

Results of the In Situ Reduction Pilot Test, Garfield Groundwater Contamination Superfund Site, New Jersey

PREPARED FOR: U.S. Environmental Protection Agency
U.S. Army Corps of Engineers

PREPARED BY: CH2M HILL

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CH2M HILL prepared this technical memorandum for the U.S. Environmental Protection Agency (USEPA) Region 2 and the U.S. Army Corps of Engineers (USACE) Kansas City District to present the results of an in situ reduction (ISR) pilot test and associated groundwater performance monitoring completed at the Garfield Groundwater Contamination Superfund site in the city of Garfield, Bergen County, New Jersey (site). This memorandum has been prepared under Contract W912DQ-11-D-3005, Task Order 0003, for the USACE Kansas City District.

The ISR pilot test was conducted to obtain information regarding the practicability of the following: (1) injecting reagents into the overburden using direct-push injections, (2) achievably reducing hexavalent chromium [Cr(VI)] in overburden groundwater, and (3) creating reducing zone barriers as a component of the full-scale remedy. The ISR pilot test study was carried out in accordance with the *Final Work Plan for Aquifer Test, Pilot Test and Groundwater Modeling, Garfield Groundwater Contamination Superfund Site* (work plan) (CH2M HILL 2013a). Deviations from the work plan are summarized at the end of the Field and Analytical Methods section of this technical memorandum. The results of the ISR pilot test will support development of full-scale remedy alternatives, allowing the feasibility study to be completed with a greater degree of certainty. The pilot test was performed in two separate areas within the boundaries of the E.C. Electroplating (ECE) property, including within the vicinity of the former chromic acid tank storage tank (source area) and on the downgradient (western) side of ECE property along Lincoln Place (barrier area). The location of the ECE property is shown in Figure 1.

Field and Analytical Methods

Overburden Monitoring Well Installation

Four monitoring wells were installed between June 2 and 4, 2014, as performance monitoring wells to evaluate the effectiveness of the ISR pilot test. Three new monitoring wells were installed within the overburden material on the ECE property, and the fourth was installed along the eastern side of Lincoln Place, just west of the ECE property. One previously installed monitoring well, EPA-13-OB, located along the eastern side of Lincoln Place, was also used to monitor the pilot system. The locations of the wells are shown in Figure 2, and well screen interval information is provided in Table 1.

Drilling, construction, and development of the four new overburden monitoring wells (EPA-29-OB through EPA-32-OB) were performed by Parratt Wolff, the drilling contractor. Well borings were drilled using a Central Mine Equipment Company 55 hollow-stem auger drill rig with continuous split-spoon core sampling for observation of soil cores. The borings were continuously logged using the Unified Soil Classification System in accordance with ASTM International Method 422-D from the ground surface to the bottom of the borehole. Lithology within the ECE property indicates fill across the site from ground surface to a depth of up to 10 feet. Below the fill layer is reddish-brown silty sand to approximately 20 feet below ground surface (bgs), where weathered bedrock is encountered. The saturated zone exists at approximately 12 feet bgs within the ECE property. No problems were encountered during the drilling activities.

With the exception of EPA-30-OB, monitoring wells were installed above the contact between the overburden and weathered bedrock zone, as determined from observations of rock fragments in soil cores

and changes in auger drilling characteristics. EPA-30-OB was installed at a shallower depth (17 to 22 feet bgs) near EPA-13-OB, which is screened to a deeper depth (22 to 32 feet bgs) at the top of weathered bedrock, to provide monitoring data at different depths across the overburden. All wells were constructed following New Jersey Department of Environmental Protection (NJDEP) guidelines. The overburden wells were completed with a 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) casing, with 5- or 10-foot, 10-slot (0.01-inch) machine-slotted PVC well screen. The annular space between the well screen and borehole of each monitoring well was filled with NJ #0 sand to 2 feet above the top of the well screen and space between the bottom of the borehole and well screen. An annular seal of fine, NJ #00-type sand was installed to fill 2 feet of annular space above the filter sand. The remaining annular space was grouted to the surface using a slurry mixture of Portland cement and bentonite. The wells were then finished with a locking cap, outer steel protective casing, and a flush-mounted concrete pad at the surface.

The monitoring wells were developed using a combination surge and purge method over the entire well screen to remove fines from the filter pack and clear debris that settled at the bottom of the well during installation. Water quality parameters, consisting of conductivity, pH, turbidity, dissolved oxygen (DO), oxidation-reduction potential (ORP), and temperature, were recorded throughout development of each well. A total of five well volumes was removed from each well, ranging anywhere from 25 to 45 gallons. All parameters were fairly stable after removing five well volumes from each of the newly installed wells.

The four newly installed wells were registered with the NJDEP, and copies of the completed well permits are included in Attachment 1. Following installation, a New Jersey-licensed surveyor surveyed the monitoring wells using global positioning system (GPS) technology, and the survey report is provided in Attachment 2. Lithologic logs, well completion diagrams, and development forms are provided in Attachment 3, including the boring log for the previously installed monitoring well EPA-13-OB for reference.

Baseline Groundwater Monitoring

Before the pilot test was initiated, a groundwater sampling event was conducted at the five monitoring wells (EPA-13-OB and EPA-29-OB through EPA-32-OB) to establish baseline Cr(VI) concentrations and geochemical conditions in the overburden aquifer.

The baseline groundwater sampling event was conducted on June 19, 2014, 2 weeks after the monitoring wells were installed, and 4 days before initiating injections. Before collecting groundwater samples, synoptic water level measurements were collected. An electronic water interface probe was used to record the depth to water at each well within an accuracy of ± 0.01 foot. Results of the baseline depth to water measurements are included in Table 2.

Groundwater samples were collected using USEPA-approved low-flow purging and sampling techniques. During purging of each well, field parameters were collected, including pH, temperature, conductivity, ORP, DO, and turbidity. Once field parameters had stabilized (depth to water, pH, conductivity, ORP, DO, and turbidity), samples were collected and sent to Australian Laboratory Services Group (ALS) in Rochester, New York, for Cr(VI) analysis, and USEPA's Contract Laboratory Program (CLP) and the Division of Environmental Science and Assessment (DESA) laboratory system for other analyses, as detailed in Table 3. Cr(VI) data were validated by the project chemist following the receipt of results and a Data Quality Evaluation Report is included in Attachment 4. Final field parameter readings for each well are included in Table 2, and groundwater monitoring forms are included in Attachment 5.

Injections

Pilot test injections were carried out within the ECE property boundaries by Vironex between June 23 and July 2, 2014. Injections were carried out at 40 locations between two areas: 12 locations within an approximately 45-foot by 60-foot area situated over the former chromic acid tank storage area (IP-17B, IP-18, IP-19, IP-20A, IP-21, IP-22, IP-23, IP-24A, IP-25, IP-28, IP-29, and IP-30) and 28 locations along a 120-foot barrier downgradient of the source area near the western property boundary (IP-1, IP-1A, IP-2, IP-3, IP-4, IP-4A, IP-5B, IP-6, IP-6A, IP-7, IP-7A, IP-7B, IP-8B, IP-8C, IP-9, IP-10, IP-10A, IP-11, IP-12, IP-12A,

IP-13, IP-14, IP-14A, IP-15, IP-15A, IP-16A, IP-26, and IP-27D) (Figure 2). Attempts were made to space the injection points 15 feet from each other; however, because of refusal during implementation, some locations needed to be moved, so distances between each injection point varied. The initial work plan called for 25 injection points within the ECE property; however, because of refusal at shallower depths than anticipated, step-out injection points and additional injection point locations were drilled to deliver the total reagent mass and volume, as designed.

Injections were carried out using direct-push technology (DPT) drilling and, where possible, a top down injection approach in which injections are initiated at the water table and advanced in conjunction with the drive rods to the top of bedrock or refusal. At some locations, a bottom-up injection approach was used in order to guarantee delivery of injection fluids to deeper depth intervals. A 1.5-inch top-down injection tool with a 2-foot screen and injection cap was used to evenly distribute the reagent solution across each interval. Refusal within the barrier area was encountered at depths varying from 11 to 28 feet bgs, and from 15 to 20 feet bgs within the source area. Injection interval details for each injection location, including refusal depths, are included in the *Vironex Injections Services Report* included in Attachment 6.

A total of 28,701 gallons of reagent solution composed of emulsified vegetable oil (EVO), magnesium sulfate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$), and water was injected at the ECE property. During injections, 3,448 gallons of 60 percent Terra Systems SRS-SD EVO product, 1,374 pounds of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, and 25,254 gallons of potable water were injected. Within the source area, a total volume of 4,800 gallons was injected at an average pressure of 14.8 pounds per square inch and an average flow rate of 2.9 gallons per minute. A total volume of 23,901 gallons was injected within the barrier area at an average flow rate of 2.6 gallons per minute and average pressure of 15.7 pounds per square inch. Injection parameter details for each injection location are included in the *Vironex Injections Services Report* included in Attachment 6.

Upon completion of each injection point, the injection rods were withdrawn, and the resulting voids were sealed with a cement-bentonite grout mixture. The injection points were surveyed by a New Jersey-licensed surveyor following injections using GPS technology, and the final survey report is included in Attachment 1.

Water levels and grab groundwater field parameters (DO, conductivity, ORP, pH, temperature, turbidity, and water color) were collected as part of the injection events to monitor groundwater mounding and indicators of reagent arrival and distribution. Before starting injections and following completion of injections (within 24 hours), the five overburden monitoring wells were monitored. Additionally, during the injection activities, monitoring wells EPA-29-OB and EPA-31-OB were monitored at the beginning of each day, every half hour during injections, and at the end of each day of injection activities conducted adjacent to the two wells. Field monitoring results from the injections are included in Attachment 6.

Post-injection Grab Groundwater Sampling

Following the injection activities, grab groundwater samples were collected at 10 locations (GW-A through GW-J, see Figure 2) between July 29 and 31, 2014, approximately 4 weeks after the injection event. The grab groundwater samples were performed to evaluate the radius of influence (ROI) and distribution of EVO and sulfate achieved during injection, and post-injection advective transport. The 10 grab groundwater locations were determined based on observations during the injection activities. Grab groundwater locations GW-F, GW-G, and GW-H were installed around injection points IP-9 and IP-11, where larger injection volumes were achieved (1,300 to 1,400 gallons per point). The locations of GW-F, GW-G, and GW-H were selected to provide more information on the injection ROI in an area where larger injection volumes more representative of an optimized full-scale injection were achieved.

Grab groundwater samples were collected using DPT. Two sample depth intervals were targeted at each location—one at the bottom 2 feet of overburden and a second near the water table. However, at two of the locations (GW-A and GW-B), depth to water was within 3 feet of refusal, and only one grab groundwater sample was collected. At each grab groundwater location, the DPT was advanced to the target depth, and a 2-foot screen was deployed at the targeted depth. At three of the grab groundwater locations (GW-C,

GW-D, and GW-I), step-out borings (designated with an “a” suffix on Figure 2) were advanced to collect the deeper sample because of refusal in the initial boring. A peristaltic pump was deployed at each screened interval, and a grab groundwater sample was collected. Upon completion of each grab groundwater sample, the DPT rods were withdrawn, and the resulting voids were sealed with a cement-bentonite grout mixture. The grab groundwater points were surveyed using a handheld GPS Trimble unit.

Water levels and field parameters (DO, conductivity, ORP, pH, temperature, turbidity, and water color) were collected at each grab groundwater. Additionally, field kits were used to analyze the grab groundwater samples for Cr(VI) and ferrous iron. Samples were collected and sent for total organic carbon (TOC) and sulfate analysis through the USEPA CLP/DESA laboratory system, as detailed in Table 3. Cr(VI) data were validated following the receipt of results, as included in the Data Validation Report (Attachment 4). Water level, field parameter readings, and analytical results for the grab samples are summarized in Table 4, and groundwater monitoring forms are included in Attachment 5.

pH Titration Tests

Based on low pH values observed during the initial baseline groundwater sampling, a soil pH titration test was carried out following the EVO injection event. A soil sample was collected from SO-B (Figure 2) during the grab groundwater sampling event and sent to ALS Laboratories in Corvallis, Oregon, for titration testing. Titrations were carried out using sodium hydroxide (NaOH) on a 1 to 1 soil to deionized water slurry. NaOH was added in increments of 50 micrograms per liter ($\mu\text{g/L}$) (0.1 millimole hydroxide) until a pH of 7 was reached. The sample was then sealed and allowed to sit for 122 hours. During the 122 hours of the test, the pH was checked incrementally to ensure it had not drifted by more than 0.5 pH units. If the pH had drifted, NaOH was added in 50 $\mu\text{g/L}$ increments until a pH of 7 was reestablished. Details on the pH titration test are included in Attachment 7.

Results of the pH titration tests indicate that to neutralize the soil within the ECE property, NaOH or a similar base would need to be added at a dosing of 0.0161 micromoles per gram of dry soil, or approximately two pounds of NaOH per cubic yard of soil.

Performance Monitoring

Following the injections, five rounds of groundwater sampling at the five monitoring wells (EPA-13-OB and EPA-29-OB through EPA-32-OB) were carried out over 7 months after the injection event to monitor the performance on the EVO injections. Performance monitoring events were carried out as follows:

- July 29–30, 2014 (Event 1)
- September 3–4, 2014 (Event 2)
- October 20–21, 2014 (Event 3)
- December 17–18, 2014 (Event 4)
- February 5–6, 2015 (Event 5)

Before collecting groundwater samples, synoptic water-level measurements were collected. An electronic water interface probe was used to record the depth to water level at each well within an accuracy of ± 0.01 foot. Results of the depth to water measurements are included in Table 2.

During performance monitoring, groundwater samples were collected using USEPA-approved low-flow purging and sampling techniques. During purging of each well, field parameters were collected including pH, temperature, conductivity, ORP, DO, and turbidity. Once field parameters had stabilized (depth to water, pH, conductivity, ORP, DO, and turbidity), samples were collected and sent to ALS in Rochester, New York, for Cr(VI) analysis, and USEPA’s CLP/DESA laboratory for analyses as detailed in Table 3. Data were validated following the receipt of results, as included in the Data Validation Report (Attachment 4). Final field parameter readings for each well are included in Table 2, and groundwater monitoring forms are included in Attachment 5.

Investigation-Derived Waste Management

Investigation-derived waste (IDW) created throughout the pilot study was stored within the ECE property. IDW soil and water produced during the installation and subsequent sampling of each borehole and monitoring well was transferred to 55-gallon Department of Transportation-regulated drums. Copies of IDW disposal waste manifests and bills of lading are included in Attachment 8.

Three IDW samples were collected for various laboratory analyses, based on the media to be disposed of and the requirements of each disposal facility. In general, IDW samples were analyzed by a subcontracted laboratory (ALS) for the following:

- IDW water: Cr(VI), volatile organic carbons (VOCs), semivolatile organic carbons (SVOCs), polychlorinated biphenyls (PCBs), pesticides, metals (including mercury and cyanide), total petroleum hydrocarbons—gasoline and diesel ranges, corrosivity, and ignitability
- IDW soils cuttings: Cr(VI), toxicity characteristic leaching procedure – VOCs, SVOCs, pesticides, herbicides; PCBs, corrosivity, and ignitability

Wastewater from the pilot study activities were classified as hazardous based on analytical results of the IDW samples collected, and waste solids were classified as nonhazardous. Capitol Environmental managed disposal of the hazardous wastewater and nonhazardous waste solids. During the pilot study, approximately 730 gallons of hazardous wastewater and 3,000 pounds of nonhazardous waste solids were disposed of at the EQ Detroit facility in Detroit, Michigan.

Work Plan Deviations

The ISR pilot test study was carried out in accordance with the work plan (CH2M HILL 2013a). Deviations from the work plan are summarized as follows:

- Three of the four monitoring wells installed (not including EPA-30-OB) were installed at depths shallower than anticipated in the work plan, due to refusal at a shallower depth. Additionally, EPA-29-OB was installed with a 5-foot screen, instead of a 10-foot screen as detailed in the work plan.
- During injections, 40 locations were advanced, including 12 within an approximately 45-foot by 60-foot area (source), and 28 along the 120 foot barrier. The 15 additional boring locations, above the 25 prescribed in the work plan, were advanced in order to deliver the design dosage of EVO substrate, after refusal was encountered at multiple injection locations. Additionally, due to refusal, not all locations were pushed on 15-foot centers, as established in the work plan.
- A bottom-up injection approach was used at some of the injection locations, in order to ensure that the substrate was delivered to deeper depths. The bottom-up approach was used most often when a top-down approach hit refusal at a shallow depth and a step out boring was advanced.
- Due to shallow refusal, not all borings received the proper dosage over a 10-foot (source) or 17-foot (barrier) interval, as prescribed in the work plan. However, additional step-out locations were drilled, and the overall dosing of EVO substrate to the subsurface was in accordance with the work plan.
- Grab groundwater samples were collected approximately 4 weeks after the completion of injections, 1 week longer than the prescribed 3-week timeframe in the work plan.
- A soil pH titration test was carried out to determine the buffering capacity of the soil after low pH was encountered in the source area.

Health and Safety

The ISR pilot test study was carried out in compliance with the *Final-Accident Prevention Plan, Garfield Groundwater Contamination Superfund Site Remedial Investigation, Revision 1* (CH2M HILL 2013b). Prior to starting fieldwork, an Operational Readiness Review call was held in order to address possible health and safety issues that could be encountered during field activities. Additionally, prior to starting each task, an Activity Hazard Analysis was performed and reviewed with the field team. Each morning, prior to starting work, the team reviewed the tasks to be performed for the day and discussed possible health and safety issues that may be encountered. If change conditions were encountered, work was stopped, and the situation and its risks were discussed within the field team prior to resuming work. The ISR pilot study was performed with no health and safety incidents. Similar risks would be involved with a full-scale implementation, with an additional risk of working outside of the ECE property boundaries within public streets, and traffic-control planning would be necessary.

Results

Analysis of Pilot Study Performance

This section provides a summary and assessment of the pilot study performance monitoring data. Overall, the pilot study demonstrated that EVO can be injected and distributed at sufficient concentrations to stimulate the reduction of Cr(VI).

Several challenges were encountered during the pilot study that affected the effectiveness of Cr(VI) reduction. Heterogeneity in the overburden resulted in non-uniform distribution of injected solutions laterally across the site. However, at most injection locations, the distribution of injected solutions did not appear to be significantly affected by vertical short-circuiting up toward the water table or down toward the weathered bedrock. At injection points where surfacing was observed, minor amounts of injection solutions were observed, and in most cases reducing flow rates proved effective for reducing surfacing.

At the source area onsite, historical releases of chromic acid have affected groundwater conditions to the point of impacting the ability to treat Cr(VI) in situ. Low pH and elevated Cr(VI) concentrations impacted microbial growth, which effectively shut down the biogeochemical processes required to reduce Cr(VI) to trivalent chromium [Cr(III)]. Downgradient of the site where pH is neutral and Cr(VI) concentrations are lower, Cr(VI) treatment was most successful, as demonstrated by indicators of microbial activity and overall Cr(VI) concentration reductions.

Pilot study performance monitoring data are summarized in Table 2, and grab groundwater monitoring data are summarized in Table 4. Figures 3 and 4 summarize results from the grab groundwater monitoring and performance monitoring. Additional discussion and interpretation of the pilot study performance monitoring data is presented in the following subsections.

TOC Concentrations and Substrate Distribution

- Refusal was encountered in many injection borings requiring step-out injection locations. In IP-4, IP-7, and IP-8, multiple step-out borings were required to complete injection of the approximate target reagent solution volume.
- At most locations, surfacing of injected reagents was not observed in the injection borings or adjacent borings and monitoring wells. In IP-4 and IP-8, surfacing was observed in the boring being injected, while in IP-7 surfacing was observed in the step-out injection boring and the adjacent original boring. Surfacing was easily mitigated by lowering the injection rates and volumes of surfaced material were minimal (less than 5 gallons). Additional grouting activities were also performed in the original IP-7 injection boring to ensure no further surfacing occurred through adjacent borings. Surfacing is an indicator of low permeability at a given location due to lithology, or smearing of the DPT boring wall causing reduction in permeability. These issues can be resolved for the most part by using properly

screened and developed permanent injection wells rather than DPT injection points. Groundwater mounding observed during injections ranged from approximately 1 foot in EPA-29-OB to 3 feet in EPA-31-OB.

- During the grab groundwater sampling event, TOC in grab groundwater samples was collected to assess substrate distribution 4 weeks after injection. The substrate used was a mixture of EVO and 4 percent lactate. The EVO itself is expected to mostly sorb to the soil particles; therefore, it is not measurable in groundwater. The lactate is soluble and can be measured in groundwater as TOC. In addition, as EVO ferments, it releases volatile fatty acids that are soluble and therefore can be measured as TOC in groundwater.
 - Baseline TOC concentrations at the site were less than 3 milligrams per liter (mg/L). Across the majority of the treatment area, TOC concentrations in grab groundwater samples were greater than 10 mg/L, but not uniformly greater than 20 mg/L (Figure 3). This suggests that substrate was distributed to most locations; however, it was not uniformly distributed to meet design concentrations at all locations. At two grab groundwater locations near the center of the barrier (GW-G and GW-H), TOC concentrations exceeded 200 mg/L. The high concentrations of TOC may be because of the presence of EVO droplets in the groundwater samples.
 - The overall TOC concentrations suggest that the distribution of the EVO was not ideally uniform, and at some locations, preferential lateral flow during injections may have carried the substrate further from the injection points. Across most of the site, vertical distribution of solutions during injection did not appear to be affected by short-circuiting up toward the water table or down toward the weathered bedrock. This was evidenced by similarities or limited differentiation between TOC and sulfate concentrations in grab samples collected near the water table versus near the weathered bedrock. The exceptions were near IP-9 and IP-11, where grab groundwater samples (GW-G and GW-H) collected near the water table contained much higher TOC concentrations than the deeper samples collected near the weathered bedrock. This could indicate localized heterogeneities that cause uneven reagent distribution during injection, and/or after injection during the first month of advective transport.
 - Due to overburden heterogeneities resulting in uneven lateral reagent distribution, a well-defined injection ROI could not be inferred from the monitoring data. On average, the estimated radius of influence achieved using DPT injection points was on the order of 5 to 10 feet, as confirmed in injection point/grab groundwater sample pairs IP-5B/GW-E, IP-9/GW-G, IP-17B/GW-A, IP-20A/GW-B and IP-23/GW-C(a).
 - Long-term TOC data were collected from monitoring wells over 8 months to evaluate the steady-state flux of organic carbon from the breakdown of the oil-based fraction of the EVO, as shown in Figure 5. Onsite TOC concentrations increased to as high as 18 mg/L in the source area and 20 mg/L inside the barrier. Downgradient of the barrier, TOC concentrations increased to as high as 38 mg/L in offsite monitoring well EPA-13-OB. Higher long-term TOC concentrations in this well suggests a greater level of microbial activity breaking down the long-chain fatty acids of the EVO.
 - The pilot test design target steady-state TOC concentration in groundwater was 60 mg/L, which is within the typical steady-state TOC range observed at other EVO injection sites (20 to 100 mg/L). Measured TOC concentrations in monitoring wells were all lower than 60 mg/L, indicating either non-uniform EVO distribution because of overburden heterogeneity, or limited microbial activity breaking down the long-chain fatty acids of the EVO.
 - TOC concentration trends over time appear to be decreasing or stable, with the exception of downgradient monitoring well EPA-13-OB, where TOC concentrations were still increasing as of the fifth performance monitoring event. The trends provide additional evidence of higher microbial activity breaking down the long-chain fatty acids of the EVO.

Sulfate Concentrations and Distribution

- As discussed in the work plan, sulfate was added to stimulate the formation of iron sulfide minerals, which can abiotically reduce Cr(VI) to Cr(III), which then precipitates out with ferric oxide [Fe(III)] to form insoluble hydroxides and oxyhydroxides. Iron sulfide minerals will re-oxidize once EVO is depleted and aerobic conditions re-establish. The Cr(VI) that has already been reduced by the iron sulfide will not reoxidize.
- Baseline sulfate concentrations ranged from 33 mg/L downgradient of the site to 200 mg/L near the source area. Background overburden sulfate concentrations in the vicinity of the ECE property, as reported in the remedial investigation report, were approximately 30 mg/L. Elevated sulfate near the source area is likely because of sulfuric acid in historically released chrome plating solutions. Following the $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ injections, sulfate concentrations in grab groundwater samples collected during the first performance monitoring event were as high as 710 mg/L and averaged approximately 300 mg/L across the rest of the site (Figure 3), which is greater than the design target sulfate concentration of 250 mg/L. The application of the sulfate data as an indicator of distribution of the injected fluids is difficult because of the presence of elevated sulfate concentrations in the source area.
- Long-term sulfate data collected from monitoring wells over 8 months showed sulfate concentrations dropping back down to near baseline concentrations, as shown in Figure 6. Sulfide (resulting from the reduction of sulfate) was not detected in any onsite monitoring well, which suggests the decrease in sulfate onsite was most likely because of advective flushing and dilution. Sulfide was detected in downgradient monitoring well EPA-13-OB, which indicates that sulfate reducing conditions were achieved downgradient of the ECE property. Both iron and manganese concentrations also increased in this well because of reducing conditions, although dissolved iron did not increase to the same magnitude as manganese. The lower dissolved iron combined with the presence of sulfide indicates a higher likelihood that iron sulfide minerals were likely formed.

Cr(VI) Concentration Trends

- Baseline Cr(VI) ranged from 224,000 to 275,000 $\mu\text{g/L}$ onsite, and from 18,400 to 125,000 $\mu\text{g/L}$ downgradient of the site (Figure 4). Cr(VI) concentrations decreased by more than 97 percent in offsite downgradient monitoring wells EPA-13-OB and EPA-30-OB (Figure 8). No appreciable Cr(VI) concentration decreases were observed onsite, as shown in Figure 7.
- The lack of Cr(VI) reduction onsite appears to be associated with low pH conditions inhibiting microbial activity, which requires neutral pH. Onsite, pH ranged from 3.1 to 6.1, whereas pH ranged from 6.2 to 7.7 offsite. Alkalinity also provides another indication of microbial activity since carbon dioxide (CO_2) is produced from microbial activity as organic carbon (naturally occurring or from the EVO injections) is consumed and the CO_2 converts to alkalinity. Alkalinity was lowest onsite closer to the source area (EPA-29-OB) and upgradient of the barrier (EPA-32-OB), and elevated within, offsite and downgradient of the barrier (greater than 250 mg/L), indicating increased microbial activity where pH was 6 or higher.
- The lack of Cr(VI) reduction also could be associated with toxic effects of high Cr(VI) concentrations on microbial growth. Studies have shown that Cr(VI) concentration greater than approximately 160,000 to 200,000 $\mu\text{g/L}$ are inhibitive for Cr(VI)-reducing bacteria (Farag and Zaki 2010). Cr(VI) concentrations onsite are above this threshold, whereas offsite concentrations are below this threshold.
- Dissolved total chromium also was analyzed to evaluate the potential for organic acids resulting from the breakdown of EVO to form soluble complexes with Cr(III). The complexation of Cr(III) by organic acids occurs after Cr(VI) is reduced either biologically or abiotically, so the presence of organic acids does not have a bearing on biotic or abiotic Cr(VI) reduction. The complexes, while stable and not likely to re-oxidize to Cr(VI), would allow Cr(III) to remain in solution at higher pH levels where Cr(III) is expected to precipitate. In most of the monitoring wells, Cr(VI) composed a majority of the dissolved chromium. In downgradient monitoring well EPA-13-OB, Cr(III) made up approximately 70 to 80 percent

of the dissolved chromium, an indication that Cr(III) had complexed with organic acids. However, the concentration of dissolved chromium in this well was still below the NJDEP Groundwater Quality Standard (GWQS) of 70 µg/L. Compared to the greater than two-orders-of magnitude reduction of total chromium and Cr(VI) concentrations in this well, the magnitude of Cr(III) complexation is not significant.

Geochemical Parameter Trends

- Typical ORP in the environment ranges from hundreds of millivolts (mv) for very oxidizing conditions, to negative hundreds of mV for methanogenic conditions. Baseline groundwater ORP ranged from 103 to 530 mV, indicating oxidizing conditions. The high ORP was likely because of the high Cr(VI) concentrations in the source area. The ORP observed at the end of the performance monitoring period (greater than 400 mV at the source area to less than –200 mV at the furthest downgradient wells) is indicative of more reducing conditions downgradient of the barrier, which also corroborates the overall Cr(VI) reduction patterns observed.
- The terminal electron acceptors evaluated included nitrate, which reduces to nitrogen gas (with nitrite as a short-lived intermediate), manganese(IV) which reduces to dissolved manganese(II); Fe(III), which reduces to dissolved Fe(II); and CO₂, which reduces to methane. Overall trends in groundwater electron acceptor concentrations also mirror the same general Cr(VI) reduction patterns, in that Cr(VI) reduction occurred where consistent reducing conditions resulting from the stimulation of microbial activity were observed downgradient of the site. Due mainly to low pH and elevated Cr(VI) concentrations, impacts to microbial activity, redox conditions observed during the pilot study ranged from oxidizing onsite to nitrate-reducing and methanogenic downgradient, as follows:
 - Background nitrate concentrations range from approximately 10 to 40 mg/L. Nitrate concentrations in all monitoring wells, except EPA-29-OB, decreased over time. The greatest nitrate decreases (decreased to less than 1 mg/L) were observed in downgradient monitoring wells EPA-13-OB and EPA-30-OB. Nitrate concentration decreases were caused by nitrate-reducing bacteria using it as a terminal electron acceptor, reducing it to nitrogen gas.
 - Iron and manganese concentration trends were difficult to interpret because of elevated background concentrations in the acidic onsite groundwater. The most significant increases in iron and manganese were observed in downgradient wells EPA-13-OB and EPA-30-OB. Iron and manganese concentrations in these wells were elevated above the NJDEP GWQSs during the fifth performance monitoring event. Concentrations are expected to drop back below maximum contaminant levels as the EVO is depleted over time and redox conditions return to background.
 - Background methane concentrations were predominately nondetect. Methane concentration increases were noted in most of the monitoring wells; however, the most significant increases were observed in downgradient monitoring wells EPA-13-OB and EPA-30-OB (1,360 and 427 µg/L, respectively). The increase of methane is a result of methanogenic bacteria using CO₂ as a terminal electron acceptor, reducing it to methane. Certain strains of methanogens are known to be tolerant of lower pH conditions, possibly explaining the slight increase in methane in EPA-29-OB. Methanogenic conditions can also exist in localized microenvironments near the EVO injections that are not representative of the overall surrounding aquifer conditions.

Recommendations for Full-scale Application of In Situ Reduction

The overall results of the pilot study show that because of microbe-inhibitory low pH and elevated Cr(VI) concentrations at the source area, biological in situ reduction should not be considered for application in the overburden at the ECE property. Either chemical in situ reduction, or a combination of chemical with pH neutralization and biological reduction, should be considered.

In situ biological reduction has the potential to be a successful component of a full-scale remedy for the Cr(VI) plume downgradient of the ECE property. For example, in situ biological reduction could be used to create reducing barriers by injecting EVO in a line of wells parallel to the groundwater flow direction.

Uneven lateral distribution of injected solution was observed during the pilot study. Greater uniformity and injection ROI can likely be achieved by using permanent injection wells rather than DPT injection points, and increasing the total injection volume. Using injection wells and larger injection volumes would be beneficial for treatment barrier applications, where uniformity of treatment is important. For full-scale application, volatile fatty acids analysis would be performed periodically to confirm the distribution of EVO and TOC concentrations.

The dosage of EVO used during the pilot study resulted in sufficient TOC concentrations to support Cr(VI) reduction (at least 20 mg/L) where microbial activity was not inhibited. However, it is uncertain at this time how long reducing conditions will persist with a single injection at the pilot study dosage. For full-scale application, increasing the EVO dosage would be recommended to maximize the longevity of the reduction barriers and to provide contingency against non-uniform EVO distribution. Based on the pH data collected from the downgradient offsite monitoring wells, adding a buffer does not appear to be necessary in the downgradient plume area to maintain neutral pH levels.

For full-scale application, it is not anticipated that the addition of sulfate would be necessary for Cr(VI) reduction to occur. However, sulfate injections may extend the effectiveness (in areal extent and longevity) of full-scale in situ reduction barriers and reduce the EVO reinjection frequency. Additional monitoring data from EPA-13-OB collected after TOC has been depleted may provide additional insight into the benefits of sulfate amendment. If sulfate is injected along with the EVO during full-scale application, amendment of iron also is recommended to supplement the low naturally occurring iron in the aquifer.

