Hart & Hickman
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Via USPS and E-mail

September 9, 2011

State of Washington - Dept of Ecology
Water Quality Program
PO Box 47600
Olympia, WA 98504

Attention: Ms. Mary Shaleen-Hansen

Re: Pilot Test Plan
Former Clariant Corporation Facility
Kalama, WA
Facility No. 24634187
VCP Project No. SWO492
H&H Job No. CLR-045

Dear Mary:

1.0 Introduction

On behalf of Clariant Corporation, Hart & Hickman, PC (H&H) has prepared this Pilot Test Plan for proposed ground water remedial 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). The site is enrolled in Washington State Department of Ecology's (Ecology) Voluntary Cleanup Program (VCP), VCP number SWO492, facility number 24634187.

H&H submitted a Remedial Action Work Plan (RAWP) for the remedial action (RA) activities to Ecology on August 6, 2010. The RA activities included excavation and off-site disposal of approximately 11,500 tons of soil from the former settling basin #2 (FSB2) area, installation of 23 vertical injection wells and six horizontal injection wells, and injection of approximately 47,000 gallons of calcium polysulfide (CaSx) into the injection wells. An Underground Injection Control (UIC) Well Registration package was submitted to Ecology on August 18, 2010, and a UIC conditional

rule authorization letter was issued by Ecology for the site on August 24, 2010. The RA activities were conducted in August and September 2010, and a RA Report documenting the RA activities was submitted to Ecology on January 19, 2011.

In accordance with the RAWP, one-month, three-month, and six-month post-injection ground water monitoring events were conducted at the site on November 2-3, 2010, December 20-21, 2010, and March 21-23, 2011, respectively. H&H submitted a Post-Injection Monitoring Report & RAWP Addendum documenting the post-injection sampling events to Ecology on July 5, 2011. A nine-month post-injection ground water monitoring event was conducted at the site on June 21, 2011. The results of the nine-month sampling event will be documented in a future submission to Ecology; however, results of the sampling event are summarized in the tables and figures that are included with this Pilot Test Report.

Based upon a review of the post-injection monitoring data, H&H proposed additional RA to address impacted ground water and residual mass of leachable zinc in soil below the depths of previous soil excavations. In the July 5, 2011 Post-Injection Monitoring Report & RAWP Addendum, H&H proposed a plan for additional RA at the site using CaSx injection and ground water re-circulation. A pilot test was included in the RAWP Addendum prior to full-scale implementation. The following sections include a discussion of site background information, site geology and hydrogeology, CaSx injection activities completed during September 2010, the results of subsequent post-injection monitoring, and details of proposed pilot-scale testing of additional CaSx injection and ground water re-circulation.

2.0 Site Background Information

2.1 Site Description and History

The site is an approximately 6.7-acre parcel located in the Port of Kalama industrial area. It is bordered to the north by a river park, to the east by Hendrickson Drive and a railroad line, to the south by a Port of Kalama property, and to the west by the Columbia River. The site is currently operated by Chemtrade for the production and distribution of sodium hydrosulfite for use as a bleaching agent in the pulp and paper and textile industries. The southern portion of the site is developed with an approximately 16,800-square foot (sf) manufacturing building, concrete secondary containment areas that contain process tanks and equipment, an approximately 900 sf building that contains a zinc oxide dryer, a truck loading area, and an empty tank and two empty silos. The area to the south of the manufacturing building and a large portion of the area to the west of the building are paved. A railroad spur runs along the east side of the site structures and crosses Hendrickson Drive to the north of the manufacturing structures. North of the manufacturing facility structures, the property is undeveloped where four settling basins were formerly located. In undeveloped areas, the ground is primarily sandy. The site is almost entirely fenced except for perimeter areas along Hendrickson Drive and the railroad spur. A site map is provided as Figure 2.

The site was developed in 1969 and manufactured zinc hydrosulfite from 1969 to 1973. From 1974 through present day, the plant has produced sodium hydrosulfite. The latter process generates zinc oxide as a byproduct. The zinc oxide is sold for use in tire production. From approximately 1974 until the late 1970s or early 1980s, the process also generated zinc carbonate sludge as a byproduct. This sludge was discharged to FSB2. Zinc carbonate sludge was apparently not discharged to FSB2 after 1984. Former settling basins #3 and #4 were never used. Former settling basin #1 received minor spillage of zinc carbonate sludge from a conveyance trough. The settling basins were closed in 1989 by removing the marketable zinc carbonate sludge from FSB2 and filling in the basins. Prior to

January 2004, cadmium sulfate was used as a catalyst in the sodium hydrosulfite manufacturing process.

2.2 Cleanup Levels and Points of Compliance

Cleanup levels (CULs) determined to be protective of human health and the environment under specified exposure conditions have been developed for cadmium and zinc in soil and ground water in accordance with the Model Toxics Control Act (MTCA). CULs, in combination with points of compliance (POCs), typically define the area or volume of soil, water, air or sediment at a site that will be addressed by the cleanup action. In accordance with Washington Administrative Code (WAC) 173-200-050, the POC is the location where the applicable CUL shall be measured.

Soil Cleanup Levels

Under the terrestrial ecological receptors evaluation procedures of MTCA, WAC 173-340-7490(4)(b) and human exposure via direct contact (WAC 173-340-740(6)(d)), the standard POC for soil is 15 ft bgs. This represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities. In the former settling basin and manufacturing plant areas, the applicable CUL (protective of terrestrial ecology) is 2 milligrams per kilogram (mg/kg) for cadmium and 360 mg/kg for zinc to the POC depth of 15 ft bgs. The applicable CULs (protective of human exposure) for cadmium and zinc are 2 and 24,000 mg/kg, respectively.

Soil excavation activities conducted in August and September 2010 (as well as previous excavation activities) have achieved the CULs for soil at the site to the POC of 15 ft. The post-excavation soil data were provided in the January 19, 2011 RA Report.

Ground Water Cleanup Levels

In accordance with WAC 173-200-060, the applicable CULs for on-site ground water are the Maximum Contaminant Levels (MCLs) of 5 micrograms per liter (µg/l) for cadmium and 5,000 µg/l

for zinc. Because site ground water is not being used for drinking water, a ground water use restriction may be used in lieu of meeting the MCL-based CULs for site ground water.

Because the site is located adjacent to the Columbia River, Ecology determined a CUL for zinc at the site's property boundary with the Columbia River as the calculated surface water standard of 74 µg/l for zinc (calculated based upon an average hardness of the Columbia River of 58 mg/l). For cadmium, the lowest surface water quality standard is 0.7 ug/l. However, based on historic sampling, the lateral extent of the cadmium plume does not extend to the western downgradient edge of the property. For this site, Ecology has approved monitoring wells AB1 and AB2 as alternative ground water POCs. Therefore, the current goal of RA at the site is to remediate ground water such that dissolved zinc is at or below 74 µg/L in POC wells AB1 and AB2.

3.0 Site Geology and Hydrogeology

The site is located within the Columbia River Basin. Site soils generally consist of dredge material and alluvial deposits from the Columbia River, primarily fine to medium-grained sands. Some gravel, coarse-grained sand, and silt lenses have also been observed in site soils. The river bank adjacent to the site is protected by a layer of rip rap that extends from the top edge of the river bank to an undetermined depth below the water surface. Bedrock underlying the site appears to dip from north and east to south and west across the site. Depth to bedrock has been observed to range from approximately 24 to 32 ft bgs in the northern and eastern portions of the site to greater than 60 ft bgs in the southwestern portion of the site.

Shallow ground water underlying the site occurs under unconfined conditions. Ground water elevation data collected from site monitor wells indicate that shallow ground water flow at the site is strongly influenced by the elevation of the Columbia River. Note that the elevation of the Columbia River is subject to daily tidal fluctuations in the location adjacent to the site. In the eastern portion of the site, there is a hydraulic gradient from east to west toward the river. The gradient has varied from less than

1% to approximately 4% during the monitoring events conducted during September 2010 through June 2011. The magnitude of this gradient appears to decrease as the elevation of the Columbia River increases (due to seasonal fluctuation and/or tidal influences), and vice versa. In the western portion of the site, hydraulic communication between the river and shallow ground water results in mounding of the ground water table near the river. The ground water mounding creates a weak hydraulic gradient (of approximately 1% or less) from west to east in that area. The ground water mound and gradient appear to vary in magnitude with the tidal fluctuations of the river (being largest at high tide and smallest at low tide), but do not appear to vary significantly with seasonal changes in the elevation of the river. These converging hydraulic gradients appear to cause ground water in the central portion of the site to be temporally stagnant.

A summary of site monitor well construction details is presented in Table 1. Site ground water and Columbia River elevation data is summarized in Table 3. Columbia River elevation/tide data were obtained from the National Oceanic and Atmospheric Administration's (NOAA) NOS/CO-OPs Observational Data Interactive Navigation program (http://tidesandcurrents.noaa.gov/gmap3). Ground water gradient maps for each set of ground water elevation measurements collected during the September 2010 through June 2011 monitoring events conducted at the site are included as Figures 3A through 3H.

4.0 Summary of Previous CaSx Injection and Post-Injection Data Evaluation

4.1 CaSx Injection

During August and September 2010, 23 permanent vertical injection wells and three observation wells were installed at the site to a depth of 30 to 35 ft bgs. In addition, six horizontal injection wells were installed at a depth of 15 ft below surrounding ground surface across the base of the open soil excavation at FSB2 prior to backfilling of the excavation. A summary of injection well construction details is presented in Table 2. A pre-injection ground water monitoring event was conducted and

samples were collected from 12 existing and newly installed wells. The results of the pre-injection sampling were generally consistent with historical ground water monitoring data collected from the site.

Approximately 47,000 gallons of CaSx were injected into the subsurface through the injection wells in September 2010. 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. Geochemical fixation using CaSx reduces soluble metals such as cadmium and zinc to insoluble sulfide compounds that will precipitate out of solution and should remain insoluble in the aquifer. CaSx is a liquid product and will move through the pore spaces of the aquifer contacting metal cations where encountered. CaSx is delivered in tankers as a solution that consists of 24-29% calcium polysulfide by weight and 71-76% water by weight. The CaSx solution has a specific gravity of 10.0 – 10.6 lbs/gal and a pH of 10.0 – 11.7. Additional CaSx information that includes a material safety data sheet (MSDS) is included in Appendix A.

CaSx solution produced by Tessenderlo Kerley was delivered to the site in 4,500-gallon tanker trucks. Three 6,500-gallon poly tanks were utilized for receiving and on-site storage of the CaSx prior to injection. The CaSx was gravity-fed or pumped at pressures of less than 10 psi directly from the poly tanks into the injection wells. Pumping was only utilized to expedite the flow of CaSx to the injection wellhead through 50 to 150 ft lengths of hose when gravity feeding the solution into the wells was inefficient. Note that it was apparent that little or no pressure was required at the injection locations to distribute the CaSx into the subsurface formation at the flow rates utilized during the injection activities.

Injection volumes and flow rates were monitored using in-line meters. CaSx injection was typically conducted simultaneously at two injection well locations. The amount of CaSx injected into each well was based on the dosage rate indicated by the results of a treatability study conducted prior to the RA activities. Approximately 900 gallons of CaSx were injected into injection wells IW-13 through IW-

23, approximately 2,250 gallons of CaSx were injected into injection wells IW-1 through IW-12, and approximately 2,000 gallons of CaSx were injected into horizontal injection wells HIW-1 through HIW-6.

During the CaSx injection activities, field readings of temperature, pH, conductivity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) were measured in select monitor wells during and after injection of CaSx into nearby injection wells. These ground water quality readings were collected to assess the effectiveness of dispersion of the CaSx during the injection and as a precautionary measure to ensure that the CaSx did not adversely affect the Columbia River surface water adjacent to the site. Field measurements collected during the injection activities indicated a rise in pH and decrease in ORP in ground water collected from several wells in the vicinity of injection wells. An increase in pH and decrease in ORP are indicative of CaSx distribution. Bright yellow liquid with an odor similar to CaSx was present in PZ12 shortly after injection into horizontal injection well HIW-1 was completed and during injection into IW-8. The liquid in PZ12 had a high pH (approximately 10) and low ORP (approximately -500 mV), which is consistent with CaSx. There were no significant changes noted in the field measurements collected from AB1 or AB2, located adjacent to the Columbia River. A summary of ground water field parameters is presented in Table 4.

4.2 Post-Injection Data Evaluation

Results of the post-injection monitoring conducted to date indicate that reductions in dissolved zinc and cadmium concentrations were observed in the first post-injection ground water sampling event conducted in November 2010. In some cases, the reductions were significant (i.e., from 37,800 µg/l to 1,940 µg/l in PZ12 and from 18,400 µg/l to 151 µg/l in PZ13). Between the November 2010 and December 2010 sampling events there was a significant increase in dissolved zinc concentrations in PZ12 and PZ13. Concentrations of dissolved zinc increased to 87,100 µg/l in PZ12 and to 79,000 µg/l in PZ13 during the December 2010 sampling. High concentrations were again detected in PZ12 and PZ13 during the March and June 2011 sampling, though they decreased in both wells between the

March and June 2011 sampling. A detailed summary of post-injection ground water analytical data results is included in the July 5, 2011 Post-Injection Monitoring Report & RAWP Addendum. A summary of ground water analytical data is presented in Table 5. Dissolved zinc concentrations and inferred isoconcentration contours for the monitoring events conducted during September 2010 through June 2011 are shown in Figures 4A through 4E.

During the December 2010 sampling event, average ground water elevations were approximately five ft higher than during the September 2010 sampling, and the ground water elevations were approximately nine inches higher during the March 2011 sampling than those measured during the December 2010 sampling. These ground water elevations were the highest that had historically been measured at the site. During the June 2011 sampling event, average ground water elevations were approximately three ft higher than those measured during the March 2011 sampling. The increase in site ground water elevations corresponded to significant Columbia River elevation increases that occurred during the period. Site ground water and Columbia River elevation data is summarized in Table 3.

A review of the PZ12 and PZ13 dissolved zinc concentration and ground water elevation data indicate a correlation between the increases in dissolved zinc concentrations and increased ground water levels through the March 2011 sampling. Note that PZ12 and PZ13 are both located within the lateral extent of FSB2 where excavations have been conducted to remove zinc-impacted soil to a depth of 15 ft bgs. However, zinc-impacted soil remains below a depth of 15 ft and the typical ground water table elevation that had been observed at the site prior to December 2010. H&H has reviewed concentration trends and other ground water parameter data (i.e., pH, ORP, etc.) obtained from the performance monitoring wells for evidence of any correlation between dissolved cadmium and/or zinc concentration changes and changes in the individual parameters. Aside from the correlation between ground water elevation and dissolved zinc concentration data in PZ12 and PZ13, no other consistent correlation has been observed between the dissolved metals concentrations and other ground water parameter data.

To further evaluate the evident correlation between the rising water table and the increased dissolved zinc concentrations detected in the FSB2 area, H&H reviewed excavation base sample data which is believed to be reasonably representative of the soils into which the ground water table rose shortly after the injection. A summary of excavation base sample analytical data is presented in Table 6. As indicated in Table 6, toxicity characteristic leaching procedure (TCLP) data from the 2003 excavation base samples indicate that zinc in the soil has the potential to leach at high concentrations (from 10,000 µg/l to 200,000 µg/l). The site ground water CUL for dissolved zinc is 74 µg/l. Although TCLP uses an acid leach process and is therefore more aggressive than rising ground water, the TCLP data indicate that there is still leachable zinc below the depths of the former excavations. Excavation base sample locations are shown in Figure 5.

H&H also performed a regression analysis on the 2003 excavation base soil sample data to estimate TCLP concentrations for base samples from the 2010 excavation (for which TCLP analysis was not performed). These data indicate that leachable zinc remains in the zone of soil located beneath the depth of the excavations. As such, it appears that the significant increase in dissolved zinc concentrations in ground water between the November 2010 and December 2010 sampling is the result of the ground water table rising into a portion of this zone where zinc remains. Residual zinc in these soils likely dissolved into the ground water as the water table rose into this zone, and there was not an adequate amount of CaSx available in the rising ground water to fix the added mass of dissolved zinc from this previously unsaturated zone into insoluble zinc sulfide. As a result, there was a significant increase in dissolved zinc in this area's ground water.

Despite the continued rise in the average ground water elevation that was observed between the March and June 2011 sampling, dissolved zinc concentrations decreased from 112,000 µg/l to 74,100 µg/l in PZ12 and from 68,200 µg/l to 21,100 µg/l in PZ13 between the two events. This decrease may be attributable to reduction of the residual zinc mass in soil caused by dissolution and dilution of the zinc by the significant influx of ground water into the impacted soil. Also note that the June 2011 ground

water elevations are approximately the same as the depth of the previous excavations conducted in the FSB2 area and that the Columbia River elevations in the vicinity of the site had been higher during May and June 2011 prior to the June sampling event.

Although increases in compound concentrations attributable to the significant rise in ground water levels were observed in some wells, dissolved zinc concentrations have steadily decreased since the CaSx injection in the two compliance wells AB1 and AB2. Concentrations of dissolved zinc in AB1 have decreased from 996 µg/l during the September 2010 sampling to 304 µg/l during the June 2011 sampling. Concentrations of dissolved zinc in AB2 have decreased from 9,290 µg/l during the September 2010 sampling to 4,210 µg/l during the June 2011 sampling. These decreases are likely the result of the positive impact of the CaSx injection and/or because of the proximity of the wells to the Columbia River and the increased river elevation since the injection.

In summary, the results indicate that the CaSx injection was successful in significantly reducing dissolved zinc and cadmium compound concentrations. However, the substantial increase in ground water elevations soon after the injection resulted in a rise of the ground water table into impacted soil between the depth of the previous excavations and the normal elevation of the ground water table. This resulted in dissolution of zinc which masked the positive impact of the CaSx injection.

5.0 Pilot-Scale CaSx Injection and Re-Circulation Testing

Based on the post-injection data evaluation discussed in Section 4.2 and an evaluation of alternative remediation products that is detailed in the Post-Injection Monitoring Report & RAWP Addendum, H&H believes that application of CaSx remains the best option for remediation of site ground water. However, it is evident that the leachable zinc in the soils located beneath the previous excavations should be addressed in addition to dissolved zinc in ground water to prevent future dissolution of zinc from this soil during periods of high ground water elevation and also from infiltrating rainwater. Therefore, the RAWP Addendum includes 1) installation of additional horizontal wells in the FSB2

area at or a few feet above the approximate depth of the former excavations and injection of CaSx into the horizontal wells to fix the zinc in these soils, and 2) additional injection of CaSx using the existing injection well network to address dissolved zinc and cadmium impacts that persist in ground water.

As part of the RAWP Addendum, H&H also proposed that the method of CaSx injection be enhanced during the proposed additional injection by re-circulation of ground water and CaSx in the subsurface via concurrent injection and extraction. We believe that natural distribution and mixing of CaSx in the aquifer may have been inhibited by the temporal stagnant ground water flow conditions indicated by ground water elevation data collected at the site (which are discussed in Section 3.0). The re-circulation will be performed in an effort to enhance subsurface distribution and mixing of the CaSx, and to pull the CaSx through targeted areas of the aquifer.

