50.37		mg/L		101	90 - 110

Lab Sample ID: LCSD 490-33305/4
Matrix: Water
Analysis Batch: 33305

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	50.0	50.25		mg/L		101	90 - 110	0	20
Sulfate	50.0	50.30		mg/L		101	90 - 110	0	20

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 490-33242/1-A
Matrix: Water
Analysis Batch: 33598

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 33242

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		0.100		mg/L		11/03/12 07:22	11/05/12 09:54	1

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: MB 490-33242/1-A — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33598 — **Prep Batch: 33242**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.00100		mg/L		11/03/12 07:22	11/05/12 09:54	1
Calcium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 09:54	1
Iron	ND		0.100		mg/L		11/03/12 07:22	11/05/12 09:54	1
Magnesium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 09:54	1
Manganese	ND		0.0150		mg/L		11/03/12 07:22	11/05/12 09:54	1
Potassium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 09:54	1
Sodium	ND		1.00		mg/L		11/03/12 07:22	11/05/12 09:54	1
Zinc	ND		0.0500		mg/L		11/03/12 07:22	11/05/12 09:54	1

Lab Sample ID: LCS 490-33242/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33598 — **Prep Batch: 33242**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	2.00	2.159		mg/L		108	80 - 120
Cadmium	0.0500	0.05370		mg/L		107	80 - 120
Calcium	5.00	5.253		mg/L		105	80 - 120
Iron	1.00	1.087		mg/L		109	80 - 120
Magnesium	5.00	5.252		mg/L		105	80 - 120
Manganese	0.500	0.5407		mg/L		108	80 - 120
Potassium	5.00	4.902		mg/L		98	80 - 120
Sodium	5.00	5.386		mg/L		108	80 - 120
Zinc	0.500	0.5180		mg/L		104	80 - 120

Lab Sample ID: 490-10435-D-7-B MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33598 — **Prep Batch: 33242**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	ND		2.00	2.072		mg/L		104	75 - 125
Cadmium	ND		0.0500	0.05290		mg/L		106	75 - 125
Calcium	2.72		5.00	7.697		mg/L		100	75 - 125
Iron	ND		1.00	1.075		mg/L		108	75 - 125
Magnesium	ND		5.00	5.544		mg/L		104	75 - 125
Manganese	ND		0.500	0.5250		mg/L		105	75 - 125
Potassium	ND		5.00	5.033		mg/L		101	75 - 125
Sodium	18.1		5.00	15.67	F	mg/L		-49	75 - 125
Zinc	ND		0.500	0.5145		mg/L		103	75 - 125

Lab Sample ID: 490-10435-D-7-C MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33598 — **Prep Batch: 33242**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	ND		2.00	2.045		mg/L		102	75 - 125	1	20
Cadmium	ND		0.0500	0.05150		mg/L		103	75 - 125	3	20
Calcium	2.72		5.00	7.617		mg/L		98	75 - 125	1	20
Iron	ND		1.00	1.047		mg/L		105	75 - 125	3	20
Magnesium	ND		5.00	5.390		mg/L		101	75 - 125	3	20
Manganese	ND		0.500	0.5140		mg/L		103	75 - 125	2	20

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 490-10435-D-7-C MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33598 — **Prep Batch: 33242**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Potassium	ND		5.00	4.879		mg/L		98	75 - 125	3	20
Sodium	18.1		5.00	16.64	F	mg/L		-30	75 - 125	6	20
Zinc	ND		0.500	0.5007		mg/L		100	75 - 125	3	20

Method: SM 2320B - Alkalinity

Lab Sample ID: MB 490-33250/3 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33250

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Alkalinity	ND		10.0		mg/L			11/02/12 21:40	1
Bicarbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 21:40	1
Carbonate Alkalinity as CaCO3	ND		10.0		mg/L			11/02/12 21:40	1

Lab Sample ID: LCS 490-33250/4 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33250

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity	100	100.3		mg/L		100	90 - 110

Lab Sample ID: 490-10450-1 MS — **Client Sample ID: PZ1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33250

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Alkalinity	18.2		100	123.8		mg/L		106	80 - 120

Lab Sample ID: 490-10450-1 DU — **Client Sample ID: PZ1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33250

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Alkalinity	18.2		20.41		mg/L		12	20
Bicarbonate Alkalinity as CaCO3	18.2		20.41		mg/L		12	20
Carbonate Alkalinity as CaCO3	ND		ND		mg/L		NC	20

Lab Sample ID: 490-10450-13 DU — **Client Sample ID: River**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33250

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Alkalinity	41.8		41.00		mg/L		2	20
Bicarbonate Alkalinity as CaCO3	41.8		41.00		mg/L		2	20
Carbonate Alkalinity as CaCO3	ND		ND		mg/L		NC	20

Method: SM 4500 NO3 F - Nitrogen, Nitrate

Lab Sample ID: MB 490-33925/4
Matrix: Water
Analysis Batch: 33925

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.100		mg/L			11/06/12 12:51	1

Lab Sample ID: LCS 490-33925/5
Matrix: Water
Analysis Batch: 33925

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	6.00	6.196		mg/L		103	90 - 110

Lab Sample ID: LCSD 490-33925/6
Matrix: Water
Analysis Batch: 33925

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	6.00	6.119		mg/L		102	90 - 110	1	20

Lab Sample ID: 490-10557-V-1 MS
Matrix: Water
Analysis Batch: 33925

Client Sample ID: Matrix Spike
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	0.339		6.00	6.273		mg/L		99	90 - 110

Lab Sample ID: 490-10557-V-1 MSD
Matrix: Water
Analysis Batch: 33925

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	0.339		6.00	6.107		mg/L		96	90 - 110	3	20

Lab Sample ID: 490-9879-A-1 DU
Matrix: Water
Analysis Batch: 33925

Client Sample ID: Duplicate
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Nitrate Nitrite as N	0.538		0.5440		mg/L		1	20

Lab Sample ID: MB 490-34245/4
Matrix: Water
Analysis Batch: 34245

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Nitrate Nitrite as N	ND		0.100		mg/L			11/07/12 13:39	1

Lab Sample ID: LCS 490-34245/5
Matrix: Water
Analysis Batch: 34245

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Nitrate Nitrite as N	6.00	6.290		mg/L		105	90 - 110

Method: SM 4500 NO3 F - Nitrogen, Nitrate (Continued)

Lab Sample ID: LCSD 490-34245/6
Matrix: Water
Analysis Batch: 34245

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N			6.00	6.279		mg/L		105	90 - 110	0	20

Lab Sample ID: 490-10450-13 MS
Matrix: Water
Analysis Batch: 34245

Client Sample ID: River
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Nitrate Nitrite as N	0.220		6.00	5.791		mg/L		93	90 - 110		

Lab Sample ID: 490-10450-13 MSD
Matrix: Water
Analysis Batch: 34245

Client Sample ID: River
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Nitrate Nitrite as N	0.220		6.00	5.812		mg/L		93	90 - 110	0	20

Lab Sample ID: 490-10450-5 DU
Matrix: Water
Analysis Batch: 34245

Client Sample ID: PZ6
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Nitrate Nitrite as N	ND			ND		mg/L				NC	20

Method: SM 4500 P E - Orthophosphate

Lab Sample ID: MB 490-33258/27
Matrix: Water
Analysis Batch: 33258

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:33	1

Lab Sample ID: MB 490-33258/5
Matrix: Water
Analysis Batch: 33258

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Orthophosphate as P	ND		0.100		mg/L			11/02/12 15:21	1

Lab Sample ID: LCS 490-33258/6
Matrix: Water
Analysis Batch: 33258

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Orthophosphate as P			0.250	0.2538		mg/L		102	90 - 110		

Method: SM 4500 P E - Orthophosphate (Continued)

Lab Sample ID: 490-10450-1 MS — **Client Sample ID: PZ1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33258

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Orthophosphate as P	0.207		0.250	0.4631		mg/L		102	72 - 129		

Lab Sample ID: 490-10450-1 MSD — **Client Sample ID: PZ1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33258

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Orthophosphate as P	0.207		0.250	0.4551		mg/L		99	72 - 129	2	20

Lab Sample ID: 490-10450-1 DU — **Client Sample ID: PZ1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33258