References

CH2M HILL. 2013a. *Final Work Plan for Aquifer Test, Pilot Test and Groundwater Modeling, Garfield Groundwater Contamination Superfund Site, Remedial Investigation/Feasibility Study, City of Garfield, Bergen County, New Jersey*. September

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TABLES

- 1 Pilot Test Monitoring Wells
- 2 Pilot Test Groundwater Analytical Results
- 3 Pilot Test Monitoring Analysis
- 4 Pilot Test Grab Groundwater Results

FIGURES

- 1 Site Location
- 2 Pilot Study Site Map
- 3 Grab Groundwater Sample Results
- 4 Total/Hexavalent Chromium Results – Performance Monitoring
- 5 Total Organic Carbon Concentration Trends in Groundwater
- 6 Sulfate Concentration Trends in Groundwater
- 7 Hexavalent Chromium Concentration Trends in Groundwater – Source Area and within Treatment Barrier
- 8 Hexavalent Chromium Concentration Trends in Groundwater – Downgradient of Treatment Barrier

ATTACHMENTS

- 1 Well Permits
- 2 Survey Data
- 3 Boring Logs, Well Completion Diagrams, and Development Forms
- 4 Data Quality Evaluation Report
- 5 Groundwater Field Logs
- 6 Vironex Injection Services Report
- 7 pH Titration Results
- 8 IDW Manifest and Bill of Lading

Tables

TABLE 1

Pilot Test Monitoring Wells*Results of In Situ Reduction Pilot Test**Garfield Groundwater Contamination Superfund Site, New Jersey*

Monitoring Well ID	Depth Interval	TOC Elevation ft amsl	Total Depth ft bgs	Screen Interval ft bgs	TOS Elevation ft amsl	BOS Elevation ft amsl	Pilot Study Location
EPA-13-OB	Overburden	55.54	32	22 to 32	33.54	23.54	Downgradient of Injection Barrier
EPA-29-OB	Overburden	58.23	20	15 to 20	43.23	38.23	Within Source Area
EPA-30-OB	Overburden	55.50	22	17 to 22	38.50	33.50	Downgradient of Injection Barrier
EPA-31-OB	Overburden	56.31	26	16 to 26	40.31	30.31	Within Injection Barrier
EPA-32-OB	Overburden	58.29	20.5	10.5 to 20.5	47.79	37.79	Upgradient of Injection Barrier, Downgradient of Source Area

Notes:

BOS = bottom of screen

ft amsl = ft above mean sea level

ft bgs = feet below ground surface

TOC = top of casing

TOS = top of screen

TABLE 2
Pilot Test Groundwater Analytical Results
Results of In Situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, New Jersey

		Well	EPA-13-OB									EPA-29-OB						
		Date Collected	6/19/2014	6/19/2014	7/29/2014	9/3/2014	10/20/2014	10/20/2014	12/18/2014	12/18/2014	2/5/2015	6/19/2014	7/30/2014	9/4/2014	9/4/2014	10/21/2014	12/17/2014	2/6/2015
		Event	Baseline	Event 1	Event 1 - Dup	Event 2	Event 3	Event 3 - Dup	Event 4	Event 4 - Dup	Event 5	Baseline	Event 1	Event 2	Event 2 - Dup	Event 3	Event 4	Event 5
			EPA-13-OB-	D-06192014-	EPA-13-OB-	EPA-13-OB-	EPA-13-OB-		GCGC-EPA-13-	D-12182014-	EPA-13-OB-	EPA-29-OB-	EPA-29-OB-	EPA-29-OB-		EPA-29-OB-	GCGC-EPA-29-	EPA-29-OB-
		Sample ID	061914	01	072914	090314	102014	D-01-102014	OB-05	01	020515	061914	072914	090414	D-01-090414	102114	OB-05	020615
Analyte	Unit	NJDEP GWQS																
Chromium , dissolved	µg/L	70	19,000	18,000	2,850	350	56.8	--	32.1	--	41	310,000	316,000	410,000	400,000	332,000	220,000	220,000
Chromium	µg/L	70	18,000	18,000	2,730	740	187	--	49.5	--	83 L	300,000	421,000	410,000	430,000	380,000	267,000	240,000
Chromium, Hexavalent (CrVI) , dissolved	µg/L	70	18,400	18,900	2,400	310	13.2 J	147 J	9	9	9	275,000	292,000	379,000	379,000	298,000	213,000	207,000
Iron , dissolved	µg/L	300	50 U	50 U	100 U	50 U	200 U	--	354	--	220	2,800	2,200	4,900	4,400	115,000	200 U	1,600
Iron	µg/L	300	50 U	50 U	100 U	50 U	200 U	--	395	--	290	3,300	6,510	4,700	5,000	128,000	1,820	1,800
Manganese , dissolved	µg/L	50	4.5	11	--	--	2,800	--	1,910	--	4,500	770	--	--	--	995	--	950
Manganese	µg/L	50	5.4	5.2	--	--	2,880	--	--	--	4,500	790	--	--	--	1,480	--	920
Methane , dissolved	µg/L		--	--	--	--	1	--	--	--	--	--	--	--	--	1.6	--	--
Methane	µg/L		2 U	--	--	--	--	--	--	--	1,360	2 U	--	--	--	--	--	47.8
Ethane	µg/L		2 U	--	--	--	--	--	--	--	2 U	2 U	--	--	--	--	--	2 U
Ethene	µg/L		2 U	--	--	--	--	--	--	--	2 U	2 U	--	--	--	--	--	2 U
ALKALINITY, TOTAL (AS CaCO3)	mg/L		210	--	--	--	262	--	--	--	280	1 U	--	--	--	2 U	--	1 U
Chloride (Cl)	mg/L		140	--	160	180	150	--	160	--	160	240	240	260	--	211	210	180
NITRATE-NITRITE (as Nitrogen)	mg/L		8.5	--	0.13	--	0.016 J	--	0.05 U	--	0.05 U	9.8	6.2	--	--	9.58	--	7.9
Sulfate	mg/L		33	--	56	57	13.5	--	12	--	3.2	160	200	190	--	214	92	110
Sulfide, Acid-Soluble	mg/L		0.01 U	--	0.01 UL	0.01 U	1.6	--	1.3	--	0.012	0.01 U	0.01 U	0.01 U	--	1 U	0.02 UL	0.01 UL
Total Organic Carbon	mg/L		1 U	1 U	13	5.2	17.3	10.6	7.4	--	38	2.6	18	10	9.9	14.3	6.3 J	7.5
Field Parameters	Unit																	
pH	s.u.		7.74	--	7.74	7.57	7.44	--	7.53	--	7.18	4.15	3.64	3.23		3.20	3.28	3.13
Temperature	°C		16.91	--	19.01	17.44	19.00	--	17.67	--	14.95	13.49	17.70	19.00		17.96	17.43	15.29
Conductivity	mS/cm		0.806	--	0.956	1.00	0.108	--	1.00	--	1.01	1.52	1.69	1.84		0.187	1.40	1.49
Oxidation-Reduction Potential	mV		149	--	17	-94	251	--	-229	--	-228	530	470	523		535	459	427
Dissolved Oxygen ^a	mg/L		1.12	--	0.00	0.00	0.00	--	1.98	--	0.00	2.95	0.00	0.51		0.40	0.00	0.00
Turbidity	NTU		2.85	--	191	40.5	6.03	--	7.07	--	9.3	98.3	339	93.1		48.4	7.09	19.6
Depth to Water	ft bgs		11.98	--	12.42	13.64	14.50	--	12.20	--	12.97	10.37	10.67	11.77		12.65	10.78	11.08
Water Elevation	ft amsl		43.56	--	43.12	41.90	41.04	--	43.34	--	42.57	47.86	47.56	46.46		45.58	47.45	47.15
Observations ^b			Yellow, Green	--	Clear, Slightly milky	Clear	Clear	--	Clear	--	Clear	Dark Yellow	Yellow, milky	Yellow		Yellow	Yellow, green	Yellow

Notes:
Shading indicates concentrations in exceedance of NJDEP GWQS
-- Analyte was not sampled for at that location

NJDEP GWQS - New Jersey Department of Environmental Protection Groundwater Quality Standard
CaCO3 - Calcium Carbonate
Dup - Duplicate
µg/L - microgram per liter
mg/L - milligram per liter
s.u. - standard pH units
°C - degrees Celsius
mS/cm - millisiemens per centimeter
mV - millivolts
NTU - Nephelometric Turbidity Units
ft bgs - feet below ground surface
ft amsl - feet above mean sea level

^a Due to equipment limitations in the field during the six sampling events , dissolved oxygen measurements are inaccurate and were not used in the assessment of the Pilot Study.

^b Yellow to orange coloring is indicative of elevated concentrations of hexavalent chromium. Green coloring is indicative of elevated concentrations of trivalent chromium. Brown to red color may be indicative of elevated precipitation of iron as a result of EVO injections.

J- The identification of the analyte is acceptable; the reported value is an estimate.

K- The identification of the analyte is acceptable; the reported value may be biased high.

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U- The analyte was not detected at or above the Reporting Limit.

TABLE 2
Pilot Test Groundwater Analytical Results
Results of In Situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, New Jersey

Analyte	Unit	NJDEP GWQS	Well	EPA-30-OB							EPA-31-OB						
			Date Collected	6/19/2014	7/29/2014	9/3/2014	10/20/2014	12/18/2014	2/5/2015	6/19/2014	7/30/2014	9/3/2014	10/20/2014	12/18/2014	2/6/2015	2/6/2015	
			Event	Baseline	Event 1	Event 2	Event 3	Event 4	Event 5	Baseline	Event 1	Event 2	Event 3	Event 4	Event 5	Event 5 - Dup	
			Sample ID	EPA-30-OB-	EPA-30-OB-	EPA-30-OB-	EPA-30-OB-	GCGC-EPA-30-	EPA-30-OB-	EPA-31-OB-	EPA-31-OB-	EPA-31-OB-	EPA-31-OB-	GCGC-EPA-31-	EPA-31-OB-	D-02062015-	
			061914	072914	090314	102014	OB-05	020515	061914	073014	090314	102014	OB-05	020615	01		
Chromium , dissolved	µg/L	70	130,000	76,800	25,000	8,400	6,940	2,300	250,000	264,000	250,000	275,000 J	211,000	250,000	250,000		
Chromium	µg/L	70	130,000	75,700	22,000	9,600	9,150	5,600	250,000	251,000	240,000	267,000	270,000	250,000	250,000		
Chromium, Hexavalent (CrVI) , dissolved	µg/L	70	125,000	68,100	25,300	10,000	9,880	2,880	241,000	237,000	246,000	288,000	241,000	249,000	253,000		
Iron , dissolved	µg/L	300	50 U	1,000 U	50 U	2,630	447	50 U	50 U	3,500 U	50 U	87,000 J	1,210	50 U	50 U		
Iron	µg/L	300	240	1,000 U	50 U	3,140	893	3,000	120	3,000 U	440	90,900	1,070	190	150		
Manganese , dissolved	µg/L	50	410	--	--	1,640	--	2,700	1,200	--	--	1,270 J	--	1,100	1,100		
Manganese	µg/L	50	420	--	--	1,830	--	2,800	1,200	--	--	772	--	1,200	1,100		
Methane , dissolved	µg/L		--	--	--	2.4	--	--	--	--	--	0.89 J	--	--	--		
Methane	µg/L		2.38	--	--	--	--	427	2 U	--	--	--	--	4.42	--		
Ethane	µg/L		2 U	--	--	--	--	2 U	2 U	--	--	--	--	2 U	--		
Ethene	µg/L		2 U	--	--	--	--	2 U	2 U	--	--	--	--	2 U	--		
ALKALINITY, TOTAL (AS CaCO3)	mg/L		250	--	--	273	--	290	210	--	--	265	--	150	--		
Chloride (Cl)	mg/L		160	160	180	163	160	170	190	190	--	170	180	170	--		
NITRATE-NITRITE (as Nitrogen)	mg/L		16	2.8	--	0.024 J	--	0.1	28	22	--	14.1	--	13	--		
Sulfate	mg/L		76	89	71	57.2	68	40	100	140	130	111	130	140	--		
Sulfide, Acid-Soluble	mg/L		0.01 U	0.01 U	0.01 U	1 U	0.02 U	0.01 U	0.01 U	0.01 U	0.01 U	1 U	0.02 U	0.01 U	--		
Total Organic Carbon	mg/L		1.7	12	3.6	3.5	3.7	6.4	2.3	20	11	12.6	8.6	6.9	7		
Field Parameters	Unit																
pH	s.u.		6.77	6.73	7.25	7.30	7.04	6.21	6.11	6.02	5.76	6.00	5.81	5.36	--		
Temperature	°C		18.35	16.91	20.16	21.30	18.72	13.24	16.90	17.98	20.50	18.32	16.91	15.29	--		
Conductivity	mS/cm		1.29	1.24	1.17	0.115	1.19	1.09	1.75	1.74	1.56	0.193	1.74	1.61	--		
Oxidation-Reduction Potential	mV		103	151	20	-84	-3	-49	202	259	206	290	331	350	--		
Dissolved Oxygen ^a	mg/L		0.83	0.00	0.75	0.73	2.17	0.00	1.49	0.00	0.00	0.41	0.00	0.00	--		
Turbidity	NTU		13.6	258	10.9	6.91	7.03	78	20.9	256	137	53.4	36.9	18.3	--		
Depth to Water	ft bgs		11.95	12.65	13.97	14.54	12.55	12.74	11.98	12.90	14.13	--	12.46	13.18	--		
Water Elevation	ft amsl		43.55	42.85	41.53	40.96	42.95	42.76	44.33	43.41	42.18	--	43.85	43.13	--		
Observations ^b			Yellow, green	Yellow	Yellow, green	Clear	Clear	Light brown	Dark Yellow	Yellow	Yellow	Yellow	Yellow	Yellow, green	--		

Notes:
Shading indicates concentrations in exceedance of NJDEP GWQS
-- Analyte was not sampled for at that location

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Pilot Test Groundwater Analytical Results
Results of In Situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, New Jersey

		Well		EPA-32-OB					
		Date Collected	6/19/2014	7/29/2014	7/29/2014	9/3/2014	10/20/2014	12/17/2014	2/5/2015
		Event	Baseline	Event 1	Event 1 - Dup	Event 2	Event 3	Event 4	Event 5
			EPA-32-OB-	EPA-32-OB-	D-07292014-	EPA-32-OB-	EPA-32-OB-	GCGC-EPA-32-	EPA-32-OB-
		Sample ID	061914	072914	01	090314	102014	OB-05	020515
Analyte	Unit	NJDEP GWQS							
Chromium , dissolved	µg/L	70	250,000	184,000	--	240,000	274,000	301,000	250,000
Chromium	µg/L	70	240,000	159,000	--	240,000	389,000	312,000	250,000
Chromium, Hexavalent (CrVI) , dissolved	µg/L	70	224,000	160,000	--	232,000	285,000	269,000	235,000
Iron , dissolved	µg/L	300	540	632	--	560	88,900	731	680
Iron	µg/L	300	690	2,040	--	1,100	105,000	2,250	2,300
Manganese , dissolved	µg/L	50	1,500	--	--	--	1,410	--	1,600
Manganese	µg/L	50	1,500	--	--	--	1,760	--	1,600
Methane , dissolved	µg/L		--	--	--	--	0.92 J	--	--
Methane	µg/L		2 U	--	--	--	--	--	2 U
Ethane	µg/L		2 U	--	--	--	--	--	2 U
Ethene	µg/L		2 U	--	--	--	--	--	2 U
ALKALINITY, TOTAL (AS CaCO3)	mg/L		1 U	--	--	--	4.4	--	1 U
Chloride (Cl)	mg/L		150	160	--	190	185	200	170
NITRATE-NITRITE (as Nitrogen)	mg/L		35	36	--	--	9.22	--	8.9
Sulfate	mg/L		200	260	--	200	169	150	200
Sulfide, Acid-Soluble	mg/L		0.01 U	0.01 U	--	0.01 U	1 U	0.02 U	0.01 U
Total Organic Carbon	mg/L		2.1	3.8	3.9	6.8	14.1	5.2	5.7
Field Parameters	Unit								
pH	s.u.		4.75	4.35	--	4.44	4.71	3.25	5.02
Temperature	°C		15.43	19.56	--	21.47	21.50	17.87	20.33
Conductivity	mS/cm		1.41	1.45	--	1.46	0.185	1.68	1.54
Oxidation-Reduction Potential	mV		474	406	--	462	375	488	419
Dissolved Oxygen ^a	mg/L		2.14	0.00	--	1.20	0.00	0.14	0.00
Turbidity	NTU		9.73	39.2	--	46.4	> 1,000	4.39	232
Depth to Water	ft bgs		12.40	13.01	--	14.35	15.20	12.79	13.40
Water Elevation	ft amsl		45.89	45.28	--	43.94	43.09	45.50	44.89
Observations ^b			Dark Yellow	Yellow	--	Yellow	Yellow-brown	Yellow - brown	Yellow, green

Notes:
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TABLE 3

Pilot Test Monitoring Analysis*Results of In Situ Reduction Pilot Test**Garfield Groundwater Contamination Superfund Site, New Jersey*

Analysis	Baseline Groundwater Sampling	Post-Injection Grab Groundwater Sampling	Performance	Performance	Performance	Performance	Performance
			Monitoring Event 1	Monitoring Event 2	Monitoring Event 3	Monitoring Event 4	Monitoring Event 5
Chromium, Hexavalent (CrVI) , dissolved	X		X	X	X	X	X
Dissolved total chromium	X		X	X	X	X	X
Total chromium	X		X	X	X	X	X
Total Organic Carbon	X	X	X	X	X	X	X
Sulfide	X		X	X	X	X	X
Chloride	X		X	X	X	X	X
Sulfate	X	X	X	X	X	X	X
Nitrate	X		X		X		X
Dissolved Iron	X		X	X	X	X	X
Total Iron	X		X	X	X	X	X
Alkalinity	X				X		X
Methane	X				X		X
Dissolved Manganese	X				X		X
Total Manganese	X				X		X
Field test kits:							
Cr(VI)		X					
Ferrous Iron							
Field measurements: pH, temperature, dissolved oxygen, turbidity, conductivity, oxidation- reduction potential	X	X	X	X	X	X	X

TABLE 4
Pilot Test Grab Groundwater Results
Results of In Situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, New Jersey

Well	Date Collected	GW-A	GW-B	GW-C(a)	GW-C	GW-D(a)	GW-D	GW-E		GW-F		GW-G		GW-H		GW-I(a)	GW-I	GW-J	
		7/30/2014	7/29/2014	7/30/2014	7/29/2014	7/30/2014	7/30/2014	7/29/2014	7/29/2014	7/30/2014	7/31/2014	7/30/2014	7/30/2014	7/31/2014	7/31/2014	7/31/2014	7/30/2014	7/31/2014	7/31/2014
Sample ID	Unit	GW-A-14-16	GW-B-12-14	GW-C(A)-17.5-19.5	GW-C-10.5-12.5	GW-D(A)-16-18	GW-D-13-15	GW-E-13-15	GW-E-16.5-18.5	GW-F-15-17	GW-F-21.5-23.5	GW-G-15-17	GW-G-24-26	GW-H-21-23	GW-H-26-28	GW-I(A)-21.5-23.5	GW-I-19-21	GW-J-15-17	GW-J-20-22
Analyte	Unit																		
Sulfate	mg/L	270	710	94	530	120	190	590	190	270	240	360	550	480	310	160	95	160	120
Total Organic Carbon	mg/L	9.2	14	25	5.1	12	13	26	16	36	65	250	18	200	59	21	12	17	23
Field Parameter	Unit																		
pH	s.u.	3.79	*	5.72	6.82	4.79	4.25	4.34	5.81	7.18	4.69	6.27	7.19	6.95	7.93	6.76	7.15	8.02	7.68
Temperature ^a	°C	18.45	*	21.88	27.15	22.30	19.43	28.01	25.64	35.03	19.90	26.44	21.98	21.25	27.01	18.34	25.98	27.73	24.74
Conductivity	mS/cm	2.02	*	1.18	1.62	1.56	1.30	1.45	1.49	1.36	0.670	1.48	2.08	1.56	1.04	0.957	0.75	0.654	1.25
Oxidation-Reduction Potential	mV	435	*	176	322	345	385	376	343	113	360	34	-210	-22	-9	-172	192	125	-300
Dissolved Oxygen ^b	mg/L	2.13	*	0.43	3.98	0.19	--	--	4.05	2.21	2.00	0.87	1.29	3.30	0.63	73	2.95	0.42	0.00
Turbidity ^c	NTU	586	*	> 1,000	--	> 1,000	> 1,000	>1,000	> 1,000	--	246	> 1,000	> 1,000	> 1,000	> 1,000	604	--	> 1,000	> 1,000
Ferrous Iron (field test)	mg/L	0.35	*	> 3.30	2.63	> 3.30	0	0	0.05	0	0.51	1.62	0	0.35	2.13	--	0	1.13	0
Hexavalent Chromium (field test) ^d	mg/L	> 0.70	*	> 0.70	> 0.70	> 0.70	> 0.70	> 0.70	> 0.70	> 0.70	> 0.70	0.1	0.35	0.17	> 0.70	--	> 0.70	> 0.70	0.12
Depth to Water	ft bgs	12.5	*	11.20	10.90	11.60	12.70	13.10	13.12	15.21	22.01	15.40	15.20	18.05	24.80	13.40	19.85	13.20	17.85
Observations ^e		Yellow	Yellow	Reddish/Yellow	White, milky	Red/Yellow	Reddish/Brown	Yellowish/Red	Reddish Brown	Light Brown	Clear/light brown	Red	Brown	Light Brown	Reddish brown	Cloudy/White	Brown	Reddish/brown	Light Brown

Notes:
-- Field parameter was not recorded at the location
mg/L - milligram per liter
s.u. - standard pH units
°C - degrees Celsius
mS/cm - millisiemens per centimeter
mV - millivolts
NTU - Nephelometric Turbidity Units
ft bgs - feet below ground surface
* - unable to collect field parameters due to lack of water


^a Increased temperatures may be due to field methodology and may not be representative of aquifer conditions, due to the grab nature in which the field parameters were collected.


^b Due to equipment error in the field, dissolved oxygen measurements are inaccurate and were not used in the assessment of the Pilot Study.
^c "> 1,000" indicates turbidity measurements exceeded the limits of the field equipment.
^d "> 0.70" indicates field tested hexavalent chromium measurements exceeded the limits of the field testing kit.
^e Yellow to orange coloring is indicative of elevated concentrations of hexavalent chromium. Green coloring is indicative of elevated concentrations of trivalent chromium. Brown to red color may be indicative of elevated precipitation of iron as a result of EVO injections.

Figures




Legend

 E.C. Electroplating - Pilot Test Study Area

 Groundwater Flow Direction



N



0 175 350 700 Feet


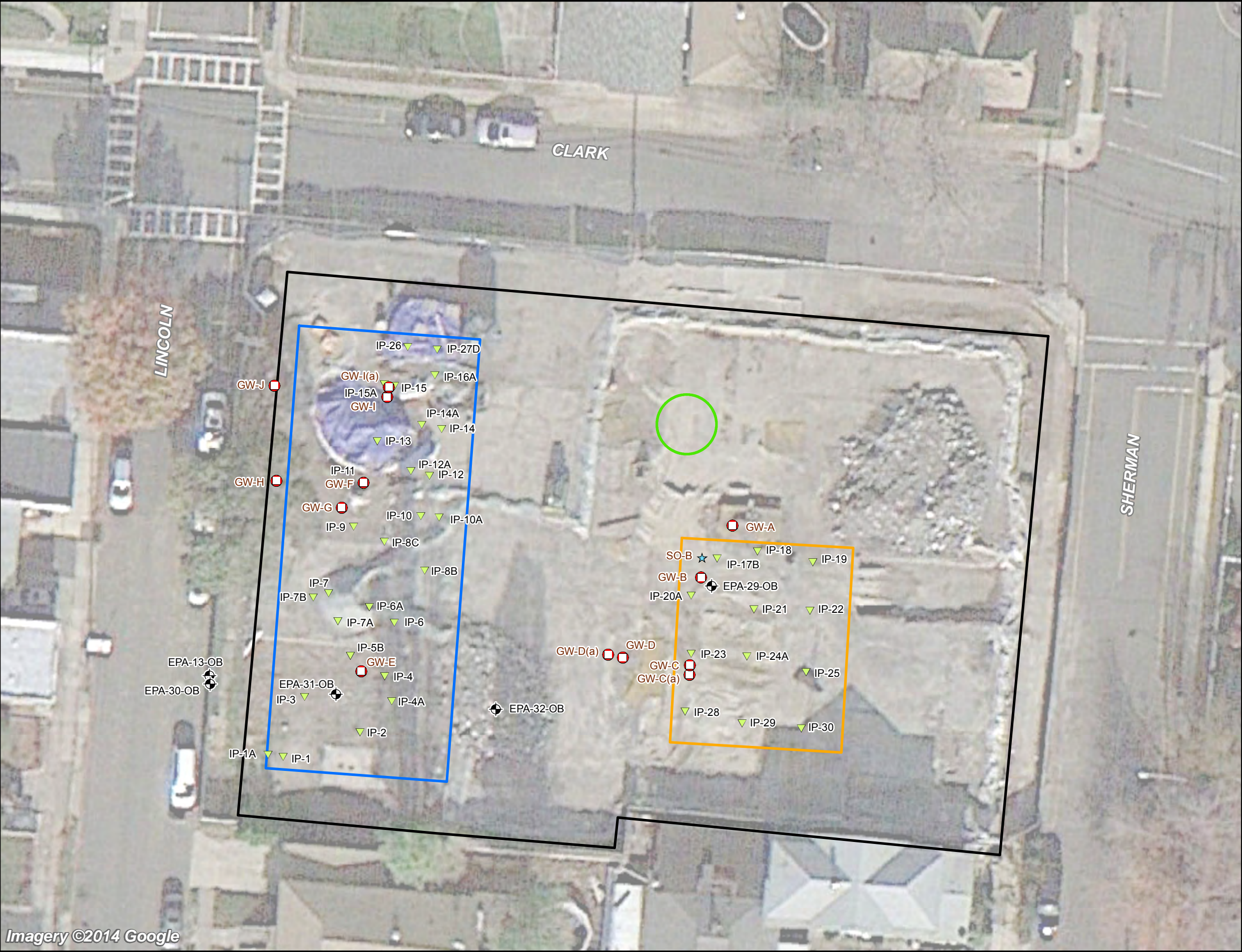


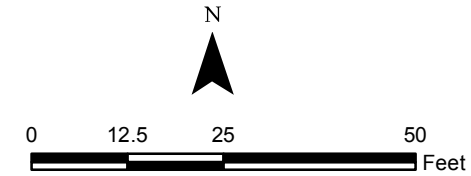
Figure 1

Site Location
In situ Reduction Pilot Test
Garfield Groundwater Contamination
Superfund Site, Garfield NJ, 07026



Imagery ©2014 Google

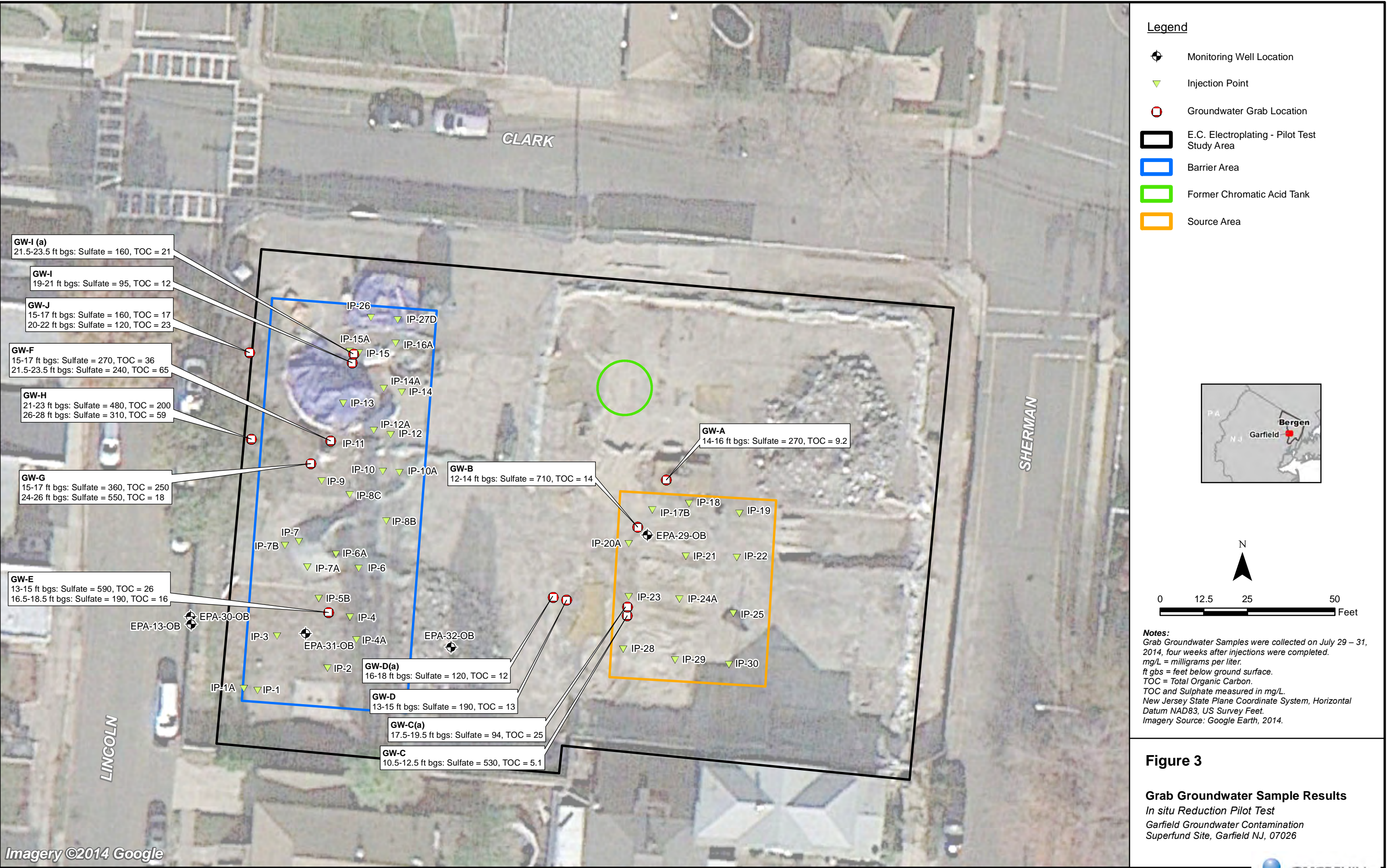
- Legend**
- Monitoring Well Location
 - Injection Point
 - Groundwater Grab Location
 - Soil Sample Location – pH Titration
 - E.C. Electroplating - Pilot Test Study Area
 - Barrier Area
 - Former Chromatic Acid Tank
 - Source Area

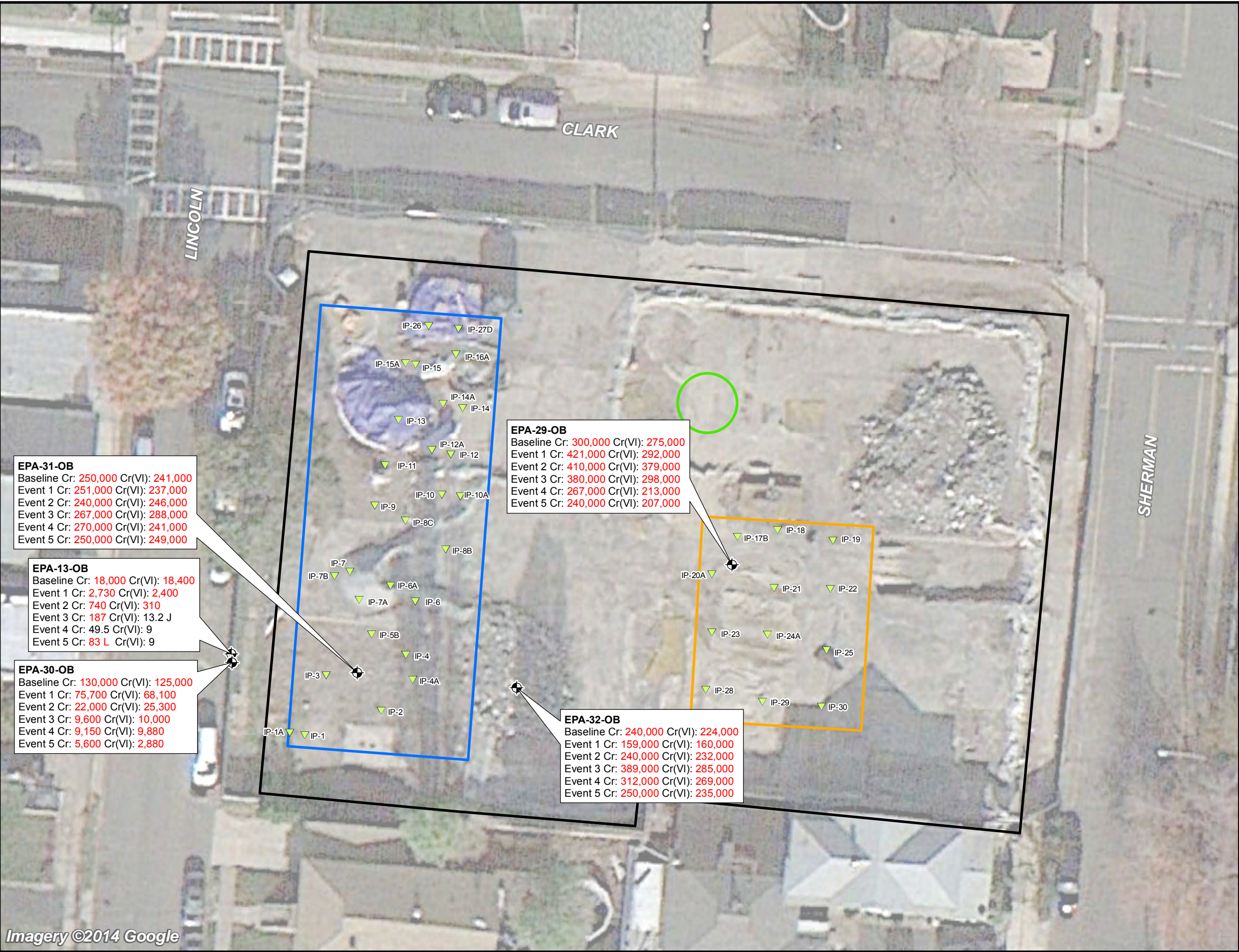


NOTES:
New Jersey State Plane Coordinate System, Horizontal
Datum NAD83, US Survey Feet
Imagery Source: Google Earth, 2014.