To evaluate the effectiveness of re-circulating ground water and CaSx as described above, pilot-scale testing will be conducted at the site. Prior to conducting the pilot test, a ground water extraction well will be installed in the FSB2 area in the approximate location shown in Figure 6. The extraction well will be installed to a depth of 35 ft bgs and will be constructed with 25 ft of 8-inch diameter PVC screen set at the bottom of the boring and up to 10 ft of 8-inch diameter well casing to the ground surface. An extraction well diagram is included as Figure 7. For the pilot test, a submersible pump will be utilized to pump ground water out of the newly installed extraction well into a 20,000 gallon frac tank where it will be mixed with CaSx solution. CaSx solution will be delivered to the site and pumped into the frac tank directly from tankers. Shortly after beginning extraction of ground water, the mixed solution of CaSx and ground water in the frac tank will be injected into existing horizontal injection well HIW-1 during one portion of the pilot test, and simultaneously into vertical injection wells IW-7, IW-8, and IW-11 during a separate portion of the pilot test. A summary of injection well construction details is presented in Table 2 and well locations are shown in Figure 6. Injection will be conducted concurrent to and at approximately the same total flow rate as extraction. The re-circulation will be conducted to create a hydraulic gradient that will aid in effective distribution, mixing, and control of the CaSx in the portion of the aquifer where the test is conducted.

Approximately 9,000 gallons of CaSx will be utilized for the pilot test. It is anticipated that the re-circulation activities will be conducted during two days. Injection and extraction flow rates and the total volume of solution re-circulated will likely be limited by the maximum extraction rate that can be produced during the testing. We anticipate utilization of a submersible pump capable of pumping approximately 160 gallons per minute (gpm) at a pressure head of 35 ft water column for extraction during the pilot testing. One or more above-ground utility pump(s) capable of pumping greater than 200 gpm will be used for injection. Injection flow rates will be regulated by in-line valves that will allow for manual control of flow into each injection well. Note that during the RA completed in September 2010, CaSx was pumped into individual injection wells at approximately 30 gpm under little to no pressure. Injection pressures, volumes, and flow rates will be monitored using in-line meters and gauges, and will be adjusted based on field observations in an attempt to optimize distribution and mixing of the CaSx while also balancing extraction and injection flow rates. In addition, the re-circulated solution may be run through an in-line filtration unit prior to injection into the subsurface to determine if insoluble zinc compounds precipitate out of solution during the above-ground mixing and if they can be efficiently removed prior to injection.

Monitoring of ground water parameters within the pilot test area will assist in evaluating the effectiveness of the re-circulation in distributing and mixing the CaSx solution throughout the targeted area of the aquifer. In order to monitor ground water parameters within the pilot test area three temporary monitor wells will be installed within the pilot test area in the approximate locations shown in Figure 6. The temporary wells will be installed using a direct push technology (DPT) drill rig to a depth of 35 ft bgs and will be screened across the ground water table. Ground water elevations, conductivity, DO, ORP, and pH will be monitored in the temporary wells and existing well PZ-12 prior to and during the pilot testing. In addition, samples will be collected from the temporary wells and PZ-12 prior to and after completion of the testing and submitted to a laboratory for analysis of sulfides and dissolved zinc. Ground water samples will be collected using low-flow/low stress sampling techniques. Samples will also periodically be collected from the frac tank influent and

effluent lines. These samples will be field-measured for ORP and pH and submitted to a laboratory for analysis of sulfides and dissolved zinc. In addition, limitations of the re-circulation process (such as maximum extraction flow rates and potential extraction well fouling) and the potential for ex-situ removal of precipitated zinc compounds will be evaluated during the testing.

Data gathered during the pilot-scale testing will be utilized to help evaluate the effectiveness of the re-circulation process to aid in planning for and implementation of full-scale CaSx injection and re-circulation at the site. We anticipate that the pilot test will be conducted during late September 2011.

6.0 Pilot-Scale Test Reporting

Following completion of the pilot-scale testing, a Pilot Test report will be prepared and submitted to Ecology. The report will document the well installation, injection, and performance monitoring activities discussed herein. It will include photographic documentation of the activities, well boring logs, and results of sample analyses. In addition, the report will include a discussion of our evaluation of the effectiveness of the re-circulation process and will describe proposed modifications, if any, made to plans for implementation of full-scale CaSx injection and re-circulation at the site based on our pilot test evaluation.

Should you have any questions or need any additional information, please feel free to contact me.

Sincerely,

Hart & Hickman, PC

Steven C. Hart
Principal

Christie Zawtocki, PE
Project Manager

cc: Eugene Radcliff, L.G.
Bill Grier (via e-mail)
Ron Walton (via e-mail)
David Burroughs (via e-mail)

Attachments

Tables

Table 1
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
AB1	07/01/03	2	28	14.1-28.2	27.53
AB2	07/01/03	2	30	14.4-30.0	28.41
OW-1	09/20/10	2	35	20-35	26.51
OW-2	09/20/10	2	35	20-35	25.99
OW-3	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
Depth and screen interval of AB1 and AB2 account for 45^{o} and 35^{o} angles of installation relative to vertical, respectively.

Table 2
Summary of Injection 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)
Vertical 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
Well ID	**Installation Date**	**Well Diameter (inches)**	**Total Length (ft)**	**Sceen Length (ft)**
Horizontal Injection Wells				
HIW-1	08/23/10	3	100	90
HIW-2	08/23/10	3	80	70
HIW-3	08/23/10	3	100	90
HIW-4	09/16/10	3	110	70
HIW-5	09/16/10	3	110	90
HIW-6	09/16/10	3	110	70

Notes:
ft bgs = feet below ground surface
Horizontal injection wells are installed at a depth of 15 ft bgs

Table 3
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	04/17/03	28.99	22.29	6.70	4:05 p.m.	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ1	05/06/03		24.16	4.83	4:48 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ1	05/21/03		23.61	5.38	11:00 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ1	07/07/03		25.92	3.07	10:31 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ1	08/13/03		24.53	4.46	10:05 a.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ1	01/28/04		22.67	6.32	8:56 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ1	01/28/04		23.04	5.95	3:00 p.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ1	04/28/04		25.45	3.54	11:58 a.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ1	04/28/04		26.58	2.41	8:22 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ1	04/29/04		25.56	3.43	12:14 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ1	07/29/04		26.15	2.84	11:40 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ1	07/29/04		25.66	3.33	3:01 p.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ1	10/27/04		25.27	3.72	12:35 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ1	10/27/04		23.84	5.15	4:36 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ1	01/27/05		24.61	4.38	12:19 p.m.	5:55 p.m.	--	12:40 p.m.	4.13
PZ1	05/03/05		24.41	4.58	3:09 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ1	07/25/05		25.90	3.09	6:12 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
PZ1	07/26/05		25.07	3.92	7:31 a.m.	7:12 a.m.	5.92	--	--
PZ1	10/26/05		26.28	2.71	12:24 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ1	10/26/05		26.19	2.80	4:19 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ1	10/27/05		26.87	2.12	7:26 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ1	10/27/05		27.19	1.80	10:03 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ1	07/12/06		24.47	4.52	2:42 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ1	02/07/07		25.16	3.83	1:47 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ1	02/04/10		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	09:54 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.	9.00	5:21 p.m.	8.36
PZ2	04/17/03	30.16	23.49	6.67	4:08 p.m.	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ2	05/06/03		25.42	4.74	4:50 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ2	05/21/03		24.81	5.35	11:04 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ2	07/07/03		27.12	3.04	10:33 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ2	08/13/03		25.80	4.36	10:43 a.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ2	01/28/04		23.79	6.37	8:59 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ2	01/28/04		24.20	5.96	2:20 p.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ2	04/28/04		26.64	3.52	11:54 a.m.	9:39 a.m.	4.60	6:46 p.m.	2.19

Table 3
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)
PZ2	04/28/04		27.81	2.35	8:19 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ2	04/29/04		26.72	3.44	12:18 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ2	07/29/04		27.37	2.79	11:38 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ2	07/29/04		26.88	3.28	2:58 p.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ2	10/27/04		26.52	3.64	12:40 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ2	10/27/04		24.91	5.25	4:38 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ2	01/27/05		25.85	4.31	12:23 p.m.	5:55 p.m.		12:40 p.m.	4.13
PZ2	05/03/05		25.53	4.63	2:30 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ2	07/25/05		27.08	3.08	6:16 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
PZ2	07/26/05		26.25	3.91	7:30 a.m.	7:12 a.m.	5.92	6:26 p.m.	2.66
PZ2	10/26/05		27.48	2.68	12:23 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ2	10/26/05		27.36	2.80	4:45 p.m.	12:36 p.m.	4.58	6:26 p.m.	2.66
PZ2	10/27/05		28.07	2.09	7:23 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ2	10/27/05		28.42	1.74	10:01 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ2	07/12/06		25.68	4.48	2:34 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ2	02/07/07		26.38	3.78	1:50 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ2	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ3	04/17/03	28.47	21.68	6.79	4:11 p.m.	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ3	05/06/03		23.73	4.74	4:53 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ3	05/21/03		23.13	5.34	11:07 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ3	07/07/03		25.33	3.14	10:37 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ3	08/13/03		24.42	4.05	11:27 a.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ3	01/28/04		21.98	6.49	9:00 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ3	01/28/04		22.26	6.21	1:05 p.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ3	04/28/04		24.90	3.57	11:46 a.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ3	04/28/04		26.16	2.31	8:17 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ3	04/29/04		24.95	3.52	12:20 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ3	07/29/04		25.70	2.77	11:33 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ3	07/29/04		25.12	3.35	2:55 p.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ3	10/27/04		24.82	3.65	12:42 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ3	10/27/04		23.09	5.38	4:40 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ3	01/27/05		24.20	4.27	12:26 p.m.	5:55 a.m.		12:40 p.m.	4.13
PZ3	05/03/05		23.76	4.71	1:10 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ3	07/25/05		25.34	3.13	6:19 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44

Table 3
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	07/26/05		24.50	3.97	7:23 a.m.	7:12 a.m.	5.92		
PZ3	10/26/05		25.75	2.72	12:11 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ3	10/26/05		25.64	2.83	4:44 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ3	10/27/05		26.42	2.05	7:21 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ3	10/27/05		26.74	1.73	10:00 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ3	07/12/06		24.04	4.43	2:40 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ3	02/07/07		24.68	3.79	1:40 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ3	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ4	04/17/03	26.78	20.00	6.78	4:13 p.m.	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ4	05/06/03		21.81	4.97	4:54 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ4	05/21/03		21.41	5.37	11:18 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ4	07/07/03		23.76	3.02	10:39 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ4	08/13/03		22.40	4.38	1:15 p.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ4	01/28/04		20.54	6.24	9:09 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ4	04/28/04		23.28	3.50	12:30 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ4	04/28/04		24.22	2.56	8:13 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ4	04/29/04		23.40	3.38	12:28 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ4	07/29/04		23.72	3.06	11:48 p.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ4	10/27/04		22.92	3.86	12:43 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ4	01/27/05		21.79	4.99	4:51 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ4	01/27/05		22.32	4.46	12:34 p.m.	5:55 a.m.		12:40 p.m.	4.13
PZ4	05/03/05		22.60	4.18	11:15 a.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ4	07/25/05		23.59	3.19	6:27 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
PZ4	07/26/05		23.01	3.77	7:17 a.m.	7:12 a.m.	5.92		
PZ4	10/26/05		24.15	2.63	12:37 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ4	10/26/05		23.96	2.82	4:42 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ4	10/27/05		24.51	2.27	7:21 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ4	10/27/05		24.84	1.94	10:10 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ4	07/12/06		21.91	4.87	2:40 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ4	02/07/07		22.78	4.00	1:32 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ4	02/04/10		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

Table 3
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)
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.	9.00	5:21 p.m.	8.36
PZ5	04/17/03	26.86	20.06	6.80	4:15 p.m.	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ5	05/06/03		21.79	5.07	4:55 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ5	05/21/03		21.51	5.35	11:22 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ5	07/07/03		23.91	2.95	10:40 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ5	08/13/03		22.73	4.13	12:53 p.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ5	01/28/04		21.78	5.08	9:08 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ5	04/28/04		23.41	3.45	12:34 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ5	04/29/04		23.57	3.29	12:27 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ5	07/29/04		23.61	3.25	11:47 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ5	10/27/04		22.89	3.97	12:44 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ5	10/27/04		22.07	4.79	4:50 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ5	01/27/05		22.30	4.56	12:32 p.m.	5:55 a.m.		12:40 p.m.	4.13
PZ5	05/03/05		22.75	4.11	10:25 a.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ5	10/26/05		24.35	2.51	12:40 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ5	10/26/05		24.06	2.80	4:40 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ5	10/27/05		24.36	2.50	7:17 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ5	10/27/05		24.77	2.09	10:12 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ5	07/12/06		21.91	4.95	2:40 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ5	02/07/07		22.80	4.06	1:34 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ5	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ6	04/17/03	27.58	20.76	6.82	4:18 p.m.	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ6	05/06/03		22.47	5.11	4:58 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ6	05/21/03		22.25	5.33	11:13 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ6	07/07/03		24.64	2.94	10:42 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ6	08/13/03		23.93	3.65	4:08 p.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ6	01/28/04		21.55	6.03	9:11 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ6	04/28/04		24.13	3.45	12:11 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19

Table 3
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	04/29/04		24.31	3.27	12:30 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ6	07/29/04		24.35	3.23	11:49 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ6	10/27/04		23.59	3.99	12:45 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ6	10/27/04		22.87	4.71	4:52 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ6	01/27/05		23.02	4.56	12:35 p.m.	5:55 a.m.	--	12:40 p.m.	4.13
PZ6	05/03/05		23.29	4.29	12:08 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ6	07/25/05		24.28	3.30	6:25 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
PZ6	07/26/05		23.86	3.72	7:15 a.m.	7:12 a.m.	5.92	--	--
PZ6	10/26/05		25.11	2.47	12:36 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ6	10/26/05		24.82	2.76	4:55 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ6	10/27/05		25.12	2.46	7:37 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ6	10/27/05		25.42	2.16	10:14 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ6	07/12/06		22.54	5.04	2:30 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ6	02/07/07		23.54	4.04	1:30 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ6	02/04/10		22.54	5.04	9:23 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
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.	9.00	5:21 p.m.	8.36
PZ7	04/29/04	28.06	24.02	4.04	12:10 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ7	07/29/04		24.15	3.91	11:50 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ7	10/27/04		23.38	4.68	12:47 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ7	10/27/04		23.31	4.75	4:55 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ7	01/27/05		22.76	5.30	12:40 p.m.	5:55 a.m.	--	12:40 p.m.	4.13
PZ7	05/03/05		22.98	5.08	4:07 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ7	07/25/05		23.66	4.40	6:08 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
PZ7	07/26/05		23.72	4.34	7:13 a.m.	7:12 a.m.	5.92	--	--
PZ7	10/26/05		24.58	3.48	12:33 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ7	10/26/05		24.55	3.51	5:03 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ7	10/27/05		24.55	3.51	7:39 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ7	10/27/05		24.63	3.43	10:16 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ7	02/04/10		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.	9.00	5:21 p.m.	8.36

Table 3
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)
PZ8	04/17/03	28.17	19.78	8.39	4:24 p.m.	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ8	05/06/03		20.81	7.36	5:00 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ8	05/21/03		20.95	7.22	11:29 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ8	07/07/03		21.30	6.87	10:46 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ8	08/13/03		21.66	6.51	12:55 p.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ8	01/28/04		20.42	7.75	9:12 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ8	04/28/04		21.13	7.04	12:20 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ8	04/29/04		21.05	7.12	12:11 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ8	07/29/04		21.53	6.64	11:52 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ8	10/27/04		21.11	7.06	12:48 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ8	10/27/04		21.14	7.03	4:54 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ8	01/27/05		20.94	7.23	12:37 p.m.	5:55 a.m.	--	12:40 p.m.	4.13
PZ8	05/03/05		20.93	7.24	4:01 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
PZ8	07/25/05		21.35	6.82	6:06 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
PZ8	07/26/05		21.33	6.84	7:10 a.m.	7:12 a.m.	5.92	--	--
PZ8	10/26/05		21.48	6.69	12:32 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ8	10/26/05		21.43	6.74	5:01 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ8	10/27/05		21.46	6.71	7:40 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ8	10/27/05		21.34	6.83	10:15 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ8	02/07/07		21.23	6.94	1:28 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ8	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ9	04/17/03	27.54	--	--	--	5:03 p.m.	8.83	12:48 p.m.	6.12
PZ9	05/06/03		22.73	4.81	4:56 p.m.	8:45 p.m.	6.71	3:27 p.m.	4.94
PZ9	05/21/03		22.12	5.42	11:25 a.m.	7:15 a.m.	6.86	4:30 p.m.	3.84
PZ9	07/07/03		24.33	3.21	10:48 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
PZ9	08/13/03		23.52	4.02	12:35 p.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
PZ9	01/28/04		21.01	6.53	9:05 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
PZ9	04/28/04		23.93	3.61	11:41 a.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ9	04/28/04		25.18	2.36	8:14 p.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
PZ9	04/29/04		23.97	3.57	12:25 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
PZ9	07/29/04		24.72	2.82	11:30 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ9	07/29/04		24.14	3.40	2:52 p.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
PZ9	10/27/04		23.74	3.80	12:10 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ9	10/27/04		22.11	5.43	4:45 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
PZ9	01/27/05		23.20	4.34	12:30 p.m.	5:55 a.m.	--	12:40 p.m.	4.13
PZ9	05/03/05		23.56	3.98	9:15 a.m.	11:36 p.m.	5.86	8:00 p.m.	3.12

Table 3
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	07/25/05		24.31	3.23	6:23 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
PZ9	07/26/05		23.54	4.00	7:21 a.m.	7:12 a.m.	5.92	6:26 p.m.	2.66
PZ9	10/26/05		24.78	2.76	12:09 p.m	11:42 a.m	4.43	6:26 p.m.	2.66
PZ9	10/26/05		24.60	2.94	12:48 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ9	10/26/05		24.56	2.98	3:48 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ9	10/26/05		24.64	2.90	4:40 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ9	10/27/05		25.40	2.14	7:15 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	10/27/05		25.54	2.00	7:51 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	10/27/05		25.65	1.89	8:26 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	10/27/05		25.76	1.78	9:00 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	10/27/05		25.79	1.75	9:30 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	10/27/05		25.79	1.75	9:45 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	10/27/05		25.77	1.77	10:00 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	10/27/05		25.68	1.86	10:20 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ9	07/12/06		22.97	4.57	2:18 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ9	02/07/07		23.69	3.85	1:38 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ9	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ10	07/26/05	26.94	22.85	4.09	2:30 p.m.	7:12 a.m.	5.92	--	--
PZ10	10/26/05		24.42	2.52	12:07 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ10	10/26/05		24.02	2.92	4:38 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ10	10/27/05		24.08	2.86	7:12 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ10	10/27/05		24.44	2.50	10:20 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
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.	9.00	5:21 p.m.	8.36
PZ11	07/27/05	30.39	27.03	3.36	3:40 p.m.	--	--	--	--
PZ11	10/26/05		27.96	2.43	12:30 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ11	10/26/05		27.67	2.72	4:53 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ11	10/27/05		28.09	2.30	7:33 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ11	10/27/05		28.46	1.93	10:09 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ11	07/12/06		25.66	4.73	3:00 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ11	02/07/07		26.47	3.92	1:45 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33