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Orthophosphate as P	0.207		0.2064		mg/L		0.4	20

Lab Sample ID: 490-10450-12 DU — **Client Sample ID: AB2**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 33258

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Orthophosphate as P	ND		ND		mg/L		NC	20

Method: SM 4500 S2 D - Sulfide, Total

Lab Sample ID: MB 490-34849/3 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34849

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide	ND		0.100		mg/L			11/07/12 12:01	1

Lab Sample ID: LCS 490-34849/4 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34849

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Sulfide	1.00	1.056		mg/L		105	90 - 110		

Lab Sample ID: LCSD 490-34849/5 — **Client Sample ID: Lab Control Sample Dup**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34849

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Sulfide	1.00	1.058		mg/L		106	90 - 110	0	10

Method: SM 4500 S2 D - Sulfide, Total (Continued)

Lab Sample ID: 490-10446-B-4 MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34849

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide	ND		1.00	ND	F	mg/L		0	70 - 130

Lab Sample ID: 490-10446-B-4 MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34849

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Sulfide	ND		1.00	ND	F	mg/L		0	70 - 130	NC	50

Lab Sample ID: 490-10557-AA-1 DU — **Client Sample ID: Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34849

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Sulfide	ND		ND		mg/L		NC	20

Method: SM4500 SiO2 C - Silica, Molybdosilicate Method

Lab Sample ID: MB 490-34608/6 — **Client Sample ID: Method Blank**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34608

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Silica	ND		1.00		mg/L			11/08/12 13:09	1

Lab Sample ID: LCS 490-34608/5 — **Client Sample ID: Lab Control Sample**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34608

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Silica	25.0	26.03		mg/L		104	90 - 110

Lab Sample ID: 490-10410-D-1 MS — **Client Sample ID: Matrix Spike**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34608

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Silica	59.3		25.0	79.35		mg/L		80	80 - 120

Lab Sample ID: 490-10410-D-1 MSD — **Client Sample ID: Matrix Spike Duplicate**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 34608

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Silica	59.3		25.0	79.35		mg/L		80	80 - 120	0	20

Method: SM4500 SiO2 C - Silica, Molybdosilicate Method (Continued)

Lab Sample ID: 490-10410-D-1 DU
Matrix: Water
Analysis Batch: 34608

Client Sample ID: Duplicate
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Silica	59.3			61.34		mg/L				3	20

HPLC/IC

Analysis Batch: 33293

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10450-1	PZ1	Total/NA	Water	9056A	
490-10450-2	PZ3	Total/NA	Water	9056A	
490-10450-2	PZ3	Total/NA	Water	9056A	
490-10450-3	PZ4	Total/NA	Water	9056A	
490-10450-3	PZ4	Total/NA	Water	9056A	
490-10450-4	PZ5	Total/NA	Water	9056A	
490-10450-5	PZ6	Total/NA	Water	9056A	
490-10450-5	PZ6	Total/NA	Water	9056A	
490-10450-6	PZ12	Total/NA	Water	9056A	
490-10450-6	PZ12	Total/NA	Water	9056A	
490-10450-7	PZ13	Total/NA	Water	9056A	
490-10450-7	PZ13	Total/NA	Water	9056A	
490-10450-8	OW1	Total/NA	Water	9056A	
490-10450-8	OW1	Total/NA	Water	9056A	
LCS 490-33293/3	Lab Control Sample	Total/NA	Water	9056A	
LCSD 490-33293/4	Lab Control Sample Dup	Total/NA	Water	9056A	
MB 490-33293/2	Method Blank	Total/NA	Water	9056A	

Analysis Batch: 33305

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10450-9	OW2	Total/NA	Water	9056A	
490-10450-9	OW2	Total/NA	Water	9056A	
490-10450-10	OW3	Total/NA	Water	9056A	
490-10450-10	OW3	Total/NA	Water	9056A	
490-10450-11	AB1	Total/NA	Water	9056A	
490-10450-12	AB2	Total/NA	Water	9056A	
490-10450-13	River	Total/NA	Water	9056A	
LCS 490-33305/3	Lab Control Sample	Total/NA	Water	9056A	
LCSD 490-33305/4	Lab Control Sample Dup	Total/NA	Water	9056A	
MB 490-33305/2	Method Blank	Total/NA	Water	9056A	

Metals

Prep Batch: 33242

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10435-D-7-B MS	Matrix Spike	Total/NA	Water	3010A	
490-10435-D-7-C MSD	Matrix Spike Duplicate	Total/NA	Water	3010A	
490-10450-1	PZ1	Total/NA	Water	3010A	
490-10450-2	PZ3	Total/NA	Water	3010A	
490-10450-3	PZ4	Total/NA	Water	3010A	
490-10450-4	PZ5	Total/NA	Water	3010A	
490-10450-5	PZ6	Total/NA	Water	3010A	
490-10450-6	PZ12	Total/NA	Water	3010A	
490-10450-7	PZ13	Total/NA	Water	3010A	
490-10450-8	OW1	Total/NA	Water	3010A	
490-10450-9	OW2	Total/NA	Water	3010A	
490-10450-10	OW3	Total/NA	Water	3010A	
490-10450-11	AB1	Total/NA	Water	3010A	
490-10450-12	AB2	Total/NA	Water	3010A	
490-10450-13	River	Total/NA	Water	3010A	
LCS 490-33242/2-A	Lab Control Sample	Total/NA	Water	3010A	
MB 490-33242/1-A	Method Blank	Total/NA	Water	3010A	

Metals (Continued)

Analysis Batch: 33598

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10435-D-7-B MS	Matrix Spike	Total/NA	Water	6010B	33242
490-10435-D-7-C MSD	Matrix Spike Duplicate	Total/NA	Water	6010B	33242
490-10450-1	PZ1	Total/NA	Water	6010B	33242
490-10450-1	PZ1	Total/NA	Water	6010B	33242
490-10450-2	PZ3	Total/NA	Water	6010B	33242
490-10450-2	PZ3	Total/NA	Water	6010B	33242
490-10450-3	PZ4	Total/NA	Water	6010B	33242
490-10450-3	PZ4	Total/NA	Water	6010B	33242
490-10450-4	PZ5	Total/NA	Water	6010B	33242
490-10450-5	PZ6	Total/NA	Water	6010B	33242
490-10450-5	PZ6	Total/NA	Water	6010B	33242
490-10450-6	PZ12	Total/NA	Water	6010B	33242
490-10450-6	PZ12	Total/NA	Water	6010B	33242
490-10450-7	PZ13	Total/NA	Water	6010B	33242
490-10450-8	OW1	Total/NA	Water	6010B	33242
490-10450-8	OW1	Total/NA	Water	6010B	33242
490-10450-9	OW2	Total/NA	Water	6010B	33242
490-10450-9	OW2	Total/NA	Water	6010B	33242
490-10450-10	OW3	Total/NA	Water	6010B	33242
490-10450-10	OW3	Total/NA	Water	6010B	33242
490-10450-11	AB1	Total/NA	Water	6010B	33242
490-10450-12	AB2	Total/NA	Water	6010B	33242
490-10450-12	AB2	Total/NA	Water	6010B	33242
490-10450-13	River	Total/NA	Water	6010B	33242
LCS 490-33242/2-A	Lab Control Sample	Total/NA	Water	6010B	33242
MB 490-33242/1-A	Method Blank	Total/NA	Water	6010B	33242

General Chemistry

Analysis Batch: 33250

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10450-1	PZ1	Total/NA	Water	SM 2320B	
490-10450-1 DU	PZ1	Total/NA	Water	SM 2320B	
490-10450-1 MS	PZ1	Total/NA	Water	SM 2320B	
490-10450-2	PZ3	Total/NA	Water	SM 2320B	
490-10450-3	PZ4	Total/NA	Water	SM 2320B	
490-10450-4	PZ5	Total/NA	Water	SM 2320B	
490-10450-5	PZ6	Total/NA	Water	SM 2320B	
490-10450-6	PZ12	Total/NA	Water	SM 2320B	
490-10450-7	PZ13	Total/NA	Water	SM 2320B	
490-10450-8	OW1	Total/NA	Water	SM 2320B	
490-10450-9	OW2	Total/NA	Water	SM 2320B	
490-10450-10	OW3	Total/NA	Water	SM 2320B	
490-10450-11	AB1	Total/NA	Water	SM 2320B	
490-10450-12	AB2	Total/NA	Water	SM 2320B	
490-10450-13	River	Total/NA	Water	SM 2320B	
490-10450-13 DU	River	Total/NA	Water	SM 2320B	
LCS 490-33250/4	Lab Control Sample	Total/NA	Water	SM 2320B	
MB 490-33250/3	Method Blank	Total/NA	Water	SM 2320B	