Figure 2

Pilot Study Site Map
In situ Reduction Pilot Test
Garfield Groundwater Contamination
Superfund Site, Garfield NJ, 07026

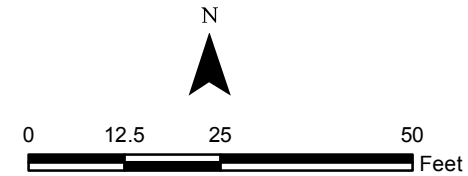




Imagery ©2014 Google

- Legend**
- Monitoring Well Location
 - Injection Point
 - E.C. Electroplating - Pilot Test Study Area
 - Barrier Area
 - Former Chromatic Acid Tank
 - Source Area

Sampling Schedule:
Baseline – June 19, 2014
Event 1 – July 29-30, 2014
Event 2 – September 3-4, 2014
Event 3 – October 20-21, 2014
Event 4 – December 17-18, 2014
Event 5 – February 5-6, 2015



Notes:
Cr = Total Chromium.
Cr(VI) = Hexavalent Chromium.
J = The identification of the analyte is acceptable; the reported value is an estimate.
NJDEP GWQS = New Jersey Department of Environmental Protection Groundwater Quality Standards.
Hexavalent/Total Chromium concentrations given in micrograms per liter (µg/L)
Concentrations shown in red are exceedances of the NJDEP GWQS for Total Cr = 70 µg/L and Hexavalent Cr = 70 µg/L.
New Jersey State Plane Coordinate System, Horizontal Datum NAD83, US Survey Feet
Imagery Source: Google Earth, 2014.

Figure 4
Total/Hexavalent Chromium Results – Performance Monitoring
In situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, Garfield NJ, 07026

FIGURE 5

Total Organic Carbon Concentration Trends in Groundwater

Results of In Situ Reduction Pilot Test

Garfield Groundwater Contamination Superfund Site, New Jersey

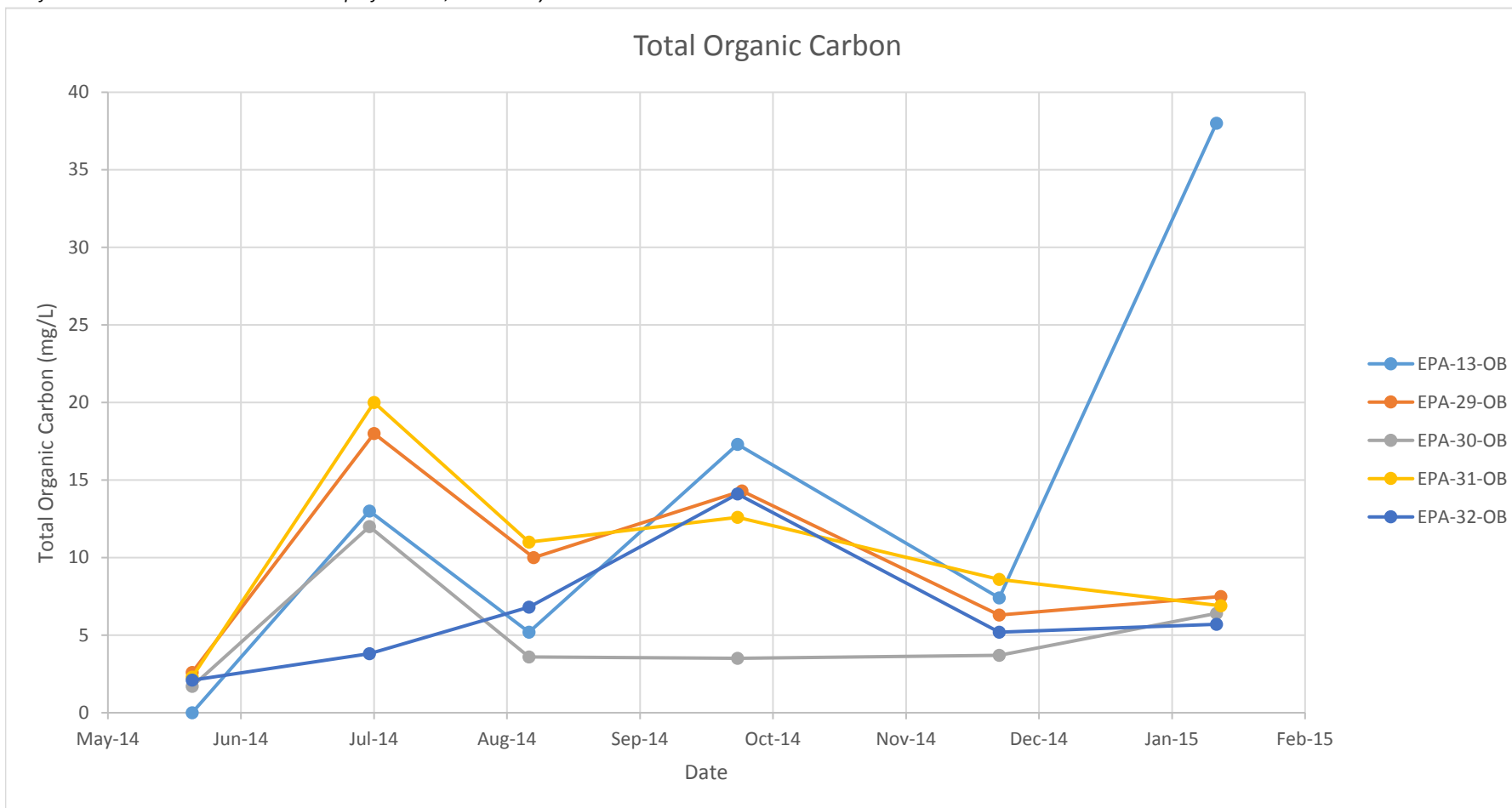


FIGURE 6

Sulfate Concentration Trends in Groundwater

Results of In Situ Reduction Pilot Test

Garfield Groundwater Contamination Superfund Site, New Jersey

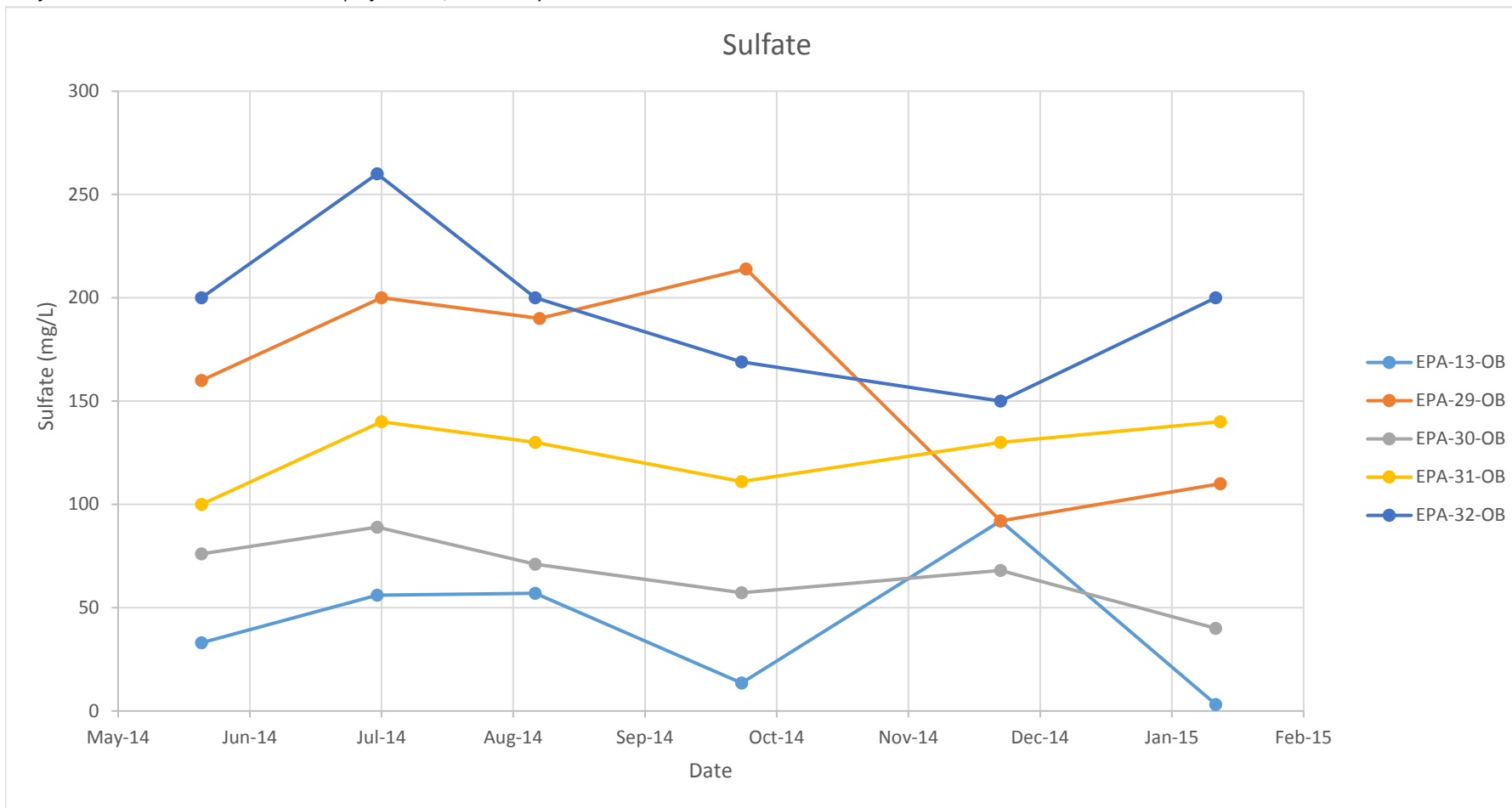


FIGURE 7

Hexavalent Chromium Concentration Trends in Groundwater - Source Area and within Treatment Barrier

Results of In Situ Reduction Pilot Test

Garfield Groundwater Contamination Superfund Site, New Jersey

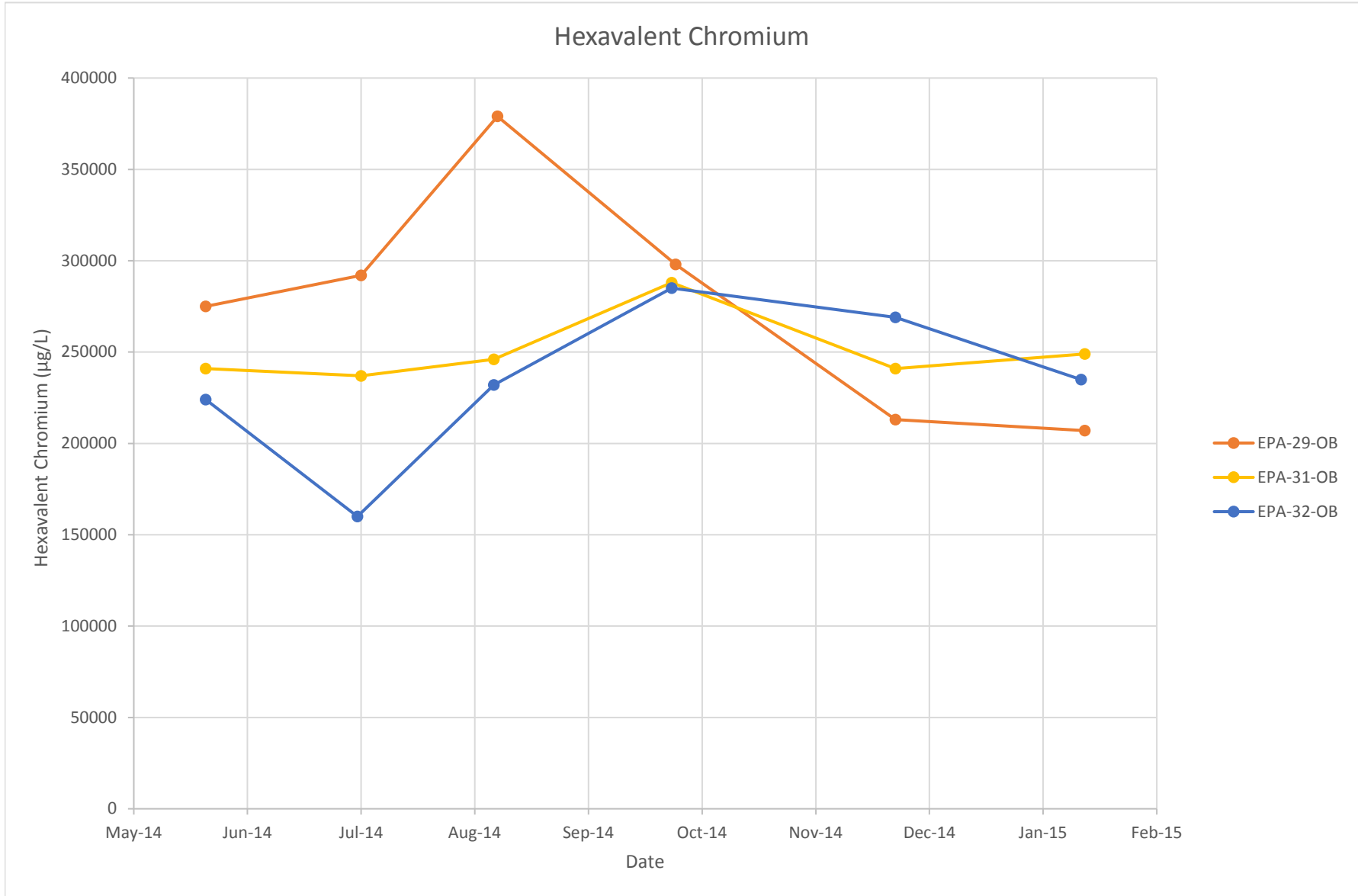
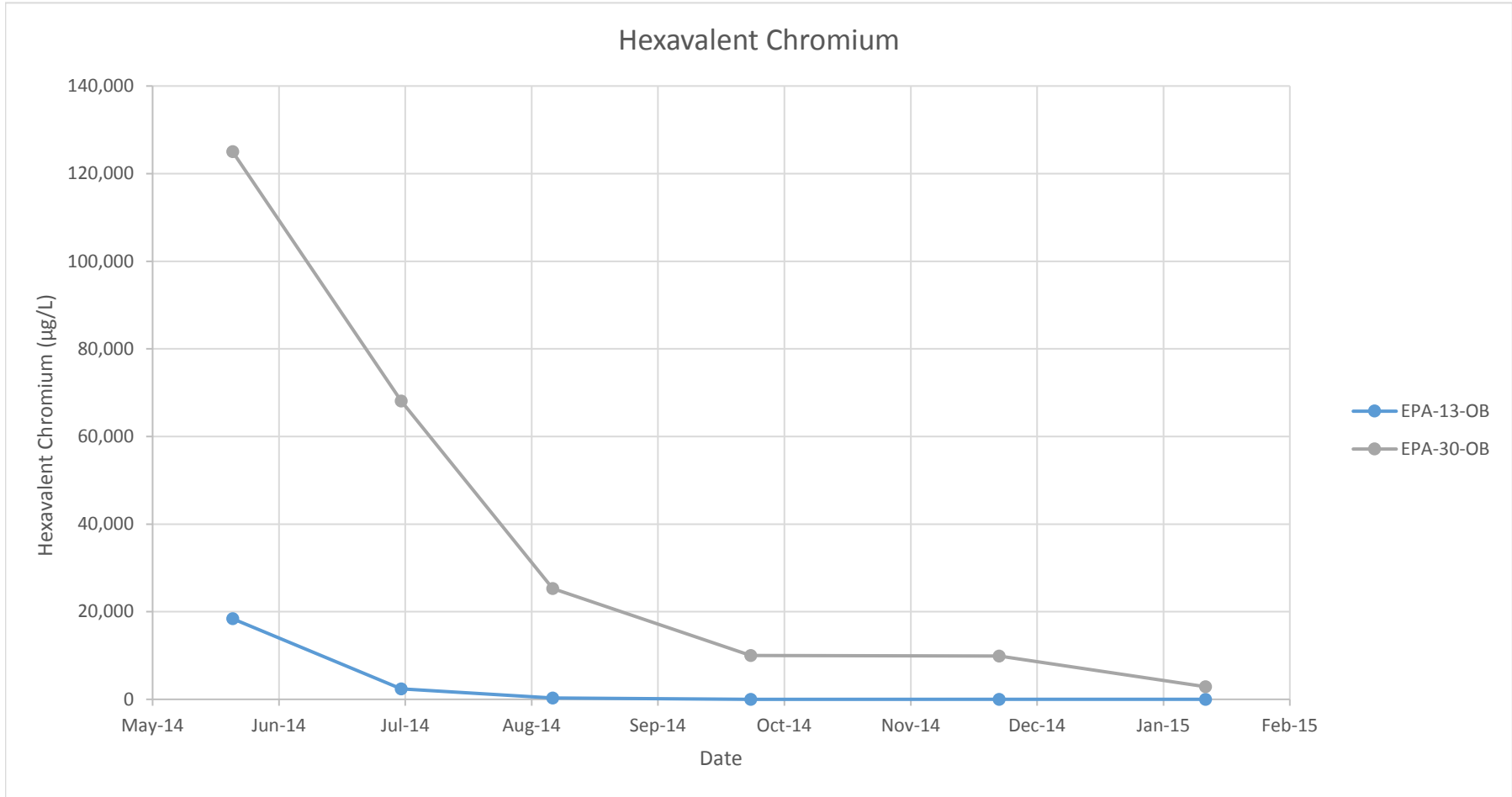


FIGURE 8
Hexavalent Chromium Concentration Trends in Groundwater - Downgradient of Treatment Barrier
Results of In Situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, New Jersey



Attachment 1
Well Permits

WELL PERMIT

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit

Certifying Driller: MICHAEL ELLINGWORTH, JOURNEYMAN LICENSE # 0002725

Permit Issued to: PARRATT-WOLFF INC

Company Address: PO BOX 56 5879 FISHER RD EAST SYRACUSE, NY 13057

PROPERTY OWNER

Name: ANDREW PAVLICA

Organization: City of Garfield

Address: 111 Outwater Lane

City: Garfield City State: New Jersey Zip Code: 07026

PROPOSED WELL LOCATION

Facility Name: Garfield Groundwater Contamination Superfund Site

Address: Lincoln Place

County: Bergen Municipality: Garfield City Lot: ROW Block: ROW

Easting (X): 601872 Northing (Y): 742961
Coordinate System: NJ State Plane (NAD83) - USFEET

Local ID: EPA-30-OB

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 2

Regulatory Program

Requiring Wells/Borings: _____

Depth (ft.): 27

Case ID Number: _____

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Augers

Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: May 15, 2014
Expiration Date: May 15, 2015

Approved by the authority of:
Bob Martin
Commissioner

Terry D. Pilawski

Terry Pilawski, Chief
Bureau of Water Allocation and Well Permitting

WELL PERMIT

DEVIATION INFORMATION	
Purpose:	
Unusual Conditions:	
Reason for Deviation:	
Proposed Well Construction	

GENERAL CONDITIONS/REQUIREMENTS
A copy of this permit shall be kept at the worksite / on the property and shall be exhibited upon request. [N.J.A.C. 7:9D-1]
A well record must be submitted by the well driller to the Bureau of Water Systems and Well Permitting. Unless prior written approval is obtained from the Bureau of Water Systems and Well Permitting the well record shall be submitted electronically through the New Jersey Department of Environmental Protection's Regulatory Services Portal Submit Well Record: within ninety (90) days after the well is completed.[N.J.A.C. 7:9D-1]
All well drilling/pump installation activities shall comply with N.J.A.C. 7:9D-1 et seq. [N.J.A.C. 7:9D-1]
For this permit to remain valid, the well approved in this permit shall be constructed within one year of the effective date of the permit. [N.J.A.C. 7:9D-1]
If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Bureau of Water Systems and Well Permitting. [N.J.A.C. 7:9D-1]
If the use of the well is to be changed a well permit for the proposed use of the well shall be submitted for review and approval. [N.J.A.C. 7:9D-1]
If you or a future property owner intend to redesignate this well as a Category 1 well (domestic, non-public, community water supply or public non-community water supply wells), the well must be constructed as a Category 1 well per the Well Construction and Abandonment Regulations at N.J.A.C. 7:0D-1.1 et seq. In addition, if the current or future property owner intends to have this well redesignated as a community water supply well, the well must be constructed by a Master well driller, which would include having a Master well driller on-site at all times during construction of the well, as specified in the Well Construction and Abandonment Regulations. Otherwise, the New Jersey Department of Environmental Protection will not allow the well to be redesignated, and a new well would have to be installed. [N.J.A.C. 7:9D-1.7((a))1i]
In accepting this permit the Property Owner and Driller agree to abide by the following terms and conditions [N.J.A.C. 7:9D-1]
In the event that this well is not constructed the well driller shall notify the Bureau of Water Systems and Well Permitting of the permit cancellation. Unless prior written approval is obtained from the Bureau of Water Systems and Well Permitting the Cancellation notification shall be submitted electronically through the New Jersey Department of Environmental Protection's Regulatory Services Portal Submit Well Permit Cancellation : by the expiration date of this permit.[N.J.A.C. 7:9D-1]
In the event this well is abandoned, the Owner or Well driller shall assume full responsibility for having the well decommissioned in a manner satisfactory to the New Jersey Department of Environmental Protection in accordance with the provisions of N.J.A.C. 7:9D-1 et seq. [N.J.A.C. 7:9D-1]
The granting of this permit shall not be construed in any way to affect the title or ownership of property, and shall not make the New Jersey Department of Environmental Protection or the State a party in any suit or question of ownership of property. [N.J.A.C. 7:9D-1]
The issuance of this permit shall not be deemed to affect in any way action by the New Jersey Department of Environmental Protection on any future application. [N.J.A.C. 7:9D-1]
This permit conveys no rights, either expressed, or implied to divert water. [N.J.A.C. 7:9D-1]
This permit does not waive the obtaining of Federal or other State or local Government consent when necessary. This permit is not valid and no work shall be undertaken until such time as all other required approvals and permits have been obtained. [N.J.A.C. 7:9D-1]
This permit is NONTRANSFERABLE [N.J.A.C. 7:9D]
This well shall not be used for the supply of potable / drinking water. [N.J.A.C. 7:9D-1]

WELL PERMIT

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit

Certifying Driller: MICHAEL ELLINGWORTH, JOURNEYMAN LICENSE # 0002725

Permit Issued to: PARRATT-WOLFF INC

Company Address: PO BOX 56 5879 FISHER RD EAST SYRACUSE, NY 13057

PROPERTY OWNER

Name: MARY PETTIT (CALDERIO)

Organization: Property Owner

Address: 115 Sherman Place

City: Garfield City State: New Jersey Zip Code: 07026

PROPOSED WELL LOCATION

Facility Name: Garfield Groundwater Contamination Superfund Site

Address: 97 Sherman Place

County: Bergen Municipality: Garfield City Lot: 15 Block: 38.01

Easting (X): 601986 Northing (Y): 743001
Coordinate System: NJ State Plane (NAD83) - USFEET

Local ID: EPA-29-OB

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 2

Regulatory Program

Requiring Wells/Borings: _____

Depth (ft.): 27

Case ID Number: _____

Pump Capacity (gpm): 0

Deviation Requested: N

Drilling Method: Hollow Stem Augers

Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: May 15, 2014
Expiration Date: May 15, 2015

Approved by the authority of:
Bob Martin
Commissioner

Terry D. Pilawski

Terry Pilawski, Chief
Bureau of Water Allocation and Well Permitting

WELL PERMIT

DEVIATION INFORMATION	
Purpose:	
Unusual Conditions:	
Reason for Deviation:	
Proposed Well Construction	

GENERAL CONDITIONS/REQUIREMENTS
A copy of this permit shall be kept at the worksite / on the property and shall be exhibited upon request. [N.J.A.C. 7:9D-1]
A well record must be submitted by the well driller to the Bureau of Water Systems and Well Permitting. Unless prior written approval is obtained from the Bureau of Water Systems and Well Permitting the well record shall be submitted electronically through the New Jersey Department of Environmental Protection's Regulatory Services Portal Submit Well Record: within ninety (90) days after the well is completed.[N.J.A.C. 7:9D-1]
All well drilling/pump installation activities shall comply with N.J.A.C. 7:9D-1 et seq. [N.J.A.C. 7:9D-1]
For this permit to remain valid, the well approved in this permit shall be constructed within one year of the effective date of the permit. [N.J.A.C. 7:9D-1]
If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Bureau of Water Systems and Well Permitting. [N.J.A.C. 7:9D-1]
If the use of the well is to be changed a well permit for the proposed use of the well shall be submitted for review and approval. [N.J.A.C. 7:9D-1]
If you or a future property owner intend to redesignate this well as a Category 1 well (domestic, non-public, community water supply or public non-community water supply wells), the well must be constructed as a Category 1 well per the Well Construction and Abandonment Regulations at N.J.A.C. 7:0D-1.1 et seq. In addition, if the current or future property owner intends to have this well redesignated as a community water supply well, the well must be constructed by a Master well driller, which would include having a Master well driller on-site at all times during construction of the well, as specified in the Well Construction and Abandonment Regulations. Otherwise, the New Jersey Department of Environmental Protection will not allow the well to be redesignated, and a new well would have to be installed. [N.J.A.C. 7:9D-1.7((a))1i]
In accepting this permit the Property Owner and Driller agree to abide by the following terms and conditions [N.J.A.C. 7:9D-1]
In the event that this well is not constructed the well driller shall notify the Bureau of Water Systems and Well Permitting of the permit cancellation. Unless prior written approval is obtained from the Bureau of Water Systems and Well Permitting the Cancellation notification shall be submitted electronically through the New Jersey Department of Environmental Protection's Regulatory Services Portal Submit Well Permit Cancellation : by the expiration date of this permit.[N.J.A.C. 7:9D-1]
In the event this well is abandoned, the Owner or Well driller shall assume full responsibility for having the well decommissioned in a manner satisfactory to the New Jersey Department of Environmental Protection in accordance with the provisions of N.J.A.C. 7:9D-1 et seq. [N.J.A.C. 7:9D-1]
The granting of this permit shall not be construed in any way to affect the title or ownership of property, and shall not make the New Jersey Department of Environmental Protection or the State a party in any suit or question of ownership of property. [N.J.A.C. 7:9D-1]
The issuance of this permit shall not be deemed to affect in any way action by the New Jersey Department of Environmental Protection on any future application. [N.J.A.C. 7:9D-1]
This permit conveys no rights, either expressed, or implied to divert water. [N.J.A.C. 7:9D-1]
This permit does not waive the obtaining of Federal or other State or local Government consent when necessary. This permit is not valid and no work shall be undertaken until such time as all other required approvals and permits have been obtained. [N.J.A.C. 7:9D-1]
This permit is NONTRANSFERABLE [N.J.A.C. 7:9D]
This well shall not be used for the supply of potable / drinking water. [N.J.A.C. 7:9D-1]

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Certifying Driller: MICHAEL ELLINGWORTH, JOURNEYMAN LICENSE # 0002725

Permit Issued to: PARRATT-WOLFF INC

Company Address: PO BOX 56 5879 FISHER RD EAST SYRACUSE, NY 13057

PROPERTY OWNER

Name: MARY PETTIT (CALDERIO)

Organization: Property Owner

Address: 115 Sherman Place

City: Garfield City State: New Jersey Zip Code: 07026

PROPOSED WELL LOCATION

Facility Name: Garfield Groundwater Contamination Superfund Site

Address: 194 Lincoln Place

County: Bergen Municipality: Garfield City Lot: 8 Block: 38.01

Easting (X): 601905 Northing (Y): 742957
Coordinate System: NJ State Plane (NAD83) - USFEET

Local ID: EPA-31-OB

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 2

Regulatory Program

Requiring Wells/Borings: _____

Depth (ft.): 27

Case ID Number: _____

Pump Capacity (gpm): 0

Deviation Requested: N


Drilling Method: Hollow Stem Augers

Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: May 15, 2014
Expiration Date: May 15, 2015

Approved by the authority of:
Bob Martin
Commissioner


Terry Pilawski, Chief
Bureau of Water Allocation and Well Permitting

WELL PERMIT

DEVIATION INFORMATION	
Purpose:	
Unusual Conditions:	
Reason for Deviation:	
Proposed Well Construction	

GENERAL CONDITIONS/REQUIREMENTS
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Certifying Driller: MICHAEL ELLINGWORTH, JOURNEYMAN LICENSE # 0002725

Permit Issued to: PARRATT-WOLFF INC

Company Address: PO BOX 56 5879 FISHER RD EAST SYRACUSE, NY 13057

PROPERTY OWNER

Name: MARY PETTIT (CALDERIO)

Organization: Property Owner

Address: 115 Sherman Place

City: Garfield City State: New Jersey Zip Code: 07026

PROPOSED WELL LOCATION

Facility Name: Garfield Groundwater Contamination Superfund Site

Address: 97 Sherman Place

County: Bergen Municipality: Garfield City Lot: 9 Block: 38.01

Easting (X): 601954 Northing (Y): 742955
Coordinate System: NJ State Plane (NAD83) - USFEET

Local ID: EPA-32-OB

SITE CHARACTERISTICS

PROPOSED CONSTRUCTION

WELL USE: MONITORING

Other Use(s): _____

Diameter (in.): 2

Regulatory Program

Requiring Wells/Borings: _____

Depth (ft.): 27

Case ID Number: _____

Pump Capacity (gpm): 0

Deviation Requested: N

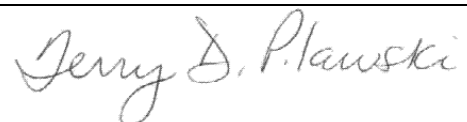
Drilling Method: Hollow Stem Augers

Attachments: _____

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: May 16, 2014
Expiration Date: May 16, 2015

Approved by the authority of:
Bob Martin
Commissioner



Terry Pilawski, Chief
Bureau of Water Allocation and Well Permitting

WELL PERMIT

DEVIATION INFORMATION	
Purpose:	
Unusual Conditions:	
Reason for Deviation:	
Proposed Well Construction	

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If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Bureau of Water Systems and Well Permitting. [N.J.A.C. 7:9D-1]
If the use of the well is to be changed a well permit for the proposed use of the well shall be submitted for review and approval. [N.J.A.C. 7:9D-1]
If you or a future property owner intend to redesignate this well as a Category 1 well (domestic, non-public, community water supply or public non-community water supply wells), the well must be constructed as a Category 1 well per the Well Construction and Abandonment Regulations at N.J.A.C. 7:0D-1.1 et seq. In addition, if the current or future property owner intends to have this well redesignated as a community water supply well, the well must be constructed by a Master well driller, which would include having a Master well driller on-site at all times during construction of the well, as specified in the Well Construction and Abandonment Regulations. Otherwise, the New Jersey Department of Environmental Protection will not allow the well to be redesignated, and a new well would have to be installed. [N.J.A.C. 7:9D-1.7((a))1i]
In accepting this permit the Property Owner and Driller agree to abide by the following terms and conditions [N.J.A.C. 7:9D-1]
In the event that this well is not constructed the well driller shall notify the Bureau of Water Systems and Well Permitting of the permit cancellation. Unless prior written approval is obtained from the Bureau of Water Systems and Well Permitting the Cancellation notification shall be submitted electronically through the New Jersey Department of Environmental Protection's Regulatory Services Portal Submit Well Permit Cancellation : by the expiration date of this permit.[N.J.A.C. 7:9D-1]
In the event this well is abandoned, the Owner or Well driller shall assume full responsibility for having the well decommissioned in a manner satisfactory to the New Jersey Department of Environmental Protection in accordance with the provisions of N.J.A.C. 7:9D-1 et seq. [N.J.A.C. 7:9D-1]
The granting of this permit shall not be construed in any way to affect the title or ownership of property, and shall not make the New Jersey Department of Environmental Protection or the State a party in any suit or question of ownership of property. [N.J.A.C. 7:9D-1]
The issuance of this permit shall not be deemed to affect in any way action by the New Jersey Department of Environmental Protection on any future application. [N.J.A.C. 7:9D-1]
This permit conveys no rights, either expressed, or implied to divert water. [N.J.A.C. 7:9D-1]
This permit does not waive the obtaining of Federal or other State or local Government consent when necessary. This permit is not valid and no work shall be undertaken until such time as all other required approvals and permits have been obtained. [N.J.A.C. 7:9D-1]
This permit is NONTRANSFERABLE [N.J.A.C. 7:9D]
This well shall not be used for the supply of potable / drinking water. [N.J.A.C. 7:9D-1]