Table 3
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)
PZ11	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ12	07/27/05	30.53	26.80	3.73	2:15 p.m.	--	--	--	--
PZ12	10/26/05		27.95	2.58	12:28 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ12	10/26/05		27.69	2.84	4:52 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ12	10/27/05		28.11	2.42	7:30 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ12	10/27/05		28.47	2.06	10:06 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ12	07/12/06		25.61	4.92	2:39 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
PZ12	02/04/10		25.42	5.11	8:34 a.m.	7:39 a.m.	5.47	2.45 p.m.	1.34
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.	9.00	5:21 p.m.	8.36
PZ13	07/27/05	30.40	26.50	3.90	9:43 p.m.				
PZ13	10/26/05		27.86	2.54	12:27 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ13	10/26/05		27.58	2.82	4:50 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
PZ13	10/27/05		27.63	2.77	7:29 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ13	10/27/05		28.10	2.30	10:05 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
PZ13	02/07/07		26.30	4.10	1:56 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ13	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ14	02/07/07	29.09	25.33	3.76	2:00 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
PZ14	02/04/10		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.	9.00	5:21 p.m.	8.36
PZ15	02/07/07	27.79	23.91	3.88	1:24 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33

Table 3
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)
PZ15	02/04/10		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
AB1[3]	07/07/03	27.53	33.70	3.70	10:35 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
AB1[3]	08/13/03		31.43	5.31	11:25 a.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
AB1[3]	01/28/04		29.49	6.68	9:03 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
AB1[3]	01/28/04		29.19	6.89	1:07 p.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
AB1[3]	04/29/04		33.72	3.69	12:22 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
AB1[3]	07/29/04		33.08	4.14	11:35 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
AB1[3]	07/29/04		33.65	3.74	2:56 p.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
AB1[3]	10/27/04		33.35	3.95	12:50 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
AB1[3]	10/27/04		30.11	6.24	4:42 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
AB1[3]	01/27/05		32.14	4.80	12:27 p.m.	5:55 a.m.		12:40 p.m.	4.13
AB1[3]	05/03/05		31.31	5.39	1:49 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
AB1[3]	07/25/05		34.18	3.36	6:20 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
AB1[3]	07/26/05		31.78	5.06	7:25 a.m.	7:12 a.m.	5.92		
AB1[3]	10/26/05		34.53	3.11	12:21 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
AB1[3]	10/26/05		33.60	3.77	4:56 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
AB1[3]	10/27/05		34.52	3.12	7:20 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
AB1[3]	07/12/06		31.14	4.39	2:40 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
AB1[3]	02/07/07		32.54	4.52	1:41 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
AB1[3]	02/04/10		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	--	--
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.	9.00	5:21 p.m.	8.36
AB2[3]	07/07/03	28.41	30.07	3.78	10:30 a.m.	9:09 a.m.	4.34	4:54 p.m.	1.41
AB2[3]	08/13/03		29.94	3.88	4:10 p.m.	4:12 a.m.	7.10	1:09 p.m.	4.54
AB2[3]	01/28/04		26.12	7.01	8:47 a.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
AB2[3]	01/28/04		26.88	6.39	3:00 p.m.	8:42 a.m.	8.10	4:54 p.m.	5.78
AB2[3]	04/28/04		29.59	4.17	11:59 a.m.	9:39 a.m.	4.60	6:46 p.m.	2.19
AB2[3]	04/29/04		29.62	4.15	12:15 p.m.	11:03 a.m.	4.71	6:39 a.m.	3.3
AB2[3]	07/29/04		30.36	3.54	11:42 a.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
AB2[3]	07/29/04		29.75	4.04	3:03 p.m.	2:36 p.m.	5.15	10:27 a.m.	2.47
AB2[3]	10/27/04		29.48	4.26	12:37 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66
AB2[3]	10/27/04		27.39	5.97	4:35 p.m.	3:15 p.m.	7.41	10:39 a.m.	3.66

Table 3
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)
AB2[3]	01/27/05		28.78	4.83	12:18 p.m.	5:55 a.m.	--	12:40 p.m.	4.13
AB2[3]	05/03/05		28.58	5.00	5:15 p.m.	11:36 p.m.	5.86	8:00 p.m.	3.12
AB2[3]	07/25/05		30.00	3.83	6:15 p.m.	8:00 p.m.	6.26	2:54 p.m.	2.44
AB2[3]	07/26/05		28.99	4.66	7:33 a.m.	7:12 a.m.	5.92	--	--
AB2[3]	10/26/05		30.35	3.55	12:26 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
AB2[3]	10/26/05		30.52	3.41	4:49 p.m.	11:42 a.m	4.43	6:26 p.m.	2.66
AB2[3]	10/27/05		31.54	2.57	7:28 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
AB2[3]	10/27/05		31.78	2.38	10:04 a.m.	12:36 p.m.	4.58	7:24 a.m.	1.48
AB2[3]	07/12/06		28.36	4.36	2:40 p.m.	6:28 p.m.	6.53	2:40 p.m.	4.00
AB2[3]	02/07/07		29.40	4.33	1:54 p.m.	7:09 a.m.	6.42	3.03 p.m.	3.33
AB2[3]	02/04/10		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.	9.00	5:21 p.m.	8.36
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.	9.00	5:21 p.m.	8.36
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	--	--
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.	9.00	5:21 p.m.	8.36
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

Table 3
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)
OW3	06/22/11		15.65	10.48	8:24 a.m.	9:48 a.m.	9.00	5:21 p.m.	8.36

Notes:

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°)
   AB2 (28.41 - WL COS 35°)

2003 through February 2010 data was obtained from CDM reports or electronic files provided to H&H by Clariant.
ft TOC = feet below top of casing.
CRD = Columbia River Datum.

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	Time Sampled	Temperature (°C)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
PZ1	04/15/03	1255	14.6	155	5.23	6.27	64.0	70	--
PZ1	07/18/03	1430	15.2	--	--	6.84	--	Clear	--
PZ1	08/13/03	1035	15.9	600	--	7.79	--	4.3	--
PZ1	01/28/04	1530	13.5	190	--	6.49	--	5.4	--
PZ1	04/28/04	0942	13.3	192	--	6.37	--	1.13	--
PZ1	07/29/04	1532	18.0	202	--	6.20	--	5.4	--
PZ1	10/27/04	0915	11.5	189	--	5.44	--	0.36	--
PZ1	01/27/05	1015	12.9	198	4.05	6.38	-43.0	0	--
PZ1	05/03/05	1532	15.6	208	--	6.02	--	0.55	--
PZ1	07/26/05	0900	15.0	167	3.38	7.25	212.9	1.20	--
PZ1	10/26/05	1535	13.9	142	--	5.67	--	--	--
PZ1	07/12/06	1836	14.9	159	--	5.90	--	2.8	--
PZ1	02/04/10	1415	13.2	160	2.04	5.29	24.0	Clear	--
PZ1	09/02/10	1400	15.8	69	8.44	5.66	-63.5	3.17	<0.200
PZ1	11/02/10	1650	14.8	84	7.62	6.57	-27.8	4.12	<0.200
PZ1	12/20/10	1634	11.2	69	6.45	6.77	43.4	3.2	<0.200
PZ1	03/22/11	1030	12.4	121	6.29	6.52	-58.5	1.32	<0.200
PZ1	06/21/11	1140	15.4	124	4.77	6.51	5.7	1.97	<0.200
PZ3	04/15/03	1645	14.6	689	0.25	5.85	43.0	40	--
PZ3	05/06/03	1550	15.4	695	1.62	6.80	24.0	4	--
PZ3	05/21/03	1215	15.7	710	--	7.15	--	Clear	--
PZ3	07/18/03	1615	15.3	--	--	7.10	--	Clear	--
PZ3	08/13/03	1202	15.5	740	--	6.72	--	1.8	--
PZ3	01/28/04	1330	13.9	517	--	6.27	--	1.05	--
PZ3	04/28/04	1747	21.6	551	--	6.27	--	1.5	--
PZ3	07/29/04	1239	18.9	421	--	6.15	--	5.3	--
PZ3	10/27/04	1100	12.9	340	--	5.95	--	1.61	--
PZ3	01/27/05	1440	14.7	459	3.39	6.68	-48.0	0.60	--
PZ3	05/03/05	1335	16.0	436	--	6.10	--	0.70	--
PZ3	07/25/05	1256	17.7	306	2.15	6.19	80.0	3.97	--
PZ3	10/27/05	0915	12.8	257	--	5.64	--	--	--
PZ3	07/13/06	0718	14.2	471	--	5.84	--	2.0	--
PZ3	07/13/06	1600	14.7	198	--	6.35	--	0.30	--
PZ3	02/05/10	1120	14.0	603	1.55	6.02	23.0	Clear	--
PZ3	09/01/10	1436	14.0	311	3.54	6.11	66.6	3.38	<0.200
PZ3	11/03/10	1310	19.0	254	5.19	6.30	76.9	2.01	<0.200
PZ3	12/21/10	1445	12.5	200	2.79	6.69	-10.2	3.07	<0.200
PZ3	03/22/11	1620	12.6	342	2.64	5.96	-110.0	0.74	<0.200
PZ3	06/21/11	1625	18.6	341	1.16	6.20	4.4	1.09	<0.200
PZ4	04/15/03	1845	14.2	1,050	4.49	5.35	91.0	67	--
PZ4	05/21/03	1246	14.8	380	--	7.16	--	Clear	--
PZ4	08/13/03	1346	15.9	510	--	6.62	--	5.2	--
PZ4	01/28/04	1110	14.1	767	--	5.53	--	0.17	--
PZ4	04/28/04	2122	14.0	811	--	5.76	--	4.97	--

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	Time Sampled	Temperature (^{o}C)	Conductivity (μs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
PZ4	07/29/04	1825	17.2	884	--	5.46	--	4.4	--
PZ4	10/27/04	1335	12.5	614	--	5.53	--	0.25	--
PZ4	01/27/05	1645	13.6	1,770	1.99	5.58	-49.0	0	--
PZ4	05/03/05	1152	14.6	957	--	5.58	--	0.87	--
PZ4	07/25/05	1530	15.2	454	0.86	5.82	236.3	2.84	--
PZ4	10/26/05	1310	13.3	692	--	5.35	--	--	--
PZ4	07/13/06	0746	14.0	465	--	5.73	--	3.1	--
PZ4	07/13/06	1640	16.5	405	--	6.18	--	8.4	--
PZ4	09/01/10	1244	13.7	636	2.91	5.50	84.8	3.72	<0.200
PZ4	11/03/10	1120	16.7	587	5.11	5.71	125.1	4.84	<0.200
PZ4	12/21/10	1515	11.8	275	2.36	6.34	-31.3	4.86	<0.200
PZ4	03/22/11	1445	12.7	668	5.72	5.94	-66.5	1.55	<0.200
PZ4	06/21/11	1515	16.96	888	6.15	5.65	35.9	2.27	<0.200
PZ5	04/16/03	1115	13.6	530	4.78	5.86	100.0	57	--
PZ5	05/21/03	1320	14.2	170	--	7.10	--	Clear	--
PZ5	08/13/03	1729	15.9	860	--	6.69	--	9.7	--
PZ5	01/28/04	1150	13.6	210	--	6.19	--	1.6	--
PZ5	04/28/04	1958	14.2	293	--	6.03	--	1.51	--
PZ5	07/29/04	1902	16.6	479	--	5.92	--	2.6	--
PZ5	10/27/04	1415	12.4	1,300	--	5.32	--	0.64	--
PZ5	01/27/05	1605	13.3	460	3.8	6.34	-27.0	7.9	--
PZ5	05/03/05	1100	14.1	281	--	5.77	--	1.09	--
PZ5	07/25/05	1737	15.8	478	3.05	5.94	199.3	5.15	--
PZ5	10/26/05	1150	14.0	770	--	5.45	--	--	--
PZ5	07/13/06	0800	13.9	190	--	5.00	--	4.70	--
PZ5	07/13/06	1658	12.0	186	--	5.80	--	4.45	--
PZ5	02/05/10	1455	13.6	433	1.9	5.76	22.0	Clear	--
PZ5	09/01/10	1521	15.8	212	4.13	5.50	87.3	5.38	<0.200
PZ5	11/03/10	1035	14.2	142	5.43	6.20	79.0	1.94	<0.200
PZ5	12/21/10	1600	10.4	142	7.21	6.22	34.6	2.25	<0.200
PZ5	03/22/11	1520	12.0	425	6.81	6.28	-84.5	1.27	<0.200
PZ5	06/21/11	1555	15.3	2,178	4.22	5.43	65.4	1.01	<0.200
PZ6	04/16/03	1310	13.8	345	7.07	4.74	162.0	17	--
PZ6	05/21/03	1415	14.4	250	--	6.85	--	Clear	--
PZ6	08/13/03	1642	16.1	880	--	6.76	--	6.9	--
PZ6	01/28/04	1020	12.1	447	--	5.96	--	0.07	--
PZ6	04/28/04	1412	19.1	293	--	5.90	--	23.9	--
PZ6	07/29/04	1738	18.2	725	--	5.80	--	6.3	--
PZ6	10/27/04	1500	12.2	747	--	5.63	--	0.42	--
PZ6	01/27/05	1730	13.0	991	3.72	5.59	12.0	3.2	--
PZ6	05/03/05	1233	14.9	1,370	--	5.28	--	0.90	--
PZ6	07/25/05	1549	16.0	1,275	4.85	4.48	290.3	0.87	--
PZ6	10/26/05	820	11.5	916	--	4.15	--	--	--
PZ6	07/13/06	0906	14.0	802	--	5.08	--	1.90	--

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	Time Sampled	Temperature (°C)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
PZ6	09/01/10	1133	12.9	728	7.60	5.68	117.6	4.36	<0.200
PZ6	11/03/10	1155	15.4	671	6.38	5.69	133.0	1.53	<0.200
PZ6	12/20/10	1715	11.8	217	6.80	6.32	55.6	3.33	<0.200
PZ6	03/22/11	1415	11.8	357	7.19	5.76	-39.7	1.99	<0.200
PZ6	06/21/11	1445	16.4	420	6.93	5.94	21.9	4.90	<0.200
PZ12	07/27/05	1452	17.6	198	2.54	9.65	15.2	3.75	--
PZ12	10/26/05	1430	13.7	164	--	5.66	--	--	--
PZ12	07/13/06	1802	14.7	193	--	5.45	--	3.09	--
PZ12	02/04/10	1230	13.2	290	2.86	5.71	25.0	Clear	--
PZ12	09/02/10	1124	12.3	185	1.54	5.61	-2.2	3.52	<0.200
PZ12	11/03/10	945	11.9	269	1.93	6.70	-65.9	3.60	<0.200
PZ12	12/21/10	1230	12.8	372	0.61	6.54	-32.8	1.83	<0.200
PZ12	03/22/11	945	12.1	641	0.22	6.03	-192.3	0.99	<0.200
PZ12	06/21/11	1405	16.2	531	2.43	5.46	-7.1	2.55	<0.200
PZ13	07/27/05	1032	15.9	168	1.52	8.61	-121.8	2.3	--
PZ13	09/02/10	1029	14.3	225	2.97	6.14	14.8	4.92	<0.200
PZ13	11/02/10	1420	16.1	1,941	0.14	9.80	-449.8	776	36
PZ13	12/21/10	1020	11.0	539	0.94	6.71	-101.4	444	<0.200
PZ13	03/22/11	900	10.5	349	4.48	6.61	-151.9	267	10.4
PZ13	06/21/11	1340	15.0	366	5.22	6.31	-59.5	21.9	1.22
AB1	07/07/03	1531	17.3	397	--	6.73	--	9	--
AB1	07/18/03	1525	15.2	--	--	6.94	--	Clear	--
AB1	08/13/03	1218	15.8	720	--	6.80	--	1.1	--
AB1	01/28/04	1410	13.6	253	--	6.82	--	3.2	--
AB1	04/28/04	1843	19.0	373	--	7.04	--	24.8	--
AB1	07/29/04	1356	20.6	334	--	6.54	--	12	--
AB1	10/27/04	1210	14.7	195	--	6.25	--	1.03	--
AB1	01/27/05	1355	14.2	209	2.38	7.12	-58.0	2.6	--
AB1	05/03/05	1408	15.0	310	--	6.52	--	0.70	--
AB1	07/25/05	1425	15.4	226	3.46	6.65	189.2	10.2	--
AB1	10/27/05	1030	12.3	177	--	6.08	--	--	--
AB1	07/13/06	0730	13.7	255	--	6.08	--	0.9	--
AB1	07/13/06	1612	16.1	505	--	5.95	--	0.9	--
AB1	02/05/10	1045	12.7	391	1.65	6.29	31.0	Clear	--
AB1	09/01/10	1339	14.6	314	5.47	6.39	67.1	6.13	<0.200
AB1	11/03/10	1245	19.3	186	6.34	6.67	62.5	1.12	<0.200
AB1	12/21/10	1410	10.8	112	9.01	7.36	23.0	4.33	<0.200
AB1	03/22/11	1600	11.5	158	8.95	6.54	-49.7	0.45	<0.200
AB1	06/21/11	1640	16.2	212	8.63	7.17	-7.3	2.35	<0.200
AB2	07/07/03	1247	15.8	174	--	6.29	--	2.7	--
AB2	07/18/03	1325	15.1	--	--	7.03	--	9	--
AB2	08/12/03	1700	14.7	710	--	7.11	--	5.7	--
AB2	01/28/04	1860	14.0	165	--	6.51	--	20	--
AB2	04/28/04	1030	16.6	192	--	6.67	--	219	--

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	Time Sampled	Temperature (^oC)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	pH	ORP (mV)	Turbidity* (NTU)	Sulfides (mg/L)
AB2	07/29/04	1628	18.5	180	--	6.35	--	68	--
AB2	10/27/04	0955	12.0	162	--	5.61	--	9.12	--
AB2	01/27/05	1135	13.5	174	1.66	6.52	-68.0	37	--
AB2	05/03/05	1732	14.5	213	--	6.18	--	95	--
AB2	07/26/05	0811	14.5	140	1.89	7.14	190.1	1.15	--
AB2	01/26/05	1510	14.4	137	--	5.88	--	--	--
AB2	07/13/06	0702	14.0	190	--	5.63	--	0.30	--
AB2	07/13/06	1542	14.4	136	--	5.94	--	0.30	--
AB2	02/04/10	1330	13.1	135	6.62	5.34	28.0	Clear	--
AB2	09/02/10	1319	15.5	79	2.42	5.42	-15.4	5.37	<0.200
AB2	11/02/10	1545	16.5	111	4.18	6.99	-62.4	1.80	<0.200
AB2	12/20/10	1610	11.2	80	2.39	6.70	22.4	0.86	<0.200
AB2	03/22/11	1125	11.6	99	7.35	6.67	-65.5	0.49	<0.200
AB2	06/21/11	935	13.7	109	7.48	6.50	339.50	1.61	<0.200
OW1	09/23/10	1000	12.7	162	10.6	6.47	-50.8	0.20	<0.200
OW1	11/02/10	1845	14.2	104	7.28	6.63	-19.4	3.89	<0.200
OW1	12/20/10	1545	11.2	91	6.02	6.84	38.9	1.13	<0.200
OW1	03/22/11	1340	12.7	192	6.4	6.62	-58.7	0.50	<0.200
OW1	06/21/11	1040	15.6	227	2.84	6.39	60.4	3.06	<0.200
OW2	09/23/10	0920	13.4	123	8.87	6.34	-43.0	1.55	<0.200
OW2	11/02/10	1645	15.3	99	7.91	6.73	-40.7	4.54	<0.200
OW2	12/20/10	1355	12.2	123	6.22	5.90	89.3	3.22	<0.200
OW2	03/22/11	1055	11.2	172	5.7	6.60	-67.8	0.59	<0.200
OW2	06/21/11	1015	14.3	224	3.58	6.25	170.5	4.61	<0.200
OW3	09/23/10	0830	13.3	104	10.46	6.43	-49.7	0.21	<0.200
OW3	11/02/10	1845	13.9	104	5.85	6.46	-4.9	4.46	<0.200
OW3	12/21/10	1110	12.9	153	2.92	6.67	13.5	2.15	<0.200
OW3	03/22/11	1150	10.9	270	5.55	6.48	-73.5	0.62	<0.200
OW3	06/21/11	1120	15.3	186	4.41	6.45	13.4	3.29	<0.200