General Chemistry (Continued)

Analysis Batch: 33258

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10450-1	PZ1	Total/NA	Water	SM 4500 P E	
490-10450-1 DU	PZ1	Total/NA	Water	SM 4500 P E	
490-10450-1 MS	PZ1	Total/NA	Water	SM 4500 P E	
490-10450-1 MSD	PZ1	Total/NA	Water	SM 4500 P E	
490-10450-2	PZ3	Total/NA	Water	SM 4500 P E	
490-10450-3	PZ4	Total/NA	Water	SM 4500 P E	
490-10450-4	PZ5	Total/NA	Water	SM 4500 P E	
490-10450-5	PZ6	Total/NA	Water	SM 4500 P E	
490-10450-6	PZ12	Total/NA	Water	SM 4500 P E	
490-10450-7	PZ13	Total/NA	Water	SM 4500 P E	
490-10450-8	OW1	Total/NA	Water	SM 4500 P E	
490-10450-9	OW2	Total/NA	Water	SM 4500 P E	
490-10450-10	OW3	Total/NA	Water	SM 4500 P E	
490-10450-11	AB1	Total/NA	Water	SM 4500 P E	
490-10450-12	AB2	Total/NA	Water	SM 4500 P E	
490-10450-12 DU	AB2	Total/NA	Water	SM 4500 P E	
490-10450-13	River	Total/NA	Water	SM 4500 P E	
LCS 490-33258/6	Lab Control Sample	Total/NA	Water	SM 4500 P E	
MB 490-33258/27	Method Blank	Total/NA	Water	SM 4500 P E	
MB 490-33258/5	Method Blank	Total/NA	Water	SM 4500 P E	

Analysis Batch: 33925

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-9879-A-1 DU	Duplicate	Total/NA	Water	SM 4500 NO3 F	
490-10450-1	PZ1	Total/NA	Water	SM 4500 NO3 F	
490-10450-2	PZ3	Total/NA	Water	SM 4500 NO3 F	
490-10450-3	PZ4	Total/NA	Water	SM 4500 NO3 F	
490-10450-4	PZ5	Total/NA	Water	SM 4500 NO3 F	
490-10450-8	OW1	Total/NA	Water	SM 4500 NO3 F	
490-10450-9	OW2	Total/NA	Water	SM 4500 NO3 F	
490-10450-10	OW3	Total/NA	Water	SM 4500 NO3 F	
490-10450-11	AB1	Total/NA	Water	SM 4500 NO3 F	
490-10450-12	AB2	Total/NA	Water	SM 4500 NO3 F	
490-10557-V-1 MS	Matrix Spike	Total/NA	Water	SM 4500 NO3 F	
490-10557-V-1 MSD	Matrix Spike Duplicate	Total/NA	Water	SM 4500 NO3 F	
LCS 490-33925/5	Lab Control Sample	Total/NA	Water	SM 4500 NO3 F	
LCSD 490-33925/6	Lab Control Sample Dup	Total/NA	Water	SM 4500 NO3 F	
MB 490-33925/4	Method Blank	Total/NA	Water	SM 4500 NO3 F	

Analysis Batch: 34245

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10450-5	PZ6	Total/NA	Water	SM 4500 NO3 F	
490-10450-5 DU	PZ6	Total/NA	Water	SM 4500 NO3 F	
490-10450-6	PZ12	Total/NA	Water	SM 4500 NO3 F	
490-10450-7	PZ13	Total/NA	Water	SM 4500 NO3 F	
490-10450-13	River	Total/NA	Water	SM 4500 NO3 F	
490-10450-13 MS	River	Total/NA	Water	SM 4500 NO3 F	
490-10450-13 MSD	River	Total/NA	Water	SM 4500 NO3 F	
LCS 490-34245/5	Lab Control Sample	Total/NA	Water	SM 4500 NO3 F	
LCSD 490-34245/6	Lab Control Sample Dup	Total/NA	Water	SM 4500 NO3 F	
MB 490-34245/4	Method Blank	Total/NA	Water	SM 4500 NO3 F	

General Chemistry (Continued)

Analysis Batch: 34608

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10410-D-1 DU	Duplicate	Total/NA	Water	SM4500 SiO2 C	
490-10410-D-1 MS	Matrix Spike	Total/NA	Water	SM4500 SiO2 C	
490-10410-D-1 MSD	Matrix Spike Duplicate	Total/NA	Water	SM4500 SiO2 C	
490-10450-1	PZ1	Total/NA	Water	SM4500 SiO2 C	
490-10450-2	PZ3	Total/NA	Water	SM4500 SiO2 C	
490-10450-3	PZ4	Total/NA	Water	SM4500 SiO2 C	
490-10450-4	PZ5	Total/NA	Water	SM4500 SiO2 C	
490-10450-5	PZ6	Total/NA	Water	SM4500 SiO2 C	
490-10450-6	PZ12	Total/NA	Water	SM4500 SiO2 C	
490-10450-7	PZ13	Total/NA	Water	SM4500 SiO2 C	
490-10450-8	OW1	Total/NA	Water	SM4500 SiO2 C	
490-10450-9	OW2	Total/NA	Water	SM4500 SiO2 C	
490-10450-10	OW3	Total/NA	Water	SM4500 SiO2 C	
490-10450-11	AB1	Total/NA	Water	SM4500 SiO2 C	
490-10450-12	AB2	Total/NA	Water	SM4500 SiO2 C	
490-10450-13	River	Total/NA	Water	SM4500 SiO2 C	
LCS 490-34608/5	Lab Control Sample	Total/NA	Water	SM4500 SiO2 C	
MB 490-34608/6	Method Blank	Total/NA	Water	SM4500 SiO2 C	

Analysis Batch: 34849

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
490-10446-B-4 MS	Matrix Spike	Total/NA	Water	SM 4500 S2 D	
490-10446-B-4 MSD	Matrix Spike Duplicate	Total/NA	Water	SM 4500 S2 D	
490-10450-1	PZ1	Total/NA	Water	SM 4500 S2 D	
490-10450-2	PZ3	Total/NA	Water	SM 4500 S2 D	
490-10450-3	PZ4	Total/NA	Water	SM 4500 S2 D	
490-10450-4	PZ5	Total/NA	Water	SM 4500 S2 D	
490-10450-5	PZ6	Total/NA	Water	SM 4500 S2 D	
490-10450-6	PZ12	Total/NA	Water	SM 4500 S2 D	
490-10450-7	PZ13	Total/NA	Water	SM 4500 S2 D	
490-10450-8	OW1	Total/NA	Water	SM 4500 S2 D	
490-10450-9	OW2	Total/NA	Water	SM 4500 S2 D	
490-10450-10	OW3	Total/NA	Water	SM 4500 S2 D	
490-10450-11	AB1	Total/NA	Water	SM 4500 S2 D	
490-10450-12	AB2	Total/NA	Water	SM 4500 S2 D	
490-10450-13	River	Total/NA	Water	SM 4500 S2 D	
490-10557-AA-1 DU	Duplicate	Total/NA	Water	SM 4500 S2 D	
LCS 490-34849/4	Lab Control Sample	Total/NA	Water	SM 4500 S2 D	
LCSD 490-34849/5	Lab Control Sample Dup	Total/NA	Water	SM 4500 S2 D	
MB 490-34849/3	Method Blank	Total/NA	Water	SM 4500 S2 D	

Lab Chronicle

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ1

Lab Sample ID: 490-10450-1

Date Collected: 10/31/12 13:40

Matrix: Water

Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 12:45	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 10:40	BB	TAL NSH
Total/NA	Analysis	6010B		100	33598	11/05/12 11:54	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 21:52	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:21	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:04	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:05	SB	TAL NSH