Attachment 2

Survey Data

Borbas Surveying & Mapping, LLC

402 Main Street, Boonton, New Jersey 07005 Phone (973) 316-8743 Fax (973) 402-6627 www.borbas.com

MONITORING WELL CHART

Garfield Groundwater Contamination Superfund Site

125 Clark Street

Garfield, New Jersey 07026

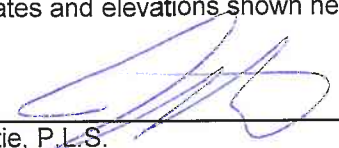
July 15, 2014

Monitor Well ID	Grade Elev	Outer Casing	Inner Casing	Northing	Easting	Latitude North	Longitude West	Survey Date
EPA-29-OB	58.6	58.56	58.23	742985.6	602009.5	40°52'20.89"	74°06'09.51"	7/15/2014
EPA-30-OB	55.9	55.86	55.50	742960.1	601879.0	40°52'20.65"	74°06'11.21"	7/15/2014
EPA-31-OB	56.7	56.71	56.31	742957.4	601911.7	40°52'20.62"	74°06'10.78"	7/15/2014
EPA-32-OB	58.7	58.67	58.29	742953.5	601953.3	40°52'20.58"	74°06'10.24"	7/15/2014
IP-1	56.0	-	-	742941.1	601898.0	40°52'20.46"	74°06'10.96"	7/15/2014
IP-1A	55.8	-	-	742941.7	601894.1	40°52'20.46"	74°06'11.01"	7/15/2014
IP-2	56.4	-	-	742947.5	601918.0	40°52'20.52"	74°06'10.70"	7/15/2014
IP-3	56.5	-	-	742956.7	601903.6	40°52'20.61"	74°06'10.89"	7/15/2014
IP-4	57.0	-	-	742962.1	601924.4	40°52'20.66"	74°06'10.62"	7/15/2014
IP-4A	56.7	-	-	742955.6	601926.2	40°52'20.60"	74°06'10.60"	7/15/2014
IP-5B	56.8	-	-	742967.4	601915.5	40°52'20.72"	74°06'10.73"	7/15/2014
IP-6	58.7	-	-	742976.0	601926.9	40°52'20.80"	74°06'10.59"	7/15/2014
IP-6A	58.8	-	-	742980.1	601920.4	40°52'20.84"	74°06'10.67"	7/15/2014
IP-7	58.8	-	-	742983.7	601909.8	40°52'20.88"	74°06'10.81"	7/15/2014
IP-7A	58.8	-	-	742976.4	601912.2	40°52'20.81"	74°06'10.78"	7/15/2014
IP-7B	58.8	-	-	742982.6	601905.8	40°52'20.87"	74°06'10.86"	7/15/2014
IP-8B	58.6	-	-	742989.6	601934.8	40°52'20.94"	74°06'10.48"	7/15/2014
IP-8C	58.5	-	-	742997.1	601924.3	40°52'21.01"	74°06'10.62"	7/15/2014
IP-9	58.4	-	-	743001.0	601916.3	40°52'21.05"	74°06'10.72"	7/15/2014
IP-10	58.5	-	-	743003.8	601933.8	40°52'21.08"	74°06'10.49"	7/15/2014
IP-10A	58.4	-	-	743003.4	601938.6	40°52'21.07"	74°06'10.43"	7/15/2014
IP-11	58.3	-	-	743011.5	601919.0	40°52'21.15"	74°06'10.69"	7/15/2014
IP-12	58.3	-	-	743014.3	601936.1	40°52'21.18"	74°06'10.46"	7/15/2014
IP-12A	58.3	-	-	743015.5	601931.2	40°52'21.19"	74°06'10.53"	7/15/2014
IP-13	58.1	-	-	743023.3	601922.5	40°52'21.27"	74°06'10.64"	7/15/2014

Monitor Well ID	Grade Elev	Outer Casing	Inner Casing	Northing	Easting	Latitude North	Longitude West	Survey Date
IP-14	58.1	-	-	743026.4	601939.2	40°52'21.30"	74°06'10.42"	7/15/2014
IP-14A	58.1	-	-	743027.5	601934.1	40°52'21.31"	74°06'10.49"	7/15/2014
IP-15	58.1	-	-	743037.7	601927.0	40°52'21.41"	74°06'10.58"	7/15/2014
IP-15A	58.1	-	-	743038.1	601924.3	40°52'21.42"	74°06'10.62"	7/15/2014
IP-16A	58.1	-	-	743040.4	601937.5	40°52'21.44"	74°06'10.44"	7/15/2014
IP-17B	58.5	-	-	742992.8	602010.9	40°52'20.96"	74°06'09.49"	7/15/2014
IP-18	58.5	-	-	742994.6	602021.4	40°52'20.98"	74°06'09.36"	7/15/2014
IP-19	58.6	-	-	742991.8	602035.8	40°52'20.95"	74°06'09.17"	7/15/2014
IP-20A	58.6	-	-	742983.1	602004.2	40°52'20.87"	74°06'09.58"	7/15/2014
IP-21	58.6	-	-	742979.5	602020.5	40°52'20.83"	74°06'09.37"	7/15/2014
IP-22	58.7	-	-	742979.2	602035.1	40°52'20.83"	74°06'09.18"	7/15/2014
IP-23	58.7	-	-	742967.9	602004.2	40°52'20.72"	74°06'09.58"	7/15/2014
IP-24A	58.7	-	-	742967.3	602018.7	40°52'20.71"	74°06'09.39"	7/15/2014
IP-25	58.8	-	-	742963.2	602034.1	40°52'20.67"	74°06'09.19"	7/15/2014
IP-26	58.1	-	-	743047.8	601930.4	40°52'21.51"	74°06'10.54"	7/15/2014
IP-27D	58.1	-	-	743047.1	601938.1	40°52'21.50"	74°06'10.44"	7/15/2014
IP-28	58.8	-	-	742952.9	602002.6	40°52'20.57"	74°06'09.60"	7/15/2014
IP-29	58.7	-	-	742949.8	602017.4	40°52'20.54"	74°06'09.41"	7/15/2014
IP-30	58.8	-	-	742948.5	602032.8	40°52'20.53"	74°06'09.21"	7/15/2014

Notes:

1. The horizontal datum is the New Jersey State Plane Coordinate System NAD83 determined by differential GPS observations from the NGS CORS Network on July 25, 2012. Reference Stations: NJI2, NJTP, NYVH.
2. The vertical datum is the North American Vertical Datum of 1988 (NAVD88) GEOID09 verified by differential GPS observation from the NGS CORS Network on July 25, 2012. New Jersey Geodetic Control Survey Monument # 9818 (NAVD88 Elevation = 28.7372') was held. NJGCS monument elevation was converted using US Army Corps of Engineers Corpscon Software version 6.0.1.
3. All coordinates and elevations shown hereon are in U.S. Survey Feet.


 John D. Beattie, P.L.S.
 NJGS 24GS04331900
 July 15, 2014

P:\LP\2012\06\120601\Documents\120601_2014-07-15_Monitoring Well and Boring Chart

Attachment 3
Boring Logs, Well Completion Diagrams, and
Development Forms

Project No: WA-120

Project: EC Electroplating

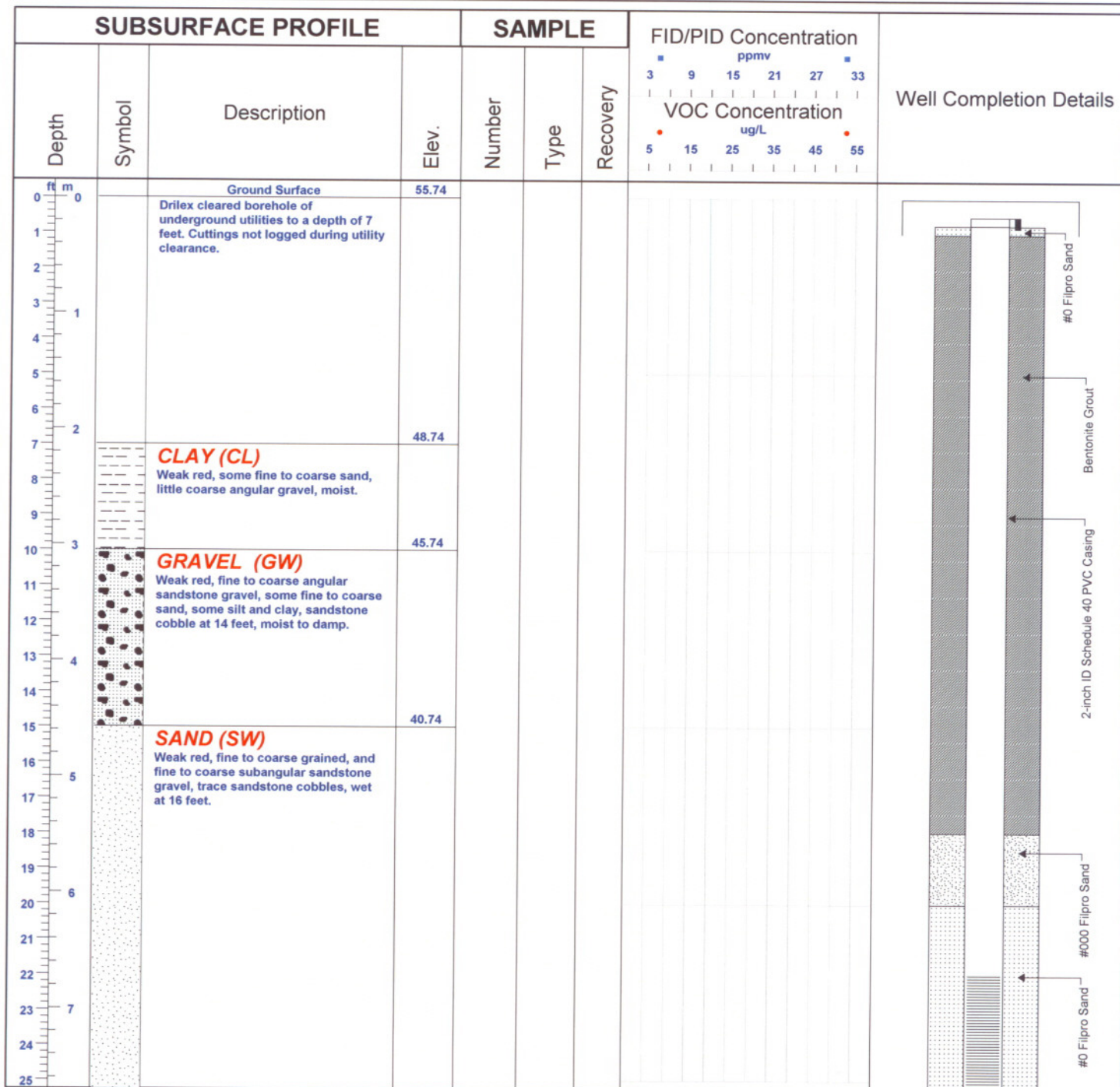
Client: EPA/ERT

Location: Lincoln Place/Clark Street, Garfield, NJ

Log of Well: EPA-13-OB

Northing (ft): 742962.30 Elevation (ft AMSL): 55.54

Easting (ft): 601878.85 Logged By: J. Bolduc



Drill Method: Rotary Sonic

Start Date: 2/28/11

Hole Size: 6-inch

Lockheed Martin/SERAS
2890 Woodbridge Avenue
Building 209 Annex
Edison, NJ 08837

Drill Company: Boart Longyear

End Date: 2/28/11

Sheet: 1 of 2

Project No: WA-120

Project: EC Electroplating

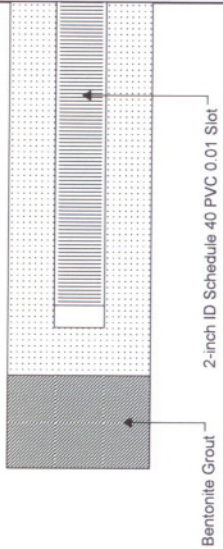
Client: EPA/ERT

Location: Lincoln Place/Clark Street, Garfield, NJ

Log of Well: EPA-13-OB

Northing (ft): 742962.30 Elevation (ft AMSL): 55.54

Easting (ft): 601878.85 Logged By: J. Bolduc

SUBSURFACE PROFILE				SAMPLE			FID/PID Concentration ppmv 3 9 15 21 27 33 VOC Concentration ug/L 5 15 25 35 45 55	Well Completion Details
Depth	Symbol	Description	Elev.	Number	Type	Recovery		
26 8			28.74					
27		BEDROCK (MUDSTONE) Grayish red, clayey, highly weathered, pulverized zone, dry to wet at 30.5 to 31.5 feet.						
28								
29								
30								
31								
32			23.74					
33		BEDROCK (SANDSTONE) Grayish red, fine grained, micaceous, massive, dry.						
34								
35			20.74					
36		End of Borehole						
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

Drill Method: Rotary Sonic

Start Date: 2/28/11

Hole Size: 6-inch

Lockheed Martin/SERAS
2890 Woodbridge Avenue
Building 209 Annex
Edison, NJ 08837

Drill Company: Boart Longyear

End Date: 2/28/11

Sheet: 2 of 2



PROJECT NUMBER
431007.06.06.02

WELL NUMBER
EPA-29-OB

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : Garfield Groundwater Contamination Superfund Site

LOCATION : Garfield, NJ

DRILLING CONTRACTOR : Parratt Wolff

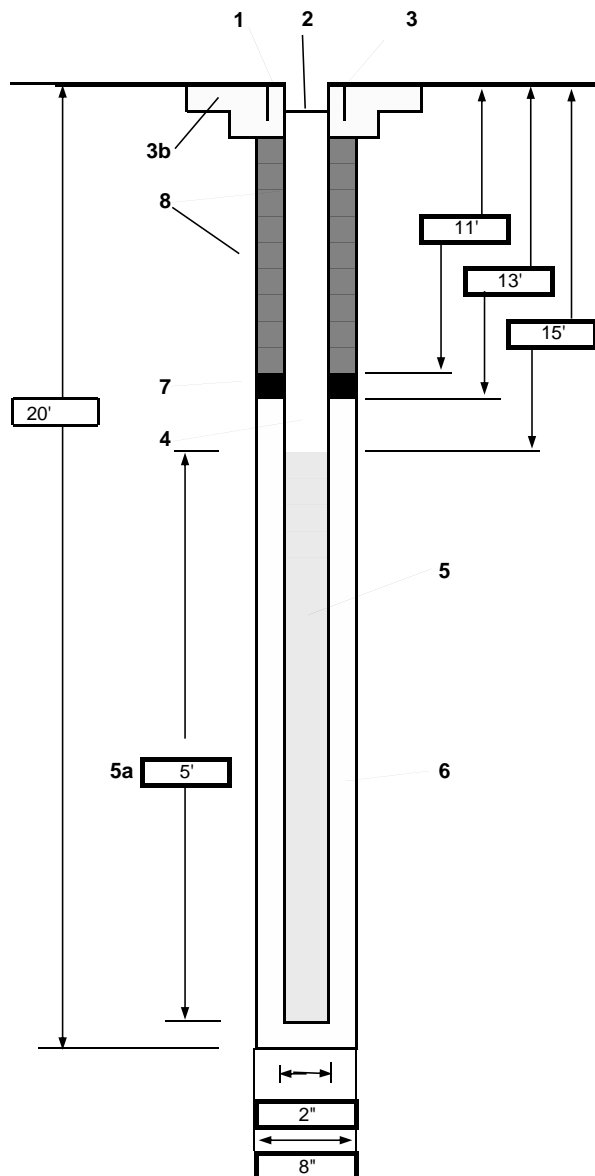
DRILLING METHOD AND EQUIPMENT USED CME 55 Drill Rig - 8" Hollow Stem Auger - 2" Stainless Steel Split Spoons

WATER LEVELS : 11.8 ft BGS

START : 6/3/2014

END : 6/3/2014

LOGGER : Balas



1- Ground elevation at well	58.6 ft. above mean sea level
2- Top of casing elevation	58.23 ft. above mean sea level
3- Wellhead protection cover type	8" Steel Manhole Cover
b) concrete pad dimensions	18" diameter by 6" deep
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	.010 machine slot PVC
a) length of screen	5 ft
6- Type screen filter	NJ #0, 50 lb bags
a) Quantity used	5 bags
7- Type of seal	NJ #00 choker sand, 50 lb bags
a) Quantity used	1 bag
8- Grout	4 bags 50 lbs portland cement / 25 lbs bentonite / 24 gallons water
b) Method of placement	Pressure grouted
c) Vol. of well casing grout	30 gallons
Development method	Surge/Purge
Development time	40 minutes
Estimated purge volume	30 gallons
Comments	During development, well never cleared up after more than 5 purge volumes were removed. Limited sediment still remains at bottom of the well.



PROJECT NUMBER:

431007

BORING NUMBER:

EPA-29-OB

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Garfield Groundwater Contamination Superfund Site

LOCATION : Garfield, NJ

ELEVATION :

DRILLING CONTRACTOR : Parratt Wolff/Cushing & Sons

DRILLING EQUIPMENT AND METHOD : CME Hollow Stem Auger Rig


ORIENTATION :

WATER LEVELS : 12.8 ft bgs

START : 6/3/14 13:50

END : 6/3/14 16:15

LOGGER : J. Balas

WATER LEVELS = 12.6 R bgs		START : 6/3/14 13:30		END : 6/3/14 16:15		LOGGER : J. Balas	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		STANDARD PENETRATION TEST RESULTS		SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	RECOVERY (in)	#TYPE	6"-6"-6"-6" (N)				
5	0.0	10.8	SS-1	7-9-2 (11)	Asphalt 0-0.5'		BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20.5, Dust = 0.006 PID = 0.0 ppm
	2.0				Gravel (GW-GM) 0.5-10.4' - gray, dry, medium dense, little silt, fine grained, angular, FILL 2' - Same as above except FILL, trace medium to coarse gravel		PID = 0.0 ppm
	4.0	24.0	SS-2	6-6-5-5 (11)	4' - Same as above		PID = 0.0 ppm
	6.0	18.0	SS-3	3-3-1-2 (4)	6' - Same as above except 6.7'-6.9' red colored brick		PID = 0.0 ppm
	8.0	13.2	SS-4	1-3-2-1 (5)	8' - Same as above except moist		PID = 0.0 ppm
	10.0	14.4	SS-5	3-1-1-1 (2)	10' - wet		PID = 0.0 ppm
	12.0	12.0	SS-6	1-1-1-9 (2)	Sandy Silt (ML) 10.4-12.4' - dark reddish brown, (5YR 3/3), moist to wet, medium stiff, non-cohesive, trace fine to medium gravel		PID = 0.0 ppm Does not look like traditional native
	14.0	16.8	SS-7	7-9-20-19 (29)	Silt (ML) 12.4-14' - dark yellowish brown, (10YR 4/4), moist, stiff, non-cohesive, few mottling reddish brown (5YR 5/3), increasing medium to fine gravel with depth 13.2' - 1" diameter sandstone piece noted at bottom of recovery		PID = 0.0 ppm
	16.0	18.0	SS-8	10-16-16-20 (32)	Silty Sand (SW-SM) 14-14.5' - dark reddish brown, (2.5YR 3/3), moist, medium dense, fine to very fine sand, SANDSTONE pieces 1/4"-1" diameter noted throughout		BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20, Dust = 0.016 PID = 0.0 ppm
	18.0		SS-9	26-31-35-50 (66)	Sandy Silt (ML) 14.5-16' - dark reddish brown, (2.5YR 3/3), moist, very stiff, non-cohesive, trace coarse to medium gravel, subrounded		PID = 0.0 ppm
	20.0	13.2	SS-10	14-30-50/4 (80/10")	Silty Sand (SW-SM) 16-19.1' - dark reddish brown, (2.5YR 3/3), wet, very dense, trace gravel, angular, increased gravel at bottom, SANDSTONE noted throughout, 1" diameter 18' - Same as above except larger SANDSTONE pieces, weathered bedrock 18.9'-19.1'		PID = 0.0 ppm
25	22.0		SS-11	50/4 (50/4")	No Recovery 19.1-20.3' Bottom of Boring at 20.3 ft bgs on 6/3/14 16:15		
30							



PROJECT NUMBER
431007.06.06.02

WELL NUMBER
EPA-30-OB

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : Garfield Groundwater Contamination Superfund Site

LOCATION : Garfield, NJ

DRILLING CONTRACTOR : Parratt Wolff

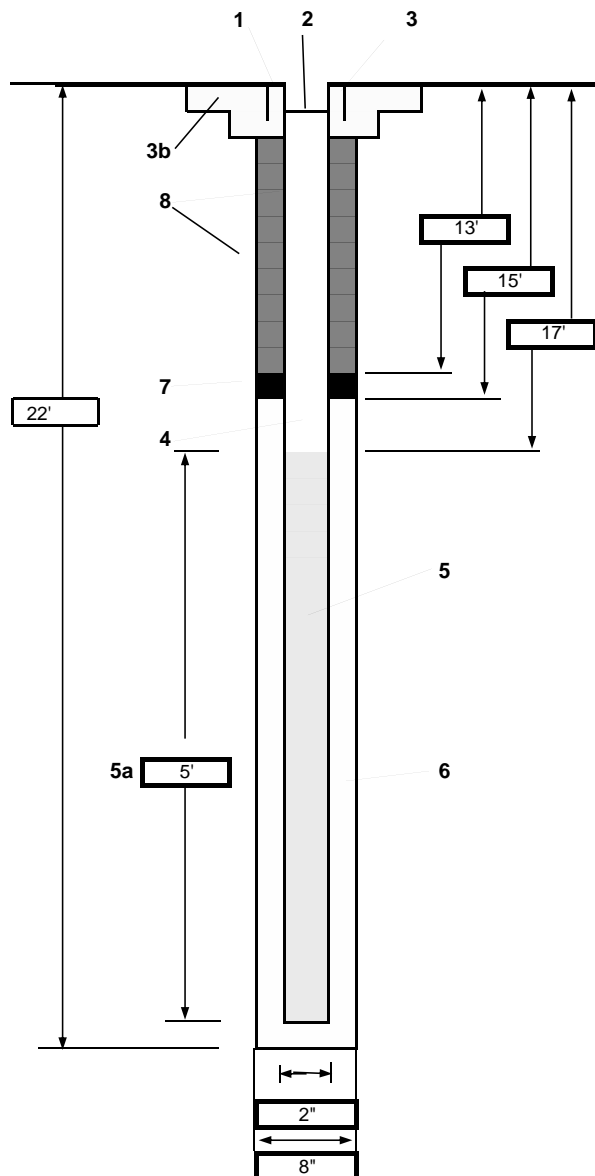
DRILLING METHOD AND EQUIPMENT USED CME 55 Drill Rig - 8" Hollow Stem Auger - 2" Stainless Steel Split Spoons

WATER LEVELS : 12.8 ft BGS

START : 6/4/2014

END : 6/4/2014

LOGGER : Balas



1- Ground elevation at well	55.9 ft. above mean sea level
2- Top of casing elevation	55.50 ft. above mean sea level
3- Wellhead protection cover type	8" Steel Manhole Cover
b) concrete pad dimensions	18" diameter by 6" deep
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	.010 machine slot PVC
a) length of screen	5 ft
6- Type screen filter	NJ #0, 50 lb bags
a) Quantity used	5 bags
7- Type of seal	NJ #00 choker sand, 50 lb bags
a) Quantity used	1 bag
8- Grout	4 bags 50 lbs portland cement / 20 lbs bentonite / 25 gallons water
b) Method of placement	Pressure grouted
c) Vol. of well casing grout	30 gallons
Development method	Surge/Purge
Development time	40 minutes
Estimated purge volume	30
Comments	



PROJECT NUMBER: <div style="font-size: 1.2em; font-weight: bold;">431007</div>	BORING NUMBER: <div style="font-size: 1.2em; font-weight: bold;">EPA-30-OB</div>
SHEET 1 OF 1	
<div style="font-size: 1.5em; font-weight: bold;">SOIL BORING LOG</div>	

PROJECT : Garfield Groundwater Contamination Superfund Site LOCATION : Garfield, NJ

ELEVATION : DRILLING CONTRACTOR : Parratt Wolff/Cushing & Sons

DRILLING EQUIPMENT AND METHOD : CME Hollow Stem Auger Rig ORIENTATION :

WATER LEVELS : --- START : 6/4/2014 END : 6/4/2014 LOGGER : J. Balas

WATER LEVELS		START : 6/4/2014		END : 6/4/2014		LOGGER : J. Davis	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS
	RECOVERY (in)	#TYPE		6"-6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		
5	0.0	14.4	SS-1	3-4-3-2 (7)	Silty Sand (SW-SM) 0-2' - dark brown, (7.5YR 3/3), fine sand, round gravel 1/2" diameter, concrete/bricks noted at 0.3'-0.5' bgs, organic material	BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 19.9, Dust = 0.011 PID = 0.0 ppm	
	2.0					PID = 0.0 ppm	
	4.0	18.0	SS-2	2-5-6-7 (11)	Sand (SW-SM) 2-2.6' - reddish brown, (7.5YR 4/3), moist, loose, some silt, fine to very fine sand, well graded	PID = 0.0 ppm	
	6.0	19.2	SS-3	5-5-6-5 (11)	Sand And Silt (SW-SM) 2.6-8' - dark reddish brown, (5YR 3/4), moist, loose, fine to very fine sand, trace fine gravel (mica), well graded, pieces of sandstone 1" diameter noted at bottom of recovery, increasing silt with depth	PID = 0.0 ppm	
	8.0	20.4	SS-4	7-11-11-7 (22)	4' - Same as above except slightly cohesive, trace gravel and sandstone noted 6' - Same as above except increase silt/clay content with depth	PID = 0.0 ppm	
10	9.6		SS-5	20-43-15-8 (58)	Large Gravel Chunk 8-8.4' - 1"-2" diameter - pulverized boulder	BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20.1, Dust = 0.036 PID = 0.0 ppm	
	10.0				Sand Silt (ML) 8.4-12' - dark reddish brown, (5YR 3/4), dry to moist, firm, non-cohesive, sandstone pieces 1/4" throughout, very fine to fine sand	PID = 0.0 ppm	
	12.0	8.4	SS-6	13-13-5-5 (18)	10' - Same as above except moist	PID = 0.0 ppm	
15	14.0	6.0	SS-7	4-5-5-7 (10)	Silty Sand (SW-SM) 12-14.7' - dark reddish brown, (5YR 3/4), moist to wet, loose, little gravel/sandstone 1/4"-1" diameter	PID = 0.0 ppm	
	16.0				14' - Same as above	PID = 0.0 ppm	
	18.0	14.4	SS-8	11-6-9-5 (15)	Sand Some Silt (SW-SM) 14.7-16' - dark reddish brown, (5YR 3/4), wet, loose, little very fine gravel, fine to medium sand	PID = 0.0 ppm	
	20.0	19.2	SS-9	9-7-9-8 (16)	Silty Sand (SW-SM) 16-18.5' - dark reddish brown, (5YR 3/4), wet, loose, trace fine gravel, increase density and silt with depth, 1/4"=1/2" diameter sandstone pieces throughout	PID = 0.0 ppm	
	22.0	10.8	SS-10	6-50/.5 (50/.5")	Silty Sand (SW-SM) 18' - dark reddish brown, (5YR 3/4), wet, dense, trace gravel, higher silt content at top of recovery, sandstone	BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20.3, Dust = 0.011 PID = 0.0 ppm	
25	22.0	15.6	SS-11	10-20-20-15 (40)	Weathered Sandstone 18.5-20.4' - dark reddish brown, (5YR 3/4), moist, hard, pulverized	PID = 0.0 ppm	
					Weathered Sandstone 20' - dark reddish brown, (5YR 3/4), wet, hard, pulverized		
					Silty Sand (SW-SM) 20.4-22' - dark reddish brown, (5YR 3/4), wet, dense, few gravel (gravel is 1/2" sandstone pieces) 20.9' - Same as above Bottom of Boring at 22.0 ft bgs on 6/4/2014		
30							



PROJECT NUMBER
431007.06.06.02

WELL NUMBER
EPA-31-OB

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : Garfield Groundwater Contamination Superfund Site

LOCATION : Garfield, NJ

DRILLING CONTRACTOR : Parratt Wolff

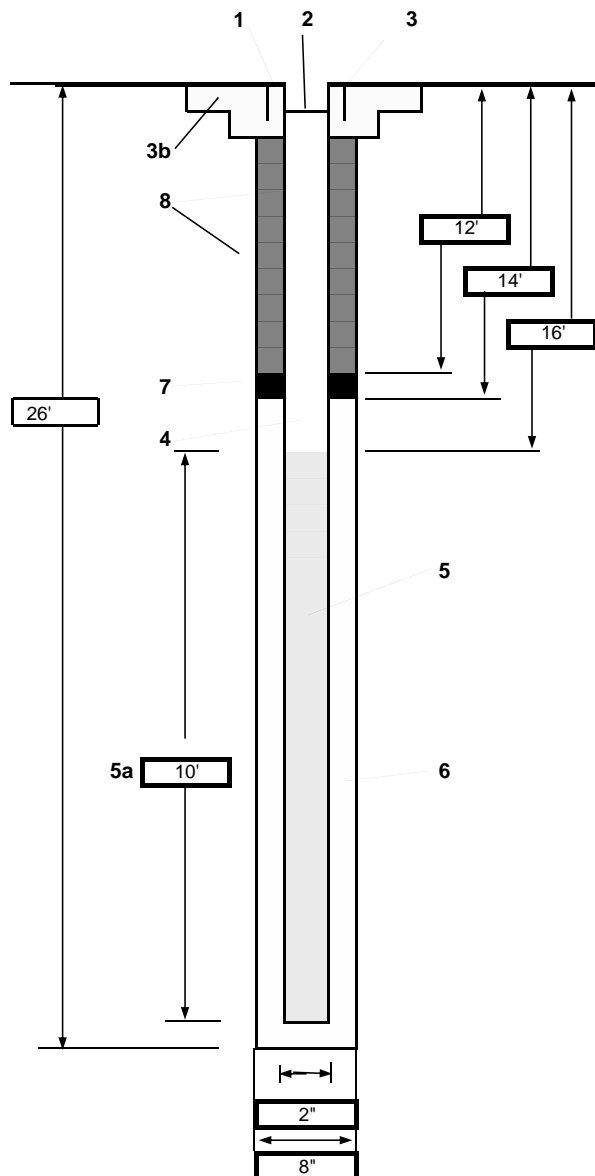
DRILLING METHOD AND EQUIPMENT USED CME 55 Drill Rig - 8" Hollow Stem Auger - 2" Stainless Steel Split Spoons

WATER LEVELS : ###

START : 6/4/2014

END : 6/4/2014

LOGGER : Balas



1- Ground elevation at well	56.7 ft. above mean sea level
2- Top of casing elevation	56.31 ft. above mean sea level
3- Wellhead protection cover type	8" Steel Manhole Cover
b) concrete pad dimensions	18" diameter by 6" deep
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	.010 machine slot PVC
a) length of screen	5 ft
6- Type screen filter	NJ #0, 50 lb bags
a) Quantity used	6 bags
7- Type of seal	NJ #00 choker sand, 50 lb bags
a) Quantity used	1 bag
8- Grout	4 bags 50 lbs portland cement / 25 lbs bentonite / 25 gallons water
b) Method of placement	Pressure grouted
c) Vol. of well casing grout	35 gallons
Development method	Surge/Purge
Development time	1 hr 15 min
Estimated purge volume	45
Comments	

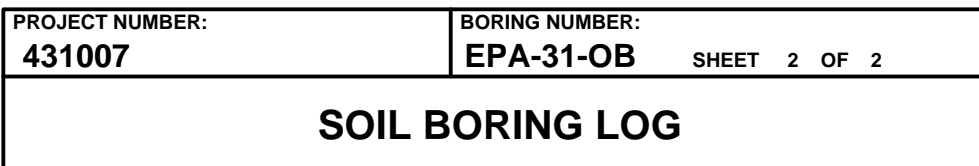


PROJECT NUMBER: <div style="font-size: 1.2em; font-weight: bold;">431007</div>	BORING NUMBER: <div style="font-size: 1.2em; font-weight: bold;">EPA-31-OB</div>
SHEET 1 OF 2	
<div style="font-size: 1.5em; font-weight: bold;">SOIL BORING LOG</div>	