Notes:
Only data for wells used for injection performance monitoring are shown
* turbidity values were collected prior to field filtering
^oC - 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 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			
PZ1	04/15/03	1255	--	2,100	--	<4.4
PZ1	07/18/03	1430	--	3,500	--	--
PZ1	08/13/03	1035	7,300	--	<4.4	--
PZ1	01/28/04	1530	10,000	--	--	--
PZ1	04/29/04	1214	--	13,000	--	--
PZ1	07/29/04	1532	--	16,000	--	--
PZ1	10/27/04	0915	--	13,000	--	--
PZ1	01/27/05	1015	--	16,100	--	--
PZ1	05/03/05	1532	--	16,800	--	--
PZ1	07/26/05	0900	--	20,500	--	<2.0
PZ1	10/26/05	1535	--	12,600	--	--
PZ1	07/12/06	1836	--	11,500	--	0.7
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
PZ3	04/15/03	1645	--	7,200	--	<4.4
PZ3	05/06/03	1550	--	11,000	--	<4.4
PZ3	05/21/03	1215	--	12,000	--	<4.0
PZ3	07/18/03	1615	--	12,000	--	--
PZ3	08/13/03	1202	7,400	--	<4.4	--
PZ3	01/28/04	1330	8,300	--	<4.4	--
PZ3	04/28/04	1747	--	11,000	--	<4.0
PZ3	07/29/04	1239	--	6,600	--	<4.0
PZ3	10/27/04	1100	--	4,300	--	<4.0
PZ3	01/27/05	1440	--	8,920	--	<2
PZ3	05/03/05	1335	--	7,160	--	<2
PZ3	07/25/05	1256	--	6,850	--	<2.0
PZ3	10/27/05	0915	--	4,140	--	<2.0
PZ3	07/13/06	0718	--	7,510	--	1.0
PZ3	07/13/06	1600	--	850	--	0.3
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	06/21/11	1625	--	2,930		<10.0
PZ4	04/15/03	1845	--	3,300	--	46
PZ4	05/21/03	1246	--	650	--	9.2
PZ4	08/13/03	1346	720	--	9.6	--

Table 5
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			
PZ4	01/28/04	1110	6,600	--	64	--
PZ4	04/28/04	2122	--	2,300	--	27
PZ4	07/29/04	1825	--	3,500	--	37
PZ4	10/27/04	1335	--	1,700	--	16
PZ4	01/27/05	1645	--	8,060	--	82
PZ4	05/03/05	1152	--	2,090	--	19
PZ4	07/25/05	1530	--	1,190	--	10
PZ4	10/26/05	1310	--	1,450	--	13
PZ4	07/13/06	0746 (HT)	--	620	--	7.7
PZ4	07/13/06	1640 (LT)	--	420	--	5.3
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
PZ5	04/16/03	1115	--	3,600	--	180
PZ5	05/21/03	1320	--	3,000	--	120
PZ5	08/13/03	1729	4,300	--	160	--
PZ5	01/28/04	1150	3,700	--	110	--
PZ5	04/28/04	1958	--	6,700	--	200
PZ5	07/29/04	1902	--	8,800	--	320
PZ5	10/27/04	1415	--	34,000	--	1,100
PZ5	01/27/05	1605	--	7,930	--	326
PZ5	05/03/05	1100	--	5,850	--	244
PZ5	07/25/05	1737	--	7,550	--	302
PZ5	10/26/05	1224	--	14,100	--	628
PZ5	07/13/06	0800 (HT)	--	3,390	--	152
PZ5	07/13/06	1658 (LT)	--	3,250	--	146
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
PZ6	04/16/03	1310	--	1,500	--	<4.4
PZ6	05/21/03	1415	--	1,400	--	<4.0
PZ6	08/13/03	1642	2,100	--	<4.4	--
PZ6	01/28/04	1020	2,600	--	--	--
PZ6	04/28/04	1412	--	1,400	--	--
PZ6	07/29/04	1738	--	4,600	--	--
PZ6	10/27/04	1500	--	2,600	--	--
PZ6	01/27/05	1730	--	5,370	--	--

Table 5
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	05/03/05	1233	--	12,500	--	--
PZ6	07/25/05	1549	--	26,200	--	6
PZ6	10/27/05	0721	--	16,800	--	6
PZ6	07/13/06	0906	3,800	--	1.7	--
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
PZ12	07/27/05	1452	--	57,300	--	<2.0
PZ12	10/26/05	1430	--	44,600	--	--
PZ12	07/12/06	1802	--	37,400	--	0.4
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
PZ13	07/27/05	1032	--	17,300	--	<2.0
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
AB1	07/07/03	1531	1,200	1,100	<4.4	<4.0
AB1	07/18/03	1525	--	610	--	--
AB1	08/13/03	1218	--	810	--	<4.0
AB1	01/28/04	1410	680	--	--	--
AB1	04/28/04	1843	--	1,200	--	--
AB1	07/29/04	1356	--	1,100	--	--
AB1	10/27/04	1210	--	660	--	--
AB1	01/27/05	1355	--	1,050	--	--
AB1	05/03/05	1408	--	1,330	--	--
AB1	07/25/05	1425	--	1,280	--	<2.0
AB1	10/27/05	1030	--	697	--	--
AB1	07/13/06	0730 (HT)	--	630	--	0.3
AB1	07/13/06	1612 (LT)	--	9,000	--	1.2
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

Table 5
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			
AB1	06/21/11	1640	--	304	--	<10.0
AB2	07/07/03	1247	3,700	3,600	<4.0	<4.0
AB2	07/18/03	1325	--	3,200	--	--
AB2	08/12/03	1700	--	2,700	--	<4.0
AB2	01/28/04	1860	3,500	--	--	--
AB2	04/28/04	1030	--	1,200	--	--
AB2	07/29/04	1628	--	6,200	--	--
AB2	10/27/04	0955	--	4,800	--	--
AB2	01/27/05	1135	--	8,490	--	--
AB2	05/03/05	1732	--	10,600	--	--
AB2	07/26/05	0811	--	7,960	--	<2.0
AB2	10/26/05	1510	--	7,540	--	--
AB2	07/13/06	0702 (HT)	--	8,010	--	0.8
AB2	07/13/06	1542 (LT)	--	4,840	--	0.5
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
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
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
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

Notes:
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
HT - sample collected at high tide, LT - sample collected at low tide

Table 6
Summary of Excavation Base Sample Soil Analytical Data
Former Clariant Facility
Kalama, WA
H&H Project No. CLR-045

Sample ID	Sample Collection Date	Total Zinc (mg/kg)	TCLP Zinc (µg/L)
Remaining Excavation Base Samples			
B8	10/02/03	6,200	200,000
B9	10/02/03	1,300	27,000
B10	09/25/03	2,400	70,000
B11	09/25/03	4,500	120,000
B12	09/19/03	2,700	69,000
B13	09/19/03	2,100	54,000
EB-1	08/20/10	780	NA
EB-2	08/20/10	480	NA
EB-3	08/20/10	560	NA
EB-4	09/02/10	462	NA
EB-5	09/02/10	793	NA
EB-6	09/02/10	738	NA
EB-7	09/16/10	2,110	NA
EB-8	09/16/10	1,380	NA
EB-9	09/16/10	1,800	NA
EB-10	09/16/10	950	NA
EB-11	09/16/10	1,160	NA
EB-12	09/16/10	1,220	NA
EB-13	09/16/10	729	NA
Removed Soil Excavation Base Samples			
B1	09/05/03	890	24,000
B4	09/12/03	670	12,000
B12	09/16/03	9,600	330,000
B13	09/16/03	4,000	110,000
B14	09/16/03	910	28,000

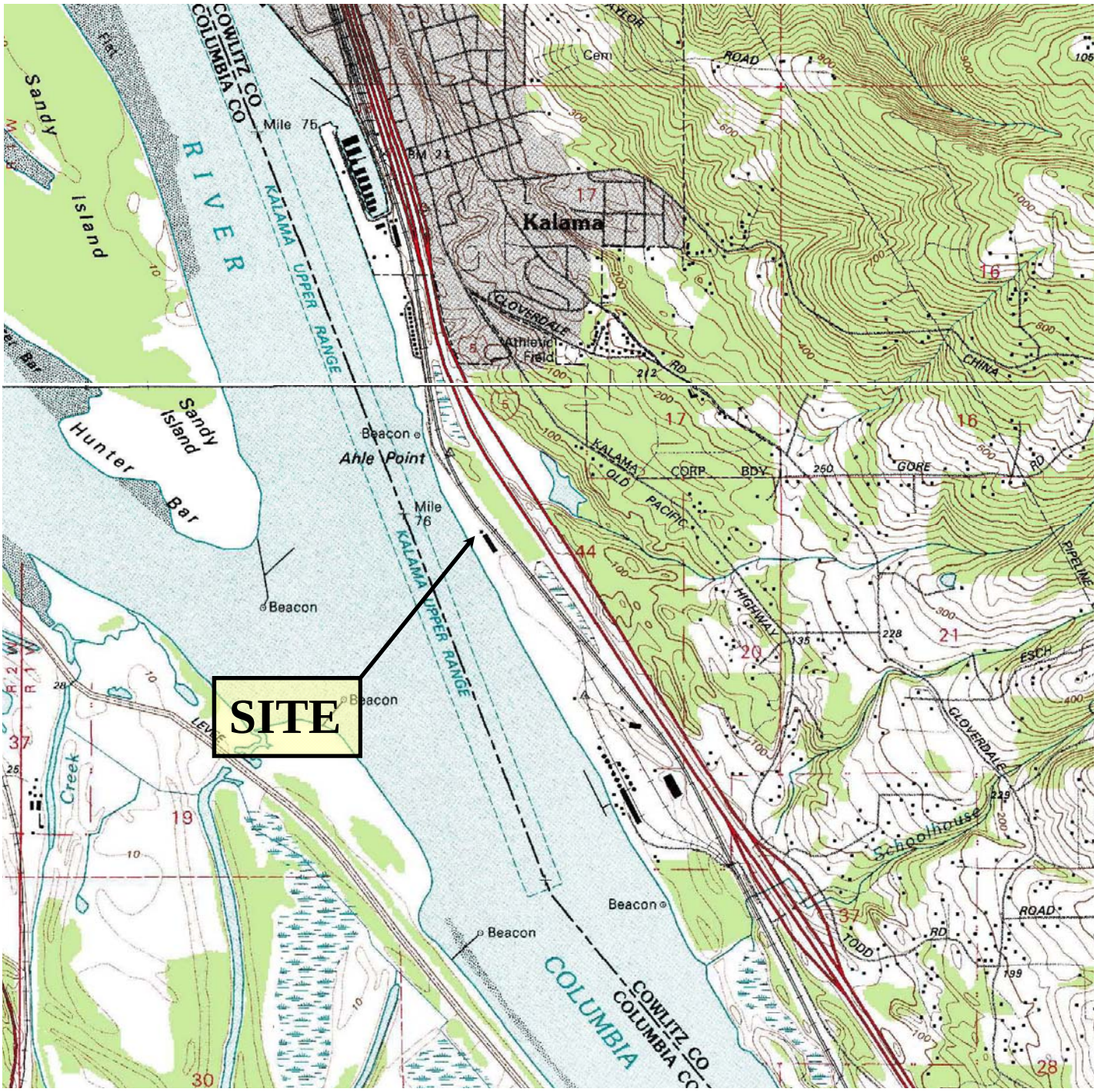
Notes:

All remaining excavation base samples were collected from 15 ft bgs from soils that were left in place. Removed excavation base samples were collected at shallower than 15 ft bgs from soils that were removed during additional excavation activities.

mg/kg = milligram per kilogram

NA = not analyzed

Figures



N

APPROXIMATE

0 2,000 4,000

SCALE IN FEET

U.S.G.S. QUADRANGLE MAP

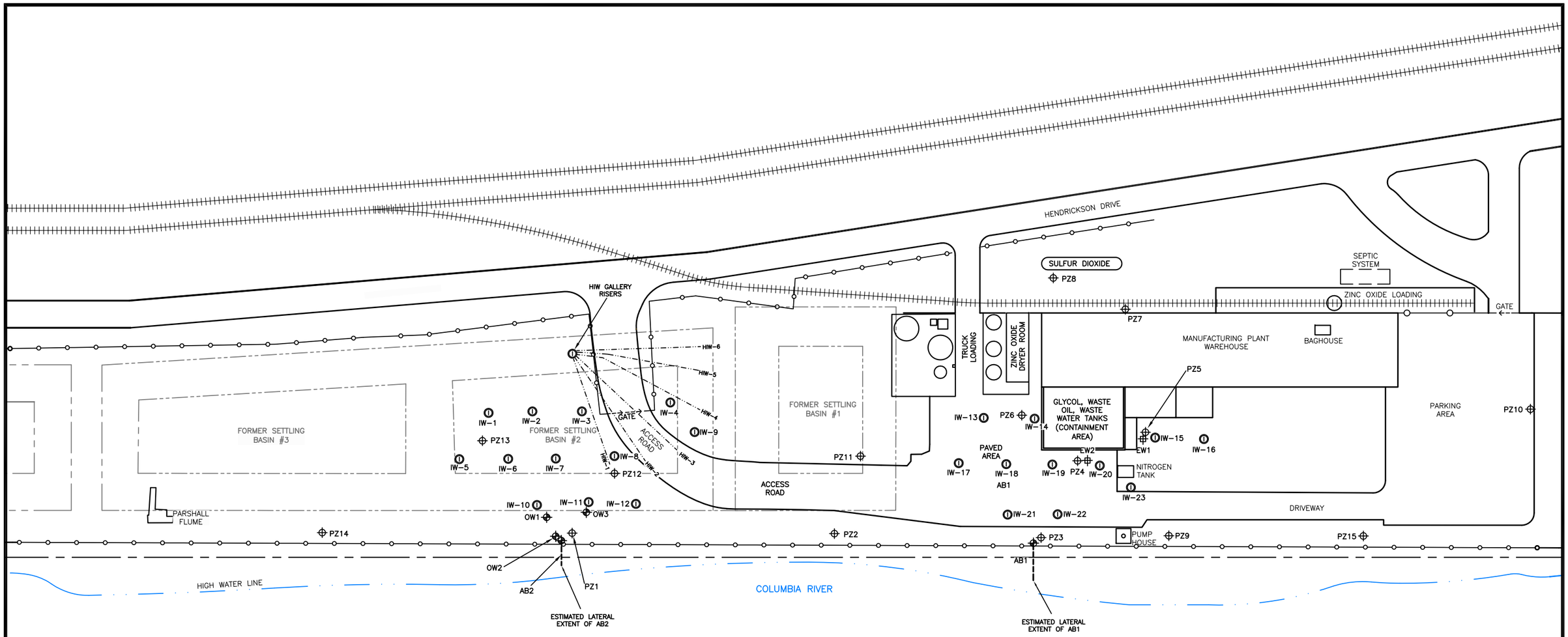
DEER ISLAND & KALAMA, WA 7.5 MIN. TOPOGRAPHIC QUADRANGLES

QUADRANGLE
7.5 MINUTE SERIES (TOPOGRAPHIC)

TITLE	SITE LOCATION MAP
PROJECT	CLARIANT CORPORATION KALAMA, WASHINGTON

Hart & Hickman
A Professional Corporation
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007 (p) 704-586-0373 (f)

DATE:	07-19-10	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

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.

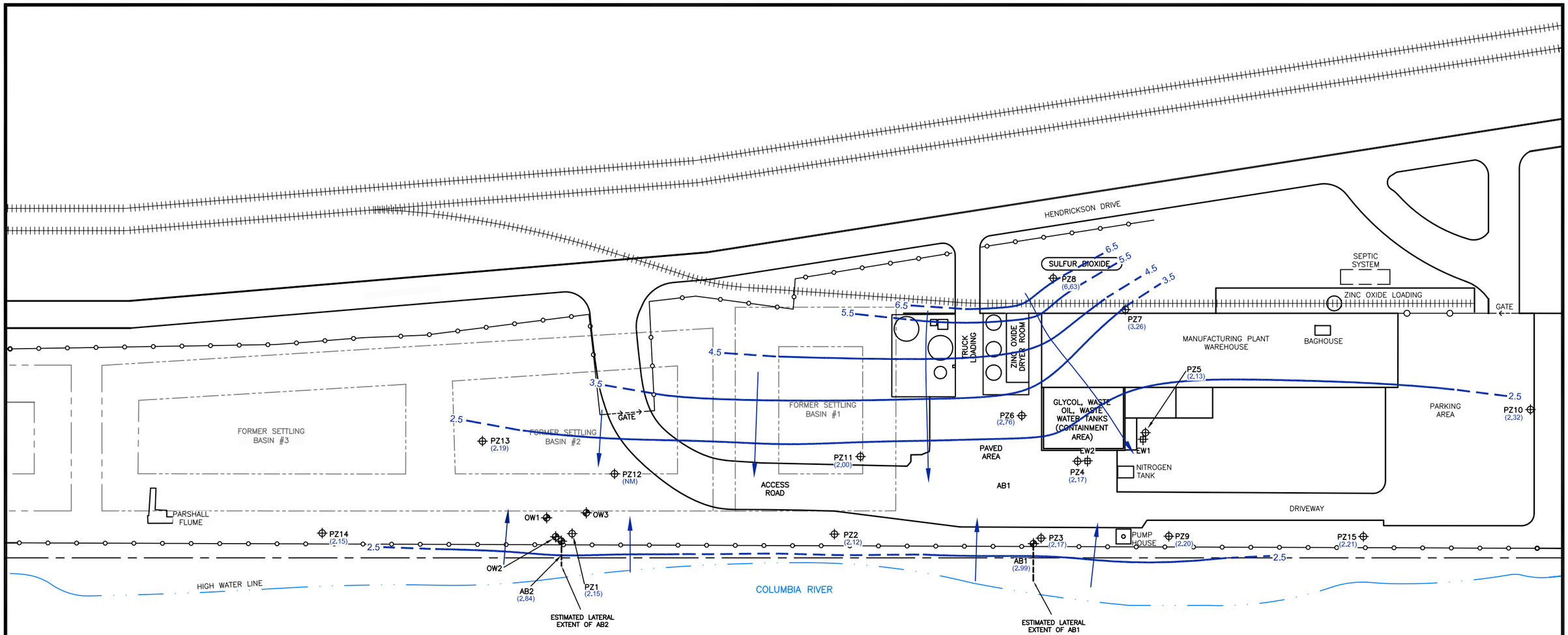
APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
SITE MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 11/04/10	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 2



LEGEND:

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

NOTE
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.