Client Sample ID: PZ3

Lab Sample ID: 490-10450-2

Date Collected: 10/31/12 10:30

Matrix: Water

Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 13:04	KD	TAL NSH
Total/NA	Analysis	9056A		5	33293	11/03/12 13:23	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 10:43	BB	TAL NSH
Total/NA	Analysis	6010B		10	33598	11/05/12 11:58	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:07	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:21	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:05	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:06	SB	TAL NSH

Client Sample ID: PZ4

Lab Sample ID: 490-10450-3

Date Collected: 10/31/12 09:45

Matrix: Water

Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 13:42	KD	TAL NSH
Total/NA	Analysis	9056A		5	33293	11/03/12 14:02	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 10:47	BB	TAL NSH
Total/NA	Analysis	6010B		5	33598	11/05/12 12:01	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:11	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:21	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:06	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:07	SB	TAL NSH

Lab Chronicle

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: PZ5

Lab Sample ID: 490-10450-4

Date Collected: 10/31/12 09:05
Matrix: Water
Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 14:21	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 10:50	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:17	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:21	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:07	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:08	SB	TAL NSH

Client Sample ID: PZ6

Lab Sample ID: 490-10450-5

Date Collected: 11/01/12 09:20
Matrix: Water
Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 14:40	KD	TAL NSH
Total/NA	Analysis	9056A		50	33293	11/03/12 14:59	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 10:53	BB	TAL NSH
Total/NA	Analysis	6010B		10	33598	11/05/12 12:04	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		20	33258	11/02/12 15:21	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	34245	11/07/12 13:42	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		5	34608	11/08/12 14:21	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:09	SB	TAL NSH

Client Sample ID: PZ12

Lab Sample ID: 490-10450-6

Date Collected: 11/01/12 10:15
Matrix: Water
Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 15:18	KD	TAL NSH
Total/NA	Analysis	9056A		20	33293	11/03/12 15:38	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:08	BB	TAL NSH
Total/NA	Analysis	6010B		100	33598	11/05/12 12:08	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:22	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:22	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	34245	11/07/12 13:44	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:09	SB	TAL NSH

Client Sample ID: PZ13

Lab Sample ID: 490-10450-7

Date Collected: 11/01/12 11:45

Matrix: Water

Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 16:35	KD	TAL NSH
Total/NA	Analysis	9056A		5	33293	11/03/12 16:54	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:11	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:27	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		20	33258	11/02/12 15:22	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	34245	11/07/12 13:45	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:10	SB	TAL NSH

Client Sample ID: OW1

Lab Sample ID: 490-10450-8

Date Collected: 10/31/12 14:55

Matrix: Water

Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33293	11/03/12 17:14	KD	TAL NSH
Total/NA	Analysis	9056A		20	33293	11/03/12 17:33	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:15	BB	TAL NSH
Total/NA	Analysis	6010B		100	33598	11/05/12 12:11	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:32	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:33	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:10	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:10	SB	TAL NSH

Client Sample ID: OW2

Lab Sample ID: 490-10450-9

Date Collected: 10/31/12 15:40

Matrix: Water

Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33305	11/03/12 13:39	KD	TAL NSH
Total/NA	Analysis	9056A		20	33305	11/03/12 13:59	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:18	BB	TAL NSH
Total/NA	Analysis	6010B		100	33598	11/05/12 12:15	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:48	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:33	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:11	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:19	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:11	SB	TAL NSH

Lab Chronicle

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: OW3

Lab Sample ID: 490-10450-10

Date Collected: 10/31/12 14:15
Matrix: Water
Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33305	11/03/12 14:19	KD	TAL NSH
Total/NA	Analysis	9056A		10	33305	11/03/12 14:40	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:22	BB	TAL NSH
Total/NA	Analysis	6010B		10	33598	11/05/12 12:18	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:52	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:33	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:12	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:26	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:12	SB	TAL NSH

Client Sample ID: AB1

Lab Sample ID: 490-10450-11

Date Collected: 10/31/12 11:05
Matrix: Water
Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33305	11/03/12 15:00	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:25	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 22:57	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:33	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:13	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:26	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:12	SB	TAL NSH

Client Sample ID: AB2

Lab Sample ID: 490-10450-12

Date Collected: 10/31/12 12:55
Matrix: Water
Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33305	11/03/12 15:20	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:28	BB	TAL NSH
Total/NA	Analysis	6010B		10	33598	11/05/12 12:22	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 23:02	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:33	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	33925	11/06/12 13:13	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:26	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:14	SB	TAL NSH

Lab Chronicle

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Client Sample ID: River

Lab Sample ID: 490-10450-13

Date Collected: 11/01/12 10:30

Matrix: Water

Date Received: 11/02/12 08:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	9056A		1	33305	11/03/12 15:40	KD	TAL NSH
Total/NA	Prep	3010A			33242	11/03/12 07:22	SR	TAL NSH
Total/NA	Analysis	6010B		1	33598	11/05/12 11:32	BB	TAL NSH
Total/NA	Analysis	SM 2320B		1	33250	11/02/12 23:08	NH	TAL NSH
Total/NA	Analysis	SM 4500 P E		1	33258	11/02/12 15:33	NH	TAL NSH
Total/NA	Analysis	SM 4500 NO3 F		1	34245	11/07/12 13:48	RG	TAL NSH
Total/NA	Analysis	SM4500 SiO2 C		1	34608	11/08/12 13:26	NH	TAL NSH
Total/NA	Analysis	SM 4500 S2 D		1	34849	11/07/12 12:15	SB	TAL NSH

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Method Summary

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Method	Method Description	Protocol	Laboratory
9056A	Anions, Ion Chromatography	SW846	TAL NSH
6010B	Metals (ICP)	SW846	TAL NSH
SM 2320B	Alkalinity	SM	TAL NSH
SM 4500 NO3 F	Nitrogen, Nitrate	SM	TAL NSH
SM 4500 P E	Orthophosphate	SM	TAL NSH
SM 4500 S2 D	Sulfide, Total	SM	TAL NSH
SM4500 SiO2 C	Silica, Molybdosilicate Method	SM	TAL NSH

Protocol References:

SM = "Standard Methods For The Examination Of Water And Wastewater",

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL NSH = TestAmerica Nashville, 2960 Foster Creighton Drive, Nashville, TN 37204, TEL (615)726-0177

Certification Summary

Client: Hart & Hickman, PC
Project/Site: Clariant Kalama

TestAmerica Job ID: 490-10450-1
SDG: CLR.045

Laboratory: TestAmerica Nashville

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
	ACIL		393	10-30-13
A2LA	ISO/IEC 17025		0453.07	12-31-13
Alabama	State Program	4	41150	05-31-13
Alaska (UST)	State Program	10	UST-087	07-24-13
Arizona	State Program	9	AZ0473	05-05-13
Arkansas DEQ	State Program	6	88-0737	04-25-13
California	NELAC	9	1168CA	10-31-13
Canadian Assoc Lab Accred (CALA)	Canada		3744	03-08-14
Colorado	State Program	8	N/A	02-28-13
Connecticut	State Program	1	PH-0220	12-31-13
Florida	NELAC	4	E87358	06-30-13
Illinois	NELAC	5	200010	12-09-12
Iowa	State Program	7	131	05-01-14
Kansas	NELAC	7	E-10229	10-31-13
Kentucky	State Program	4	90038	12-31-12
Kentucky (UST)	State Program	4	19	09-15-13
Louisiana	NELAC	6	LA120025	12-31-12
Louisiana	NELAC	6	30613	06-30-13
Maryland	State Program	3	316	03-31-13
Massachusetts	State Program	1	M-TN032	06-30-13
Minnesota	NELAC	5	047-999-345	12-31-12
Mississippi	State Program	4	N/A	06-30-13
Montana (UST)	State Program	8	NA	01-01-15
Nevada	State Program	9	TN00032	07-31-13
New Hampshire	NELAC	1	2963	10-09-13
New Jersey	NELAC	2	TN965	06-30-13
New York	NELAC	2	11342	04-01-13
North Carolina DENR	State Program	4	387	12-31-12
North Dakota	State Program	8	R-146	06-30-13
Ohio VAP	State Program	5	CL0033	01-19-14
Oklahoma	State Program	6	9412	08-31-13
Oregon	NELAC	10	TN200001	04-30-13
Pennsylvania	NELAC	3	68-00585	06-30-13
Rhode Island	State Program	1	LAO00268	12-30-12
South Carolina	State Program	4	84009 (001)	02-28-13
South Carolina	State Program	4	84009 (002)	02-23-14
Tennessee	State Program	4	2008	02-23-14
Texas	NELAC	6	T104704077-09-TX	08-31-13
USDA	Federal		S-48469	11-02-13
Utah	NELAC	8	TAN	06-30-13
Virginia	NELAC	3	460152	06-14-13
Washington	State Program	10	C789	07-19-13
West Virginia DEP	State Program	3	219	02-28-13
Wisconsin	State Program	5	998020430	08-31-13
Wyoming (UST)	A2LA	8	453.07	12-31-13