PROJECT : Garfield Groundwater Contamination Superfund Site	LOCATION : Garfield, NJ
ELEVATION :	DRILLING CONTRACTOR : Parratt Wolff/Cushing & Sons
DRILLING EQUIPMENT AND METHOD : CME Hollow Stem Auger Rig	ORIENTATION :

WATER LEVELS : ---	START : 6/4/2014	END : 6/4/2014	LOGGER : J. Balas
--------------------	------------------	----------------	-------------------

WATER LEVELS		START : 0/4/2014		END : 0/4/2014		LOGGER : J. Davis	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS
	RECOVERY (in)	#TYPE		6"-6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		
	0.0	16.8	SS-1	4-7-7-7 (14)	#2 Gravel 0-0.2'	BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20.4, Dust = 0.011 PID = 0.0 ppm	
	2.0				Silty Sand (SW-SM) 0.2-1.4' - dark brown, (7.5YR 3/3), dry, loose, few fine to medium gravel, organic material noted, some brick fragments noted throughout	PID = 0.0 ppm	
	4.0	2.4	SS-2	50/2 (50/2")	#2 Gravel 1.4-4' - concrete below 2.4' bgs	PID = 0.0 ppm	
5	6.0	9.6	SS-3	7-9-11-11 (20)	Sand And Silt (SW-SM) 4-6' - dark reddish brown, (5YR 3/4), dry, dense, trace gravel	PID = 0.0 ppm	
	8.0	10.8	SS-4	9-11-13-16 (24)	Sandstone 6-6.3' - dark reddish brown, (5YR 3/4), pulverized boulder	PID = 0.0 ppm	
	10.0	0.0	SS-5	50/2 (50/2")	Silty Sand (SW-SM) 6.3-8' - dark reddish brown, (5YR 3/4), dry, medium dense, trace gravel No Recovery 8-10'	PID = 0.0 ppm	
10	12.0	9.6	SS-6	21-28-13-14 (41)	Sandstone 10-10.4' - dark reddish brown, (5YR 3/4), pulverized boulder	PID = 0.0 ppm	
	14.0	24.0	SS-8	13-10-13-16 (23)	Silty Sand (SW-SM) 10.4-13.7' - dark reddish brown, (5YR 3/4), dry, dense, trace gravel Silty Sand (SW-SM) 12' - dark reddish brown, (5YR 3/4), moist to wet, loose, trace gravel, fine sand, well graded	BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20.3, Dust = 0.012 PID = 0.0 ppm	
15	16.0	8.4	SS-9	10-20-27-20 (47)	Sand (SW-SM) 13.7-18.6' - dark reddish brown, (5YR 3/4), moist to wet, loose, little silt, few gravel, fine to medium sand, poorly graded	PID = 0.0 ppm	
	18.0	24.0	SS-10	14-16-25-22 (41)	Sand (SW-SM) 14' - dark reddish brown, (7YR 4/4), moist to wet, loose, some silt, trace fine gravel, fine to medium sand, well graded, some pulverized sandstone at bottom of recovery	PID = 0.0 ppm	
20	20.0	21.6	SS-11	38-20-12-29 (32)	Sand (SW-SM) 14.7' - dark reddish brown, (5YR 3/4), wet, dense, some silt, trace gravel, fine to very fine sand, 1" rounded gravel	PID = 0.0 ppm	
	22.0	21.6	SS-12	5-4-19-15 (23)	18' - Same as above	PID = 0.0 ppm	
	24.0	9.6	SS-13	15-50/3 (50/3")	Silty Sand (SW-SM) 18.6-20.5' - dark reddish brown, (5YR 3/4), wet, dense, few gravel 1/4"-1" diameter, some is sandstone	PID = 0.0 ppm	
25	26.0		SS-14	23-50/4 (50/4")	20' - Same as above Sand 20.5-22' - very dusky red, (2.5YR 2.5/2), moist to wet, very dense, little silt, trace gravel, gravel is sandstone	PID = 0.0 ppm	
					Sandy Silt (ML) 22-22.4' - dark reddish brown, (5YR 4/3), wet, trace gravel		
					Silt (ML) 22.4-24' - dark reddish brown, (5YR 4/3), moist, very hard, some sand, trace gravel, non-cohesive		
30							





PROJECT NUMBER
431007.06.06.02

WELL NUMBER
EPA-32-OB

SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : Garfield Groundwater Contamination Superfund Site

LOCATION : Garfield, NJ

DRILLING CONTRACTOR : Parratt Wolff

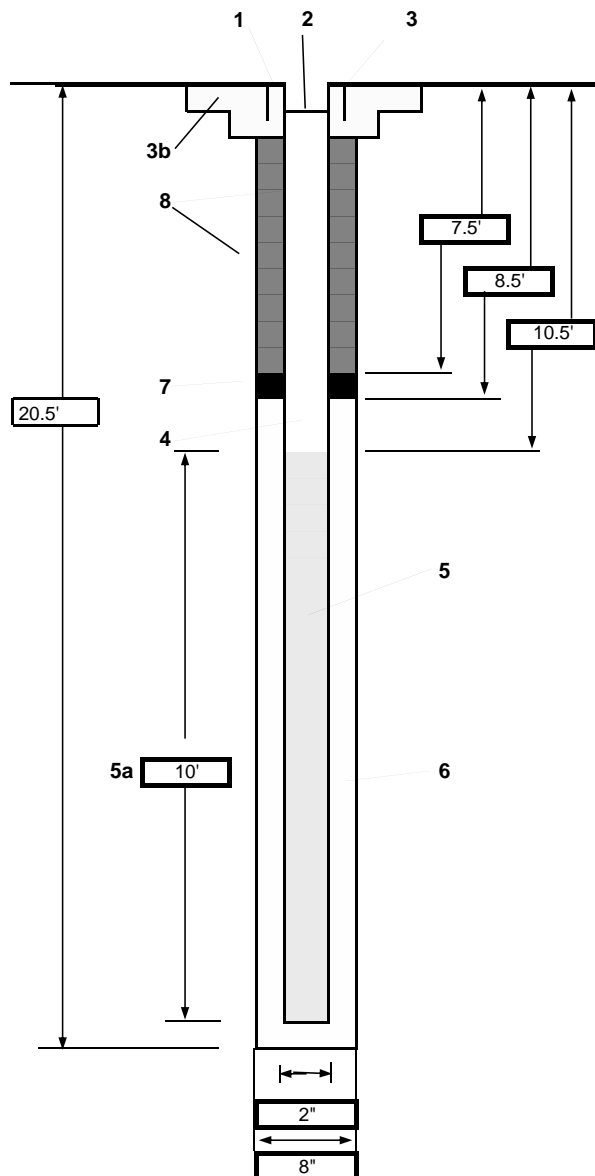
DRILLING METHOD AND EQUIPMENT USED CME 55 Drill Rig - 8" Hollow Stem Auger - 2" Stainless Steel Split Spoons

WATER LEVELS : 12.5 ft BGS

START : 6/3/2014

END : 6/3/2014

LOGGER : Balas



1- Ground elevation at well	58.7 ft. above mean sea level
2- Top of casing elevation	58.29 ft. above mean sea level
3- Wellhead protection cover type	8" Steel Manhole Cover
b) concrete pad dimensions	18" diameter by 6" deep
4- Dia./type of well casing	2" Schedule 40 PVC
5- Type/slot size of screen	.010 machine slot PVC
a) length of screen	10 ft
6- Type screen filter	NJ #0, 50 lb bags
a) Quantity used	7 bags
7- Type of seal	NJ #00 choker sand, 50 lb bags
a) Quantity used	1 bag
8- Grout	94 lbs portland cement / 5 lbs bentonite / 6 gallons water
b) Method of placement	Pressure grouted
c) Vol. of well casing grout	10 gallons
Development method	Surge/Purge
Development time	1 hr 45 min
Estimated purge volume	25 gallons
Comments	During development, well never cleared up after more than 5 purge volumes were removed. Limited sediment still remains at bottom of the well.



PROJECT NUMBER: <div style="font-size: 1.2em; font-weight: bold;">431007</div>	BORING NUMBER: <div style="font-size: 1.2em; font-weight: bold;">EPA-32-OB</div> <div style="text-align: right; font-weight: bold;">SHEET 1 OF 1</div>
<div style="font-size: 1.5em; font-weight: bold;">SOIL BORING LOG</div>	

PROJECT : Garfield Groundwater Contamination Superfund Site	LOCATION : Garfield, NJ
ELEVATION :	DRILLING CONTRACTOR : Parratt Wolff/Cushing & Sons
DRILLING EQUIPMENT AND METHOD : CME Hollow Stem Auger Rig	ORIENTATION :

WATER LEVELS : 12.5 ft bgs	START : 6/2/2014	END : 6/3/2014	LOGGER : J. Balas
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WATER LEVELS 12.5 R bgs		START: 02/2014		END: 03/2014		LOGGER: J. Davis	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)		STANDARD PENETRATION TEST RESULTS	SOIL DESCRIPTION		SYMBOLIC LOG	COMMENTS
	RECOVERY (in)	#TYPE		6"-6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		
	2.0				Reinforced Concrete 0-2'		BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20, Dust = 0.075 Refusal at 8" bgs, move north 10', resume
	4.0	8.4	SS-1	2-3-3-2 (6)	Fill, Silty Sand(SM) 2-4' - dark brown, (7.5YR 3/2), dry, loose, trace gravel, fine sand and gravel, black slag noted		PID = 0.0 ppm
5	6.0	12.0	SS-2	2-1-3-4 (4)	Sand (SW-SM) 4-8' - dark yellowish brown, (10YR 4/6), dry, medium dense, little silt, trace subangular gravel, fine sand, some of the gravel is red sandstone well graded		BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20.5, Dust = 0.008 PID = 0.0 ppm
	8.0	14.4	SS-3	5-5-5-7 (10)	6' - dark reddish brown, (2.5YR 3/4), dry, medium dense, some silt, fine sand, trace round quartz noted, well graded		PID = 0.0 ppm
10	10.0	14.4	SS-4	5-9-5-4 (14)	Sandy Silt(ML) 8-10' - dark reddish brown, (2.5YR 3/4), moist, dense, non-cohesive, trace cobbles of 1" diameter sandstone, trace quartz and mica noted throughout, fine sand		PID = 0.0 ppm
	12.0	18.0	SS-5	5-8-9-10 (17)	Silty Sand(SW-SM) 10-20.5' - dark reddish brown, (2.5YR 3/4), moist, medium dense, fine sand, well graded, trace sandstone 1" diameter, trace quartz and mica		PID = 0.0 ppm
15	14.0	20.4	SS-6	9-10-11-13 (21)	Silty Sand(SW-SM) 12' - dark reddish brown, (2.5YR 4/3), moist to wet, medium dense, well graded, trace gravel, subangular to rounded, trace sandstone 1" diameter, trace quartz and mica		BZ: H2S = 0, VOC = 0, CO = 0, LEL = 0, O2 = 20.9, Dust = 0.011 PID = 0.0 ppm
	16.0	14.4	SS-7	18-23-18-25 (41)	14' - dark reddish brown, (2.5YR 3/3), moist, dense, fine sand, weathered bedrock-sandstone (14.1'-14.4' bgs, 14.9'-15' bgs), trace mica, 1" diameter sandstone chunks throughout		PID = 0.0 ppm
20	18.0	15.6	SS-8	26-28-11-8 (39)	16' - dark reddish brown, (2.5YR 3/3), wet, very dense, fine sand, weathered/incompetent bedrock, 1" diameter pieces of sandstone throughout, trace quartz 1/4" diameter		PID = 0.0 ppm
	20.0	6.0	SS-9	6-8-50/4 (58/10")	18' - dark reddish brown, (2.5YR 3/3), wet, very dense, fine to very fine sand, 2" diameter piece of sandstone in shoe		PID = 0.0 ppm
25	22.0		SS-10	29-50/1 (50/1")	20' - dark reddish brown, (2.5YR 3/3), wet, very dense, fine to very fine sand, weathered pieces 1"-2" diameter sandstone, trace quartz		PID = 0.0 ppm
					Bottom of Boring at 20.5 ft bgs on 6/3/2014		
30							



WELL DEVELOPMENT LOG

PROJECT : Garfield Superfund Site

LOCATION: Garfield, NJ

Development Contractor: Pa

START Time: 0756

END Time : 0913

LOGGER : Balas

Diameter of Well (inches) & Type:

Depth of Well (feet): 23.75

Depth to Water (feet) 12.23

Water Column Height (feet): 11.02

Gallons per Foot: $.163 \times 11.02 + 10 \times .5 =$

One Well Volume (gallons): $1.8 + 4 = 6.8$

Five Well Volumes (gallons): 45

Development Method: Surge/Purge

Surge Block Used: Yes

Screen Interval Surged: 15-25

Water Quality Meter (Manufacturer/Model/Serial #):

Haribon v-52

Maximum Drawdown During Pumping:

Average Discharge Rate & Range: 1 (9)

Total Quantity of Water Discharged: 45

Disposition of Discharge Water: clear water

Dia. (in)	Gal./Ft.	Dia. (in)	Gal./Ft.
1"	0.041	5"	1.02
2"	0.163	6"	1.469
3"	0.367	8"	2.611
4"	0.653	10"	4.08

[illegible]

Comments:

High over range

NJDEP Well Permit #

Attachment 4
Data Validation Report

Data Quality Evaluation Report

2014/2015 Garfield Groundwater Pilot Test

Garfield Groundwater Contamination Superfund Site
City of Garfield, Bergen County, New Jersey

Prepared for

U.S. Army Corps of Engineers

Contract No. W912DQ-11-D-3005, Task Order 0003

May 2015

Revised July 2015

Prepared by

CH2MHILL®

119 Cherry Hill Road
Suite 300
Parsippany, NJ 07054

**DATA QUALITY EVALUATION REPORT
2014/2015 GARFIELD GROUNDWATER PILOT TEST
GARFIELD GROUNDWATER CONTAMINATION SUPERFUND SITE**

**CITY OF GARFIELD
BERGEN COUNTY, NEW JERSEY**

USACE Contract No. W912DQ-11-D-3005
Task Order No. 0003

May 2015
Revised July 2015

NONDISCLOSURE STATEMENT

This document has been prepared for the U.S. Army Corps of Engineers under Contract No. W912DQ-11-D-3005. The material contained herein is not to be disclosed to, discussed with, or made available to any persons for any reason without the prior expressed approval of a responsible official of the U.S. Army Corps of Engineers.

Contents

Contents	v
Acronyms and Abbreviations	vii
Introduction	1-1
1.1 Analytical Laboratories and Analytical Methods	1-1
Field Sample Collection	2-1
Data Review and Validation Process	3-1
3.1 Data Validation Definition	3-1
3.2 Overall Data Validation Findings.....	3-1
3.3 Results Detected between the Method Detection Limit and Reporting Limit	3-1
3.4 Field Duplicates.....	3-1
Summary of Precision, Accuracy, Representativeness, Comparability, and Completeness	4-1
4.1 Precision.....	4-1
4.2 Accuracy.....	4-1
4.3 Representativeness.....	4-1
4.4 Appropriateness of Reporting Limits	4-1
4.5 Comparability.....	4-1
4.6 Completeness	4-1
4.7 Conclusions	4-1
Reference	5-1

Tables

1	Sample Summary by Chain of Custody—Data Summary
2	Sample Chronology—Data Summary
3	Site Completeness by Analyte—Flagging Statistics
4	Field Duplicate—Qualified Data
5	Site Completeness

Acronyms and Abbreviations

ALS	Australian Laboratory Services
DESA	Division of Environmental Science and Assessment (USEPA)
FD	field duplicate
IDW	investigation-derived waste
LCS	laboratory control sample
MS	matrix spike
MSD	matrix spike duplicate
QAPP	quality assurance project plan
QC	quality control
RL	reporting limit
SDG	sample delivery group
USEPA	U.S. Environmental Protection Agency

Introduction

This data quality evaluation report contains an assessment of the quality and usability of analytical data from environmental groundwater samples collected during the 2014 and 2015 U.S. Environmental Protection Agency (USEPA) pilot testing sampling events at the Garfield Groundwater Contamination Superfund Site in Garfield, Bergen County, New Jersey, by CH2M HILL, on behalf of the U.S. Army Corps of Engineers.

The analytical work was conducted in accordance with the Remedial Investigation Uniform Federal Policy for Quality Assurance Project Plan, Garfield Groundwater Contamination Superfund Site, Aquifer Test and Pilot Test, Garfield, Bergen County, New Jersey (project QAPP; CH2M HILL 2012).

This report discusses the details of groundwater sample results that were collected and validated during the 2014 and 2015 sampling events and were analyzed outside of the USEPA Division of Environmental Science and Assessment (DESA) and Contract Laboratory Program laboratory systems. USEPA data validation reports are not provided by the DESA laboratory. Samples collected as part of the investigation-derived waste (IDW) samples are not included in this data quality discussion because the data were not validated in accordance with the project QAPP.

1.1 Analytical Laboratories and Analytical Methods

Australian Laboratory Services (ALS), (formerly Columbia Analytical Services) of Rochester, New York, performed all sample analyses. After collection, the samples were delivered to the ALS laboratories by overnight courier for analysis. The analytical methods used were as follows:

- USEPA Method EPA 218.6 Hexavalent Chromium

SECTION 2

Field Sample Collection

Six sample delivery groups (SDGs) of analytical data were evaluated for data quality. Table 1 lists the SDGs, sample identifications, and collection and analysis chronology associated with the project samples.

Thirty groundwater samples were collected between June 19, 2014 and February 6, 2015. Field duplicate (FD) collection goals were met with four groundwater FDs completed. Other quality control (QC) samples including matrix spike (MS)/matrix spike duplicates (MSDs) and field blanks were collected and analyzed in accordance with the project QAPP (CH2M HILL 2012). Table 2 summarizes the field samples collected by date.

Data Review and Validation Process

3.1 Data Validation Definition

All analytical data from this investigation were evaluated as described in the project QAPP (CH2M HILL 2012). All (100 percent) of the hexavalent chromium analytical results were validated, except for IDW samples not included in this report. The data assessment included reviewing the following laboratory summary forms:

- Chain-of-custody documentation
- Holding time
- QC sample frequencies
- Method blanks
- Laboratory control samples (LCSs)
- Surrogate spikes
- MS/MSDs
- Initial and continuing calibration information
- FD precision
- Case narrative review and other method-specific criteria

Data flags (if applicable) were assigned using the QC acceptance limits and procedures defined in the project QAPP (CH2M HILL 2012). Data flags, and the reason for each flag, were entered into an electronic database and are available to the data users. Multiple flags can be routinely applied to a specific sample method/matrix/analyte combination, but only one final flag is applied to the data according to the most conservative of the validation flags.

3.2 Overall Data Validation Findings

Table 3 presents an overall summary of definitive data sample results and the reasons each sample was flagged. The information in Table 3 is presented so that each flag applied to a method, matrix, and analyte is shown. In addition, a statistical evaluation of the results is provided so the percentage of results affected by a specific data quality condition or flag, with respect to the total results available for any target analyte/matrix, is shown. Only out-of-control conditions noted during the data validation are discussed in Table 3 and in the following subsections.

3.3 Results Detected between the Method Detection Limit and Reporting Limit

Analytes that were detected at concentrations greater than the method detection limit, but less than the reporting limit (RL), were qualified as “J” and are considered to be qualitative concentrations.

3.4 Field Duplicates

FDs were submitted at a minimum frequency of 1 per 20 project samples. Four FDs were submitted for the effort in a manner such that the duplicate association was “blind” to the laboratory. FD precision for hexavalent chromium in groundwater was out of control for the duplicate pair EPA-13-OB-102014 and D-01-102014. Out-of-control detected results from the FD were qualified as estimated concentrations, flagged “J”, and are believed to be caused by sample heterogeneity or matrix interference in the analytical process. Table 4 presents results that were qualified because of out-of-control FD precision.

Summary of Precision, Accuracy, Representativeness, Comparability, and Completeness

The quality of the field sampling efforts and laboratory results were evaluated for compliance with project data quality objectives by reviewing overall precision, accuracy, representativeness, comparability, and completeness. Procedures used to assess these criteria were in accordance with the respective analytical methods and the project QAPP (CH2M HILL 2012) and QAPP addendum (CH2M HILL 2013) requirements.

4.1 Precision

Matrix precision from MS/MSDs was in control. Matrix precision also was evaluated through the results of FD samples. The results of the FD sample were out of control. The FD sample was within the oxidizing sample group and may indicate the other oxidizing samples have similar amounts of imprecision or uncertainty. Laboratory precision was acceptable as shown by the repeated in-control performance (accuracy) of the LCSs.

4.2 Accuracy

Matrix accuracy from MS/MSDs was in control. The laboratory accuracy of LCSs and calibrations was in control. The accuracy of blanks was in control overall and contamination was not significant to the sample concentrations. Both laboratory and matrix accuracy were acceptable.

4.3 Representativeness

Sample data were representative of the site conditions at the time of sample collection. All samples were properly stored and preserved. Analytical data were reported from an analysis conducted within the project-specified hold time. Blank contamination was not an issue with this data set.

4.4 Appropriateness of Reporting Limits

This project was designed to allow risk-based decisions to be made based on the results of common USEPA-approved analytical methodologies. Sample dilutions required from matrix interference and/or high target analyte concentrations resulted in elevated RLs for sample data. The RLs achieved were the best possible based on sample variables.

4.5 Comparability

All samples were reported in industry standard units. Analytical protocols for the methods were followed. Results obtained were comparable to industry standards in that collection and analytical techniques followed approved, documented procedures.

4.6 Completeness

Project completeness for hexavalent chromium is 100 percent. No results were qualified as unusable for project objectives. Table 5 presents the completeness results.

4.7 Conclusions

The data generated from groundwater sample analyses were of sufficient quality and quantity necessary for accomplishing the project objectives. Sample results indicate the presence and/or absence of target analyte

contamination at sampled locations when considering the accuracy and precision bias as discussed in this report.

Samples were collected and analyzed as specified in the project QAPP (CH2M HILL 2012). Sample results are believed to be representative of site conditions at the time of collection. Results obtained are comparable to industry standards in that collection, and analytical techniques followed approved, documented procedures. All results were reported in industry standard units. Although field blank contamination from equipment blanks did occur, it was not significant to the sample data. The results obtained for sample analyses reflect the best achievable data for the site-specific conditions.

SECTION 5

Reference

CH2M HILL. 2012. *Remedial Investigation Sampling Uniform Federal Policy for Quality Assurance Project Plan, Garfield Groundwater Contamination Superfund Site, Garfield, Bergen County, New Jersey*. March.

CH2M HILL. 2013. *Remedial Investigation - Uniform Federal Policy for Quality Assurance Project Plan, Aquifer Test and Pilot Test, Garfield Groundwater Contamination Superfund Site, Garfield, Bergen County, New Jersey*. September.

Tables

TABLE 1
Sample Chronology – Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
CASR	R1404720	D-06192014-01	E218.6	6/19/2014	6/20/2014		6/23/2014
		EPA-13-OB-061914	E218.6	6/19/2014	6/20/2014		6/23/2014
		EPA-29-OB-061914	E218.6	6/19/2014	6/20/2014		6/23/2014
		EPA-30-OB-061914	E218.6	6/19/2014	6/20/2014		6/23/2014
		EPA-31-OB-061914	E218.6	6/19/2014	6/20/2014		6/23/2014
		EPA-32-OB-061914	E218.6	6/19/2014	6/20/2014		6/23/2014
	R1405819	EPA-13-OB-072914	E218.6	7/29/2014	7/30/2014		7/30/2014
		EPA-29-OB-072914	E218.6	7/30/2014	7/31/2014		7/31/2014
		EPA-30-OB-072914	E218.6	7/29/2014	7/30/2014		7/30/2014
		EPA-30-OB-072914MS	E218.6	7/29/2014	7/30/2014		7/30/2014
		EPA-30-OB-072914SD	E218.6	7/29/2014	7/30/2014		7/30/2014
		EPA-31-OB-073014	E218.6	7/30/2014	7/31/2014		7/31/2014
		EPA-31-OB-073014MS	E218.6	7/30/2014	7/31/2014		7/31/2014
		EPA-31-OB-073014SD	E218.6	7/30/2014	7/31/2014		7/31/2014
		EPA-32-OB-072914	E218.6	7/29/2014	7/30/2014		7/30/2014
	R1406953	D-01-090414	E218.6	9/4/2014	9/5/2014		9/10/2014
		EPA-13-OB-090314	E218.6	9/3/2014	9/5/2014		9/5/2014
		EPA-29-OB-090414	E218.6	9/4/2014	9/5/2014		9/10/2014
		EPA-30-OB-090314	E218.6	9/3/2014	9/5/2014		9/5/2014
		EPA-31-OB-090314	E218.6	9/3/2014	9/5/2014		9/10/2014
		EPA-32-OB-090314	E218.6	9/3/2014	9/5/2014		9/10/2014
	R1408420	D-01-102014	E218.6	10/20/2014	10/23/2014		11/3/2014
		EPA-13-OB-102014	E218.6	10/20/2014	10/23/2014		11/4/2014
		EPA-29-OB-102114	E218.6	10/21/2014	10/23/2014		11/3/2014
		EPA-30-OB-102014	E218.6	10/20/2014	10/23/2014		11/3/2014
		EPA-31-OB-102014	E218.6	10/20/2014	10/23/2014		11/3/2014
		EPA-32-OB-102014	E218.6	10/20/2014	10/23/2014		11/3/2014
ALSR	R1410146	GCGC-EPA-13-OB-05	E218.6	12/18/2014	12/19/2014		12/29/2014
		GCGC-EPA-13-OB-05MS	E218.6	12/18/2014	12/19/2014		12/29/2014
		GCGC-EPA-13-OB-05SD	E218.6	12/18/2014	12/19/2014		12/29/2014
		GCGC-EPA-29-OB-05	E218.6	12/17/2014	12/18/2014		12/29/2014
		GCGC-EPA-30-OB-05	E218.6	12/18/2014	12/19/2014		12/29/2014
		GCGC-EPA-31-OB-05	E218.6	12/18/2014	12/19/2014		12/29/2014
		GCGC-EPA-32-OB-05	E218.6	12/17/2014	12/18/2014		12/29/2014
	R1500842	D-02062015-01	E218.6	2/6/2015	2/7/2015		2/10/2015

TABLE 1
Sample Chronology – Data Summary

Laboratory	SDG	Sample ID	Method	Sample Date	Receive Date	Extract Date	Analysis Date
ALSR	R1500842	EPA-13-OB-020515	E218.6	2/5/2015	2/6/2015		2/10/2015
		EPA-29-OB-020615	E218.6	2/6/2015	2/7/2015		2/10/2015
		EPA-30-OB-020515	E218.6	2/5/2015	2/6/2015		2/10/2015
		EPA-31-OB-020615	E218.6	2/6/2015	2/7/2015		2/10/2015
		EPA-32-OB-020515	E218.6	2/5/2015	2/6/2015		2/10/2015

TABLE 2

Sample Summary by Chain of Custody – Data Summary

CoC Number	Sample Date	Matrix	Sample ID / QAQC Type	SDG	Laboratory
R1404720	19-Jun-14	WATER	D-06192014-01 / FD	R1404720	CASR
			EPA-13-OB-061914 / N	R1404720	CASR
			EPA-29-OB-061914 / N	R1404720	CASR
			EPA-30-OB-061914 / N	R1404720	CASR
			EPA-31-OB-061914 / N	R1404720	CASR
			EPA-32-OB-061914 / N	R1404720	CASR
R1405819	29-Jul-14	WATER	EPA-13-OB-072914 / N	R1405819	CASR
	30-Jul-14		EPA-29-OB-072914 / N	R1405819	CASR
	29-Jul-14		EPA-30-OB-072914 / N	R1405819	CASR
			EPA-30-OB-072914MS / MS	R1405819	CASR
			EPA-30-OB-072914SD / SD	R1405819	CASR
	30-Jul-14		EPA-31-OB-073014 / N	R1405819	CASR
			EPA-31-OB-073014MS / MS	R1405819	CASR
			EPA-31-OB-073014SD / SD	R1405819	CASR
	29-Jul-14		EPA-32-OB-072914 / N	R1405819	CASR
R1406953	04-Sep-14	WATER	D-01-090414 / FD	R1406953	CASR
	03-Sep-14		EPA-13-OB-090314 / N	R1406953	CASR
	04-Sep-14		EPA-29-OB-090414 / N	R1406953	CASR
	03-Sep-14		EPA-30-OB-090314 / N	R1406953	CASR
			EPA-31-OB-090314 / N	R1406953	CASR
			EPA-32-OB-090314 / N	R1406953	CASR
R1408420	20-Oct-14	WATER	D-01-102014 / FD	R1408420	CASR
			EPA-13-OB-102014 / N	R1408420	CASR
	21-Oct-14		EPA-29-OB-102114 / N	R1408420	CASR
	20-Oct-14		EPA-30-OB-102014 / N	R1408420	CASR
			EPA-31-OB-102014 / N	R1408420	CASR
			EPA-32-OB-102014 / N	R1408420	CASR
R1410146	18-Dec-14	WATER	GCGC-EPA-13-OB-05 / N	R1410146	ALSR

TABLE 2

Sample Summary by Chain of Custody – Data Summary

CoC Number	Sample Date	Matrix	Sample ID / QAQC Type	SDG	Laboratory
R1410146	18-Dec-14	WATER	GCGC-EPA-13-OB-05MS / MS	R1410146	ALSR
			GCGC-EPA-13-OB-05SD / SD	R1410146	ALSR
	17-Dec-14		GCGC-EPA-29-OB-05 / N	R1410146	ALSR
	18-Dec-14		GCGC-EPA-30-OB-05 / N	R1410146	ALSR
			GCGC-EPA-31-OB-05 / N	R1410146	ALSR
	17-Dec-14		GCGC-EPA-32-OB-05 / N	R1410146	ALSR
R1500842	06-Feb-15	WATER	D-02062015-01 / FD	R1500842	ALSR
	05-Feb-15		EPA-13-OB-020515 / N	R1500842	ALSR
	06-Feb-15		EPA-29-OB-020615 / N	R1500842	ALSR
	05-Feb-15		EPA-30-OB-020515 / N	R1500842	ALSR
	06-Feb-15		EPA-31-OB-020615 / N	R1500842	ALSR
	05-Feb-15		EPA-32-OB-020515 / N	R1500842	ALSR

QAQC Type

N = normal environmental sample

FD = field duplicate

MS = matrix spike

SD = spike duplicate

TB = trip blank

EB = equipment blank

AB = ambient blank

FB = field blank

TABLE 3

Site Completeness by Analyte – Flagging Statistics

Matrix	Method	Analyte	Number of Samples
WATER			
	E218.6		
		Chromium, Hexavalent, Dissolved	34
		Validation Flag Category: FieldDuplicate	2 J Flags (5.88%) for Field duplicate exceeds RPD criteria

Note: The total number of validation flags may exceed the actual number of samples if multiple flags were applied to the same sample. Consequently, the percentage of total flags (flags applied/number of samples) may exceed 100 percent.

* The most severe flag for each analyte becomes the final validation flag.

Qualifier Description:

J = The analyte was positively identified, the quantitation is an estimate.

TABLE 4

Field Duplicate Precision – Qualified Data

Method	Matrix	Sample ID	Analyte	Result	Field Duplicate Qualifier*	Criteria
E218.6	WATER		Chromium, Hexavalent, Dissolved			
		D-01-102014		147 UG/L	J	FD>RPD
		EPA-13-OB-102014		13.2 UG/L	J	FD>RPD

* The most severe flag for each analyte becomes the final validation flag.

Qualifier Description:

J = The analyte was positively identified, the quantitation is an estimate.