N

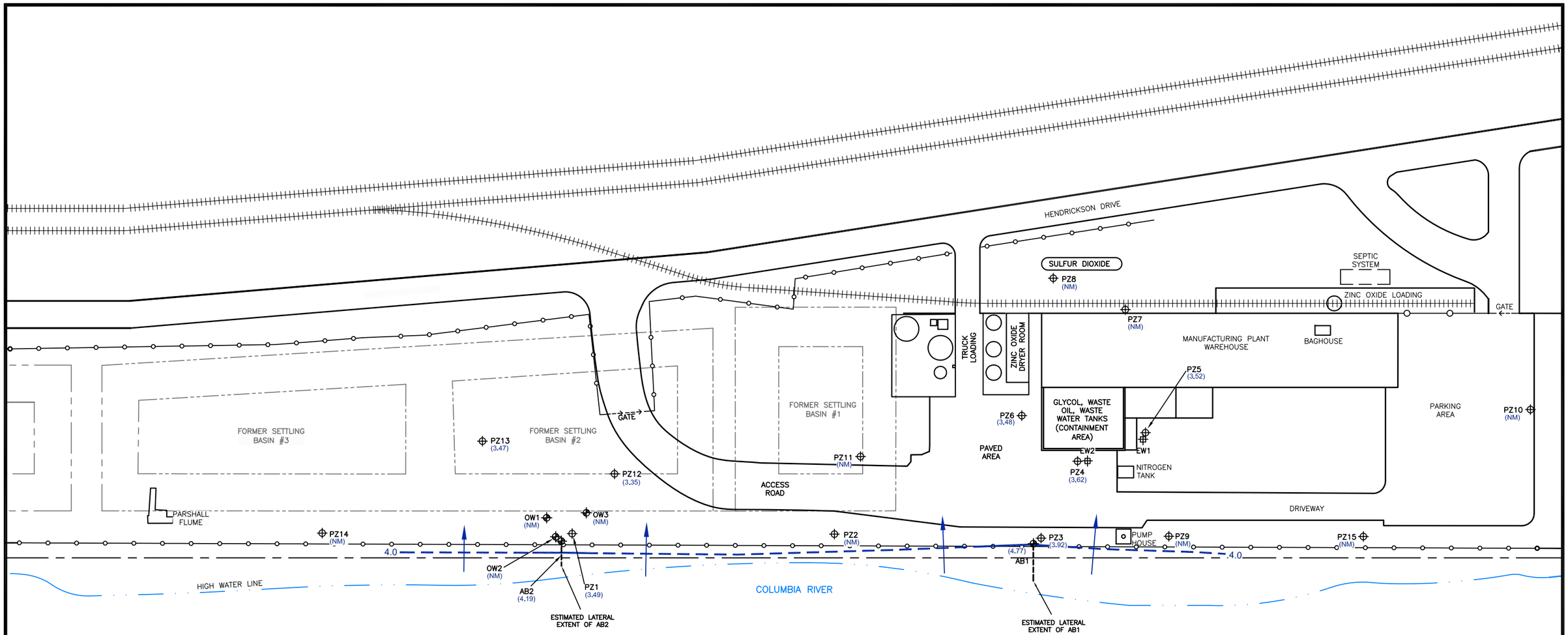
APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
GROUND WATER GRADIENT MAP
SEPTEMBER 1, 2010

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 11/21/10	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 3A



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- (3.49) 11/02/10 GROUND WATER ELEVATION (FT CRD)
- 4.0 GROUND WATER ELEVATION CONTOUR IN FT CRD (DASHING INDICATES EXTRAPOLATED CONTOUR)
- INFERRED GROUND WATER FLOW DIRECTION

NOTE
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.

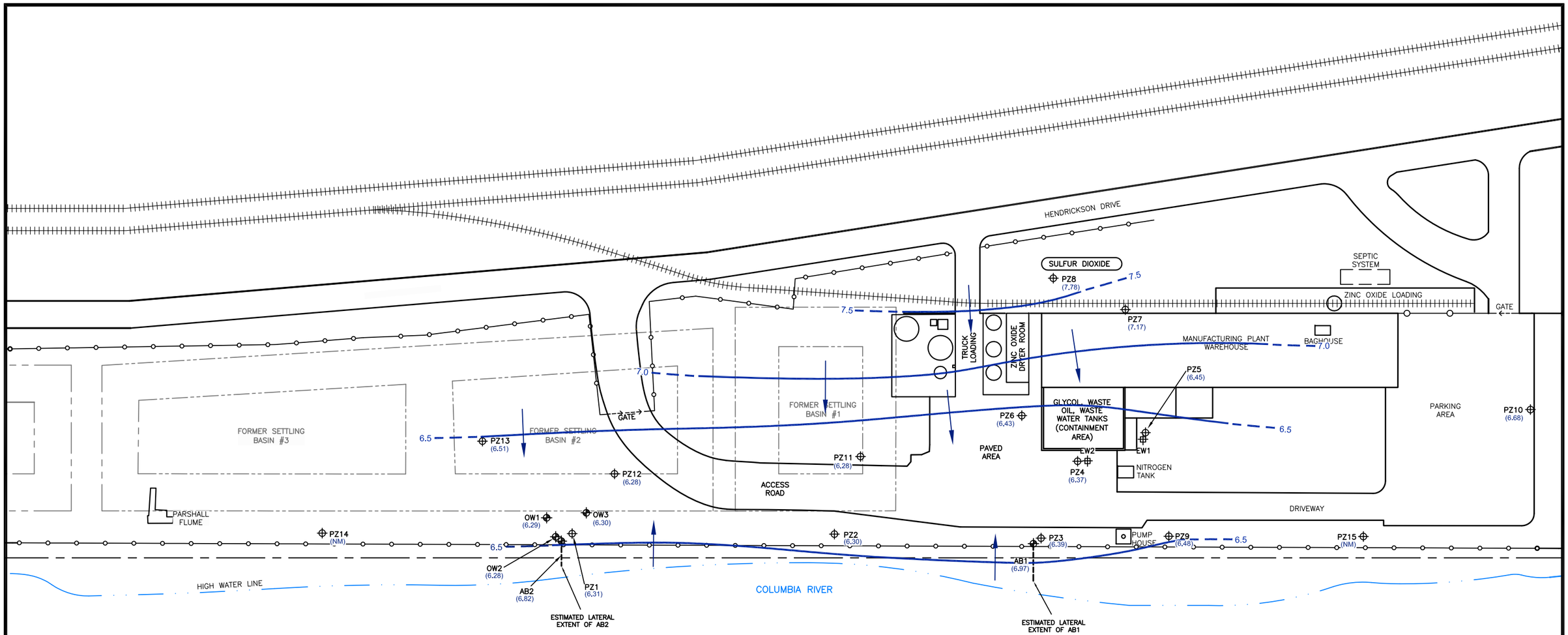
APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
GROUND WATER GRADIENT MAP
NOVEMBER 1, 2010

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 11/21/10	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 3B



LEGEND:

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

NOTES
1. GROUND WATER ELEVATION MEASUREMENTS WERE TAKEN AT APPROXIMATE TIME OF PREDICTED LOW DAILY TIDAL ELEVATION OF COLUMBIA RIVER.
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.

N

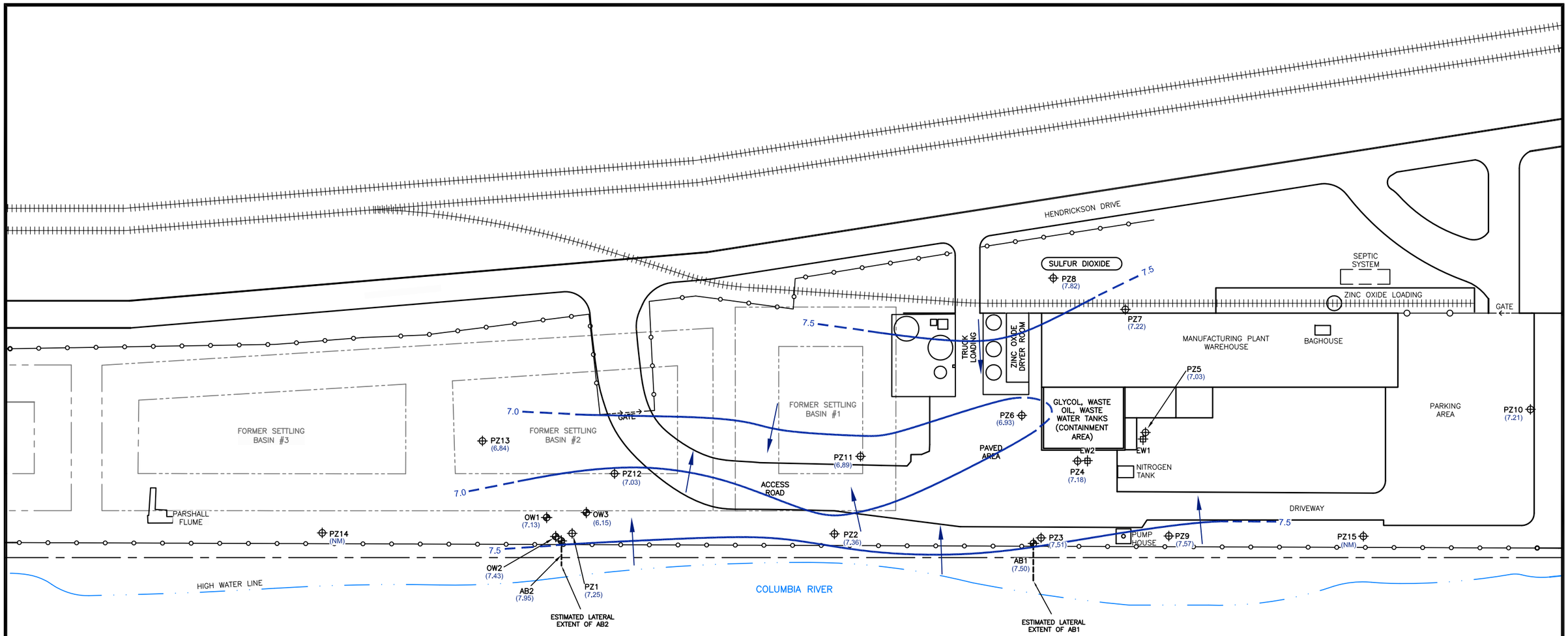
APPROXIMATE
0 80 160
SCALE IN FEET

TITLE: GROUND WATER GRADIENT MAP (LOW TIDE) DECEMBER 20, 2010

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

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 04/18/11	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 3C



LEGEND:

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

NOTES
1. GROUND WATER ELEVATION MEASUREMENTS WERE TAKEN AT APPROXIMATE TIME OF PREDICTED HIGH DAILY TIDAL ELEVATION OF COLUMBIA RIVER.
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. OW3 WAS NOT USED IN CONTOURING DUE TO ANOMALOUS READING.

N

APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
GROUND WATER GRADIENT MAP (HIGH TIDE)
DECEMBER 20, 2010

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 04/18/11	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 3D

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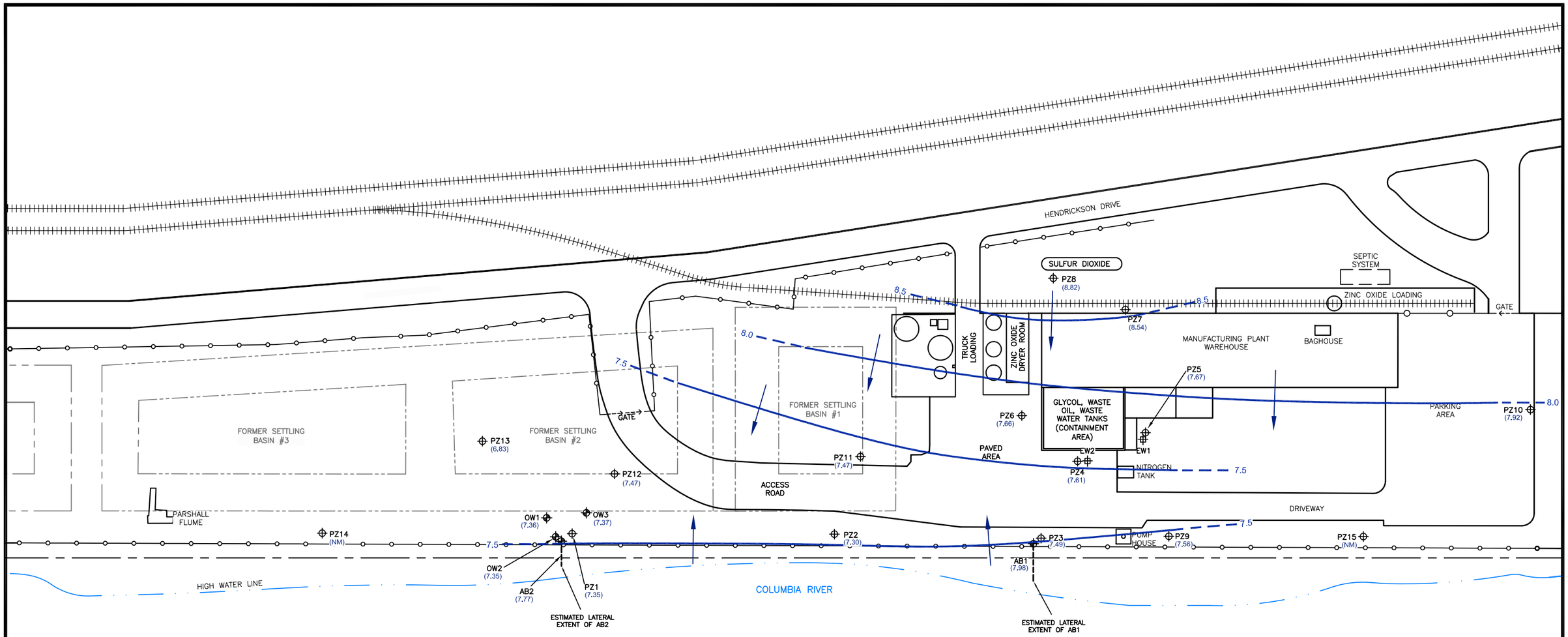


LEGEND:

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

NOTES
1. GROUND WATER ELEVATION MEASUREMENTS WERE TAKEN AT APPROXIMATE TIME OF PREDICTED LOW DAILY TIDAL ELEVATION OF COLUMBIA RIVER.
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.

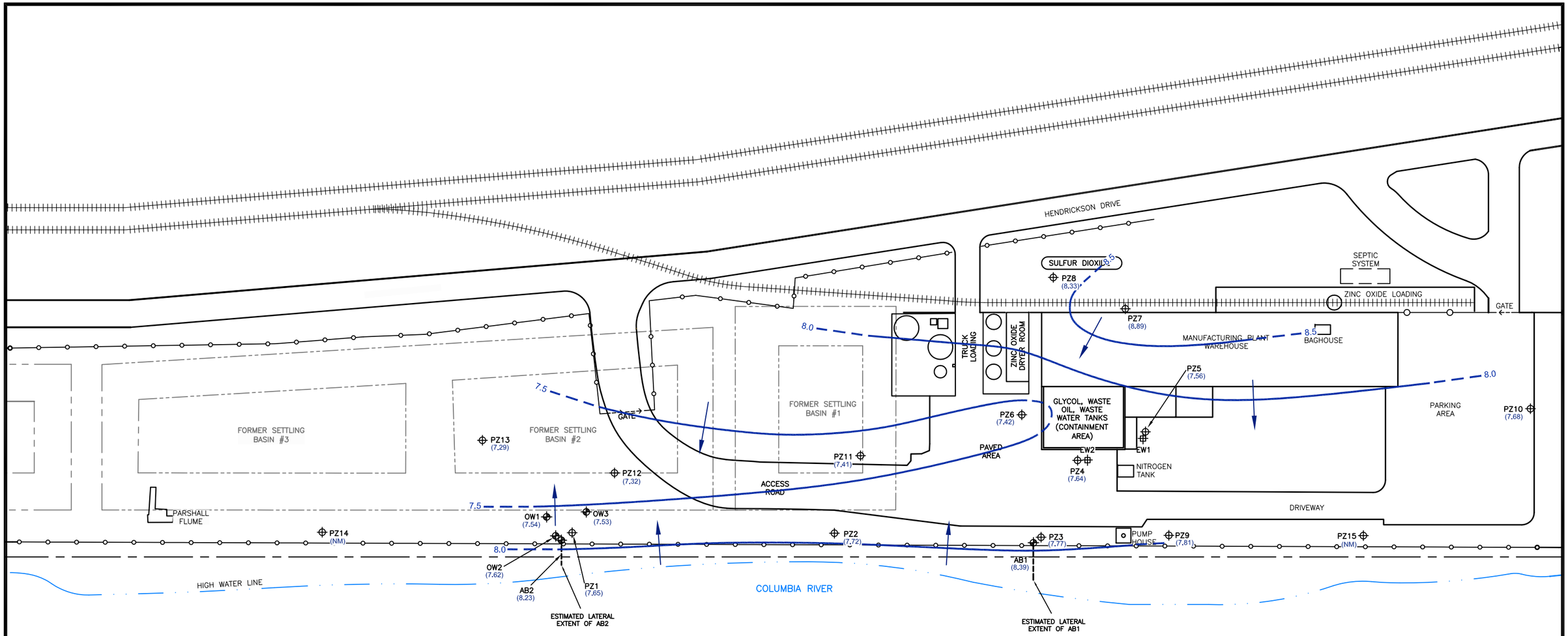
APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
GROUND WATER GRADIENT MAP (LOW TIDE)
MARCH 21, 2011

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 04/18/11	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 3E



LEGEND:

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

NOTES
1. GROUND WATER ELEVATION MEASUREMENTS WERE TAKEN AT APPROXIMATE TIME OF PREDICTED HIGH DAILY TIDAL ELEVATION OF COLUMBIA RIVER.
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.