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

COOLER RECEIPT FORM

490-10450 Chain of Custody

Cooler Received/Opened On 11/2/2012 @ 0800

1. Tracking # 3320 (last 4 digits, FedEx)

Courier: FedEx IR Gun ID 94660220

2. Temperature of rep. sample or temp blank when opened: 4.9 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO..(NA)

4. Were custody seals on outside of cooler? YES..(NO)..NA

If yes, how many and where: _____

5. Were the seals intact, signed, and dated correctly? YES...NO..(NA)

6. Were custody papers inside cooler? (YES)..NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) (W)

7. Were custody seals on containers: YES (NO) and Intact YES...NO..(NA)

Were these signed and dated correctly? YES...NO..(NA)

8. Packing mat'l used? (Bubblewrap) (Plastic bag) Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: (Ice) Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? (YES)..NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? (YES)..NO...NA

12. Did all container labels and tags agree with custody papers? (YES)...NO...NA

13a. Were VOA vials received? YES..(NO)..NA

b. Was there any observable headspace present in any VOA vial? YES...NO..(NA)

14. Was there a Trip Blank in this cooler? YES...NO..(NA) If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) _____

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? (YES)..NO..NA EF 11-2-12

b. Did the bottle labels indicate that the correct preservatives were used (YES)..NO...NA

16. Was residual chlorine present? YES..(NO)..NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) _____

17. Were custody papers properly filled out (ink, signed, etc)? (YES)..NO...NA

18. Did you sign the custody papers in the appropriate place? (YES)..NO...NA

19. Were correct containers used for the analysis requested? (YES)..NO...NA

20. Was sufficient amount of sample sent in each container? (YES)..NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) _____

I certify that I attached a label with the unique LIMS number to each container (intial) _____

21. Were there Non-Conformance issues at login? YES..(NO) Was a PIPE generated? YES..(NO)..# _____

BIS = Broken in shipment

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

Loc: 490
10450

COOLER RECEIPT FORM

Cooler Received/Opened On 11/2/2012 @ 0800

1. Tracking # 2596 (last 4 digits, FedEx)

Courier: FedEx IR Gun ID 94660220

2. Temperature of rep. sample or temp blank when opened: 3.3 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO..(NA)

4. Were custody seals on outside of cooler? YES..(NO)..NA

If yes, how many and where:_____

5. Were the seals intact, signed, and dated correctly? YES...NO..(NA)

6. Were custody papers inside cooler? (YES)..NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) (w)

7. Were custody seals on containers: YES (NO) and Intact YES...NO..(NA)

Were these signed and dated correctly? YES...NO..(NA)

8. Packing mat'l used? (Bubblewrap) (Plastic bag) Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: (Ice) Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? (YES)..NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? (YES)..NO...NA

12. Did all container labels and tags agree with custody papers? (YES)..NO...NA

13a. Were VOA vials received? YES..(NO)..NA

b. Was there any observable headspace present in any VOA vial? YES...NO..(NA)

14. Was there a Trip Blank in this cooler? YES...NO..(NA) If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) _____

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? (YES)..NO..NA

b. Did the bottle labels indicate that the correct preservatives were used (YES)..NO...NA

16. Was residual chlorine present? YES..(NO)..NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) _____

17. Were custody papers properly filled out (ink, signed, etc)? (YES)..NO...NA

18. Did you sign the custody papers in the appropriate place? (YES)..NO...NA

19. Were correct containers used for the analysis requested? (YES)..NO...NA

20. Was sufficient amount of sample sent in each container? (YES)..NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) _____

I certify that I attached a label with the unique LIMS number to each container (intial) _____

21. Were there Non-Conformance issues at login? YES..(NO) Was a PIPE generated? YES..(NO)..# _____

BIS = Broken in shipment

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
Nashville, TN

Loc: 490
10450

COOLER RECEIPT FORM

Cooler Received/Opened On 11/2/2012 @ 0800

1. Tracking # 3397 (last 4 digits, FedEx)

Courier: FedEx IR Gun ID 94660220

2. Temperature of rep. sample or temp blank when opened: 2.7 *Degrees Celsius*

3. If Item #2 temperature is 0°C or less, was the representative sample or temp blank frozen? YES NO (NA)

4. Were custody seals on outside of cooler? YES (NO) NA

If yes, how many and where: _____

5. Were the seals intact, signed, and dated correctly? YES...NO...(NA)

6. Were custody papers inside cooler? (YES)...NO...NA

I certify that I opened the cooler and answered questions 1-6 (intial) MS

7. Were custody seals on containers: YES (NO) and Intact YES...NO...(NA)

Were these signed and dated correctly? YES...NO...(NA)

8. Packing mat'l used? (Bubblewrap) (Plastic bag) Peanuts Vermiculite Foam Insert Paper Other None

9. Cooling process: (Ice) Ice-pack Ice (direct contact) Dry ice Other None

10. Did all containers arrive in good condition (unbroken)? (YES)...NO...NA

11. Were all container labels complete (#, date, signed, pres., etc)? (YES)...NO...NA

12. Did all container labels and tags agree with custody papers? (YES)...NO...NA

13a. Were VOA vials received? YES...(NO)...NA

b. Was there any observable headspace present in any VOA vial? YES...NO...(NA)

14. Was there a Trip Blank in this cooler? YES...NO...(NA) If multiple coolers, sequence # NA

I certify that I unloaded the cooler and answered questions 7-14 (intial) MS

15a. On pres'd bottles, did pH test strips suggest preservation reached the correct pH level? (YES)...NO...(NA)

b. Did the bottle labels indicate that the correct preservatives were used (YES)...NO...NA

16. Was residual chlorine present? YES...(NO)...NA

I certify that I checked for chlorine and pH as per SOP and answered questions 15-16 (intial) MS

17. Were custody papers properly filled out (ink, signed, etc)? (YES)...NO...NA

18. Did you sign the custody papers in the appropriate place? (YES)...NO...NA

19. Were correct containers used for the analysis requested? (YES)...NO...NA

20. Was sufficient amount of sample sent in each container? (YES)...NO...NA

I certify that I entered this project into LIMS and answered questions 17-20 (intial) MS

I certify that I attached a label with the unique LIMS number to each container (intial) MS

21. Were there Non-Conformance issues at login? YES...(NO) Was a PIPE generated? YES...(NO)...#_____

BIS = Broken in shipment
Cooler Receipt Form.doc

LF-1
End of Form

Revised 6/24/09

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

5755 8th Street East, Tacoma, WA 98424-1317 253-922-2310 FAX 922-5047
11922 E. First Ave., Spokane WA 99206-5302 509-924-9200 FAX 924-9290
9405 SW Nimbus Ave., Beaverton, OR 97008-7145 503-906-9200 FAX 906-9210
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

11/12/2012

CHAIN OF CUSTODY REPORT

Work Order #:

CLIENT: Hart + Hickman, PC

INVOICE TO: H+H
Attn: Cynthia Wells

REPORT TO: Scott Dorsey Sdorsey@harthickman.com
ADDRESS: 2923 S. Tryon St. Ste 100
Charlotte, NC 28210
PHONE: 7045840004 FAX:

P.O. NUMBER:

PROJECT NAME: Clariant Celanese
PROJECT NUMBER: CLR.045
SAMPLED BY: Scott Dorsey

TURNAROUND REQUEST in Business Days *

Organic & Inorganic Analyses: 10 STD. | 7 | 5 | 4 | 3 | 2 | 1 | <1

Petroleum Hydrocarbon Analyses: 5 STD. | 4 | 3 | 2 | 1 | <1

OTHER Specify: STD

* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE: Nitric Acid; Zn/Ac; H2SO4