Criteria:

FD>RPD = Field duplicate exceeds RPD criteria

TABLE 5
Site Completeness by Analyte – Qualified Data

Method	Analyte	Units	Number of Occurrences						Contractor Completeness (%)	Overall Completeness (%)
			Analyses	Detects	Non- detects	Blank Flags	J-Flags	Contractor R-Flags		
E218.6	Chromium, Hexavalent, Dissolved	MG/L	28	28			2		100	100
E218.6	Chromium, Hexavalent, Dissolved	UG/L	6	6			2		100	100

Attachment 5
Groundwater Field Logs

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-29-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>J. Balas + P. Reamer</u>		Date: <u>6/19/14</u>	Project #: <u>431007</u>
Well Depth (ft.): <u>19.65</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>10.37</u>	USEPA - Low Flow	2"	.163
Water Column (ft.): <u>9.28</u>	Sampling Procedures	3"	.367
Well Diameter (in.): <u>2</u>	with submersible pump	4"	.653
Gal. per ft.: <u>0.163</u>	Water Quality Meter:		
Well Volume (gal.): <u>1.51</u>	Horiba U-52		
Depth of Screen (ft.): <u>~15-20' BGS</u>			

Field Parameters											
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial											
1454	10.92	400	1.5	4.06	13.58	1.59	535	2.81	254	0.8	Yellow / no odor
1500	10.96	400	2.4	4.10	13.57	1.57	533	2.74	185	0.8	Dark Yellow / no od.
1505	10.98	400	3.0	4.14	13.48	1.55	530	2.82	108	0.8	" / "
1510	10.99	400	3.5	4.15	13.52	1.53	530	2.90	94.5	0.8	" / "
1515	11.00	400	3.1	4.15	13.49	1.52	530	2.95	98.3	0.8	" / "
				3.	13.66	OF					
Post-Purge											
1540	11.27	400	3.1	3.96	13.96	1.58	540	3.57	46.2	0.8	"

Remarks:	Pump Intake Depth: <u>816.5 sample</u>	Control Box Setting (Hz): <u>NA</u>	Sampling: (Sample at 100-250 ml/min) <u>200</u>
	<u>16' BTIC</u>		
	<u>17.5'</u>		
		<u>Fe = 0.07 mg/l</u>	

SAMPLING	
Depth to Water Before Sampling:	<u>11.00</u>
Sample Methodology:	USEPA - Low Flow Sampling Procedures with submersible pump
Sample Name:	<u>EPA-29-03</u>
QC Sample:	<u>NA</u>
Sample Date/Time:	<u>6/19/14 @ 1520</u>
Sampler / Signature:	<u>P. Reamer</u>
Filtered Metals Collected:	<u>Y</u>
Filter Size:	<u>0.45</u>
Sample Observations:	<u>Yellow no odor</u>
Notes:	1 = stabilization of this parameter is not required prior to collecting sample
Parameters:	<u>Selot total + dissolved metals/anions / TOC / nitrate + nitrite</u>

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-30-013</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>Balas</u>		Date: <u>6/19/14</u>	Project #: <u>431007</u>
Well Depth (ft.): <u>21.40</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>11.95</u>	USEPA - Low Flow	2"	.163
Water Column (ft.): <u>10.45</u>	Sampling Procedures	5"	1.020
Well Diameter (in.): <u>2"</u>	with submersible pump	3"	.367
Gal. per ft.: <u>.163</u>	Water Quality Meter:	4"	.653
Well Volume (gal.): <u>1.7</u>	Horiba U-52		
Depth of Screen (ft.): <u>17-22</u>			

Field Parameters

	Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
	Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial	1007	12.98	350	-	6.72	19.86	1.25	112	3.74	OR	.6	brassy yellow
	1021	12.71	300	1.0	6.25	18.16	4.07	31107	.94	85.5	.7	yellow
	1026	12.73	300	1.5	6.33	18.01	1.31	103	.89	56.2	.7	yellow/green
	1031	12.78	300	1.8	6.35	18.02	1.30	101	.87	40.8	.7	yellow/green
	1041	12.80	300	2.5	6.38	18.10	1.29	100	.92	16.9	.6	yellow/green
	1046	12.75	300	2.8	6.41	18.12	1.29	104	.85	12.5	.6	yellow/green
	1051	12.76	300	3.1	6.46	18.27	1.29	103	.83	12.6	.6	yellow/green
	1056	12.72	300	3.6	6.77	18.35	1.29	103	.83	13.6	.6	yellow/green
	1100	collect sample										
Post-Purge												
	1130	12.75	200	-	6.50	16.82	1.34	111	2.97	55.2	.7	yellow/green

Remarks: Pump Intake Depth:

~ 20

Control Box Setting (Hz):

100

Sampling: (Sample at 100-250 ml/min)

green

Cr VI - OR

Ferric Iron - 0.0 mg/l

SAMPLING

Depth to Water Before Sampling: 12.69

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: EPA-30-013-061914

QC Sample: none

Sample Date/Time: 6/19/14 1100

Sampler / Signature: [Signature]

Filtered Metals Collected: ☒ N Filter Size: .45

Sample Observations:

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: select metals, anions, CH₄, NO₃, TOC, Cr VI, Cu, Fe, Mn, Zn, Pb, Cd, Hg, As, Se, Mo, B, Ni, V, Co, Cr, U, Th, Pa, Y, Zr, Hf, Ta, Nb, W, Bi, Sb, Sn, Te, Po, At, Rn, Fr, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Tl, Pb, Bi, Po, At, Rn, Fr, Ac, Th, Pa, U, Np, Pu, Am, Cm, Bk, Cf, Es, Fm, Md, No, Lr, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu

105
1163
315
630
105
1.7

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-13-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>J. Balas + D. Reamer</u>		Date: <u>6-19-14</u> Project #: <u>431007</u>	
Well Depth (ft.): <u>22-32</u>	Purge Methodology: <u>USEPA - Low Flow</u>	Diameter	Gal. Per Foot
DTW (ft.): <u>11.98</u>	Sampling Procedures <u>with submersible pump</u>	2"	.163
Water Column (ft.): <u>20.12</u>	Water Quality Meter: <u>Horiba U-52</u>	3"	.367
Well Diameter (in.): <u>2</u>		4"	.653
Gal. per ft.: <u>0.163</u>		Diameter	Gal. Per Foot
Well Volume (gal.): <u>3.3</u>		5"	1.020
Depth of Screen (ft.): <u>22-32</u>		6"	1.469
		8"	2.611

Field Parameters											
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
1016	12.60	300	0.7	7.84	16.77	0.789	150	1.42	9.94	0.4	Yellowish green
1021	12.62	300	1.2	7.79	16.86	0.791	150	1.24	6.42	0.4	" / "
1026	12.64	300	1.7	7.76	16.48	0.794	150	1.16	5.62	0.4	" / "
1031	12.64	300	2.1	7.76	16.83	0.796	149	1.05	5.20	0.4	" / "
1036	12.65	300	2.4	7.75	16.83	0.800	149	1.09	3.10	0.4	" / "
1041	12.65	300	2.7	7.74	16.84	0.803	149	1.08	3.09	0.4	" / "
1046	12.65	300	3.2	7.74	16.91	0.806	149	1.12	2.85	0.4	
	12.9 (PR)										
1131	12.90	250	3.2	7.74	17.48	0.820	158	1.12	4.06	0.4	" / "

Remarks:	Pump Intake Depth: <u>27'</u>	Control Box Setting (Hz): <u>111</u>	Sampling: (Sample at 100-250 ml/min) <u>250</u>
Fe: 0.00mg/L			

SAMPLING	
Depth to Water Before Sampling:	<u>16.65</u>
Sample Methodology:	<u>USEPA - Low Flow Sampling Procedures with submersible pump</u>
Sample Name:	<u>EPA-13-03-061914</u>
QC Sample:	<u>Dup: D-06192014-01</u>
Sample Date/Time:	<u>6-19-14 @ 1050</u>
Sampler / Signature:	<u>D. Reamer</u>
Filtered Metals Collected:	<u>(Y) N</u>
Filter Size:	<u>0.45</u>
Sample Observations:	<u>Yellowish green color</u>
Notes:	<u>1 = stabilization of this parameter is not required prior to collecting sample</u>
Parameters:	<u>Cu, metals, TOC, anions, nitrate/nitrite</u>
	<u>(Select)</u>

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-31-0B</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>J. Balas / D. Ream</u>		Date: <u>6/19/14</u>	Project #: <u>431007</u>
Well Depth (ft.): <u>24.91</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>11.98</u>	USEPA - Low Flow	<u>2"</u>	<u>.163</u>
Water Column (ft.):	Sampling Procedures	5"	1.020
Well Diameter (in.): <u>2</u>	with submersible pump	6"	1.469
Gal. per ft.: <u>0.163</u>	Water Quality Meter:	8"	2.611
Well Volume (gal.):	Horiba U-52		
Depth of Screen (ft.): <u>15-25</u>			

Field Parameters

Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 1329	12.90	300	1.55	6.24	16.62	1.68	184	2.60	275	0.8	dark yellow
1334	12.95	300	1.6	6.23	16.45	1.67	187	2.24	189	0.8	" "
1349	12.98	300	3.0	6.22	16.19	1.69	194	2.09	69.6	0.9	" "
1359	12.98	300	3.7	6.22	16.14	1.90	195	1.78	33.9	0.9	" "
1404	12.98	300	4.0	6.21	16.02	1.72	196	1.64	22.5	0.9	" "
1409	12.98	300	4.4	6.16	16.72	1.73	199	1.51	21.4	0.9	" "
1414	12.98	300	4.8	6.12	16.87	1.74	202	1.47	22.6	0.9	" "
1419	12.98	300	5.1	6.11	16.90	1.75	202	1.79	20.9	0.9	" "
1425	collect sample										
Post-Purge 1445	12.98	200	-	6.22	16.24	1.77	207	1.86	47.9	0.9	yellow

Remarks: Pump Intake Depth:

Control Box Setting (Hz):

Sampling: (Sample at 100-250 ml/min)

~ 20.5 BTIC
started at 1316

Ferrrous Iron - 0.0 mg/L
cr VI black - OR

SAMPLING

Depth to Water Before Sampling: 12.91

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: EPA-31-0B-061914 QC Sample: None

Sample Date/Time: 6/19/14 1425

Sampler / Signature: [Signature]

Filtered Metals Collected: Y / N Filter Size:

Sample Observations:

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: select metals (dissolved) anions, NO₃, CH₄, TOC, sulfates, cr VI

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-32-013</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>J. Balas / P. Ream</u>		Date: _____ Project #: <u>431007</u>	
Well Depth (ft.): <u>19.92</u> DTW (ft.): <u>12.40</u> Water Column (ft.): <u>7.52</u> Well Diameter (in.): <u>2</u> Gal. per ft.: <u>0.163</u> Well Volume (gal.): <u>1.2</u> Depth of Screen (ft.): <u>-10-20 BGS</u>		Pump Methodology: USEPA - Low Flow Sampling Procedures with submersible pump Water Quality Meter: Horiba U-52	
		Diameter Gal. Per Foot <u>2" .163</u> 3" .367 4" .653	Diameter Gal. Per Foot 5" 1.020 6" 1.469 8" 2.611

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial											
1330	12.77	300	0.9	4.80	15.17	1.33	454	2.41	over	0.7	Yellowish brown/nor
1343	12.86	300	2.0	4.70	15.11	1.36	472	2.30	38.3	0.7	Brownish yellow/nor
1348	12.90	300	2.6	4.70	15.28	1.37	472	2.25	16.1	0.7	Dark yellow/nor
1358	12.92	300	3.0	4.71	15.31	1.38	472	2.17	12.8	0.7	" / "
1358	12.93	300	3.4	4.72	15.29	1.39	472	2.13	10.5	0.7	" / "
1403	12.94	300	3.8	4.73	15.36	1.40	474	2.15	9.67	0.7	" / "
1408	12.96	300	4.3	4.75	15.43	1.41	474	2.14	9.73	0.7	" / "
1412	12.96	250									
Post-Purge											
1428	13.15	250	4.3	4.70	15.30	1.46	469	3.44	36.3	0.7	" / "

Remarks:	Pump Intake Depth: <u>17' BTIC</u>	Control Box Setting (Hz): <u>84.99</u>	Sampling: (Sample at 100-250 ml/min) <u>250</u>
Ferrous Iron = 0.00 mg/l			

SAMPLING	
Depth to Water Before Sampling: <u>12.96</u>	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>EPA-32-013-061914</u>	QC Sample: <u>None</u>
Sample Date/Time: <u>6/19/14 @ 1410</u>	
Sampler / Signature: <u>David Ream</u>	
Filtered Metals Collected: <u>YDN</u>	Filter Size: <u>0.45</u>
Sample Observations: <u>Yellow / no odor</u>	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>Select total + dissolved metals / Anions / Nitrite + Nitrate / Hex chromium</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-30-03</u>						Site: <u>Garfield Groundwater Contamination Superfund Site</u>																									
Field Crew: <u>T. SANCIBURN / T. BEAUS</u>						Date: <u>7/29/14</u> Project #: <u>431007</u>																									
Well Depth (ft.): <u>21.40</u> DTW (ft.): <u>12.65'</u> Water Column (ft.): <u>8.75'</u> Well Diameter (in.): <u>2"</u> Gal. per ft.: <u>0.163</u> Well Volume (gal.): <u>1.42</u> Depth of Screen (ft.): <u>17-22</u>						Purge Methodology: USEPA - Low Flow Sampling Procedures with submersible pump Water Quality Meter: Horiba U-52						<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>Diameter</th> <th>Gal. Per Foot</th> <th>Diameter</th> <th>Gal. Per Foot</th> </tr> <tr> <td>2"</td> <td>.163</td> <td>5"</td> <td>1.020</td> </tr> <tr> <td>3"</td> <td>.367</td> <td>6"</td> <td>1.469</td> </tr> <tr> <td>4"</td> <td>.653</td> <td>8"</td> <td>2.611</td> </tr> </table>				Diameter	Gal. Per Foot	Diameter	Gal. Per Foot	2"	.163	5"	1.020	3"	.367	6"	1.469	4"	.653	8"	2.611
Diameter	Gal. Per Foot	Diameter	Gal. Per Foot																												
2"	.163	5"	1.020																												
3"	.367	6"	1.469																												
4"	.653	8"	2.611																												
Field Parameters																															
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor																				
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%																						
267 Initial 1259	15.17	650	0.5	6.63	17.11	1.30	158	2.47	408	0.10	Yellow - Brown																				
140 1304	14.00	600	0.8	6.71	16.66	1.20	153	0.00	235	0.10	Yellow																				
193 1309	14.55	500	1.4	6.74	16.92	1.25	149	0.00	273	0.10	Yellow																				
182 1314	14.60	450	2.0	6.74	16.90	1.24	150	0.00	264	0.10	Yellow																				
175 1319	14.68	450	2.6	6.74	16.91	1.24	150	0.00	255	0.10	Yellow																				
1324				Collect Sample																											
1324	14.57	500	3.3	6.73	16.91	1.24	151	0.00	258	0.10	Yellow																				
1329				Collect Sample																											
170 Post-Purge 1310	14.60	500	5	6.74	17.50	1.23	151	0.00	207	0.10	Yellow																				
Remarks: <u>Pump Intake Depth: 20'</u> <u>FE -> 0.00 mg/L</u> <u>CFC -> 0.70 LIMIT</u> <u>* DID NOT COLLECT SAMPLE DUE TO TURBIDITY @ 1324; COLLECT @ 1329</u>																															
Control Box Setting (Hz): <u>100 Hz @ 1259</u> <u>96 Hz @ 1304</u> <u>93 Hz @ 1309</u>																															
Sampling: (Sample at 100-250 ml/min)																															
SAMPLING																															
Depth to Water Before Sampling:																															
Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump																															
Sample Name:																															
QC Sample:																															
Sample Date/Time: <u>13:29 7/29/14</u>																															
Sampler / Signature:																															
Filtered Metals Collected: Y / N Filter Size:																															
Sample Observations:																															
Notes: 1 = stabilization of this parameter is not required prior to collecting sample																															
Parameters:																															

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: 2AP-13-08				Site: Garfield Groundwater Contamination Superfund Site			
Field Crew: 5 SITESBURG / 12 BIALAS				Date: 7/24/14 Project #: 431007			
Well Depth (ft.): 32.10		Purge Methodology: USEPA - Low Flow		Diameter		Gal. Per Foot	
DTW (ft.): 12.42		Sampling Procedures: with submersible pump		2" .163		5" 1.020	
Water Column (ft.): 19.68		Water Quality Meter: Horiba U-52		3" .367		6" 1.469	
Well Diameter (in.): 2"				4" .653		8" 2.611	
Gal. per ft.: 0.163							
Well Volume (gal.): 3.3							
Depth of Screen (ft.): 17.22-22.32							

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
1104	14.60	900	1.5	7.43	16.76	0.886	75	0.18	55.1	0.4	MILKY WHITE
1109	14.67	900	2.5	7.54	16.36	0.938	34	0.00	124	0.5	" "
1114	14.67	650	3.5	7.64	16.29	0.954	23	0.00	167	0.5	" "
1119	13.41	500	3.9	7.72	17.82	0.945	15	0.00	161	0.5	CLEARING
1124	13.11	450	4.4	7.72	18.58	0.958	16	0.00	192	0.5	CLEAR SUBSIDY
1129	13.11	450	4.4	7.72	18.86	0.957	17	0.00	194	0.5	" "
1134	13.10	450	5.4	7.74	19.01	0.954	17	0.00	191	0.5	" "
1139				SATURATE COLLECTED							
1155				7.74	18.99	0.956	19	0.00	212	0.5	CLEAR, SEVERELY

Remarks: Pump Intake Depth: 27'		Control Box Setting (Hz): 115Hz @ 1104		Sampling: (Sample at 100-250 ml/min)	
Fe → 0.00 mg/L		1114Hz @ 1109			
Cr6 → 0.70 mg/L LIMIT		108Hz @ 1114			

SAMPLING	
Depth to Water Before Sampling: 13.10	
Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump	
Sample Name:	QC Sample:
Sample Date/Time: 11.39 7/24/14	
Sampler / Signature: <i>[Signature]</i>	
Filtered Metals Collected: Y / N Filter Size:	
Sample Observations: CLEAR, SEVERELY MILKY APPROPRIATE	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters:	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-32-03</u>						Site: <u>Garfield Groundwater Contamination Superfund Site</u>					
Field Crew: <u>T. S. A. S. R. K. S. / D. B. H. A. S.</u>						Date: <u>7/29/14</u> Project #: <u>431007</u>					
Well Depth (ft.): <u>19.92</u>						Diameter Gal. Per Foot					
DTW (ft.): <u>13.01</u>						2" .163					
Water Column (ft.): <u>6.91</u>						3" .367					
Well Diameter (in.): <u>2"</u>						4" .653					
Gal. per ft.: <u>0.163</u>						5" 1.020					
Well Volume (gal.): <u>1.13</u>						6" 1.469					
Depth of Screen (ft.): <u>10.2 - 19.92</u>						8" 2.611					
<div> <div>Purge Methodology:</div> <div>USEPA - Low Flow Sampling Procedures with submersible pump</div> <div>Water Quality Meter:</div> <div>Horiba U-52</div> </div>											
Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial	1451	13.86	300	0.2	5.77	19.26	1.35	265	2.50	757	0.7 Yellow - B.P. 14
328	1456	14.10	300	0.7	4.97	19.43	1.28	328	0.20	434	" "
371	1501	14.02	300	0.1	4.80	19.89	1.30	343	0.11	331	" "
425	1506	14.07	300	1.6	4.78	20.29	1.31	343	0.00	569	0.7 Yellow
193	1511	14.19	300	2.1	4.68	19.86	1.33	355	0.00	241	0.7 " "
94.7	1516	14.25	300	2.6	4.59	19.52	1.38	370	0.06	116	0.7 Yellow
49.3	1521	14.28	300	3.2	4.52	19.44	1.39	380	0.09	69.0	0.7 Yellow
36.4	1526	14.29	300	3.8	4.47	19.49	1.41	387	0.06	51.6	0.7 Yellow
31.5	1531	14.30	300	4.1	4.45	19.46	1.42	390	0.03	44.6	0.7 Yellow
25.0	1536	14.29	300	5.0	4.43	19.45	1.43	394	0.00	36.5	0.7 Yellow
21.5	1541	14.31	300	5.6	4.40	19.41	1.44	399	0.00	30.9	0.7 Yellow
22.1	1546	14.30	300	6.2	4.39	19.41	1.45	401	0.00	29.2	0.9 Yellow
Post-Purge											
<div> <div>Remarks: Pump Intake Depth: <u>17'</u></div> <div>Control Box Setting (Hz): <u>85 Hz @ 1449</u></div> <div>Sampling: (Sample at 100-250 ml/min)</div> </div>											
<div> <div><u>Fe → 0.01 mg/L</u></div> <div><u>90 Hz @ 1450</u></div> <div><u>Cr6 → 0.70 mg/L LIMIT</u></div> <div><u>FLIP OVER</u></div> </div>											
SAMPLING											
Depth to Water Before Sampling:											
Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump											
Sample Name: QC Sample: <u>D-07292014-01</u>											
Sample Date/Time: <u>16:00 7/29/14</u>											
Sampler / Signature: <u>[Signature]</u>											
Filtered Metals Collected: Y / N Filter Size:											
Sample Observations:											
Notes: 1 = stabilization of this parameter is not required prior to collecting sample											
Parameters:											

CONT. ON BACK

TURB	TIME	DTW	FLAV	VOL	PH	TEMP	COND	ORP	DO	TURB	SAL
32.0	1551	14.30	300	6.7	4.38	19.36	1.45	403	0.00	53.0	0.7
31.2	1556	14.31	300	7.2	4.37	19.57	1.45	404	0.00	47.1	0.7
30.4	1601	14.30	300	7.7	4.35	19.56	1.45	406	0.00	39.2	0.7
1600	COLLECT SAMPLE										

88.3	ST → 1622	14.50	300	8.5	4.53	20.09	1.49	407	(DROPPING) 0.81	221	0.7
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Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: EPA-29-OB-073014						Site: Garfield Groundwater Contamination Superfund Site					
Field Crew: T. S. H. S. B. J. C. C.						Date: 7/30/14 Project #: 431007					
Well Depth (ft.): 19.65 DTW (ft.): 10.67 Water Column (ft.): 8.98 Well Diameter (in.): 2 Gal. per ft.: 163 Well Volume (gal.): 146 Depth of Screen (ft.): 15-20						Purge Methodology: USEPA - Low Flow Sampling Procedures with submersible pump Water Quality Meter: Horiba U-52					
Diameter Gal. Per Foot 2" .163 3" .367 4" .653						Diameter Gal. Per Foot 5" 1.020 6" 1.469 8" 2.611					

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
1150	12.15	400	0.2	3.62	15.10	1.75	470	4.62	OVER	1.0	Yellow-CREAMY
1155	11.23	400	0.9	3.65	17.05	1.71	464	0.00	788	0.9	" "
1200	11.22	400	1.7	3.58	17.77	1.69	472	0.00	657	0.9	" "
1205	11.23	450	2.4	3.58	18.02	1.71	473	0.00	677	0.9	" "
1210	11.21	400	3.0	3.62	18.46	1.70	470	0.00	559	0.9	" "
1215	11.22	400	3.7	3.62	17.49	1.71	470	0.51	434	0.9	" "
1220	11.35	400	4.2	3.65	17.70	1.69	468	0.27	402	0.9	" "
1225	11.32	400	4.9	3.65	17.21	1.69	469	0.00	354	0.8	" "
1230	11.31	400	5.5	3.66	17.54	1.68	469	0.00	346	0.8	" "
1235	11.32	400	6.1	3.64	17.70	1.69	470	0.00	359	0.9	" "
1240				Collect		5.4490					
1304	11.28			3.53	17.13	1.74	480	0.00	436	0.9	

Remarks:	Pump Intake Depth: 17.5	Control Box Setting (Hz): 120 Hz @ 1150	Sampling: (Sample at 100-250 ml/min)
	Fe → 0.00	100 Hz @ 1152	
	CEG → 0.070	90 Hz @ 1157	
	Limit		
	Micro		

SAMPLING	
Depth to Water Before Sampling:	11.32
Sample Methodology:	USEPA - Low Flow Sampling Procedures with submersible pump
Sample Name:	EPA-29-OB-073014
Sample Date/Time:	1240 7/30/14
QC Sample:	
Sampler / Signature:	
Filtered Metals Collected:	Y / N Filter Size:
Sample Observations:	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters:	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-31-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. SANCER</u>		Date: <u>7/30/14</u>	Project #: <u>431007</u>
Well Depth (ft.): <u>24.91</u> DTW (ft.): <u>12.90</u> Water Column (ft.): <u>12.01</u> Well Diameter (in.): <u>2</u> Gal. per ft.: <u>0.103</u> Well Volume (gal.): <u>1.157</u> Depth of Screen (ft.): <u>15-25</u>		Purge Methodology: USEPA - Low Flow Sampling Procedures with submersible pump Water Quality Meter: Horiba U-52	
Diameter	Gal. Per Foot	Diameter	Gal. Per Foot
2"	.163	5"	1.020
3"	.367	6"	1.469
4"	.653	8"	2.611

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 0923	14.54	900	0.4	5.15	15.93	140	247	10.74	0.62	0.7	Yellow
0928	13.65	600	1.3	5.75	16.49	160	247	6.64	6.97	0.8	Yellow
0933	13.67	400	2.0	5.78	16.84	163	250	6.08	5.24	0.8	Yellow
0938	13.40	400	2.7	5.80	16.86	164	250	5.54	4.67	0.8	Yellow
0943	13.82	400	3.4	5.86	16.41	167	248	4.73	4.54	0.8	Yellow
0948	13.80	400	4.1	5.90	16.82	169	249	3.95	4.27	0.9	Yellow
0953	13.78	400	4.8	5.92	17.22	169	251	3.43	3.95	0.9	Yellow
0958	13.77	400	5.5	5.93	18.18	169	252	2.98	3.57	0.9	Yellow
1003	13.35	400	6.1	5.94	18.13	170	252	2.70	3.38	0.9	" "
1008	13.30	400	6.6	5.94	18.42	170	253	2.30	3.26	0.9	" "
1013	13.30	400	7.1	5.94	18.56	170	254	2.06	2.97	0.9	" "
Post-Purge 1018	13.24	400	7.7	5.98	18.39	172	256	1.54		0.9	" "

Remarks: Pump Intake Depth: 20.5
 Control Box Setting (Hz): 94Hz @ 0920
87Hz @ 0928
85Hz @ 1000
 Sampling: (Sample at 100-250 ml/min)
Fe → 0.00
Cd → 0.70 LIMIT
Yellow color is Bold, mostly opaque

SAMPLING	
Depth to Water Before Sampling: <u>13.40</u>	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>EPA-31-03-073014</u>	QC Sample:
Sample Date/Time: <u>10/9 7/30/14</u>	
Sampler / Signature:	
Filtered Metals Collected: <u>Y / N</u>	Filter Size:
Sample Observations:	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters:	

TIME	DTW	Flow	VEL	PH	TEMP	COND	ORP	DO	TK43	SATC	Color
1023	13.41	400	8.3	5.98	17.20	1.73	256	1.04	281	0.9	yellow
1028	13.40	400	8.9	5.98	17.74	1.73	257	0.64	278	0.9	yellow
1033	13.43	400	9.6	6.00	17.77	1.74	258	0.35	269	0.9	yellow
1038	13.44	400	10.3	6.01	17.91	1.74	259	0.02	260	0.9	yellow
1044	13.40	400	10.9	6.02	17.98	1.74	259	0.0	256	0.9	yellow

1049	SAMPLE										
1135 (Post)	13.38	400	~12	6.03	17.68	1.75	261	0.05	264	0.9	yellow

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: E-16.5-18.5					Site: Cartel 12					
Field Crew: Palas					Date: 7/29/14 Project #: 431007.06-06.02					
Well Depth (ft.): DTW					Purge Methodology: peristaltic					
DTW (ft.): 13.12					Diameter Gal. Per Foot					
Water Column (ft.): 16.5-18.5					Diameter Gal. Per Foot					
Well Diameter (in.): 16.5-18.5					Diameter Gal. Per Foot					
Gal. per ft.:					Diameter Gal. Per Foot					
Well Volume (gal.):					Diameter Gal. Per Foot					
Depth of Screen (ft.):					Diameter Gal. Per Foot					
Field Parameters										
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
1212	N/A	N/A	N/A	5.18	25.64	1.49	343	4.05	OK	Reddish brown
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
Interval does not produce a continuous flow of water - will grab reading + sample										
SAMPLING										
Depth to Water Before Sampling:										
Sample Methodology: grab										
Sample Name: HW-E-16.5-18.5 QC Sample: none										
Sample Date/Time: 7/29/14 1220										
Sampler / Signature: [Signature]										
Filtered Metals Collected: TIN Filter Size: [Signature]										
Sample Observations:										
Parameters: TOC / sulfate										

Fe Ion = .05 mg/L
 Cr VI = 8.70 mg/L - over range

Low-Flow Groundwater Sampling: Field Data Sheet

Revision No.: 1
Date: September July 2013

Low-Flow Groundwater Sampling: Field Data Sheet

Revision No.: 1
Date: September July 2013

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>C-10.5-12.5</u>					Site: <u>Garfield</u>					
Field Crew: <u>Balas</u>					Date: <u>7/29/14</u> Project #: <u>431007.06.06.02</u>					
Well Depth (ft.): <u>12.8</u>					Purge Methodology:					
DTW (ft.): <u>10.9</u>					Diameter Gal. Per Foot					
Water Column (ft.):					Diameter Gal. Per Foot					
Well Diameter (in.): <u>10.5-12.5</u>					Diameter Gal. Per Foot					
Gal. per ft.:					Diameter Gal. Per Foot					
Well Volume (gal.):					Diameter Gal. Per Foot					
Depth of Screen (ft.):					Diameter Gal. Per Foot					
Field Parameters										
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
<u>1650</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>6.82</u>	<u>27.15</u>	<u>1.62</u>	<u>322</u>	<u>3.98</u>	<u>N/A</u>	<u>white milky/noise</u>
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
Fe - 263 mg/L Cr VI - 1.70 mg/L over range										
SAMPLING										
Depth to Water Before Sampling:										
Sample Methodology: <u>penetration</u>										
Sample Name: <u>GW-C-10.5-12.5</u> QC Sample: <u>none</u>										
Sample Date/Time: <u>7/29/14 1655</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected: <u>Y</u> Filter Size:										
Sample Observations:										
Parameters: <u>POC / sulfate</u>										

SOP No-24b: Pilot Test Direct-Push Groundwater sampling


Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>A-14-16</u>					Site: <u>60461d</u>					
Field Crew: <u>B9195</u>					Date: <u>7/30/14</u> Project #: <u>431007.06.00.02</u>					
Well Depth (ft.): <u>15.8</u>					Purge Methodology: <u>penstock</u>					
DTW (ft.): <u>12.5</u>					Diameter Gal. Per Foot					
Water Column (ft.):					Diameter Gal. Per Foot					
Well Diameter (in.):					Diameter Gal. Per Foot					
Gal. per ft.:					Diameter Gal. Per Foot					
Well Volume (gal.):					Diameter Gal. Per Foot					
Depth of Screen (ft.):					Diameter Gal. Per Foot					
Water Quality Meter: <u>Hanba U-52</u>					Diameter Gal. Per Foot					
Field Parameters										
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
<u>0730</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>3.79</u>	<u>18.45</u>	<u>202</u>	<u>435</u>	<u>2.13</u>	<u>586</u>	<u>y/k/bw</u>
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
Fe - .35 mg/L Cr VI - 7.70 mg/L over range										
SAMPLING										
Depth to Water Before Sampling:										
Sample Methodology: <u>Penstock</u>										
Sample Name: <u>GW-A-14-16</u> QC Sample: <u>none</u>										
Sample Date/Time: <u>7/30/14 0730</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected: <u>Y / N</u> Filter Size:										
Sample Observations:										
Parameters: <u>DOC, Sulfate</u>										

Low-Flow Groundwater Sampling: Field Data Sheet

Revision No.: 1
Date: September July 2013

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: D-13-15				Site: Garfield Superfund							
Field Crew: Belas				Date: 7/30/14 Project #: 631007.04.06.02							
Well Depth (ft.): 13-15		Purge Methodology: peristaltic		Diameter		Gal. Per Foot		Diameter		Gal. Per Foot	
DTW (ft.): 12.7				2"		.163		5"		1.020	
Water Column (ft.): N/A				3"		.367		6"		1.469	
Well Diameter (in.): N/A				4"		.653		8"		2.611	
Gal. per ft.:		Water Quality Meter:									
Well Volume (gal.): 13-15		Monba U-92									
Depth of Screen (ft.): 13-15											
Field Parameters											
Time	DTW (ft.)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor	
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3%	+/- 10 mV	+/- 10%	+/- 10%		
11:20	N/A	N/A	N/A	4.25	19.43	130	385		0.8	reddish/brown	
<div>Blank</div>											
Remarks: Pump Intake Depth: Control Box Setting (Hz): purge water cleared up											
Cr VI - 8.70 mg/L average											
Fe - 0 mg/L											
SAMPLING											
Depth to Water Before Sampling:											
Sample Methodology: peristaltic											
Sample Name: GW-D-13-15 QC Sample: None											
Sample Date/Time: 7/30/14 11:25											
Sampler / Signature: 											
Filtered Metals Collected: <input checked="" type="checkbox"/> N Filter Size:											
Sample Observations:											
Parameters: TOC / surfan											

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>DA16-18</u>				Site: <u>Cathfield Superfund</u>						
Field Crew: <u>SE/AS</u>				Date: <u>7/30/14</u> Project #: <u>43107-06:0602</u>						
Well Depth (ft.): <u>17.95</u>		Purge Methodology: <u>Penstaltic</u>		Diameter		Gal. Per Foot				
DTW (ft.): <u>11.6</u>				2"		.163				
Water Column (ft.):				3"		.367				
Well Diameter (in.):				4"		.653				
Gal. per ft.:				5"		1.020				
Well Volume (gal.):				6"		1.469				
Depth of Screen (ft.): <u>16-18</u>		Water Quality Meter: <u>Horiba U-52</u>		8"		2.611				
Field Parameters										
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
<u>1318</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>4.79</u>	<u>22.30</u>	<u>156</u>	<u>345</u>	<u>19</u>	<u>OR</u>	<u>Red/Yellow</u>
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
<u>Cr6 - 8.70 mg/L over range</u> <u>Fe - 75.30 mg/L OR</u>										
SAMPLING										
Depth to Water Before Sampling: <u>N/A</u>										
Sample Methodology: <u>Penstaltic</u>										
Sample Name: <u>DA16-18</u> QC Sample: <u>none</u>										
Sample Date/Time: <u>7/30/14 1320</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected: <u>Y / N</u> Filter Size:										
Sample Observations:										
Parameters: <u>TOC / Sulfate</u>										