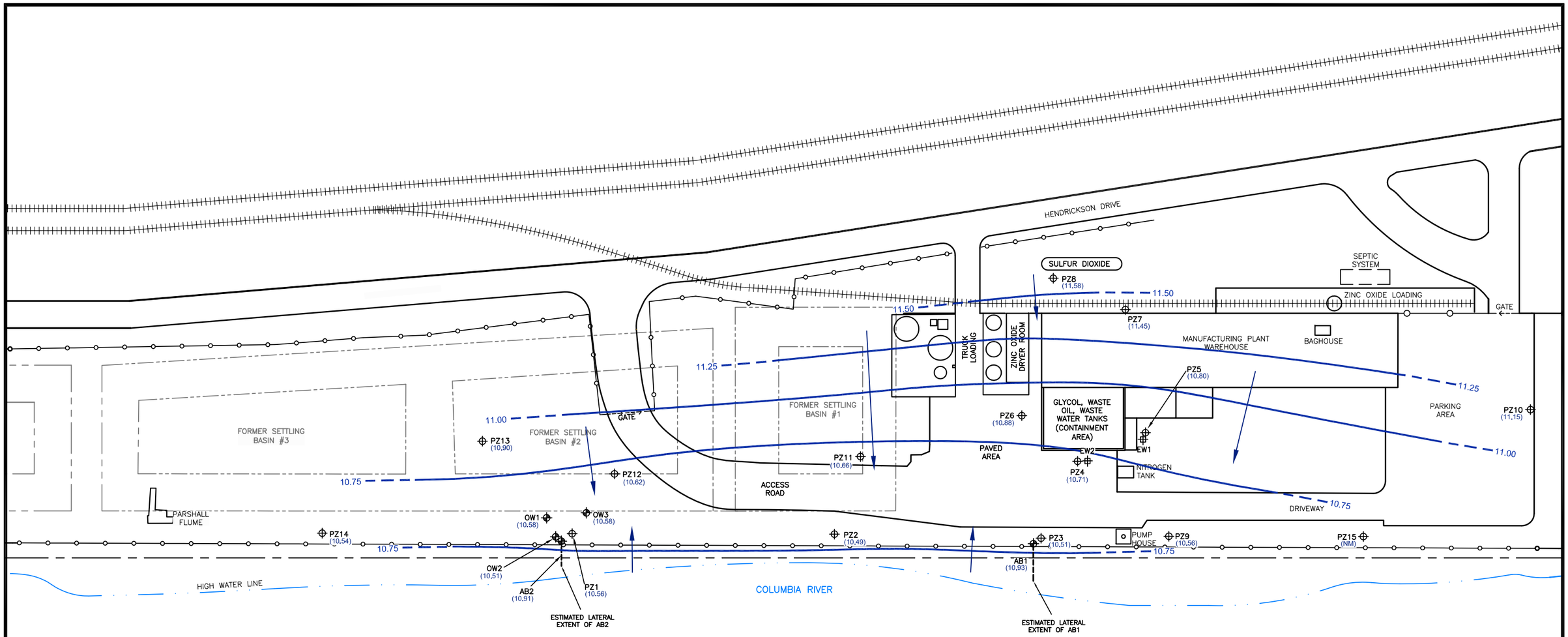
APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
GROUND WATER GRADIENT MAP (HIGH TIDE)
MARCH 23, 2011

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 04/18/11	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 3F



LEGEND:

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

NOTES
1. GROUND WATER ELEVATION MEASUREMENTS WERE TAKEN AT APPROXIMATE TIME OF PREDICTED LOW DAILY TIDAL ELEVATION OF COLUMBIA RIVER.
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.

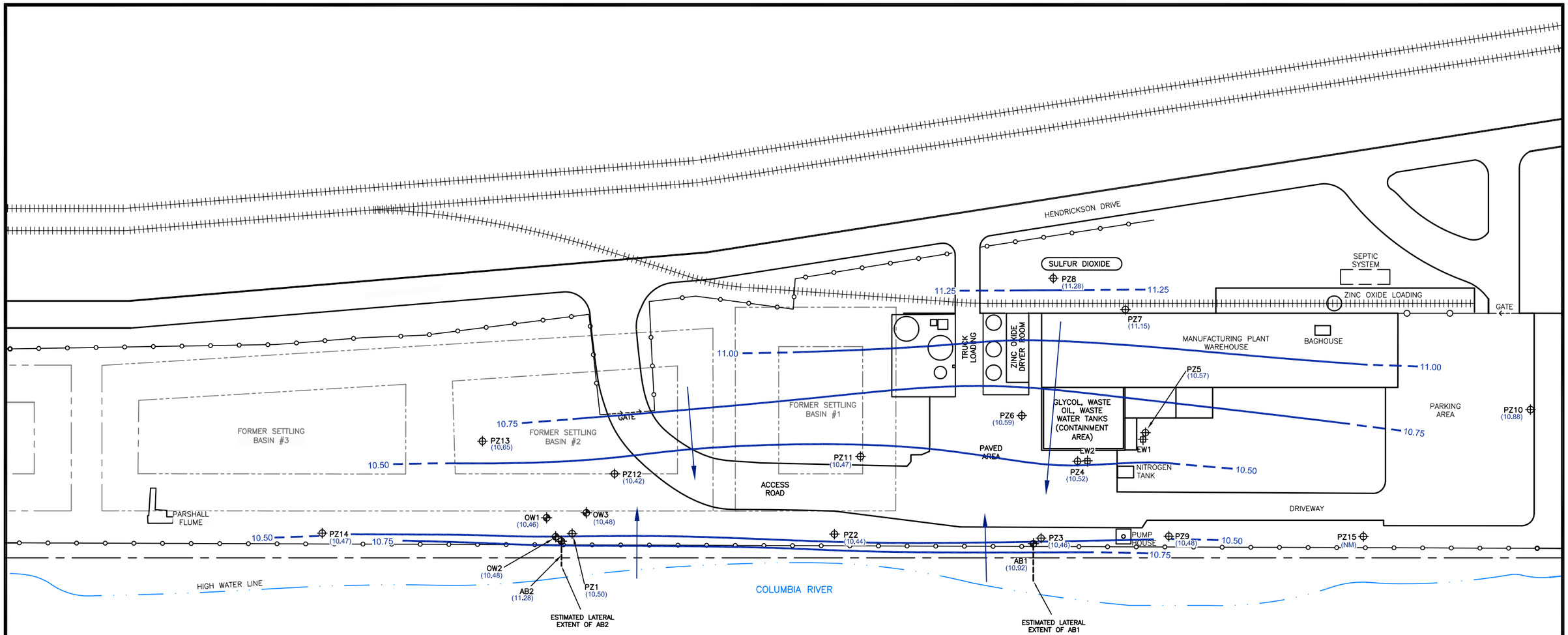
APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
GROUND WATER GRADIENT MAP (LOW TIDE) JUNE 21, 2011

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 06/27/11	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 3G



LEGEND:

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

NOTES
1. GROUND WATER ELEVATION MEASUREMENTS WERE TAKEN AT APPROXIMATE TIME OF PREDICTED HIGH DAILY TIDAL ELEVATION OF COLUMBIA RIVER.
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.

N

APPROXIMATE
0 80 160
SCALE IN FEET

TITLE
GROUND WATER GRADIENT MAP (HIGH TIDE) JUNE 22, 2011

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A Professional Corporation
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 06/27/11	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 3H

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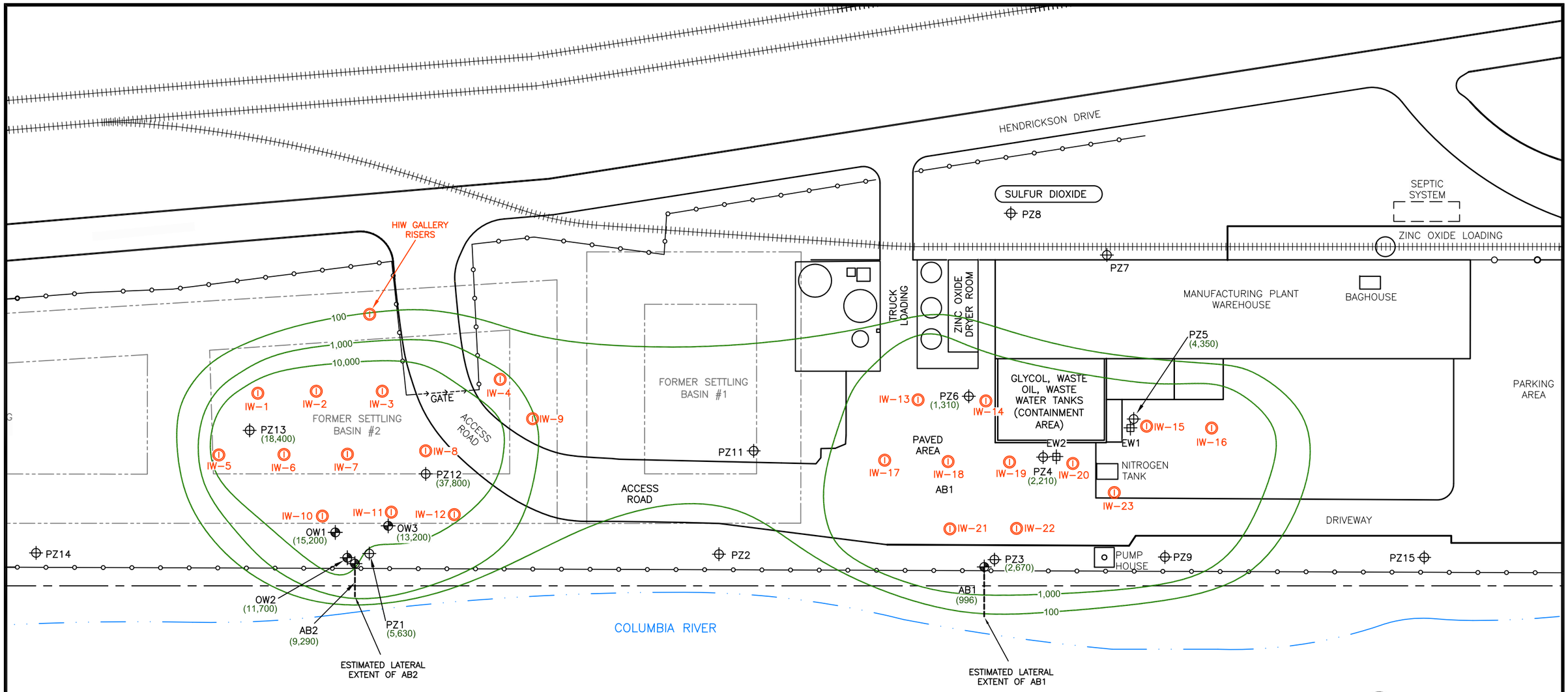


LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- (5,630) SEPTEMBER 2010 ZINC CONCENTRATION (µg/L)
- 1,000 ZINC ISOCONCENTRATION CONTOUR IN µg/L

APPROXIMATE
0 60 120
SCALE IN FEET

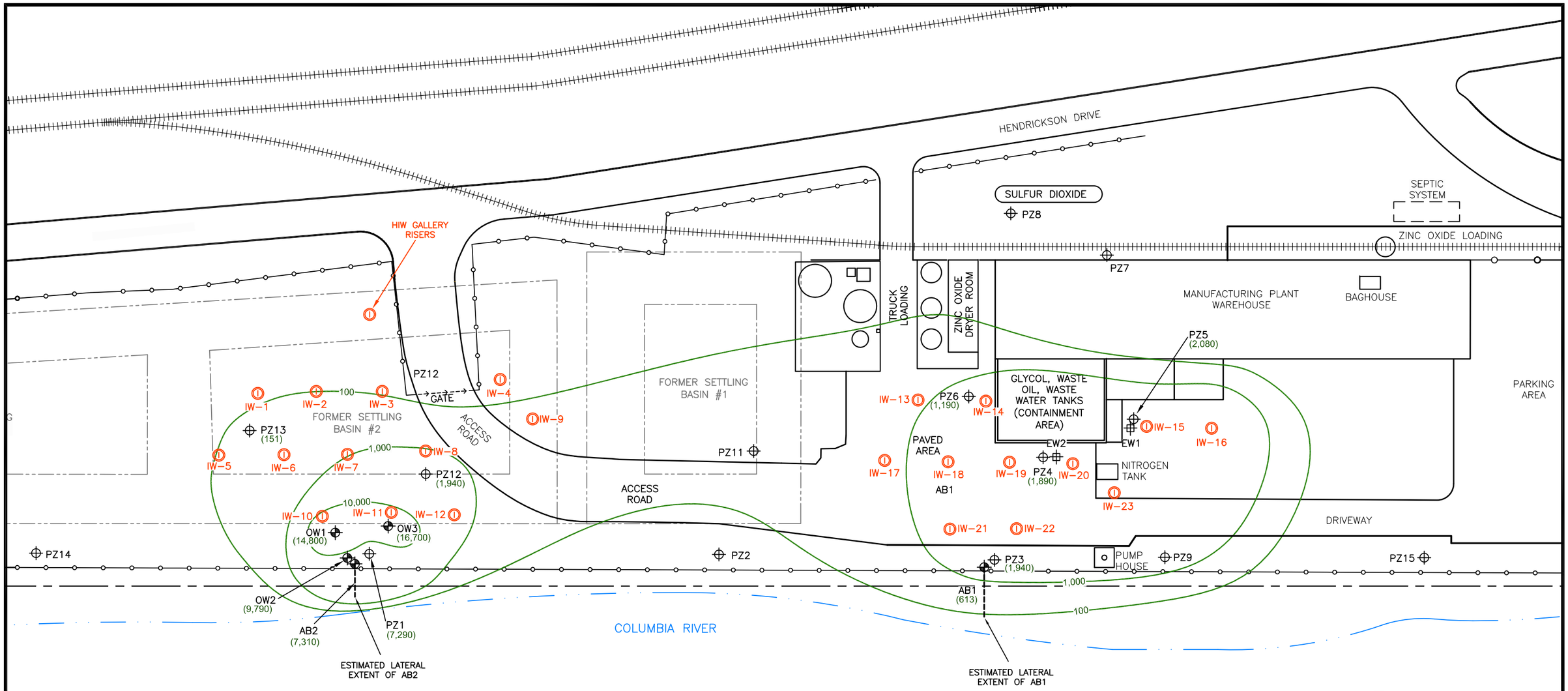
NOTES
1. HISTORICAL GROUND WATER SAMPLE DATA USED TO AID IN CONTOURING.
2. THE BOTTOM OF ANGLE WELLS AB1 AND AB2 ARE LOCATED APPROXIMATELY 30 AND 20 FEET (RESPECTIVELY) SOUTHWEST OF THE WELL LOCATION DEPICTED ON THE MAP. THE DASHED LINES EXTENDING TOWARD THE COLUMBIA RIVER FROM THOSE WELLS INDICATES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

TITLE
PRE-INJECTION (BASELINE)
ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 11/21/10 | 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
- (7,290) NOVEMBER 2–3, 2010 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 INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION. THE ESTIMATED LOCATION OF THE BOTTOM OF EACH SCREEN WAS USED IN CONTOURING.

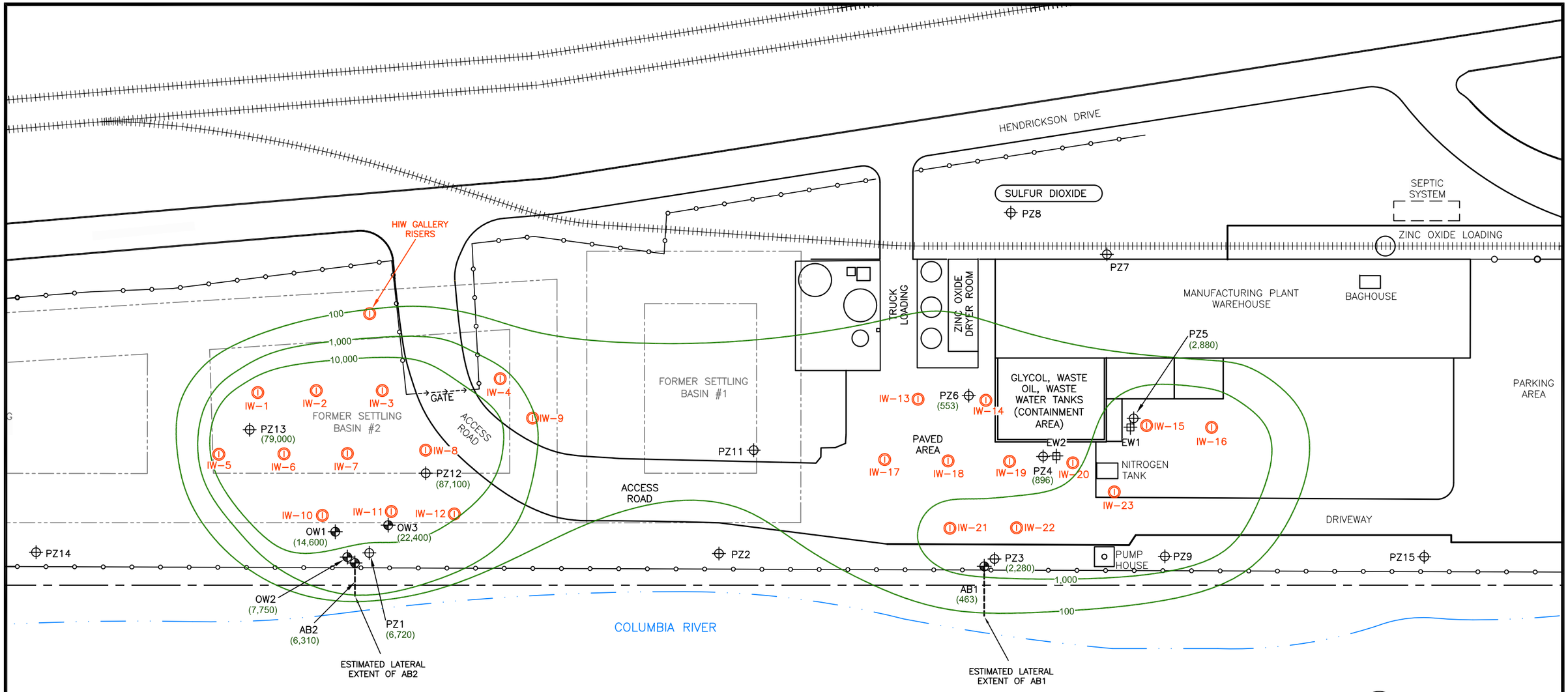
TITLE
ONE MONTH POST-INJECTION ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269

DATE: 11/21/10	REVISION NO. 0
JOB NO. CLR–045	FIGURE NO. 4B

S:\AAA-Master Projects\Clariant - CLR\CLR-045 Kalama, WA RA\GWM\GWM Figures.dwg, FIG.4B, 5/10/2011 7:29:08 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
- (6,720) DECEMBER 20–21, 2010 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 INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION. THE ESTIMATED LOCATION OF THE BOTTOM OF EACH SCREEN WAS USED IN CONTOURING.