REQUESTED ANALYSES: Zn, Ca, Mn, Fe; Al, Mg, Na, K, B by 6010; Si by SM4500; Hco3/Co3 + Tot. Alkalinity; Sulfide SM4500-S2-D; NO2, NO3; Ortho-PO4; SO4; Cl-

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	MATRIX (W, S, O)	# OF CONT.	LOCATION/ COMMENTS	TA WO ID
1	PZ1	10/31/12 1340	W	6		
2	PZ3	10/31/12 1030				
3	PZ4	10/31/12 0945				
4	PZ5	10/31/12 0905				
5	PZ6	11/1/12 0920				
6	PZ12	11/1/12 1015				
7	PZ13	11/1/12 1145				
8	~~AST~~ OW1	10/31/12 1455				
9	~~AG~~ OW2	10/31/12 1540				
10	OW3	10/31/12 1415				

Loc: 490
10450

RELEASED BY: Scott	DATE: 11/1/12	RECEIVED BY:	DATE: 11-2-12
PRINT NAME: Scott Dorsey	FIRM: H+H TIME:	PRINT NAME: Easton Ford	FIRM: TAN TIME: 08:00
RELEASED BY:	DATE:	RECEIVED BY:	DATE:
PRINT NAME:	FIRM: TIME:	PRINT NAME:	FIRM: TIME:

ADDITIONAL REMARKS: Titrate entire sample volume for alkalinity determination (Do not subsample for alkalinity titration)

TEMP: PAGE OF

TAL-1000 (0612)

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

5755 8th Street East, Tacoma, WA 98424-1317 253-922-2310 FAX 922-5047
11922 E. First Ave., Spokane WA 99206-5302 509-924-9200 FAX 924-9290
9405 SW Nimbus Ave., Beaverton, OR 97008-7145 503-906-9200 FAX 906-9210
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

11/12/2012

CHAIN OF CUSTODY REPORT

Work Order #:

CLIENT: H+H

INVOICE TO: H+H
Cynthia Weiss

REPORT TO: Scott Denny
ADDRESS: 2923 S. Tryon St Ste 100
Charlotte 28210

PHONE: 7045862007 FAX:

P.O. NUMBER:

PROJECT NAME: CLARIANT KALAMA

PROJECT NUMBER: CLA.045

SAMPLED BY: BSA

TURNAROUND REQUEST in Business Days *

Organic & Inorganic Analyses: 10 STD. | 7 | 5 | 4 | 3 | 2 | 1 | <1

Petroleum Hydrocarbon Analyses: 5 STD. | 4 | 3 | 2 | 1 | <1

OTHER Specify: STD

* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVE: Nitric Acid | Zn/Re | H_2SO_4

REQUESTED ANALYSES: Zn, Cd, Mn, Fe, Al, Mg, Na, K, By 6010 | Si By SM4500 | HCO_3/CO_3 + Total Alkalinity | Sulfide SM4500-S2- D | NO_2, NO_3 | Ortho-PO4 | SO_4 | Cl^-

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	MATRIX (W, S, O)	# OF CONT.	LOCATION/ COMMENTS	TA WO ID
1	AB1	10/31/12 1105	W	6		
2	AB2	10/31/12 1255	W	6		
3	River	11/1/12 1030	W	6		
4						
5						
6						
7						
8						
9						
10						

Loc: 490
10450

RELEASED BY: Scott D DATE: 11/1/12
PRINT NAME: Scott Denny FIRM: H+H TIME:

RECEIVED BY: Easton Ford DATE: 11-2-12
PRINT NAME: Easton Ford FIRM: TAL TIME: 08:00

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS: TITRATE ENTIRE SAMPLE VOLUME FOR ALKALINITY DETERMINATION (DO NOT SUBSAMPLE FOR THE ALKALINITY TITRATION)

TEMP:

PAGE OF

TAL-1000 (0612)

Login Sample Receipt Checklist

Client: Hart & Hickman, PC

Job Number: 490-10450-1
SDG Number: CLR.045

Login Number: 10450
List Number: 1
Creator: Ford, Easton

List Source: TestAmerica Nashville

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

APPLIED SPECIATION
AND CONSULTING, LLC

18804 Northcreek Parkway Bothell, WA, 98011
Tel: (425) 483-3300 Fax: (425) 483-9818
www.appliedspeciation.com

November 26, 2012

Scott Drury
Hart & Hickman
2923 South Tryon Street Suite 100
Charlotte, NC 28203
(704) 586-0007

Project Name: Clariant Kalama

Mr. Drury,

Attached is the report associated with ten (10) soil samples submitted for cationic metals sequential extraction on November 1, 2012. The samples were received on November 2, 2012 in a sealed container at 5.3^{o}C. The sequential extraction procedure for cationic metals was performed using the method presented by the European Community Bureau of Reference (BCR). Any analytical issues associated with the analysis are addressed in the following report.

If you have any questions, please feel free to contact me at your convenience.

Sincerely,

Russell Gerads
Vice President
Applied Speciation and Consulting, LLC

Applied Speciation and Consulting, LLC

Report Prepared for:

Scott Drury
Hart & Hickman
2923 South Tryon Street Suite 100
Charlotte, NC 28203

Project Name: Clariant Kalama

November 26, 2012

1. Sample Reception

Ten (10) soil samples were submitted for cationic metals sequential extractions on November 1, 2012. All samples were received in acceptable condition on November 2, 2012 in a sealed container at 5.3^{o}C.

The samples were received in a laminar flow clean hood void of trace metals contamination and ultra-violet radiation. Immediately upon reception all samples were designated secrete sample identifiers and were stored in a freezer maintained at a temperature of -20^{o}C until sequential extractions could be performed.

2. Sample Preparation

All sample preparation is performed in laminar flow clean hoods known to be free from trace metals contamination. All applied water for dilutions and sample preservatives are monitored for contamination to account for any biases associated with the sample results.

All samples were received as field sample cores. Only the middle 1/3 portion of the sample cores were used for processing the samples.

Cationic Trace Metals Sequential Extraction by the European Community Bureau of Reference (BCR). A four stage sequential extraction method, presented by the European Community Bureau of Reference (BCR), was employed for correlation between Fe, Mn, Co, Ca, Mg, Na, Ni, and Zn.

Approximately 1g of soil was transferred to a 50mL polyethylene vial and 40mL of 0.11 M acetic acid (pH=2.85) was added to each vial. Each vial was capped and shaken on an inverted shaker for 16 hours at room temp at 30 RPM.

The samples were removed from the shaker and centrifuged for 20 minutes at 3000RPM. After the supernatant was decanted into a separate vial for trace metals analysis and labeled "Fraction 1" a total of 20mL of ultra pure deionized water was added to each vial. The vials were shaken vigorously and centrifuged for 20 minutes at 3000RPM. The supernatant was decanted and discarded.

Exactly 40mL of 0.1 M $NH_2OH.HCl$ (pH=2.0) was added to each vial. Each vial was capped and shaken on an inverted shaker for 16 hours at room temp at 30 RPM.

The samples were removed from the shaker and centrifuged for 20 minutes at 3000RPM. After the supernatant was decanted into a separate vial for trace metals analysis and labeled "Fraction 2" a total of 20mL of ultra pure deionized water was added to each vial. The vials were shaken vigorously and centrifuged for 20 minutes at 3000RPM. The supernatant was decanted and discarded.

Exactly 10mL of 30% (v/v) H_2O_2 was slowly added to each vial. Set tubes aside for one hour (swirl the tubes every 15 min). The vials were then refluxed in a Hotblock digestion apparatus for 60 min at 85^{o}C. The reflux cones were then removed and the samples were heated until near dryness (~3mL of solution remaining).

After the addition of 10mL of H_2O_2 each vial was refluxed at 85^{o}C for 60 minutes. The reflux cones were then removed and the samples were heated until near dryness (~3mL of solution remaining). The vials were then brought to volume (50mL) with 1.0 M ammonium acetate (pH=2). Each vial was capped and shaken on an inverted shaker for 16 hours at room temp at 30 RPM.