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>0-15-17</u>					Site: <u>Acetate Superfund</u>					
Field Crew: <u>Balas</u>					Date: <u>7/30/14</u> Project #: <u>431007-06-06-05</u>					
Well Depth (ft.): <u>17</u>					Purge Methodology: <u>peristaltic</u>					
DTW (ft.): <u>15.4</u>					Diameter Gal. Per Foot					
Water Column (ft.): <u>N/A</u>					Diameter Gal. Per Foot					
Well Diameter (in.): <u>N/A</u>					Diameter Gal. Per Foot					
Gal. per ft.: <u>N/A</u>					Diameter Gal. Per Foot					
Well Volume (gal.): <u>15-17</u>					Water Quality Meter: <u>Hanna U-50</u>					
Depth of Screen (ft.): <u>15-17</u>										
Field Parameters										
Time	DTW (ft.)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (°C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3%	+/- 10 mV	+/- 10%	+/- 10%	
1910	N/A	N/A	N/A	6.27	26.47	1.48	34	1.87	CXL	red / none
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
Fe - 1.62 mg/L Cr VI - 1.0 mg/L depth to water not stable										
SAMPLING										
Depth to Water Before Sampling:										
Sample Methodology: <u>peristaltic</u>										
Sample Name: <u>0-15-17-GW-0-15-17</u> QC Sample: <u>none</u>										
Sample Date/Time: <u>7/30/14 1415</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected: <u>Y/N</u> Filter Size:										
Sample Observations:										
Parameters: <u>TOC / Sulfate / Fe</u>										

Low-Flow Groundwater Sampling: Field Data Sheet

Revision No.: 1
Date: September July 2013

Low-Flow Groundwater Sampling: Field Data Sheet

Revision No.: 1
Date: September July 2013

Low-Flow Groundwater Sampling: Field Data Sheet

Revision No.: 1
Date: September July 2013

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>F-21.5-23.5</u>					Site: <u>Barfield</u>					
Field Crew: <u>B. G. S.</u>					Date: <u>7/31</u> Project #: <u>431007.06.06.02</u>					
Well Depth (ft.): <u>23.5</u>					Purge Methodology: <u>pen</u>					
DTW (ft.): <u>22.011</u>					Diameter Gal. Per Foot					
Water Column (ft.): <u>21.5-23.5</u>					Diameter Gal. Per Foot					
Well Diameter (in.): <u>1.5</u>					Diameter Gal. Per Foot					
Gal. per ft.: <u>1.5</u>					Diameter Gal. Per Foot					
Well Volume (gal.): <u>21.5-23.5</u>					Diameter Gal. Per Foot					
Depth of Screen (ft.): <u>21.5-23.5</u>					Diameter Gal. Per Foot					
Field Parameters										
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
0745				9.09	19.90	0.070	300	2.00	246	CLEAR/LT BROWN
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
<p>start on 7/30</p> <p>Fe - .51 mg/L</p> <p>Cr VI - 7.70 mg/L over</p>										
SAMPLING										
Depth to Water Before Sampling: <u>13.55</u>										
Sample Methodology: <u>pen</u>										
Sample Name: <u>GW-F-21.5-23.5</u> QC Sample: <u>none</u>										
Sample Date/Time: <u>750 7/31/14</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected: Y / N Filter Size:										
Sample Observations:										
Parameters: <u>TOC / Sulfate</u>										

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

21.5-23.5

Well Number: <u>2a-23.5</u>				Site: <u>Cephed</u>						
Field Crew: <u>Belas/Selsburg</u>				Date: <u>7/31</u> Project #: <u>Y31067.CK.OG.O2</u>						
Well Depth (ft.): <u>23.5</u>		Purge Methodology: <u>Peri</u>		Diameter		Gal. Per Foot				
DTW (ft.): <u>13.4</u>				2"		163				
Water Column (ft.):				3"		367				
Well Diameter (in.):				4"		653				
Gal. per ft.:				5"		1020				
Well Volume (gal.): <u>21.5-23.5</u>		Water Quality Meter: <u>Hanba US 2</u>		6"		1469				
Depth of Screen (ft.): <u>21.5-23.5</u>				8"		2611				
Field Parameters										
Time	DTW (ft.)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. (Surface) (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
<u>0855</u>	<u>13.4</u>	<u>300</u>	<u>15.4</u>	<u>6.70</u>	<u>18.34</u>	<u>957</u>	<u>-172</u>	<u>73</u>	<u>604</u>	<u>cloudy white</u>
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
ATTEMPT TO RETRACT SCREEN 1' INSTEAD OF 2 TO ATTEMPT TO CAPTURE THE PROPOSED INTERVAL. LET SIT OVER NIGHT TO RECHARGE										
SAMPLING										
Depth to Water Before Sampling: <u>13.4</u>										
Sample Methodology: <u>Peri</u>										
Sample Name: <u>CW-1(a)-21.5-23.5</u> QC Sample: <u>none</u>										
Sample Date/Time: <u>7/31/14</u> <u>0900</u> <u>0800</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected: <u>Y</u> <u>N</u> Filter Size:										
Sample Observations:										
Parameters: <u>TOC</u> <u>gulfake</u>										

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>H-21-23</u>					Site: <u>Garfield</u>					
Field Crew: <u>Ba. 10.5 / Scl. shurg</u>					Date: <u>7/31</u> Project #: <u>4/31007-06-06-02</u>					
Well Depth (ft.): <u>23</u>					Purge Methodology: <u>Peri</u>					
DTW (ft.): <u>18.05</u>					Diameter Gal. Per Foot					
Water Column (ft.): <u>18.05</u>					Diameter Gal. Per Foot					
Well Diameter (in.): <u>21-23</u>					Diameter Gal. Per Foot					
Gal. per ft.: <u>21-23</u>					Diameter Gal. Per Foot					
Well Volume (gal.): <u>21-23</u>					Diameter Gal. Per Foot					
Depth of Screen (ft.): <u>21-23</u>					Diameter Gal. Per Foot					
Water Quality Meter: <u>Hanba 1152</u>					Diameter Gal. Per Foot					
Field Parameters										
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. (Surface) (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
<u>1035</u>	<u>18.05</u>	<u>-</u>	<u>-</u>	<u>6.95</u>	<u>21.25</u>	<u>1.56</u>	<u>-22</u>	<u>3.30</u>	<u>OVER</u>	<u>lt Brown</u>
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
<p>Ferrous = .35 mg/L</p> <p>Cr VI = .17 mg/L</p>										
SAMPLING										
Depth to Water Before Sampling:										
Sample Methodology: <u>PER</u>										
Sample Name: <u>GW-H-21-23</u> QC Sample: <u>None</u>										
Sample Date/Time: <u>10:30 7/31/14</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected: <u>Y N</u> Filter Size:										
Sample Observations:										
Parameters: <u>TOC / sulfate</u>										

SOP No-24b: Pilot Test Direct-Push Groundwater sampling

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>H-26-28</u>					Site: <u>Garfield</u>					
Field Crew: <u>T. Salszda / J. Brooks</u>					Date: <u>7/31/14</u> Project #: <u>431007.016.06.02</u>					
Well Depth (ft.): <u>28</u>					Purge Methodology: <u>PERISTALTIC</u>					
DTW (ft.): <u>29.80</u>					Diameter Gal. Per Foot					
Water Column (ft.):					Diameter Gal. Per Foot					
Well Diameter (in.):					Diameter Gal. Per Foot					
Gal. per ft.:					Diameter Gal. Per Foot					
Well Volume (gal.): <u>20-28</u>					Water Quality Meter: <u>ITRIBA</u>					
Depth of Screen (ft.): <u>20-28</u>										
Field Parameters										
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Color/Odor
Stabilization	< 0.3'	300 - 500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%	
<u>1210</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>7.93</u>	<u>22.0</u>	<u>1.04</u>	<u>-9</u>	<u>.63</u>	<u>OR</u>	<u>reddish brown</u>
Blank										
Remarks: Pump Intake Depth: Control Box Setting (Hz):										
<u>2.13 - Fe mg/L</u>										
<u>CrVI - 7.7 mg/L OR</u>										
SAMPLING										
Depth to Water Before Sampling:										
Sample Methodology:										
Sample Name: <u>GW-H-26-28</u> QC Sample: <u>none</u>										
Sample Date/Time: <u>7/31/14 1140</u>										
Sampler / Signature: <u>[Signature]</u>										
Filtered Metals Collected Y / N Filter Size:										
Sample Observations:										
Parameters: <u>TAC / SULFATE</u>										

Low-Flow Groundwater Sampling: Field Data Sheet

20-22
1230

Low-Flow Groundwater Sampling: Field Data Sheet

[illegible]

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-13-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. SALSBUCK</u>		Date: <u>9/3/14</u>	Project #: <u>431007</u>
Well Depth (ft.): <u>32</u>	Purge Methodology: <u>USEPA - Low Flow</u>	Diameter	Gal. Per Foot
DTW (ft.): <u>13.64</u>	Sampling Procedures: <u>with submersible pump</u>	<u>2"</u>	<u>.163</u>
Water Column (ft.): <u>21.99</u>	Water Quality Meter: <u>Horiba U-52</u>	3"	.367
Well Diameter (in.): <u>2"</u>		4"	.653
Gal. per ft.: <u>0.163</u>			
Well Volume (gal.): <u>2.99</u>			
Depth of Screen (ft.): <u>22-32</u>			

Field Parameters

	Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity (PPT)	Color/Odor
	Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial	1034	15.13	600	0.2	7.14	17.88	0.870	-75	0.00	69.2	0.4	CLEAR, LITTLE MILKY
	1039	15.01	500	1.1	7.33	17.60	0.905	-79	0.00	50.3	0.4	" "
	1044	15.02	480	2.1	7.39	17.58	0.938	-86	0.00	26.8	0.5	" "
	1049	15.01	480	3.0	7.40	17.47	0.958	-89	0.00	38.2	0.5	" "
	1054	15.01	480	4.0	7.40	17.40	0.961	-89	0.00	32.6	0.5	LEAKING UP
	1059	15.01	480	4.8	7.40	17.41	0.973	-90	0.00	34.8	0.5	" "
	1104	15.00	480	5.6	7.58	17.46	0.999	-99	0.00	35.5	0.5	CLEAR
	1109	15.00	480	6.4	7.57	17.47	0.997	-97	0.00	38.4	0.5	CLEAR
	1114	15.00	480	7.2	7.57	17.44	1.00	-94	0.00	40.5	0.5	CLEAR
	1120				COLLECT SAMPLE							
	1125											
Post-Purge												

Remarks:	Pump Intake Depth: <u>27'</u>	Control Box Setting (Hz): <u>89.3 Hz</u>	Sampling: (Sample at 100-250 ml/min) <u>89%</u>
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SAMPLING

Depth to Water Before Sampling: <u>15.00</u>	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>EPA-13-03-090314</u>	QC Sample: <u>✓</u>
Sample Date/Time: <u>9/3/14</u>	
Sampler / Signature: <u>[Signature]</u>	
Filtered Metals Collected: <u>① N</u>	Filter Size: <u></u>
Sample Observations: <u>CLEAR</u>	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>Cr Fe TOL SURFACE Hex Cr</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-29-0B</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. SALSBURG</u>		Date: <u>9/4/14</u>	Project #: <u>431007</u>
Well Depth (ft.): <u>20</u>	Purge Methodology:	Diameter Gal. Per Foot	
DTW (ft.): <u>11.77</u>	USEPA - Low Flow	2" .163	5" 1.020
Water Column (ft.): <u>8.23</u>	Sampling Procedures	3" .367	6" 1.469
Well Diameter (in.): <u>2"</u>	with submersible pump	4" .653	8" 2.611
Gal. per ft.: <u>0.163</u>	Water Quality Meter:		
Well Volume (gal.): <u>1.34</u>	Horiba U-52		
Depth of Screen (ft.): <u>15'-20'</u>			

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		/
Initial 0817	12.09	480	—	3.10	17.93	1.90	523	1.08	OVER	0.9	CREAMY YELLOW
0822	12.89	480	1.5	3.25	17.52	1.89	522	1.01	OVER	1.0	" "
0827	12.90	440	2.5	3.23	17.70	1.89	523	0.72	OVER	1.0	" "
0832	12.81	440	3.9	3.19	17.96	1.88	525	0.68	OVER	0.9	CLEAR YELLOW
0837	12.78	440	4.2	3.21	18.19	1.88	523	0.65	173	1.0	YELLOW
0842	12.78	440	4.8	3.25	18.27	1.90	521	0.64	135	1.0	YELLOW
0847	12.75	440	5.5	3.18	17.87	1.92	527	0.59	423	1.0	YELLOW
0852	12.78	425	6.2	3.21	18.31	1.81	520	0.57	4303	0.9	YELLOW
0857	12.73	425	6.9	3.22	18.75	1.82	520	0.55	173	0.9	YELLOW
0902	12.68	425	7.6	3.26	18.94	1.81	517	0.54	125	0.9	YELLOW
0907	12.67	425	8.3	3.28	19.24	1.81	517	0.53	115	0.9	YELLOW
Post-Purge 0912	12.80	425	9.0	3.21	18.80	1.90	527	0.52	91.2	1.0	" "

Remarks: <u>Pump Intake Depth: 17.5'</u>	<u>Control Box Setting (Hz): 87.1</u>	Sampling: (Sample at 100-250 ml/min)
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SAMPLING	
Depth to Water Before Sampling:	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name:	QC Sample: <u>DUP</u>
Sample Date/Time:	
Sampler / Signature:	
Filtered Metals Collected: <u>Y / N</u>	Filter Size:
Sample Observations:	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters:	

CONTINUED

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-29-03 CONTINUED</u>						Site: <u>Garfield Groundwater Contamination Superfund Site</u>							
Field Crew:						Date: <u>9/4/14</u> Project #: <u>431007</u>							
Well Depth (ft.):			Purge Methodology:			Diameter		Gal. Per Foot		Diameter		Gal. Per Foot	
DTW (ft.):			USEPA - Low Flow			2"		.163		5"		1.020	
Water Column (ft.):			Sampling Procedures			3"		.367		6"		1.469	
Well Diameter (in.):			with submersible pump			4"		.653		8"		2.611	
Gal. per ft.:			Water Quality Meter:										
Well Volume (gal.):			Horiba U-52										
Depth of Screen (ft.):													

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 0917	12.79	420	9.6	3.22	18.94	1.85	524	.53	95.0	0.9	Yellow
0922	12.78	420	10.3	3.23	19.00	1.84	523	0.51	93.1	0.9	Yellow
0927				COLLECT SAMPLE							
Post-Purge 0954	12.76	420	-	3.21	18.40	1.87	528	1.26	79.3	0.9	YELLOW

Remarks:	Pump Intake Depth:	Control Box Setting (Hz):	Sampling: (Sample at 100-250 ml/min)
	17.5'	87Hz	

SAMPLING	
Depth to Water Before Sampling: <u>12.78</u>	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>EPA-29-03-090414</u>	QC Sample: <u>DUP</u>
Sample Date/Time: <u>9/4/14 0927</u>	
Sampler / Signature: <u>J. Lee</u>	
Filtered Metals Collected: <u>Al N</u> Filter Size: <u> </u>	
Sample Observations: <u>Yellow</u>	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>Cr Se TOC SULFIDE Hex Cr</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: EPA-30-03		Site: Garfield Groundwater Contamination Superfund Site	
Field Crew: D. Reamer		Date: 9/3/14	Project #: 431007
Well Depth (ft.): ~22' BGS	<u>Purge Methodology:</u>	Diameter	Gal. Per Foot
DTW (ft.): 13.97	USEPA - Low Flow	2"	.163
Water Column (ft.): 8.3	Sampling Procedures	3"	.367
Well Diameter (in.): 2"	with submersible pump	4"	.653
Gal. per ft.: 0.163	<u>Water Quality Meter:</u>		
Well Volume (gal.): 1.35	Horiba U-52		
Depth of Screen (ft.): 17'-22'			

[illegible]

Remarks:	<u>Pump Intake Depth:</u>	<u>Control Box Setting (Hz):</u>	<u>Sampling:</u> (Sample at 100-250 ml/min)
	~ 20' BGS	91.70	150
		Turbidity HACH	Horiba US2 -
		2100 Q	SN MUKY25M8
		S/N 130800027512	Pine Env.
NM - Not measured			

SAMPLING

Depth to Water Before Sampling: 15.28

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: EPA-30-GB-090314 QC Sample: None

Sample Date/Time: 9/3/14 1120

Sampler / Signature: David Reamer

Filtered Metals Collected: ☒ Y / ☐ N Filter Size: 0.45

Sample Observations: clear - to yellowish green water

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: Select total + dissolved metals (iron + chromium) sulfate + chlorides.

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-31-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. SALSBURG</u>		Date: <u>9/3/14</u> Project #: <u>431007</u>	
Well Depth (ft.): <u>25'</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>14.13</u>	USEPA - Low Flow	2"	.163
Water Column (ft.):	Sampling Procedures	3"	.367
Well Diameter (in.): <u>2"</u>	with submersible pump	4"	.653
Gal. per ft.: <u>0.163</u>	Water Quality Meter:	5"	1.020
Well Volume (gal.): <u>1.77</u>	Horiba U-52	6"	1.469
Depth of Screen (ft.): <u>15-25</u>		8"	2.611

Field Parameters

Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. (Surface) (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 1357	14.60	300	—	5.50	23.05	1.26	214	1.32	632	0.6	YELLOW
1356	14.65	350	0.6	5.38	20.58	1.38	230	0.00	717	0.7	YELLOW
1401	14.64	350	1.6	5.39	20.32	1.42	209	0.00	552	0.7	YELLOW
1406	14.65	380	2.0	5.42	20.24	1.45	197	0.00	381	0.7	YELLOW
1411	14.64	300	2.4	5.47	20.19	1.46	205	0.00	308	0.7	YELLOW
1416	14.64	300	2.8	5.53	20.15	1.49	197	0.00	254	0.7	YELLOW
1421	14.64	300	3.3	5.63	20.01	1.52	183	0.00	192	0.8	YELLOW
1426	14.64	300	3.8	5.69	19.97	1.54	202	0.00	161	0.8	YELLOW
1431	14.64	300	4.3	5.74	20.29	1.56	207	0.00	149	0.8	YELLOW
1436	14.65	300	4.8	5.76	20.50	1.56	206	0.00	137	0.8	" "
1440				CONC OF SAMPLE							
Post-Purge 1510	14.65	300	—	5.82	21.70	1.53	222	0.00	129	0.8	YELLOW

Remarks: Pump Intake Depth: 20' Control Box Setting (Hz): 91.1 Sampling: (Sample at 100-250 ml/min)

SAMPLING

Depth to Water Before Sampling: 14.65

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: EPA-31-03-090314 QC Sample: ✓

Sample Date/Time: 9/3/14 1440

Sampler / Signature: Jylee Prang

Filtered Metals Collected: 0/ N Filter Size:

Sample Observations: yellow

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: CS FE TOC HEX CS SULFIDE

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-32-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>D. Reamer / T. Saltsburg</u>		Date: <u>9/3/14</u>	Project #: <u>431007</u>
Well Depth (ft.): <u>19.87</u>	Purge Methodology: USEPA - Low Flow Sampling Procedures with submersible pump	Diameter	Gal. Per Foot
DTW (ft.): <u>14.35</u>		2"	.163
Water Column (ft.): <u>5.52</u>		3"	.367
Well Diameter (in.): <u>2</u>		4"	.653
Gal. per ft.: <u>0.163</u>	Water Quality Meter: Horiba U-52	Diameter	Gal. Per Foot
Well Volume (gal.): <u>0.9</u>		5"	1.020
Depth of Screen (ft.): <u>10-20</u>		6"	1.469
		8"	2.611

Field Parameters

Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. (Surface) (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 1410	16.23	350	1.25	4.69	21.32	1.51	412	2.67	780	0.8	Yellowish brown / no odor
1415	16.27	350	1.75	4.52	21.20	1.48	440	1.30	385	0.7	Yellowish / no odor
1425	16.25	400	3.0	4.41	21.13	1.47	463	1.20	24.9	0.7	" / "
1430	16.10	460	3.5	4.39	21.26	1.46	465	1.15	20.4	0.7	" / "
1435	15.92	200	3.6	4.40	22.11	1.46	460	1.25	50.4	0.7	" / "
1440	15.58	300	4.2	4.42	21.63	1.46	463	1.21	48.3	0.7	" / "
1445	15.62	400	4.7	4.44	21.47	1.46	462	1.20	46.4	0.7	" / "
1450	- Sample	collected	4.20	21.70	(PR)						
Post-Purge 1500	16.32	150	5.0	4.20	21.70	1.47	484	4.96	66.4	0.7	" / "

Remarks: Pump Intake Depth: ~17' BGS Control Box Setting (Hz): 95.20 Sampling: (Sample at 100-250 ml/min)

HACH 2100Q
SN 131006028903

Horiba U-52
SN MUKY25M8

SAMPLING

Depth to Water Before Sampling:

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: EPA-32-03-090314

QC Sample: None

Sample Date/Time: 9/3/14 1450

Sampler / Signature: David Reamer / T. Saltsburg

Filtered Metals Collected: (Y) N Filter Size: 0.45

Sample Observations: Yellowish color

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: Hex chrom / Total dissolved chrom / sulfide / sulfate / chloride / TOC

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-30-083</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. SALSBURY / K. NOBLE</u>		Date: <u>10/20/14</u> Project #: <u>431007</u>	
Well Depth (ft.): <u>21.34</u>	Purge Methodology: <u>USEPA - Low Flow</u>	Diameter	Gal. Per Foot
DTW (ft.): <u>14.54</u>	Sampling Procedures: <u>with submersible pump</u>	2"	.163
Water Column (ft.): <u>6.8</u>	Water Quality Meter: <u>Horiba U-52</u>	5"	1.020
Well Diameter (in.): <u>2"</u>		3"	.367
Gal. per ft.: <u>0.163</u>		4"	.653
Well Volume (gal.): <u>1.108</u>			
Depth of Screen (ft.): <u>21.34'</u>			

Field Parameters

Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 1153	15.60	350	✓	7.4	18.29	0.119	-5	2.45	OVER	0.1	CLEAR/LTBrown
1158	15.64	350	0.4	7.4	20.38	0.093	-79	1.60	33.2	0.1	CLEAR/CHEM O
1203	15.65	350	0.75	7.4	20.84	0.112	-115	1.36	14.0	0.1	CLEAR
1208	15.72	300	1.1	7.4	21.02	0.119	-128	1.25	10.1	0.1	CLEAR
1213	15.71	300	1.4	7.4	21.18	0.119	-129	1.14	9.62	0.1	CLEAR
1218	15.70	300	1.7	7.4	21.46	0.116	-119	1.06	8.37	0.1	CLEAR
1223	15.68	300	2.0	7.3	21.69	0.120	-103	1.00	7.91	0.0	CLEAR
1228	15.68	300	2.2	7.3	21.87	0.120	-87	0.99	7.80	0.1	↓
1233	15.60	300	2.4	7.3	21.78	0.121	-87	0.70	7.33	0.1	↓
1238	15.56	300	2.7	7.3	21.57	0.118	-85	0.72	7.20	0.1	↓
1243	15.54	300	3.0	7.3	21.30	0.115	-84	0.73	6.91	0.1	
Post-Purge 1330	15.64	300	✓	7.3	22.04	0.112	-166	3.71	5.36	0.1	CLEAR

Remarks: Pump Intake Depth: 18.6' Control Box Setting (Hz): 95 Sampling: (Sample at 100-250 ml/min) 200

SAMPLING

Depth to Water Before Sampling: 15.54

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: EPA-30-08-102014 QC Sample: ✓

Sample Date/Time: 10/20/14 1300

Sampler / Signature: J. Salas

Filtered Metals Collected: ① N Filter Size:

Sample Observations: CLEAR

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: Hex C, METALS, Cl/SULFATE, SULFIDE, TOC, ALK, METHANE, NITRATE, NITRITE

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-29-0B</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. SALSBERG</u>		Date: <u>10/21/14</u>	Project #: <u>431007</u>
Well Depth (ft.): DTW (ft.): <u>12.65'</u> Water Column (ft.): Well Diameter (in.): Gal. per ft.: Well Volume (gal.): Depth of Screen (ft.): <u>15-20</u>	<u>Purge</u> <u>Methodology:</u> USEPA - Low Flow Sampling Procedures with submersible pump <u>Water Quality Meter:</u> Horiba U-52	Diameter	Gal. Per Foot
		2"	.163
		3"	.367
		4"	.653
		5"	1.020
		6"	1.489
		8"	2.611

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 0915	13.30	500	✓	4.3	16.25	0.134	412	2.41	245	0.1	Yellow
0920	13.50	500	0.9	3.2	17.34	0.176	530	0.86	175	0.1	Yellow
0925	13.54	500	1.9	3.1	17.73	0.186	540	0.61	165	0.1	Yellow
0930	13.58	500	2.9	3.1	17.79	0.187	540	0.48	58.4	0.1	Yellow
0935	13.60	500	3.9	3.2	17.93	0.185	535	0.44	52.7	0.1	Yellow
0940	13.61	500	4.8	3.2	17.96	0.187	535	0.40	48.4	0.1	Yellow
Post-Purge 1003				3.0	17.86	0.149	571	2.68		0.1	

Remarks: Pump Intake Depth: 17.5' Control Box Setting (Hz): 87 Sampling: (Sample at 100-250 ml/min) 200

SAMPLING	
Depth to Water Before Sampling: <u>13.61</u>	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>EPA-29-0B-102114</u>	QC Sample: <u>✓</u>
Sample Date/Time: <u>10/21/14</u> <u>9:45</u>	
Sampler / Signature: <u>[Signature]</u>	
Filtered Metals Collected: <u>(X) N</u> Filter Size: _____	
Sample Observations: <u>YELLOW</u>	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>Hex CC, THM METALS (FILTER/UNFILTER) Cl/SULFATE/SULPHIDE, TOC, ALK, METHANE, NITRATE/NITRATA</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA 13-013</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>Kevin Noble / Taylor Seiberg</u>		Date: <u>10-20-14</u> Project #: <u>431007</u>	
Well Depth (ft.): <u>32.1</u>	Purge Methodology: USEPA - Low Flow	Diameter	Gal. Per Foot
DTW (ft.): <u>14.5</u>	Sampling Procedures with submersible pump	<u>2"</u>	<u>.163</u>
Water Column (ft.): <u>17.6</u>	Water Quality Meter: Horiba U-52	5"	1.020
Well Diameter (in.): <u>2"</u>		6"	1.469
Gal. per ft.: <u>16.3</u>		8"	2.611
Well Volume (gal.): <u>2.97</u>			
Depth of Screen (ft.):			

Field Parameters

Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 12:15	15.75	250	—	7.27	17.4	0.104	242	0.0	12.0	0.0	clear
12:20	15.75	250	1.9	7.50	18.3	0.105	246	0.0	9.11	0.0	clear
12:25	15.75	250	1.50	7.49	18.5	0.105	244	0.0	7.49	0.0	clear
12:30	15.75	250	2.0	7.45	19.0	0.107	247	0.0	5.75	0.0	clear
12:35	15.75	250	2.5	7.46	19.1	0.107	250	0.0	5.51	0.0	clear
12:40	15.75	250	3.0	7.46	19.0	0.107	249	0.0	6.12	0.0	clear
12:45	15.75	250	3.5	7.46	19.0	0.108	250	0.0	6.14	0.0	clear
12:50	15.75	250	4.0	7.44	19.0	0.104	251	0.0	6.03	0.0	clear
12:55	collect			sample							
13:15	15.75	—	—	7.48	19.0	0.109	252	0.0	6.14	0.0	clear
Post-Purge											

Remarks: Pump Intake Depth: 29.6' Control Box Setting (Hz): 91.0 Sampling: (Sample at 100-250 ml/min) 250 ml/min

SAMPLING

Depth to Water Before Sampling: 15.75
Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump
Sample Name: EPA 13-013-102014 QC Sample: DUP
Sample Date/Time: 10-20-14 12:55
Sampler / Signature: [Signature]
Filtered Metals Collected: PDN Filter Size:
Sample Observations: clear no odor rotten egg
Notes: 1 = stabilization of this parameter is not required prior to collecting sample
Parameters:

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA - 320B</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew:		Date:	Project #: <u>431007</u>
Well Depth (ft.): <u>20'</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>15.3</u>	USEPA - Low Flow	<u>2"</u>	<u>.163</u>
Water Column (ft.): <u>4-7</u>	Sampling Procedures	3"	.367
Well Diameter (in.): <u>2'</u>	with submersible pump	4"	.653
Gal. per ft.: <u>.163</u>	Water Quality Meter:	Diameter	Gal. Per Foot
Well Volume (gal.): <u>0.7661</u>	Horiba U-52	5"	1.020
Depth of Screen (ft.):		6"	1.469
		8"	2.611

Field Parameters

Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 15:15	15.8	200	—	5.60	19.4	0.199	294	0.0	1K	0.1	yellow
15:20	15.8	200	0.25	5.48	19.5	0.198	306	0.0	1K	0.1	Brown/none
15:25	15.8	200	0.50	5.05	19.5	0.195	339	0.0	1K	0.1	yellow
15:30	15.8	200	0.75	5.05	22.1	0.198	358	0.0	1K	0.1	Brown/none
15:35	15.8	200	1.0	4.15	21.4	0.180	416	0.0	1K	0.1	
15:40	17.8	200	1.5	4.12	21.2	0.189	409	0.0	1K	0.1	
15:45	17.8	200	1.75	4.11	21.5	0.185	375	0.0	1K	0.1	
15:50	17.8	200	2.0	4.71	21.5	0.185	374	0.0	1K	0.1	
15:55	17.8	200	2.35	4.71	21.5	0.185	377	0.0	1K	0.1	
16:00	17.8	200	3.0	4.71	21.5	0.185	375	0.0	1K	0.1	
16:30	collect										
Post-Purge											

Remarks: Pump Intake Depth: 18' Control Box Setting (Hz): 111Hz Sampling: (Sample at 100-250 ml/min)

Water level continues to drop having draw down issues. Dried pump down. 16:00 pump off well dry will be back for half hour sample -

SAMPLING

Depth to Water Before Sampling: 15.8 After Purge:

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: EPA-320B-102014 QC Sample: NONE

Sample Date/Time: 10-20-14 16:30

Sampler / Signature: [Signature]

Filtered Metals Collected: (Y) N Filter Size:

Sample Observations: yellow Brown Uggie 0.1, 50211

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters:

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-31-08</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. S. B. B. / K. N. B. B.</u>		Date: <u>10/20/14</u>	Project #: <u>431007</u>
Well Depth (ft.):	<u>Purge Methodology:</u>	Diameter	Gal. Per Foot
DTW (ft.):	<u>USEPA - Low Flow</u>	2"	.163
Water Column (ft.):	<u>Sampling Procedures</u>	5"	1.020
Well Diameter (in.):	<u>with submersible pump</u>	6"	1.469
Gal. per ft.:	<u>Water Quality Meter:</u>	8"	2.611
Well Volume (gal.):	<u>Horiba U-52</u>		
Depth of Screen (ft.): <u>15.25</u>			

Field Parameters											
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial	1532	15.70	400	6.0	18.14	0.176	254	3.21	OVER	0.1	Yellow BROWN
	1537	15.82	500	0.4	5.9	18.51	0.183	265	1.32	OVER	0.1
	1542	15.91	500	1.8	6.0	18.28	0.183	273	0.88	957	0.1
	1547	15.93	500	2.8	6.0	18.12	0.141	279	0.69	OVER	0.1
	1552	15.95	500	3.8	6.0	18.15	0.184	285	0.51	OVER	0.1
	1557	15.97	500	4.8	6.0	18.17	0.185	286	0.49	77.9	0.1
	1602	15.96	500	5.8	6.0	18.06	0.179	288	0.45	62.5	0.1
	1607	15.95	500	6.8	6.0	18.48	0.143	289	0.43	58.1	0.1
	1612	15.95	500	7.8	6.0	18.32	0.143	290	0.41	53.4	0.1
Post-Purge	1641	15.75	300	6.1	18.36	0.148	272	2.45	40.2	0.1	Yellow

Remarks:	<u>Pump Intake Depth:</u>	<u>Control Box Setting (Hz):</u>	<u>Sampling: (Sample at 100-250 ml/min)</u>
	<u>20.5</u>	<u>95</u>	<u>250</u>