TITLE
THREE MONTH POST-INJECTION ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
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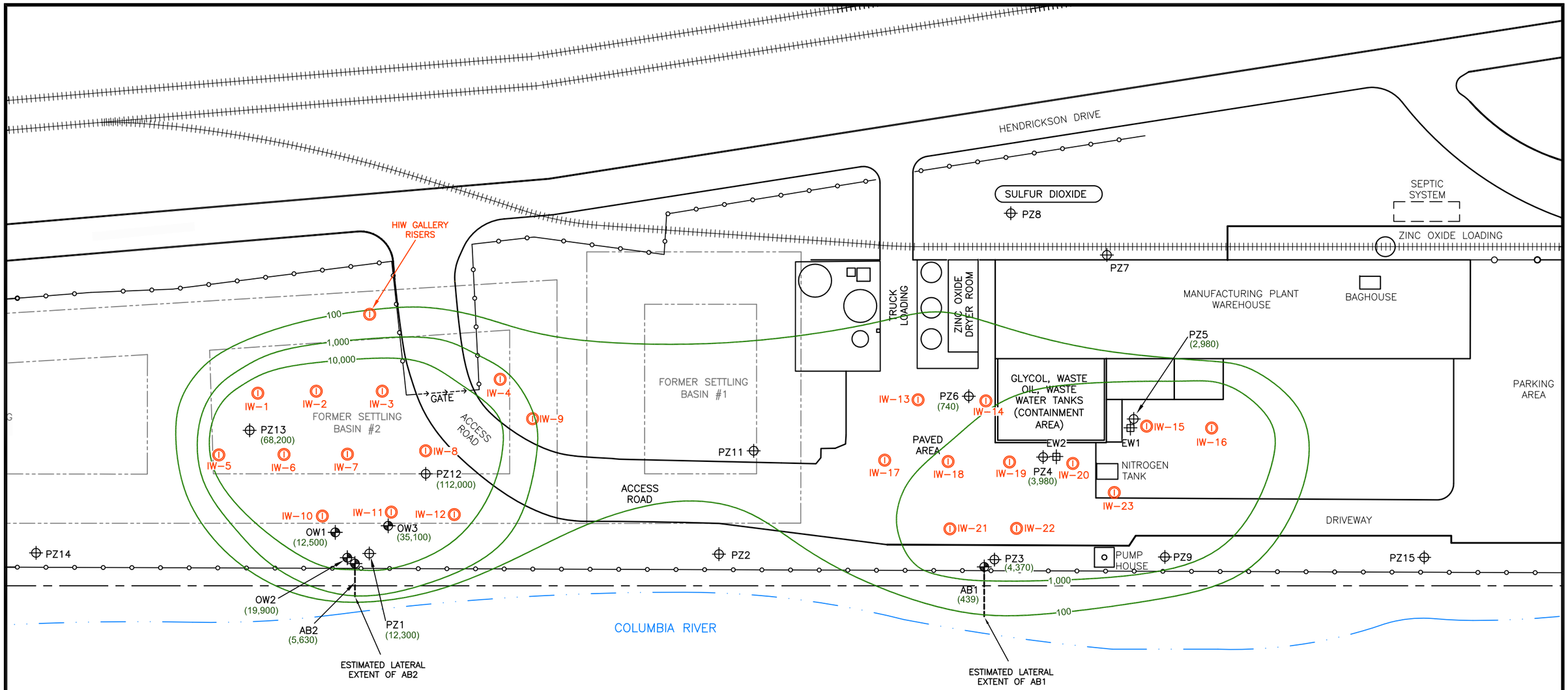
License # C-1269

DATE: 04/18/11	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
- (12,300) MARCH 22, 2011 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 INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION. THE ESTIMATED LOCATION OF THE BOTTOM OF EACH SCREEN WAS USED IN CONTOURING.

APPROXIMATE
0 60 120
SCALE IN FEET

TITLE
SIX MONTH POST-INJECTION ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

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Charlotte, North Carolina 28203
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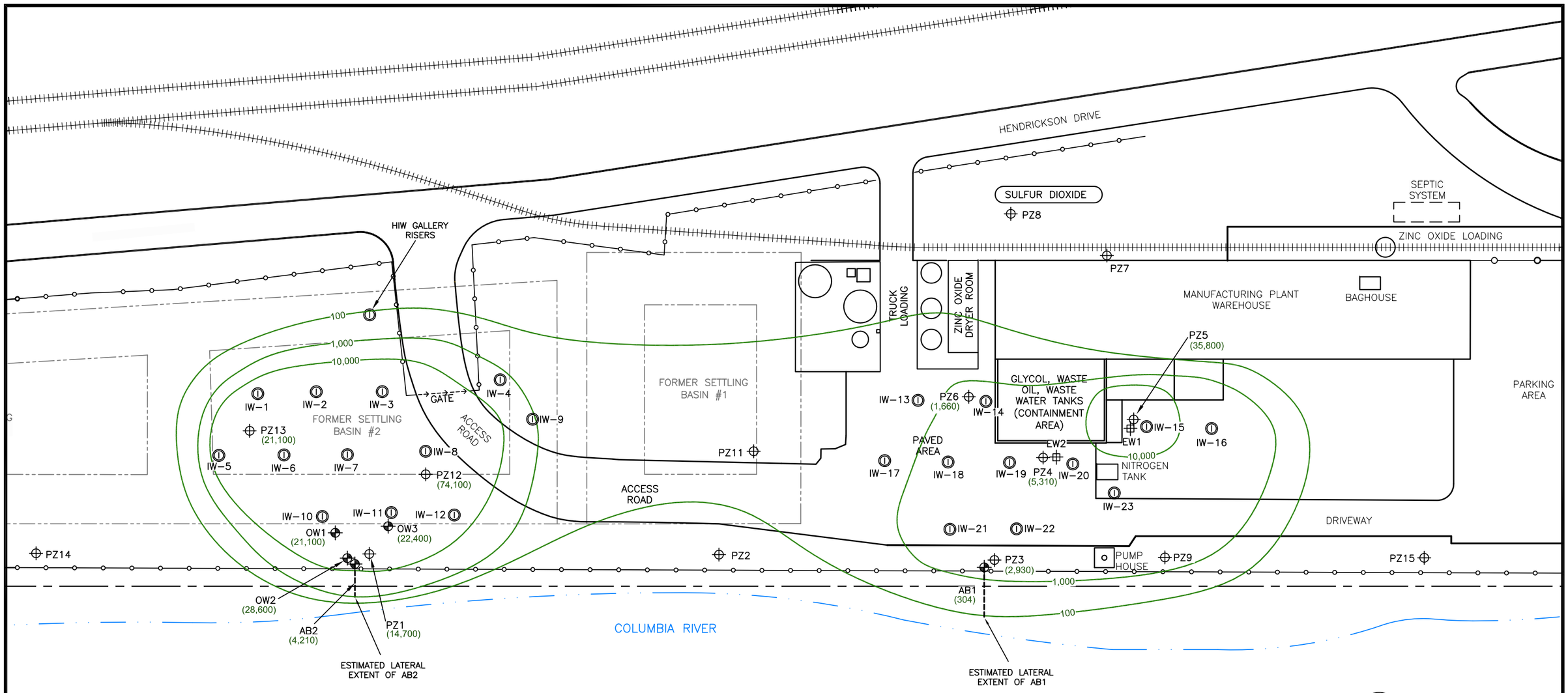
License # C-1269

DATE: 04/18/11	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4D



LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- (14,700) JUNE 21, 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 INDICATES THE ESTIMATED LATERAL EXTENT OF EACH WELL IN THAT DIRECTION. THE ESTIMATED LOCATION OF THE BOTTOM OF EACH SCREEN WAS USED IN CONTOURING.

TITLE
NINE MONTH POST-INJECTION ZINC ISOCONENTRATION MAP

PROJECT
CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

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License # C-1269

DATE: 07/27/11	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 4E

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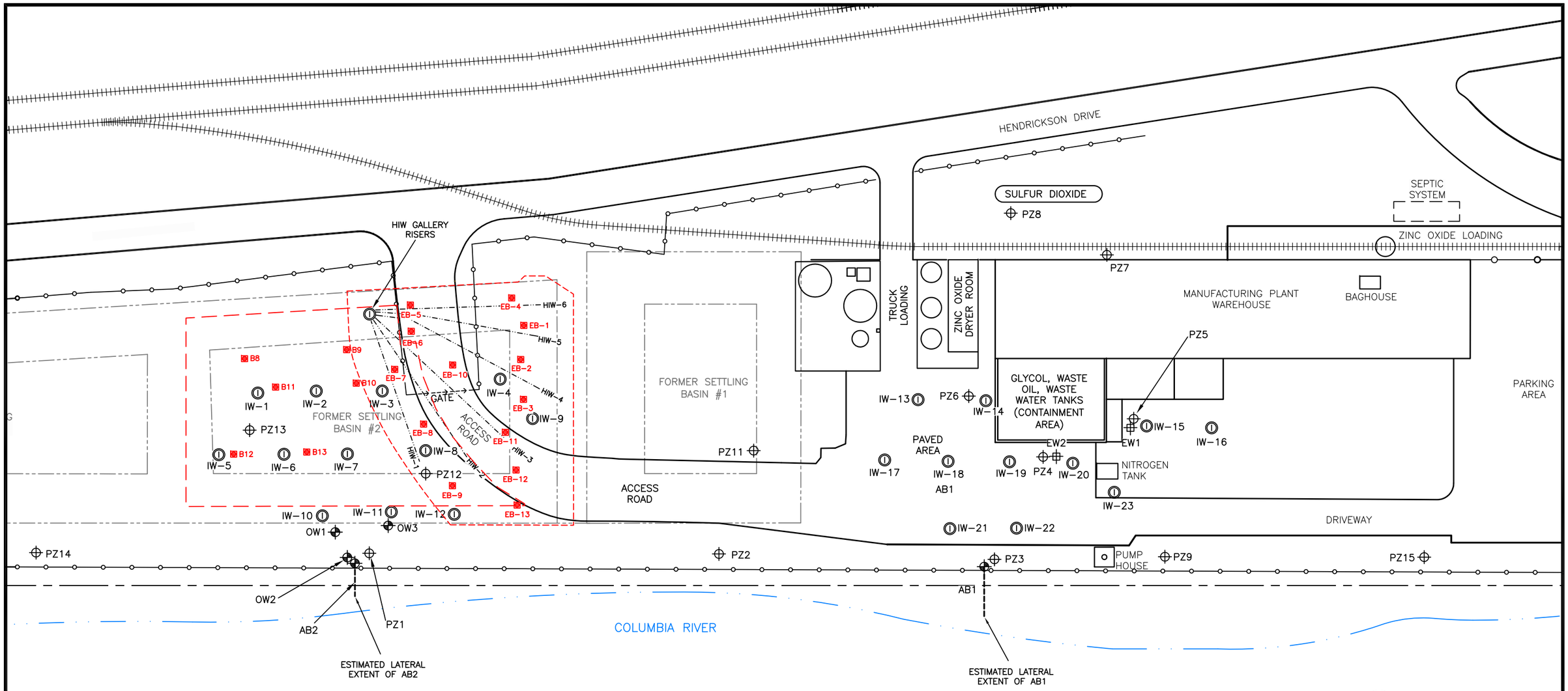

LEGEND:

- 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
- EXTENT OF 2003 EXCAVATION IN FSB2 AREA
- EXTENT OF 2010 EXCAVATION IN FSB2 AREA
- EXCAVATION BASE SAMPLE

APPROXIMATE
0 60 120
SCALE IN FEET

TITLE
EXCAVATION BASE SAMPLE MAP

PROJECT
CLARIANT - KALAMA SITE
KALAMA, WASHINGTON

Hart & Hickman
A PROFESSIONAL CORPORATION
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License # C-1269

DATE: 05/12/11	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 5

HENDRICKSON DRIVE

SULFUR DIOXIDE

PZ8

PZ7

ZINC

MANUFACTURING PLANT
WAREHOUSE

BAGHOUSE

TRUCK
LOADING

ZINC OXIDE
DRYER ROOM

PZ5

GLYCOL, WASTE
OIL, WASTE
WATER TANKS
(CONTAINMENT
AREA)

HIW GALLERY
RISERS

HIW-6

HIW-5

HIW-4

HIW-3

HIW-2

HIW-1

GATE

ACCESS
ROAD

FORMER SETTLING
BASIN #3

FORMER SETTLING
BASIN #2

FORMER SETTLING
BASIN #1

IW-1
IW-2
IW-3
IW-4
IW-5
IW-6
IW-7
IW-8
IW-9
IW-10
IW-11
IW-12
IW-13
IW-14
IW-15
IW-16
IW-17
IW-18
IW-19
IW-20
IW-21
IW-22
IW-23

PZ13
PZ12
PZ11
PZ6
PZ4

EW1
EW2

PAVED
AREA

NITROGEN
TANK

DRIVEWAY

ACCESS
ROAD

OW1
OW2
OW3

PZ14
PZ2
PZ3
PZ9
PZ15

PUMP
HOUSE

AB1
AB2
PZ1

IGH WATER LINE

COLUMBIA RIVER

ESTIMATED LATERAL
EXTENT OF AB2

ESTIMATED LATERAL
EXTENT OF AB1

LEGEND:

- PROPERTY LINE
- FENCE LINE
- RAILROAD TRACK
- EAST EDGE OF COLUMBIA RIVER
- EXTENT OF FORMER SETTLING BASIN
- SUBSURFACE EXTENT OF EXISTING HORIZONTAL INJECTION WELL
- EXTENT OF 2003 EXCAVATION IN FSB2 AREA
- EXTENT OF 2010 EXCAVATION IN FSB2 AREA
- MONITORING/OBSERVATION WELL
- PIEZOMETER
- INJECTION WELL
- EXTRACTION WELL
- PROPOSED EXTRACTION WELL LOCATION
- PROPOSED PILOT TEST EXTRACTION WELL LOCATION
- PROPOSED PILOT TEST TEMPORARY MONITOR WELL LOCATION
- PROPOSED HORIZONTAL INJECTION WELLHEAD
- SUBSURFACE EXTENT OF PROPOSED HORIZONTAL INJECTION WELL

APPROXIMATE
0 60 120
SCALE IN FEET

TITLE

PROPOSED WELL LOCATIONS MAP

PROJECT

CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

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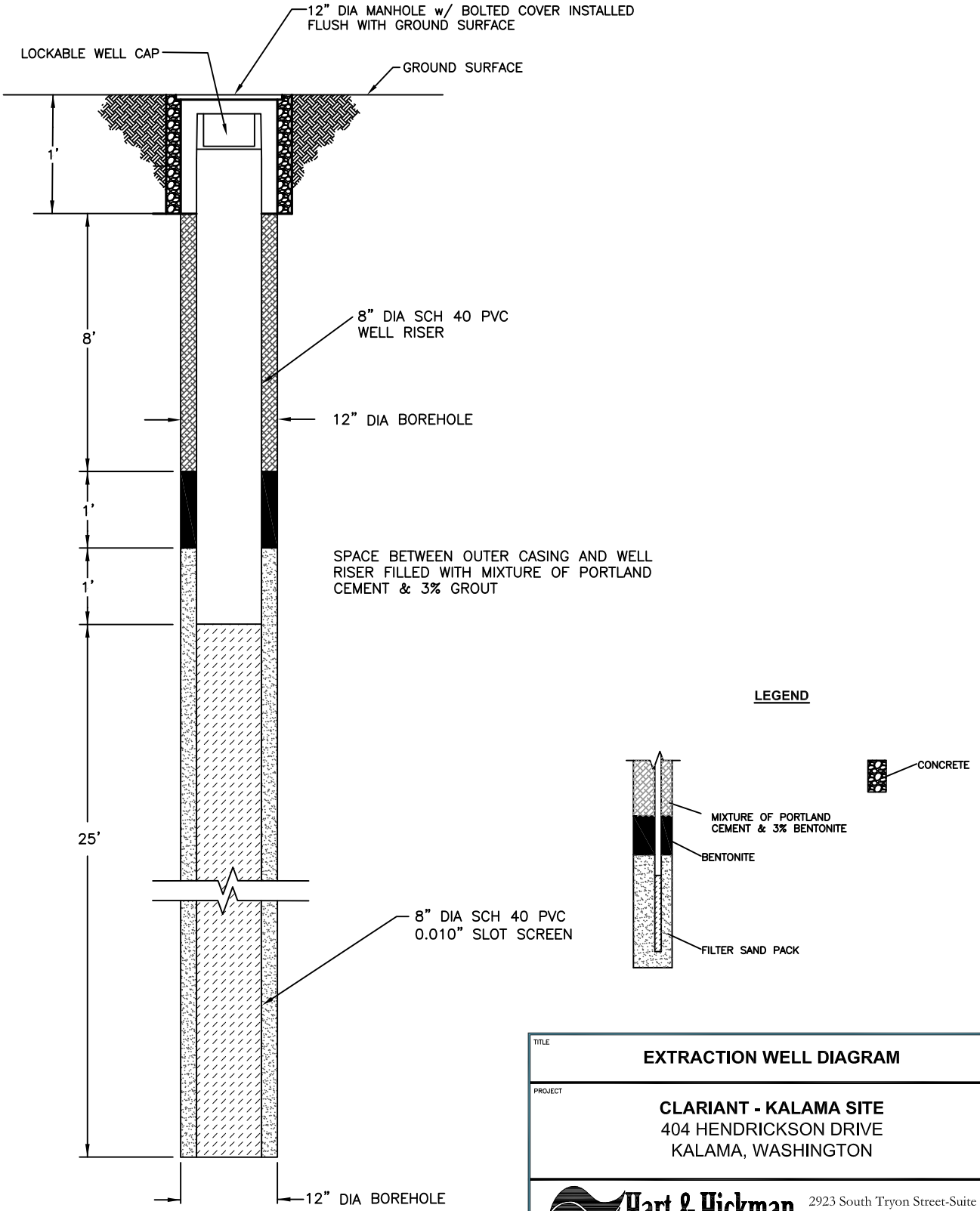
DATE: 05/24/11	REVISION NO. 0
JOB NO. CLR-045	FIGURE NO. 6



TITLE

EXTRACTION WELL DIAGRAM

PROJECT

CLARIANT - KALAMA SITE
404 HENDRICKSON DRIVE
KALAMA, WASHINGTON

Hart & Hickman
A Professional Corporation
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)

DATE: 08-09-11	REVISION NO. 0
JOB NO. CLR-039	FIGURE NO. 7

Appendix A

Calcium Polysulfide Information

Tessenderlo
KERLEY

Calcium Polysulfide

Calmet®

Handbook

October 2008

TABLE OF CONTENTS

OVERVIEW

Calmet® is a non-hazardous liquid with a typical pH of 10.0 – 11.7. The liquid solution is ruby-red in color and may have an odor of rotten eggs. Solutions of Calmet® are considered stable in normal transportation. Solutions range from 24 to 29% strength by weight and weigh 10.0 to10.6 pounds per U.S. gallon (1.2 to 1.27 gm/cc)

The vapor space over Calmet® solutions is largely water vapor with some hydrogen sulfide..

Calcium polysulfide solutions can be stored in stainless steel tanks as well as fiberglass, non-metallic (poly) and carbon steel lined tanks (See Construction Materials for Storage and Handling).

Personnel handling Calcium polysulfide solutions should wear Personnel Protective Equipment (PPE) to avoid exposure to the skin or eyes (See Handling).

HEALTH HAZARDS

The primary health hazards associated with Calmet® are irritation of the eyes (eye contact) and gastrointestinal tract (if accidentally ingested). Also inhalation of product vapors containing hydrogen sulfide.

INHALATION

Inhalation of product vapors are predominantly water vapor with small amounts of hydrogen sulfide..

SKIN OR EYE CONTACT

Prolonged or repeated skin contact with Calmet® solutions or mist might cause skin irritation. Eye contact with Calmet™ mist or solution or product vapors may result in redness, pain, conjunctivitis (inflammation of the eyelids) and tears.