The samples were removed from the shaker and centrifuged for 20 minutes at 3000RPM. After the supernatant was decanted into a separate vial for trace metals analysis and labeled "Fraction 3" a total of 20mL of ultra pure deionized water was added to each vial. The vials were shaken vigorously and centrifuged for 20 minutes at 3000RPM. The supernatant was decanted and discarded.

Exactly 7mL concentrated HCl and 2.3mL concentrated HNO3 was added to each vial. The vials were then refluxed in a Hotblock digestion apparatus for 2 hours at 100^{o}C. The samples were then allowed to cool to room temperature and were brought to volume (50mL) with ultra pure deionized water.

All extraction fractions were then analyzed for Zn, Cd, Fe, Mn, Al, Ca, and Mg by inductively coupled plasma dynamic reaction cell mass spectrometry (ICP-DRC-MS).

3. Sample Analysis

All sample analysis is precluded by a minimum of a five-point calibration curve spanning the entire concentration range of interest. Calibration curves are performed at the beginning of each analytical day. All calibration curves, associated with each species of interest, are standardized by linear regression resulting in a response factor.

All sample results are **instrument blank corrected** to account for any operational biases associated with the analytical platform.

Prior to sample analysis, all calibration curves are verified using second source standards which are identified as initial calibration verification standards (ICV).

Ongoing instrument performance is identified by the analysis of continuing calibration verification standards (CCV) and continuing calibration blanks (CCB) at a minimal interval of every ten analytical runs.

Trace Metals Quantification by ICP-DRC-MS All samples for trace metals quantification were analyzed by inductively coupled plasma dynamic reaction cell mass spectrometry (ICP-DRC-MS). Aliquots of each sample are introduced into a radio frequency (RF) plasma where energy-transfer processes cause desolvation, atomization, and ionization. The ions are extracted from the plasma through a differentially-pumped vacuum interface and travel through a pressurized chamber (DRC) containing a specific reactive gas which preferentially reacts with interfering ions of the same target mass to charge ratios (m/z). A solid-state detector detects ions transmitted through the mass analyzer, on the basis of their mass-to-charge ratio (m/z), and the resulting current is processed by a data handling system.

4. Analytical Issues

The overall analyses went very well and no significant analytical issues were encountered. All quality control parameters associated with these samples were within acceptance limits.

If you have any questions or concerns regarding this report, please feel free to contact me at (425) 483-3300.

Sincerely,

Russell Gerads
Vice President
Applied Speciation and Consulting, LLC

BCR Sequential Extraction Results for Hart & Hickman
Contact: Scott Drury
Project Name: Clariant Kalama

Date: November 26, 2012
Report Generated by: Russell Gerads
Applied Speciation and Consulting, LLC

Sample Results

Sample PZ1 (16-18)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	6.23	16.6	76.8	702	74.8	0.065	6.29
0.1M NH2OH HCl	Reducible (Fe and Mn)	219	72.2	59.7	136	10.1	0.032	2.52
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	5.32	6.06	22.0	145	25.5	0.047	4.4
Aqua Regia	Residual non-silicate bound	17100	143	5380	2620	2150	0.027	42.4
Aqua Regia	Total (Original sample)	17200	236	5740	3340	2200	0.135	53.6
SEP % Recovery		101%	101%	96%	108%	103%	126%	104%

Sample Results

Sample PZ1 (20-25)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	5.95	17.7	65.4	600	60.2	0.074	7.12
0.1M NH2OH HCl	Reducible (Fe and Mn)	184	67.3	48.8	123	8.74	0.033	2.64
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	5.53	5.23	24.7	97.9	23.3	0.041	4.8
Aqua Regia	Residual non-silicate bound	15000	123	4700	2220	1790	0.021	37.6
Aqua Regia	Total (Original sample)	17500	299	6810	3750	2290	0.218	60.4
SEP % Recovery		87%	71%	71%	81%	82%	77%	86%

All results are reported on a Dry Weight basis in units of mg/kg

BCR Sequential Extraction Results for Hart & Hickman
Contact: Scott Drury
Project Name: Clariant Kalama

Date: November 26, 2012
Report Generated by: Russell Gerads
Applied Speciation and Consulting, LLC

Sample Results

Sample PZ3 (13.5-15.5)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	4.46	8.07	61.0	430	28.8	0.034	419
0.1M NH2OH HCl	Reducible (Fe and Mn)	206	154	54.3	108	6.70	0.030	75.7
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	2.53	10.3	22.2	139	22.7	0.055	35.4
Aqua Regia	Residual non-silicate bound	16600	145	5560	2260	2170	0.043	74.2
Aqua Regia	Total (Original sample)	17500	251	6140	3250	2560	0.110	520
SEP % Recovery		96%	127%	93%	90%	87%	148%	116%

Sample Results

Sample PZ3 (23-25)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	5.82	15.1	67.1	542	41.2	0.070	326
0.1M NH2OH HCl	Reducible (Fe and Mn)	184	91.1	47.4	99.0	6.26	0.025	44.4
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	4.91	6.26	25.4	92.7	21.3	0.056	23.2
Aqua Regia	Residual non-silicate bound	14600	117	4420	1980	1700	0.020	56.9
Aqua Regia	Total (Original sample)	17700	303	6760	3630	2540	0.174	568
SEP % Recovery		84%	76%	67%	75%	70%	98%	79%

All results are reported on a Dry Weight basis in units of mg/kg

BCR Sequential Extraction Results for Hart & Hickman
Contact: Scott Drury
Project Name: Clariant Kalama

Date: November 26, 2012
Report Generated by: Russell Gerads
Applied Speciation and Consulting, LLC

Sample Results

Sample PZ5 (14-16)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	8.13	8.84	215	234	37.0	0.242	71.5
0.1M NH2OH HCl	Reducible (Fe and Mn)	101	6.46	90.9	80.2	5.57	0.104	12.7
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	10.4	1.27	19.2	37.5	11.4	0.239	17.3
Aqua Regia	Residual non-silicate bound	16400	127	5820	2510	1710	0.526	107
Aqua Regia	Total (Original sample)	16300	153	6980	3170	2090	0.961	201
SEP % Recovery		101%	94%	88%	90%	84%	116%	104%

Sample Results

Sample PZ5 (23-25)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	5.29	6.00	74.9	448	85.9	7.92	196
0.1M NH2OH HCl	Reducible (Fe and Mn)	163	96.4	64.2	128	14.4	3.55	61.5
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	2.4	11.0	31.8	209	25.4	1.56	48.5
Aqua Regia	Residual non-silicate bound	14100	133	6290	2270	1810	1.76	96.7
Aqua Regia	Total (Original sample)	14400	223	5470	2880	1990	10.1	300
SEP % Recovery		99%	111%	118%	106%	97%	147%	134%

All results are reported on a Dry Weight basis in units of mg/kg

BCR Sequential Extraction Results for Hart & Hickman
Contact: Scott Drury
Project Name: Clariant Kalama

Date: November 26, 2012
Report Generated by: Russell Gerads
Applied Speciation and Consulting, LLC

Sample Results

Sample PZ12 (17.5-19.5)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	21.9	51.3	86.1	640	113	0.073	209
0.1M NH2OH HCl	Reducible (Fe and Mn)	198	4.31	66.3	122	11.6	0.010	54.4
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	3.2	3.36	16.8	107	27.4	0.057	55.5
Aqua Regia	Residual non-silicate bound	15100	118	5600	2070	1970	0.027	115
Aqua Regia	Total (Original sample)	14900	179	6630	3110	2270	0.130	429
SEP % Recovery		103%	99%	87%	95%	93%	128%	101%

Sample Results

Sample PZ12 (23-25)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	42.8	3.29	70.9	343	12.1	0.031	1010
0.1M NH2OH HCl	Reducible (Fe and Mn)	175	1.52	41.4	76.4	3.87	0.010	133
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	7.5	3.36	14.0	96.0	21.2	0.054	63.4
Aqua Regia	Residual non-silicate bound	17600	136	5400	2490	2100	0.049	124
Aqua Regia	Total (Original sample)	19300	164	6580	3250	3040	0.137	1600
SEP % Recovery		92%	88%	84%	92%	70%	105%	83%

All results are reported on a Dry Weight basis in units of mg/kg

BCR Sequential Extraction Results for Hart & Hickman
Contact: Scott Drury
Project Name: Clariant Kalama