INGESTION

Ingestion of Calmet® will cause irritation of the gastrointestinal tract to include nausea, vomiting and diarrhea.

FIRST AID

Treatment of personnel exposed to solutions of Calcium polysulfide begins with the removal of the victim to an uncontaminated atmosphere. Always wear the correct Personal Protective Equipment (PPE) to avoid exposure to other personnel. SCBA must be worn when rescuing personnel overcome by exposure to product vapors.

INHALATION

Remove the victim from contaminated atmosphere to fresh air. Wear necessary PPE. If victim's breathing is labored, administer oxygen. If breathing has ceased, clear airway and start artificial respiration. If heart has stopped beating, external heart massage should be applied. Obtain immediate medical attention.

SKIN CONTACT

Immediately flush the exposed area with large quantities of water. Remove contaminated clothing under a safety shower. Obtain immediate medical attention.

EYE CONTACT

Immediately flush eyes with large quantities of water for 15 minutes. Hold eyelids open during irrigation to insure thorough flushing of the entire eye and lids with water. Obtain immediate medical attention.

INGESTION

DO NOT INDUCE VOMITING. Immediately give two to four glasses of water to dilute ingested material. Obtain immediate medical attention.

FLAMMABILITY

Solutions of Calcium polysulfide are not flammable. The vapors above a Calmet® solution are not flammable.

FIRE RESPONSE

If vessels containing Calmet® are involved in a fire, fire fighting personnel should be equipped with SCBA gear because of the potential of hydrogen sulfide and sulfur dioxide vapors. Fire fighting personnel should also be equipped with necessary PPE to prevent skin and eye contact with the solution.. Use extinguishing media suitable for the combustible materials involved in the fire. Fire fighting personnel should approach the fire from the upwind direction.

Vessels of Calcium polysulfide should be kept cool with water spray. Be aware that pressurized containers exposed to high heat may rupture from excessive pressure.

STORAGE

For materials of construction used in storage, See “CONSTRUCTION MATERIALS” Section on a later page.

STORAGE TANKS

Locate storage vessels in open, well ventilated areas away from any combustible materials or potential sources of heat. If storage is in a containment area, the containment area should not include storage of flammable products or acidic materials. Storage vessels may be open vent to the atmosphere, pressurized (bullet tanks) or closed from the atmosphere.

Small containers (drums, pails) should be stored in cool, dry, well ventilated areas out of direct sunlight. Small containers, 55 gallon drums or less, can develop high vapor pressures if left exposed to direct sunlight for very long. Such exposure can place the drums integrity in question or expose personnel opening such drums to a sudden pressure release as soon as the drum seal is broken.

Where very low temperatures may be encountered, the tanks should be insulated or heated and/or the product circulated or the piping heat traced. Temperatures above 40°F (4°C) will not cause crystal or freezing problems.

HANDLING

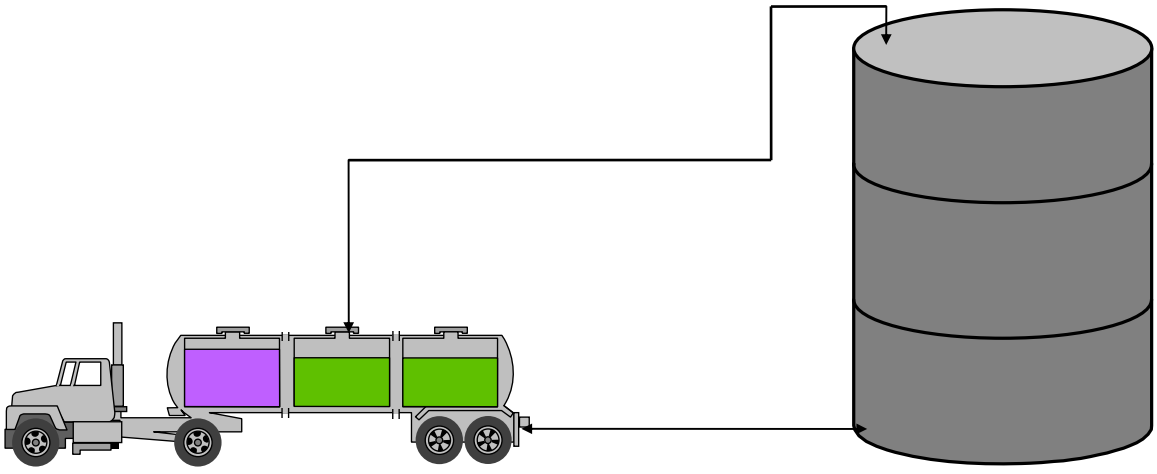
Solutions of Calmet® should be handled with two criteria in mind. Avoid any solution contact with the skin and/or eyes. Secondly minimize exposure to excessive heat and/or acids or acidic materials to prevent excessive generation of hydrogen sulfide vapors.

PERSONAL PROTECTIVE EQUIPMENT (PPE).

Contact with the skin or eyes can be largely prevented by wearing the correct PPE. For routine handling of small quantities, minimum PPE consists of a neoprene apron, gloves, chemical goggles and preferably a full-face shield. If duties require opening the dome of a tank truck or railcar containing Calmet® or work is to be performed near an open storage tank cover, an SCBA or airline supplied respirator, may be worn to prevent personnel exposure to hydrogen sulfide vapors or in case the container lacks sufficient oxygen (i.e., below 19.5%)

TRANSFERS.

A vapor return system is advisable for all bulk solution transfers to prevent releasing any vapors to the atmosphere. Carefully inspect all connections (including hoses) which use seals, gaskets or packing to make certain that they are in good condition and correctly positioned prior to starting any transfer. Replace any defective units prior to starting the transfer.



CONSTRUCTION MATERIALS

Copper, brass galvanized materials and carbon steel are not resistant to Calcium polysulfide solutions. These materials of construction should not be used for storage or anywhere in the product handling system (piping, valves and pumps) where they would come in direct contact with Calmet®.

Solutions of Calmet® are stored in 304 stainless steel, fiberglass, polypropylene, HD polyethylene and lined carbon steel. Consult with tank manufacturers to confirm whether a specific resin is acceptable for Calmet® service. Drums should be polypropylene, DOT specification of UN1H1/Z1.4.

EQUIPMENT

SAFETY EQUIPMENT.

A safety shower complete with eye wash should be located in the immediate area of transfer points and any other locations where there is a possible exposure to the product.

VALVES

Valves will provide good service in Calmet® use if constructed of 304/316 ss and utilizing teflon seats or seals. Lead or mercury valve parts should not be used in Calmet® service.

PIPING

Stainless steel or PVC is preferable for all applications. Welded and flanged connections are preferred over threaded connections. Schedule 40 piping is typically used for continuous service. Garlock, EPDM, Teflon or flexatallic gaskets are recommended for flanged fittings.

Protection of lines against low temperature will depend upon location of the line, amount of exposure to low temperatures, and whether or not the line will be self-draining. In very cold weather climates piping or tubing in intermittent service should be insulated and electric heat traced. It is a good practice to equip all lines with a steam connection so the lines may be blown out before and after use to insure there are no crystal deposits.

SHIPPING

The Department of Transportation (DOT) has classified Calcium polysulfide as non-hazardous for commercial shipments.

PLACARDING & LABELING

Non-hazardous – not applicable

CONTAINERS

Non-hazardous – not applicable

RELEASES

Personnel responding to releases of Calcium polysulfide must be properly trained in accordance with OSHA's 29 CFR 1910.120, "Hazardous waste operations and Emergency Response". This training is required for releases of Calmet® of sufficient size to present a health or physical hazard exposure to facility employees. Drips or very small spills which the facility can show (utilizing monitoring and/or chemical knowledge) that the amount of Calmet™ released does not represent a health threat to an employee can treat and cleanup the Calmet® without the above required training. The treatment and cleanup can be done provided the employees involved have been trained on chemical recognition, the hazards of the chemical, the proper PPE required and proper cleanup procedures.

NOTIFICATION

No federal notifications normally required unless release is to a body of water and in sufficient quantities to cause an impact on animal/plant life in the water.

SMALL SPILLS/LEAKS

Absorb with earth, sand, clay, fly ash or other inert commercial sorbents. Dispose of Absorbed material as non-hazardous waste in a chemical waste landfill.

LARGE SPILLS/LEAKS

Confine the spill to qualified personnel. Wear proper protective equipment. Shut off release if safe to do so. Contain the release to as small an area as possible by diking with earth, sand or other available materials. Do not allow product into sewers or drain or discharge into surface waterways because of potential aquatic toxicity. Recover as much of the solution as possible. Handle the remaining material in the same manner as a small release (above).

DISPOSAL CONSIDERATIONS

Calcium polysulfide solutions released to the environment is not listed as a waste nor does it exhibit any waste characteristic to cause it to be classified as a hazardous waste in accordance with 40 CFR 261.

MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet

Calmet® solution

MSDS Number 1545 (Revised: 10/31/08) 6 Pages

Section 1: CHEMICAL PRODUCT and COMPANY IDENTIFICATION

1.1 Product Name ..... **Calmet® solution**
Chemical Family ..... Inorganic salt solution
Synonyms ..... Calcium polysulfide, CaPS, calcium sulfide, lime sulphur
Formula ..... CaS_x

1.2 Manufacturer ..... Tessenderlo Kerley Inc.
2255 N. 44th Street, Suite 300
Phoenix, Arizona 85008-3279
Information ..... (602) 889-8300

1.3 Emergency Contact ..... (800) 877-1737 (Tessenderlo Kerley)
(800) 424-9300 (CHEMTREC)

Section 2: COMPOSITION, INFORMATION ON INGREDIENTS

2.1 Chemical Ingredients (% by wt.)

Calcium polysulfide	CAS #:1344-81-6	24 - 29%
Water	CAS #:7732-18-5	71 - 76%

(See Section 8 for exposure guidelines)

Section 3: HAZARDS IDENTIFICATION

NFPA: Health - 2 Flammability - 0 Reactivity - 0

EMERGENCY OVERVIEW

Warning:
Avoid inhalation of product fumes (hydrogen sulfide) near openings on storage container. Release of the product to the environment may cause the evolution of highly toxic hydrogen sulfide vapors. Product solution is alkaline and may cause irritation of the skin. Eye contact will cause eye irritation and possible corneal damage. Ingestion will result in irritation of tissues and the release of hydrogen sulfide in the gastrointestinal tract.

Section 3: HAZARDS IDENTIFICATION (Cont.)

3.1 POTENTIAL HEALTH EFFECTS

EYE: Contact with the eyes by product mist or solution will cause irritation and a burning sensation. Eye contact may result in severe corneal injury.

SKIN CONTACT: Contact with product mist or solution will cause skin irritation and may result in corrosion of the skin.

SKIN ABSORPTION: Absorption is unlikely to occur.

INGESTION: Ingestion of product solution will cause irritation and corrosion of the gastrointestinal tract to include nausea, vomiting and diarrhea. Contact with stomach acid will cause highly toxic hydrogen sulfide to evolve.

INHALATION: Inhalation of product vapors (hydrogen sulfide) may cause dizziness and unconsciousness possibly resulting in serious falls from elevated positions..

CHRONIC EFFECTS/CARCINOGENICITY: Not listed as a carcinogen by NTP, IARC or OSHA.

Section 4: FIRST AID MEASURES

4.1 EYES: Immediately flush with large quantities of water for 15 minutes. Hold eyelids apart during irrigation to insure thorough flushing of the entire area of the eye and lids. Obtain immediate medical attention.

4.2 SKIN: Immediately flush with large quantities of water. Remove contaminated clothing under a safety shower. Obtain immediate medical attention.

4.3 INGESTION: DO NOT INDUCE VOMITING. If victim is conscious, immediately give large quantities of water. If vomiting does occur, continue to give fluids. Obtain immediate medical attention.

4.4 INHALATION: Remove victim from contaminated atmosphere. If breathing is labored, administer oxygen. If breathing has ceased, clear airway and start mouth to mouth resuscitation. If heart has stopped beating, external heart massage should be applied. Obtain immediate medical attention.

Section 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

FLASH POINT: Not flammable (See Section 5.4) **METHOD USED:** NA

5.2 FLAMMABLE LIMITS **H_2S** **LFL**: 4% **UFL**: 44%

5.3 EXTINGUISHING MEDIA: Water spray or foam or as appropriate for combustibles involved in fire.

5.4 FIRE & EXPLOSIVE HAZARDS: When heated or diluted, hydrogen sulfide vapors will evolve. This gas may form explosive mixtures with air. (See Section 5.2) Keep containers/storage vessels in fire area cooled with water spray.

Section 5: FIRE FIGHTING MEASURES (Cont.)

5.5 FIRE FIGHTING EQUIPMENT: Because of the possible presence of toxic gases and the irritating nature of the product, wear self-contained breathing apparatus, positive pressure, (MSHA/NIOSH approved or equivalent) and full protective gear.

Section 6: ACCIDENTAL RELEASE MEASURES

6.1 Small releases: Confine and absorb small releases on sand, earth or other inert absorbent. Released material may contain residual sulfides. Spray with weak (~5%) hydrogen peroxide to oxidize sulfides.

6.2 Large releases: Confine area to qualified personnel. Wear proper protective equipment. Shut off release if safe to do so. Dike spill area to prevent runoff into sewers, drains (possible toxic or explosive mixtures) or surface waterways (potential aquatic toxicity). Spray product vapors with fine water spray or mist. Recover as much of the solution as possible. Treat remaining material as a small release (above).

Section 7: HANDLING and STORAGE

7.1 Handling: Handle in enclosed containers to avoid breathing product. Avoid contact with skin and eyes. Dilute only in enclosed containers. Use in a well ventilated area. Wash thoroughly after handling.

7.2 Storage: Store in well ventilated areas in enclosed containers. Do not store combustibles in the area of storage vessels. Keep away from any sources of heat or flame. Store tote, drums and small containers out of direct sunlight at moderate temperatures [<90ºF (32ºC)]. (See Section 10.4 for materials of construction)

Section 8: EXPOSURE CONTROLS, PERSONAL PROTECTION

8.1 RESPIRATORY PROTECTION: Have self-contained breathing apparatus, positive pressure, MSHA/NIOSH (approved or equivalent) readily available in case of spillage or equipment failure.

8.2 SKIN PROTECTION: Gloves, boots, and chemical suit should be worn to prevent liquid contact. Wash contaminated clothing prior to reuse. Contaminated shoes cannot be cleaned and should be discarded

8.3 EYE PROTECTION: Chemical goggles and a full face shield.

8.4 EXPOSURE GUIDELINES:

	OSHA		ACGIH	
	TWA	STEL	TLV	STEL
Hydrogen sulfide	20 ppm (ceiling)		10 ppm (ceiling)	

8.5 ENGINEERING CONTROLS: Use adequate exhaust ventilation to prevent inhalation of product vapors. Maintain eyewash/safety shower in areas where chemical is handled.

Section 9: PHYSICAL and CHEMICAL PROPERTIES

9.1 APPEARANCE:	Ruby-red liquid
9.2 ODOR:	Strong odor of rotten eggs
9.3 BOILING POINT:	Not determined
9.4 VAPOR PRESSURE:	Not determined (Believed to be minimal)
9.5 VAPOR DENSITY:	Not determined
9.6 SOLUBILITY IN WATER:	Dissolves with precipitation of elemental sulfur.
9.7 SPECIFIC GRAVITY:	1.20 – 1.27 (10.0 – 10.6 lbs/gal)
9.8 FREEZING POINT:	Not determined
9.9 pH:	10.0 - 11.7
9.10 VOLATILE:	Not applicable

Section 10: STABILITY and REACTIVITY

10.1 STABILITY: This is a stable material

10.2 HAZARDOUS POLYMERIZATION: Will not occur.

10.3 HAZARDOUS DECOMPOSITION PRODUCTS: Heating this product will evolve hydrogen sulfide vapors. Continued heating will also cause oxides of sulfur to be released.

10.4 INCOMPATIBILITY: Strong oxidizers such as nitrates, nitrites or chlorates can cause explosive mixtures if heated to dryness. Acids, acidic materials or dilution with water will cause the release of hydrogen sulfide, a highly toxic gas.

Section 11: TOXICOLOGICAL INFORMATION

11.1 ORAL: Oral Rat LD_{50} : 820 mg/kg

11.2 DERMAL: Dermal Rabbit LD_{50} : 2,000 mg/kg

11.3 INHALATION: Inhalation-Rat LC_{50} 3.6 mg/L (4 Hr. exposure)

11.4 CHRONIC/CARCINOGENICITY: No evidence available

11.5 TERATOLOGY: Data not available

11.6 REPRODUCTION: Data not available

11.7 MUTAGENICITY: Data not available

Section 12: ECOLOGICAL INFORMATION

No data available.

Section 13: DISPOSAL CONSIDERATIONS

If released to the environment for other than its intended purpose, this product should be checked to see it meets the criteria of reactive sulfides D003, Reactive waste.

Section 14: TRANSPORT INFORMATION

14.1 DOT Shipping Name: Calcium polysulfide solution

14.2 DOT Hazard Class: NA

14.3 UN/NA Number: NA

14.4 Packing Group: NA

14.5 DOT Placard: NA

14.6 DOT Label(s): NA

14.7 IMO Shipping Name: Not determined

14.8 RQ (Reportable Quantity): NA

14.9 RR STCC Number: Not Determined

Section 15: REGULATORY INFORMATION

15.1 OSHA: This product is listed as a hazardous material under criteria of the Federal OSHA Hazard Communication Standard, 29 CFR 1910.1200.

15.2 SARA TITLE III:

a. **EHS** (Extremely Hazardous Substance) List: No

b. Section 311/312, (Tier I,II) Categories:

Immediate (acute)	Yes
Fire	No
Sudden release	No
Reactivity	Yes
Delayed (chronic)	No

c. Section 313 (Toxic Release Reporting-Form R): No

Chemical Name	CAS Number	Concentration
NA		

d. **TPQ** (Threshold Planning Quantity): No

15.3 CERCLA/SUPERFUND: RQ (Reportable Quantity) No

15.4 TSCA (Toxic Substance Control Act) Inventory List: Yes

Section 15: REGULATORY INFORMATION (Cont.)

15.5 RCRA (Resource Conservation and Recovery Act) Status:	Possible D002 (See Section 13)
15.6 WHMIS (Canada) Hazard Classification:	NA
15.7 DOT Hazardous Material: (See Section 14)	No
15.8 CAA Hazardous Air Pollutant (HAP)	No
15.9 Proposition 65 (California)	No

Section 16: OTHER INFORMATION

REVISIONS: The entire MSDS was reformatted to comply to ANSI Standard Z400.1-1993, by Technical Services-Tessenderlo Kerley, Inc.

Revised Section 11.3, Inhalation toxicity and Section 14 Dot classification, 12/8/2004
Revised Section 2.1, Ingredients, 3, Hazard Identification, 9,Physical characteristics, 11, Toxicological Information, 14, Transportation, Revised 1/14/05
Section 8.1, Respiratory Protection, revised, 6/21/05
Section 11.1, 11.2, toxicity data revised, 10/25/05.