Date: November 26, 2012
Report Generated by: Russell Gerads
Applied Speciation and Consulting, LLC

Sample Results

Sample PZ13 (16.5-18.5)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	474	22.1	123	112	32.0	0.225	7930
0.1M NH2OH HCl	Reducible (Fe and Mn)	320	2.12	57.9	114	5.48	0.012	469
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	4.1	3.18	9.77	101	19.6	0.036	302
Aqua Regia	Residual non-silicate bound	14600	123	5630	2790	2110	0.015	330
Aqua Regia	Total (Original sample)	15600	154	5950	3200	2070	0.243	8460
SEP % Recovery		99%	98%	98%	97%	105%	119%	107%

Sample Results

Sample PZ13 (23-25)

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	168	3.5	118	247	10.2	0.040	3330
0.1M NH2OH HCl	Reducible (Fe and Mn)	253	1.74	61.2	173	8.44	0.004	282
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	6.2	2.85	7.94	100	21.5	0.031	218
Aqua Regia	Residual non-silicate bound	16300	131	5520	2850	1970	0.016	320
Aqua Regia	Total (Original sample)	18800	152	6050	3420	2400	0.065	4590
SEP % Recovery		89%	92%	94%	99%	84%	141%	90%

All results are reported on a Dry Weight basis in units of mg/kg

BCR Sequential Extraction Results for Hart & Hickman
Contact: Scott Drury
Project Name: Clariant Kalama

Date: November 26, 2012
Report Generated by: Russell Gerads
Applied Speciation and Consulting, LLC

Sample Results

Sample PZ13 (23-25) MD

Fraction	Analyte (mg/kg)	Fe	Mn	Al	Ca	Mg	Cd	Zn
0.11M CH3COOH	Exchangeable; Water and Acid Soluble (Carbonates)	167	3.09	134	257	10.8	0.032	3240
0.1M NH2OH HCl	Reducible (Fe and Mn)	220	1.63	63.1	168	8.48	0.002	256
8.8M H2O2 + 1.0M CH3COONH4	Oxidizable (Organic)	10.1	2.85	11.39	105	21.1	0.030	213
Aqua Regia	Residual non-silicate bound	16100	126	5110	2600	2550	0.014	259
Aqua Regia	Total (Original sample)	17600	147	6570	3480	2550	0.076	5190
SEP % Recovery		94%	91%	81%	90%	102%	103%	76%

All results are reported on a Dry Weight basis in units of mg/kg

APPLIED SPECIATION AND CONSULTING, LLC

18804 Northcreek Parkway
Bothell, WA 98011

Phone (425) 483-3300
Fax (425) 483-9818

Company Name: Hart + Hickman, PC
Contact Person: Scott Drury
Address: 2923 S. Tryon St Ste 100
Charlotte, NC 28210
Phone Number: 704 586 0007
Fax Number:
Email Address: sdrury@harthickman.com
Project Name: Currant Kalama
Project Number: CLR-045
PO Number: CLR-045

ASC Project Manager: Russ Gerads

By submitting of samples the client agrees to all terms and conditions set forth in the quotation provided by the ASC project manager. If you are not familiar with the term and conditions associated with your project, please contact your ASC representative as soon as possible (425) 483-3300.

Requested Turn Around Time: STA
Method of Sample Delivery:
Currier Tracking Number:
Confirmation of Sample Reception: ☒ Yes ☐ No

Sample ID	Bottle ID	Date and Time	Matrix*	Volume	Preservative	Initials	Requested Analytes and Methods	Comments
PZ1 (16-18)		10/30/12 1225	Soil (SL)		None	BSD	*Bar Seagentian Extraction	All samples by
PZ1 (23-25) ★		10/30/12 1240				BSD	method to ID the class of	same analyses
PZ3 (14.5-16.5)		10/30/12 1315				BSD	Soil Phases Associated w/ Metals	
PZ3 (23-25)		10/30/12 1340				BSD	in the system.	
PZ5 ~~(13)~~ (14-16)		10/30/12 1400				BSD	*Metals: Zn, Cd, Fe, Mn, Al,	
PZ5 (23-25)		10/30/12 1420				BSD	Ca, Mg	
~~PZ4~~ No sample (BSD)		~~10/30/12~~				BSD	*Dry weight Basis	
~~PZ11~~ No sample (BSD)		~~10/30/12~~				BSD	*Avoid large particles if	
PZ12 (17.5-19.5')		10/30/12 1100				BSD	Encountered in selecting the	
PZ12 (23-25')		10/30/12 1120				BSD	Subsample for analyses.	
PZ13 (16.5-18.5')		10/30/12 1150				BSD		
PZ13 (23-25')		10/30/12 1210				BSD		

Relinquished by: (sign) [signature] (print) Scott Drury Date/Time:
Received by: (sign) Nancy Cullinan (print) Nancy Cullinan Date/Time: 11/2/12 9:20
Comments:
Temp: 5.3°C

Relinquished by: (sign) (print) Date/Time:
Received by: (sign) (print) Date/Time:
Comments:
Temp:

Please account for each sample bottle as a seperate line item for verification purposes.

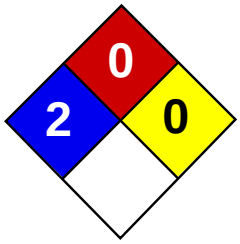
*Matrix: Air, Freshwater (FW), seawater (SW), groundwater (GW), wastewater (WW), soil (SL), sediment (SD), tissue (TS), product (P), other (O)

Rev 1.1 (April 2005)

★ - Sample says PZ1 (20-25) does not match COC. NGC 11/2/12

Appendix B

Ferrous Sulfate and Magnesium Hydroxide MSDS



Material Safety Data Sheet
Ferrous sulfate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ferrous sulfate

Catalog Codes: SLF1516

CAS#: 13463-43-9

RTECS: Not available.

TSCA: TSCA 8(b) inventory: No products were found.

CI#: Not available.

Synonym: Ferrous Sulfate Hydrate; Ferrous Sulfate Dried Powder

Chemical Name: Ferrous Sulfate

Chemical Formula: FeSO4.xH2O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ferrous sulfate	13463-43-9	100

Toxicological Data on Ingredients: Ferrous sulfate LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, cardiovascular system, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes.

Storage:
Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 151.9 g/mole + H20

Color: Grayish -white to yellowish. (Light.)

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatibles

Incompatibility with various substances: Not available.

Corrosivity: Not available.

Special Remarks on Reactivity:
Hygroscopic. Loses water at about 300 C. No other information found.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: May cause damage to the following organs: kidneys, liver, cardiovascular system, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. Eyes: May cause eye irritation. Inhalation: May cause respiratory tract irritation. Ingestion: Harmful if swallowed. May cause gastrointestinal tract distrubances and irritation with nausea, vomiting, colic, constipation, diarrhea, black stool. May also affect behavior/Central Nervous System (somnolence -general depressed activity), respiration, cardiovascular system, liver, kidneys (pink urine discoloration). Chronic Potential Health Effects: Repeated exposure via ingestion may increase iron levels in the liver, and spleen. Damage may occur to spleen and liver.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: No products were found.

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):
R36/38- Irritating to eyes and skin. S2- Keep out of the reach of children. S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

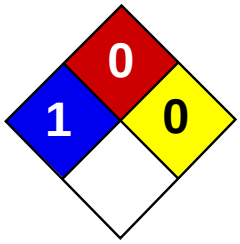
References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:33 PM

Last Updated: 06/09/2012 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Magnesium hydroxide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium hydroxide

Catalog Codes: SLM2437, SLM3811, SLM1663

CAS#: 1309-42-8

RTECS: OM3570000

TSCA: TSCA 8(b) inventory: Magnesium hydroxide

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Mg(OH)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Magnesium hydroxide	1309-42-8	100

Toxicological Data on Ingredients: Not applicable.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact: Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions: No specific safety phrase has been found applicable for this product.

Storage:
No specific storage is required. Use shelves or cabinets sturdy enough to bear the weight of the chemicals. Be sure that it is not necessary to strain to reach materials, and that shelves are not overloaded.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 58.32 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: 2.36 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Not available.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Magnesium hydroxide

Other Regulations: Not available..

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):
This product is not classified according to the EU regulations.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:22 PM

Last Updated: 06/09/2012 12:00 PM