SAMPLING	
Depth to Water Before Sampling:	<u>15.95</u>
Sample Methodology:	<u>USEPA - Low Flow Sampling Procedures with submersible pump</u>
Sample Name:	<u>EPA-31-08-102014</u>
QC Sample:	<u>✓</u>
Sample Date/Time:	<u>10/20/14 16:20</u>
Sampler / Signature:	<u>[Signature]</u>
Filtered Metals Collected:	<u>ND</u> Filter Size:
Sample Observations:	<u>Yellow</u>
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>HEX CS, METALS, Cl/SULFATE, SULFIDE, TOC, ALK, METHANE, NITRITE, NITRATE</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-13-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>D. Holmes</u>		Date: <u>12/18/14</u>	Project #: <u>431007.04.03.05</u>
Well Depth (ft.): <u>32</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>12.2</u>	USEPA - Low Flow	2" <u>.163</u>	5" 1.020
Water Column (ft.): <u>19.8</u>	Sampling Procedures	3" .367	6" 1.469
Well Diameter (in.): <u>2</u>	with submersible pump	4" .653	8" 2.611
Gal. per ft.: <u>0.163</u>	Water Quality Meter:		
Well Volume (gal.): <u>3.23</u>	Horiba U-52		
Depth of Screen (ft.): <u>22-32</u>			

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 1118	13.30	500	0.0	7.59	16.17	0.987	-155	2.19	12.7	0.5	Clear/sulfur-like color
1123	13.40	400	0.6	7.55	16.98	0.994	-185	2.02	11.04	0.5	" "
1128	13.40	400	1.2	7.55	17.25	0.997	-200	1.97	7.52	0.5	" "
1133	13.40	400	1.8	7.54	17.32	1.00	-212	1.94	5.53	0.5	" "
1138	13.40	400	2.5	7.54	17.40	1.00	-218	1.92	5.29	0.5	" "
1143	13.40	400	3.1	7.53	17.63	1.00	-224	2.04	5.15	0.5	" "
1148	13.40	400	3.6	7.53	17.67	1.00	-229	1.98	7.07	0.5	" "
1155				Collect Sample							
Post-Purge 1217	13.58	400	5.5	7.54	17.85	1.02	-172	1.79	8.74	0.5	" "

Remarks: <u>Pump Intake Depth: 27'</u>	<u>Control Box Setting (Hz): 85.4</u>	<u>Sampling: (Sample at 100-250 ml/min)</u>
<p>Ferrous Iron: 0.00 mg/L</p>		

SAMPLING	
Depth to Water Before Sampling: <u>13.40</u>	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>GGGC-EPA-13-03-03</u>	QC Sample: <u>Field Dip for Hex Chrom and Total Chrom</u>
Sample Date/Time: <u>12/18/14</u>	
Sampler / Signature: <u>D. Holmes / Daniel Holman</u>	
Filtered Metals Collected: <u>B/N</u> Filter Size: <u>0.45 mm</u>	
Sample Observations: <u>No issues</u>	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>Hex Chrom, Total Chrom, Pilot Study Parameters</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-29-013</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>A Harderick</u>		Date: <u>12/17/14</u>	Project #: <u>431007.04.03.05</u>
Well Depth (ft.): <u>19.30</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>10.78</u>	USEPA - Low Flow	2"	.163
Water Column (ft.): <u>8.52</u>	Sampling Procedures	3"	.367
Well Diameter (in.): <u>2</u>	with submersible pump	4"	.653
Gal. per ft.: <u>0.163</u>	Water Quality Meter:	Diameter	Gal. Per Foot
Well Volume (gal.): <u>1.4</u>	Horiba U-52	5"	1.020
Depth of Screen (ft.): <u>15-20</u>		6"	1.469
		8"	2.611

PAGE 1 of 2

Field Parameters

Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 9:10	11.44	320	—	5.11	16.01	1.17	266	0.57	30.1	0.6	yellow, no odor
9:15	11.48	330	0.7	4.45	16.44	1.17	268	0.24	21.7	0.6	greenish yellow, no odor
9:20	No measurements - phone call from James										
9:25	11.50	340	2.1	4.68	16.86	1.20	296	0.00	13.15	0.6	Same as above (SAA)
9:30	11.50	330	2.5	4.58	16.89	1.21	313	0.00	11.47	0.6	SAA
9:35	11.48	330	3.0	4.43	16.93	1.24	333	0.00	9.58	0.6	SAA
9:40	11.49	330	3.7	4.30	17.01	1.26	355	0.00	8.86	0.6	SAA
9:45	11.49	330	4.2	4.20	17.10	1.29	372	0.00	8.65	0.6	SAA
9:50	11.49	340	5.0	4.00	17.08	1.31	394	0.00	7.39	0.7	SAA
9:55	11.46	340	5.4	3.84	17.05	1.32	411	0.00	7.05	0.7	SAA
10:00	11.47	340	5.8	3.73	17.17	1.34	421	0.00	6.71	0.7	SAA
Post-Purge 10:57	11.48	350	8.9	3.12	17.33	1.44	478	0.00	6.95	0.7	SAA

Remarks: Pump Intake Depth: 17.5 Control Box Setting (Hz): 79.70 Sampling: (Sample at 100-250 ml/min)

- Ferrous Iron hatch result: 0.00 mg/L

SAMPLING

Depth to Water Before Sampling: 10.48

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: GCGC - EPA-29-013-05 QC Sample: None

Sample Date/Time: 12/17/14 / 10:35

Sampler / Signature: A Harderick / G. S. K. J.

Filtered Metals Collected: (Y) N Filter Size: 0.45 um

Sample Observations: Greenish yellow color, no odor observed

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: Hexavalent chromium, total chromium, dissolved chromium + iron, total iron, sulfide, sulfate, chloride, total organic carbon

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: EPA-29-0B		Site: Garfield Groundwater Contamination Superfund Site	
Field Crew: A. Harklerode		Date: 12/17/14 Project #: 431007.04.03.05	
Well Depth (ft.):	<u>Purge</u> Methodology:	Diameter	Gal. Per Foot
DTW (ft.):	USEPA - Low Flow	2"	.163
Water Column (ft.):	Sampling Procedures	3"	.367
Well Diameter (in.):	with submersible pump	4"	.653
Gal. per ft.:	<u>Water Quality Meter:</u>	Diameter	Gal. Per Foot
Well Volume (gal.):	Horiba U-52	5"	1.020
Depth of Screen (ft.):		6"	1.469
		8"	2.611

PAGE 2 of 2

[illegible]

Post-Purge

Remarks: Pump Intake Depth:

Control Box Setting (Hz):

Sampling: (Sample at 100-250 ml/min)

See Page 1

SAMPLING

Depth to Water Before Sampling:

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name:

QC Sample:

Sample Date/Time:

Sampler / Signature:

Filtered Metals Collected: Y / N Filter Size:

Sample Observations:

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters:

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-30-013</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>D. Holmes</u>		Date: <u>12/18/14</u>	Project #: <u>431007.04.03.05</u>
Well Depth (ft.): <u>22</u>	<u>Purge Methodology:</u> USEPA - Low Flow Sampling Procedures with submersible pump <u>Water Quality Meter:</u> Horiba U-52	Diameter	Gal. Per Foot
DTW (ft.): <u>12.55</u>		2"	.183
Water Column (ft.): <u>9.45</u>		3"	.367
Well Diameter (in.): <u>2</u>		5"	1.020
Gal. per ft.: <u>0.163</u>		6"	1.469
Well Volume (gal.): <u>154</u>		4"	.653
Depth of Screen (ft.): <u>17-22</u>		8"	2.611

Field Parameters

Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 0844	13.20	320	0.0	7.39	12.22	1.30	73	9.43	88	0.6	Brownish, dark/No odor
0849	13.29	320	0.3	6.93	13.96	1.27	76	5.14	63	0.6	" "
0854	13.53	320	0.6	7.00	15.28	1.27	-12	4.16	23.6	0.6	" "
0859	13.53	300	0.9	7.02	15.62	1.26	-20	3.72	12.9	0.6	Clear/No odor
0904	13.48	300	1.2	7.02	15.89	1.26	-22	3.43	11.64	0.6	" "
0909	13.45	300	1.5	7.62	15.93	1.26	-19	3.31	10.02	0.6	" "
0914	13.25	150	1.8	7.04	15.48	1.26	-17	3.24	19.2	0.6	" "
0919	13.20	150	2.1	7.06	15.97	1.27	-14	3.12	11.5	0.6	" "
0924	13.95	500	2.6	7.05	16.57	1.25	-13	3.09	14.68	0.6	" "
0929	13.05	100	2.8	7.06	15.79	1.26	-12	3.02	14.08	0.6	" "
0934	12.96	150	3.0	7.06	15.64	1.25	-9	2.93	11.54	0.6	" "
Post-Purge 0939	12.95	150	3.2	7.07	16.26	1.25	-5	2.83	10.87	0.6	" "

Remarks: Pump Intake Depth: 19.5'Control Box Setting (Hz): 97.30

Sampling: (Sample at 100-250 ml/min)

- Issues getting consistent flow rate

158.40

SAMPLING

Depth to Water Before Sampling:

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name:

QC Sample:

Sample Date/Time:

Sampler / Signature:

Filtered Metals Collected: Y / N Filter Size:

Sample Observations:

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters:

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-30-05 (cont.)</u>						Site: <u>Garfield Groundwater Contamination Superfund Site</u>							
Field Crew:						Date: <u>Project #: 431007.04.03.05</u>							
Well Depth (ft.):		<u>Purge</u>				Diameter		Gal. Per Foot		Diameter		Gal. Per Foot	
DTW (ft.):		<u>Methodology:</u>				2"		.163		5"		1.020	
Water Column (ft.):		USEPA - Low Flow				3"		.367		6"		1.469	
Well Diameter (in.):		Sampling Procedures				4"		.653		8"		2.611	
Gal. per ft.:		with submersible pump											
Well Volume (gal.):		<u>Water Quality Meter:</u>											
Depth of Screen (ft.):		Horiba U-52											
Field Parameters													
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. (Surface) (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor		
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%				
Initial 0944	14.48	500	3.7	7.09	19.48	1.25	-9	5.54	24.4	0.6	Clear/No odor		
0949	14.10	400	4.1	7.07	19.15	1.23	-7	5.07	15.1	0.6	" "		
0954	13.70	350	4.4	7.03	18.66	1.21	3	2.26	11.53	0.6	" "		
0959	13.84	350	4.9	7.08	18.00	1.19	-16	2.29	9.36	0.6	" "		
1004	13.95	350	5.5	7.07	18.82	1.19	-10	2.17	8.28	0.6	" "		
1009	14.10	350	5.9	7.04	18.72	1.19	-3	2.17	7.03	0.6	" "		
1015	Collect Sample												
Post-Purge 1035	15.0		9.0	7.06	19.14	1.21	8	2.09	51.5	0.6			
Remarks: <u>Pump Intake Depth:</u> <u>Control Box Setting (Hz):</u> <u>Sampling: (Sample at 100-250 ml/min)</u> <div style="text-align: center; font-size: 1.2em;">Ferrous Iron: 0.15 mg/L</div>													
SAMPLING													
Depth to Water Before Sampling: <u>14.1'</u>													
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>													
Sample Name: <u>GCGC-EPA-30-05</u>						QC Sample: <u>None</u>							
Sample Date/Time: <u>12/18/14 / 1015</u>													
Sampler / Signature: <u>D. Holmes / Daniel Holmes</u>													
Filtered Metals Collected: <u>M / N</u> Filter Size: <u>0.45 um</u>													
Sample Observations: <u>No issues</u>													
Notes: ¹ = stabilization of this parameter is not required prior to collecting sample													
Parameters: <u>Hex Chrom, Total Chrom, Pilot Study Parameters</u>													

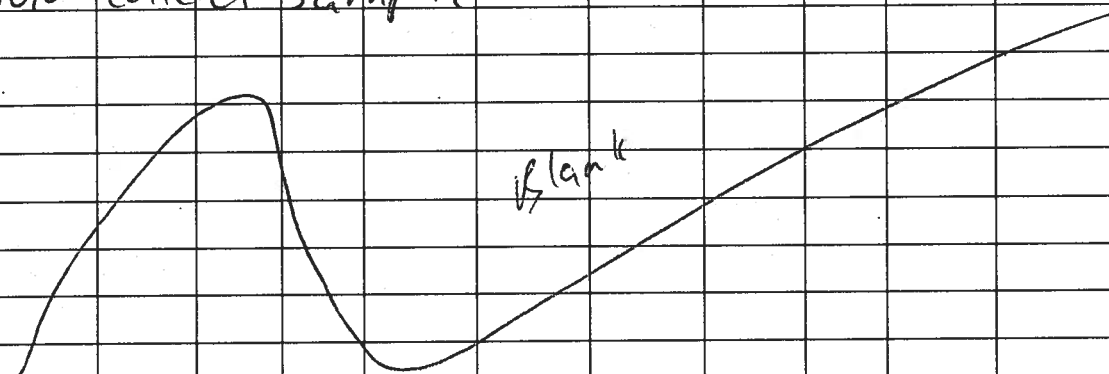
Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: EPA-31-03				Site: Garfield Groundwater Contamination Superfund Site							
Field Crew: B9193				Date: 12/18				Project #: 431007.04.03.05			
Well Depth (ft.): 25.0 DTW (ft.): 12.46 Water Column (ft.): 12.54 Well Diameter (in.): 3" Gal. per ft.: .163 Well Volume (gal.): 210.25 Depth of Screen (ft.): 14.25				Purge Methodology: USEPA - Low Flow Sampling Procedures with submersible pump Water Quality Meter: Horiba U-52				Diameter Gal. Per Foot 2" .163 3" .367 4" .653 Diameter Gal. Per Foot 5" 1.020 6" 1.469 8" 2.611			
Field Parameters											
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. (Surface) (mg/l)	Turbidity (NTU)	Salinity (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial	0848	13.25	425	7.49	12.81	1.50	266	3.15	488	0.8	yellow/none
	0853	13.02	350	5.44	14.43	1.60	347	1.02	270	0.8	yellow/none
	0858	13.05	350	5.34	15.93	1.61	347	.72	202	0.8	yellow/none
	0903	13.00	350	5.36	16.24	1.63	347	.57	186	0.8	yellow/none
	0908	13.02	340	5.40	16.44	1.64	346	.44	144	0.8	yellow/none
	0918	13.02	340	5.50	16.73	1.66	343	.24	89.3	0.8	yellow/none
	0928	13.00	350	5.95	16.85	1.68	340	.10	64.6	0.8	yellow/none
	0933	13.00	350	5.62	16.89	1.69	338	0.00	56.4	0.9	yellow/none
	0938	13.00	350	5.66	16.94	1.70	337	0.00	52.0	0.9	yellow/none
	0943	13.00	340	5.74	16.88	1.72	334	0.00	47.1	0.9	yellow/none
	0948	13.00	350	5.77	16.88	1.73	334	0.00	40.8	0.9	yellow/none
Post-Purge	0953	13.00	350	5.78	16.97	1.73	333	0.00	38.7	0.9	yellow/none
Remarks: Pump Intake Depth: 20 Control Box Setting (Hz): 86.40 Sampling: (Sample at 100-250 ml/min) 250 Ferric Iron - Error limit - yellow water color interference reading											
SAMPLING											
Depth to Water Before Sampling: 13.00											
Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump											
Sample Name: GCG - EPA-31-03-05 : QC Sample: none											
Sample Date/Time: 12/18/14 1010											
Sampler / Signature: [Signature]											
Filtered Metals Collected: [X] N Filter Size: .45											
Sample Observations:											
Notes: 1 = stabilization of this parameter is not required prior to collecting sample											
Parameters: 0.56 / Pilot study											

12.5
16.3
3.75
7.50

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EA-31-013</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>Balas</u>		Date: <u>12/18/10</u>	Project #: <u>431007.04.03.05</u>
Well Depth (ft.):	<u>See page 1</u>	Purge Methodology:	
DTW (ft.):		USEPA - Low Flow	
Water Column (ft.):		Sampling Procedures	
Well Diameter (in.):		with submersible pump	
Gal. per ft.:		Water Quality Meter:	
Well Volume (gal.):		Horiba U-52	
Depth of Screen (ft.):			

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
0958	13.00	350	6.8	5.80	14.94	1.74	331	0.00	35.2	0.9	yellow/ma
1003	13.00	350	7.3	5.81	16.92	1.74	331	0.00	36.9	0.9	yellow/ma
1010	collect sample										
											
1028	13.00	250	-	5.90	16.08	1.79	326	0.00	34.1	0.9	yellow/ma

Remarks: Pump Intake Depth: Control Box Setting (Hz): Sampling: (Sample at 100-250 ml/min)

See page 1

SAMPLING	
Depth to Water Before Sampling:	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name:	QC Sample:
Sample Date/Time:	
Sampler / Signature:	
Filtered Metals Collected: <u>Y / N</u>	Filter Size:
Sample Observations:	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters:	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-32-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>A. Harclerode</u>		Date: <u>12/17/14</u>	Project #: <u>431007.04.03.05</u>
Well Depth (ft.): <u>19.55</u>	Purge Methodology:	Diameter Gal. Per Foot	
DTW (ft.): <u>12.79</u>	USEPA - Low Flow	2" .163	5" 1.020
Water Column (ft.): <u>6.76</u>	Sampling Procedures	3" .367	6" 1.469
Well Diameter (in.): <u>2</u>	with submersible pump	4" .653	8" 2.611
Gal. per ft.: <u>0.163</u>	Water Quality Meter:		
Well Volume (gal.): <u>1.1</u>	Horiba U-52		
Depth of Screen (ft.): <u>10-20</u>			

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 11:40	13.30	400	—	3.51	16.22	1.73	462	0.76	50.7	0.9	brownish yellow, no od
11:45	13.77	390	1.0	3.75	17.62	1.71	440	0.00	33.8	0.9	Same as above (SAA)
11:50	14.06	410	1.6	3.74	18.01	1.71	439	0.00		0.9	SAA
11:55	No measurements - pump rate inconsistency										
12:00	14.01	310	2.5	3.60	18.62	1.67	451	0.00	35.3	0.8	SAA
12:10	16.90	420	4.0	3.46	18.07	1.70	466	0.00	34.1	0.9	SAA
12:15	16.35	400	4.5	3.26	17.79	1.68	485	0.19	13.9	0.8	SAA
12:20	16.18	410	5.1	3.25	17.91	1.68	487	0.17	9.81	0.8	SAA
12:25	15.90	420	5.6	3.25	17.91	1.67	488	0.14	6.86	0.8	SAA
12:30	15.95	400	6.0	3.25	17.87	1.68	488	0.14	4.39	0.8	SAA
12:35	Collect Sample										
Post-Purge 12:45	15.05	330	6.2	3.37	17.28	1.68	476	0.59	4.05	0.8	SAA

Remarks: Pump Intake Depth: 15' b/lc - lowered to 16.8' b/lc of pumping issues Control Box Setting (Hz): 90.80 - 97.50 Sampling: (Sample at 100-250 ml/min) 90.50

Ferrous Iron Hach Result: 0.27 mg/L

SAMPLING	
Depth to Water Before Sampling:	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>GLGC-EPA-32-03-05</u>	QC Sample: <u>None</u>
Sample Date/Time: <u>12/17/14 1235</u>	
Sampler / Signature: <u>A. Harclerode</u>	
Filtered Metals Collected: <u>01 N</u>	Filter Size: <u>0.45 um</u>
Sample Observations: <u>brownish yellow, no odor</u>	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>Hexavalent chromium, total and dissolved chromium and iron,</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-32-03</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>D. Holmes</u>		Date: <u>2/5/15</u> Project #: <u>431007.06.06.02</u>	
Well Depth (ft.): <u>20</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>13.40</u>	USEPA - Low Flow	<u>2"</u>	<u>.163</u>
Water Column (ft.): <u>6.60</u>	Sampling Procedures	5"	1.020
Well Diameter (in.): <u>2</u>	with submersible pump	6"	1.469
Gal. per ft.: <u>0.163</u>	Water Quality Meter:	8"	2.611
Well Volume (gal.): <u>1.08</u>	Horiba U-52		
Depth of Screen (ft.): <u>10-20</u>			

Field Parameters

	Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
	Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial	1352	13.70	200	0.0	5.81	11.77	1.64	381	0.93	121	0.8	Yellow/Green, No odor
	1357	13.68	200	0.4	5.31	13.05	1.57	414	0.00	74.6	0.8	" "
	1402	13.55	200	0.6	5.20	13.90	1.58	422	0.00	48.7	0.8	" "
	1407	13.60	150	0.7	5.14	12.70	1.60	427	0.00	37.5	0.8	" "
	1412	13.60	100	1.0	5.12	14.32	1.56	428	0.00	48.9	0.8	" "
	1417	13.64	100	1.2	5.09	15.76	1.56	434	0.00	57.6	0.8	" "
	1422	13.62	100	1.5	5.05	15.55	1.58	435	0.00	73.7	0.8	" "
	1427	13.62	100	1.7	5.04	17.51	1.55	420	0.00	170	0.8	" "
	1432	13.65	150	2.0	5.05	19.18	1.54	418	0.00	265	0.8	" "
	1437	13.68	100	2.2	5.02	20.33	1.54	419	0.00	232	0.8	" "
	1445			Collect Sample								
Post-Purge	1525	13.65	150	3.2	5.05	17.03	1.56	444	0.20	102	0.8	" "

Remarks: Pump Intake Depth: 15 Control Box Setting (Hz): 123 Sampling: (Sample at 100-250 ml/min)

- Issues maintaining flow rate, equipment issue

SAMPLING

Depth to Water Before Sampling: 13.65

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: GCL-EPA-32-03-05 QC Sample: None

Sample Date/Time: 2/5/15 / 1445

Sampler / Signature: D. Holmes / [Signature]

Filtered Metals Collected: 0 / N Filter Size: 0.45 um

Sample Observations: Flow rate issues

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: Hex Chrom, full suite

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: GA-30-08						Site: Garfield Groundwater Contamination Superfund Site							
Field Crew: T. Sullivan						Date: 2/5/15 Project #: 431007.06.06.02							
Well Depth (ft.): 22 DTW (ft.): 12.74 Water Column (ft.): Well Diameter (in.): 2" Gal. per ft.: 0.165 Well Volume (gal.): Depth of Screen (ft.): 17-22						Purge Methodology: USEPA - Low Flow Sampling Procedures with submersible pump Water Quality Meter: Horiba U-52							
						Diameter		Gal. Per Foot		Diameter		Gal. Per Foot	
						2"		.163		5"		1.020	
						3"		.367		6"		1.469	
						4"		.653		8"		2.611	
Field Parameters													
Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor		
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%				
Initial	1316	13.30	300	-	6.90	10.90	1.10	-27	0.30	210	0.5	LT BROWN	
	1321	13.89	300	0.3	6.67	12.42	1.09	-53	0.00	66.5	0.5	" "	
	1326	13.85	300	0.6	6.44	12.79	1.09	-65	0.00	78.3	0.5	37.7 NTU	
	1331	13.81	300	0.9	6.37	13.01	1.09	-63	0.00	90.9	0.5	CLEAR	
	1336	13.83	300	1.2	6.31	13.16	1.09	-63	0.00	180	0.5	LIGHT BROWN	
	1341	13.84	300	1.6	6.25	13.31	1.09	-60	0.00	159	0.5	LIGHT BROWN	
	1346	13.84	300	1.9	6.22	13.23	1.09	-57	0.00	88	0.5	" "	
	1351	13.83	300	2.3	6.21	13.27	1.09	-51	0.00	79	0.5	" "	
	1356	13.82	300	2.6	6.21	13.24	1.09	-49	0.00	78	0.5	" "	
1405	COLLECT SAMPLE												
Post-Purge	1415	13.78	300	-	6.38	13.85	1.08	-78	0.00	252	0.5	LT BROWN	
Remarks: Pump Intake Depth: 19.5' Control Box Setting (Hz): 85 Sampling: (Sample at 100-250 ml/min)													
SAMPLING													
Depth to Water Before Sampling:													
Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump													
Sample Name: GA-30-08-020515 QC Sample: X													
Sample Date/Time: 1405 2/5/15													
Sampler / Signature: <i>[Signature]</i>													
Filtered Metals Collected: 0/1 N Filter Size:													
Sample Observations: LT BROWN													
Notes: 1 = stabilization of this parameter is not required prior to collecting sample													
Parameters: SULL													

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EPA-13-08</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. S. [Signature]</u>		Date: <u>2/5/15</u>	Project #: <u>431007.06.06.02</u>
Well Depth (ft.): <u>32'</u>	Purge Methodology:	Diameter	Gal. Per Foot
DTW (ft.): <u>12.97</u>	USEPA - Low Flow	2"	.163
Water Column (ft.):	Sampling Procedures	3"	.387
Well Diameter (in.): <u>2</u>	with submersible pump	4"	.653
Gal. per ft.: <u>0.163</u>	Water Quality Meter:	Diameter	Gal. Per Foot
Well Volume (gal.):	Horiba U-52	5"	1.020
Depth of Screen (ft.): <u>22-32</u>		6"	1.469
		8"	2.611

Field Parameters

	Time	DTW (ft)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
	Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial	1142	14.40	400	/	7.35	13.35	0.961	-188	0.70	63.3	0.5	CLEAR
	1147	13.95	300	0.4	7.17	13.01	0.945	-201	0.05	12.1	0.5	CLEAR
	1152	13.85	250	0.6	6.85	14.05	0.975	-190	0.00	12.1	0.5	CLEAR
	11:57	13.82	250	0.8	6.63	14.45	0.983	-192	0.00	10.5	0.5	CLEAR
	1202	13.82	250	1.0	6.60	14.52	0.997	-192	0.00	9.3	0.5	CLEAR
	1207	13.83	250	1.2	6.59	14.69	0.996	-194	0.00	10.9	0.5	" "
	1212	13.83	250	1.4	6.77	14.68	1.01	-207	0.00	10.4	0.5	" "
	1217	13.82	250	1.6	7.07	14.75	1.01	-223	0.00	9.2	0.5	" "
	1222	13.82	250	1.9	7.18	14.87	1.01	-229	0.00	9.6	0.5	" "
	1227	13.81	250	2.2	7.18	14.95	1.01	-228	0.00	9.3	0.5	" "
	1236	COLLECT SAMPLE										
Post-Purge	1245	3.87	250	-	7.23	14.01	1.07	-218	0.00	8.3	0.5	CLEAR

Remarks: Pump Intake Depth: 27 Control Box Setting (Hz): 87 Sampling: (Sample at 100-250 ml/min)

SAMPLING

Depth to Water Before Sampling:

Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump

Sample Name: GLGLC-EPA-13-08-020515 QC Sample: ☒

Sample Date/Time: 2/5/15 1230

Sampler / Signature: [Signature]

Filtered Metals Collected: ☒ N Filter Size:

Sample Observations: CLEAR

Notes: 1 = stabilization of this parameter is not required prior to collecting sample

Parameters: Full

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: <u>EAA-29</u>		Site: <u>Garfield Groundwater Contamination Superfund Site</u>	
Field Crew: <u>T. SURSORE</u>		Date: <u>2/6/15</u> Project #: <u>431007.06.06.02</u>	
Well Depth (ft.): <u>20 20</u>	Purge Methodology: <u>USEPA - Low Flow</u>	Diameter	Gal. Per Foot
DTW (ft.): <u>11.08</u>	Sampling Procedures: <u>with submersible pump</u>	2"	.163
Water Column (ft.): <u>2'</u>	Water Quality Meter: <u>Horiba U-52</u>	5"	1.020
Well Diameter (in.): <u>2"</u>		3"	.367
Gal. per ft.: <u>0.163</u>		4"	.653
Well Volume (gal.): <u>15-20</u>		6"	1.469
Depth of Screen (ft.): <u>15-20</u>		8"	2.611

Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
Initial 1116	11.50	300	-	3.11	12.40	1.57	449	0.00	39.2	0.8	YELLOW
1121	11.56	300	0.3	3.13	14.37	1.50	435	0.00	48.7	0.7	YELLOW
1126	11.58	300	0.6	3.13	14.75	1.49	432	0.00	117	0.7	" "
1131	11.61	300	0.9	3.14	15.06	1.48	428	0.00	109	0.7	" "
1136	11.61	300	1.2	3.15	15.17	1.47	427	0.00	24.7	0.7	" "
1141	11.62	300	1.5	3.15	15.25	1.47	425	0.00	22.0	0.7	" "
1146	11.63	300	1.8	3.13	15.29	1.49	427	0.00	19.6	0.7	" "
1150		COLLECT		SAMPLE							
Post-Purge 1216	11.64	300	-	3.10	15.46	1.61	447	0.00	29.6	0.8	YELLOW

Remarks:	Pump Intake Depth: <u>17.5</u>	Control Box Setting (Hz): <u>81</u>	Sampling: (Sample at 100-250 ml/min)
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SAMPLING	
Depth to Water Before Sampling: <u>11.63</u>	
Sample Methodology: <u>USEPA - Low Flow Sampling Procedures with submersible pump</u>	
Sample Name: <u>GCL-EAA-29-08-020615</u>	QC Sample: <u>X</u>
Sample Date/Time: <u>2/6/15 1150</u>	
Sampler / Signature: <u>[Signature]</u>	
Filtered Metals Collected: <u>0</u> N Filter Size: <u></u>	
Sample Observations: <u>yellow</u>	
Notes: 1 = stabilization of this parameter is not required prior to collecting sample	
Parameters: <u>FULL SUITE</u>	

Low-Flow Groundwater Sampling: Field Data Sheet

Well Number: EPA-31-08				Site: Garfield Groundwater Contamination Superfund Site							
Field Crew: D. Holmes				Date: 2/6/15 Project #: 431007.06.06.02							
Well Depth (ft.): 25		Purge Methodology:		Diameter		Gal. Per Foot		Diameter		Gal. Per Foot	
DTW (ft.): 13.18		USEPA - Low Flow		4"		.163		5"		1.020	
Water Column (ft.): 11.82		Sampling Procedures		3"		.367		6"		1.469	
Well Diameter (in.): 2		with submersible pump		4"		.653		8"		2.611	
Gal. per ft.: 0.163		Water Quality Meter:									
Well Volume (gal.): 1.93		Horiba U-52									
Depth of Screen (ft.): 15-25											
Field Parameters											
Time	DTW (tic)	Flow Rate (ml/min)	Total Volume (gal)	pH (Std. Units)	Temp (C)	Cond. (mS/cm)	ORP (mV)	D.O. [Surface] (mg/l)	Turbidity (NTU)	Salinity ¹ (PPT)	Color/Odor
Stabilization	< 0.3'	Purge at 200-500		+/- 0.1		+/- 3 %	+/- 10 mV	+/- 10%	+/- 10%		
1031	13.60	400	0.0	4.69	10.97	1.50	387	2.05	113	0.7	Yellow/green
1036	13.68	480	0.6	4.83	14.26	1.49	378	0.00	92.8	0.7	" "
1041	13.68	480	1.2	4.89	14.79	1.50	374	0.00	75.2	0.8	" "
1046	13.70	480	1.8	4.95	15.00	1.52	371	0.00	55.6	0.8	" "
1051	13.70	480	2.4	5.02	15.11	1.54	367	0.00	39.9	0.8	" "
1056	13.70	480	3.0	5.09	15.14	1.56	364	0.00	32.0	0.8	" "
1101	13.70	480	3.6	5.17	15.21	1.58	359	0.00	23.3	0.8	" "
1106	13.70	480	4.2	5.23	15.23	1.59	356	0.00	20.3	0.8	" "
1111	13.70	480	4.8	5.28	15.32	1.60	354	0.00	19.7	0.8	" "
1116	13.70	480	5.4	5.36	15.29	1.61	350	0.00	18.3	0.8	" "
1120	—	—	Collect	Sample	—	—	—	—	—	—	—
1150	13.80	480	8.0	5.46	12.74	1.72	341	2.82		0.9	" "
Remarks: Pump Intake Depth: 20 Control Box Setting (Hz): 87 Sampling: (Sample at 100-250 ml/min)											
SAMPLING											
Depth to Water Before Sampling: 13.70											
Sample Methodology: USEPA - Low Flow Sampling Procedures with submersible pump											
Sample Name: GC6C-EPA-31-08-05						QC Sample: Field Dup					
Sample Date/Time: 2/6/15 / 1120											
Sampler / Signature: D. Holmes / Daniel Holmes											
Filtered Metals Collected: Y / N Filter Size: 0.45 um											
Sample Observations: None											
Notes: 1 = stabilization of this parameter is not required prior to collecting sample											
Parameters: Full suite											

Attachment 6
Vironex Injection Services Report

Injection Services Report

Prepared for:



Prepared by:



Garfield Groundwater Contamination Superfund Site

Garfield, NJ

June 23, 2014 – July 2, 2014

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Table of Contents

Project Summary.....	1
Site Map	2
Injection Summary	3
Project Photographs	4
Appendix – Injection Logs	6

Project Summary

Project Name: Garfield Superfund Site

Project Dates: June 23, 2014 – July 2, 2014

Manpower: Brendan Gerber (Regional Manager); Robert Jones (Technician); Mat Bacher (Technician)

Equipment: DC5 (Truck Platform) equipped with two stainless steel batch mixing tanks, integrated secondary containment, safety shower and eye wash, Air Diaphragm Pump for distribution.

Tooling: 1.5 inch top down injection tools with a 2 foot screen length and equipped with injection caps

Rental Equipment: Forklift (chemical management) Conex Box (chemical management)

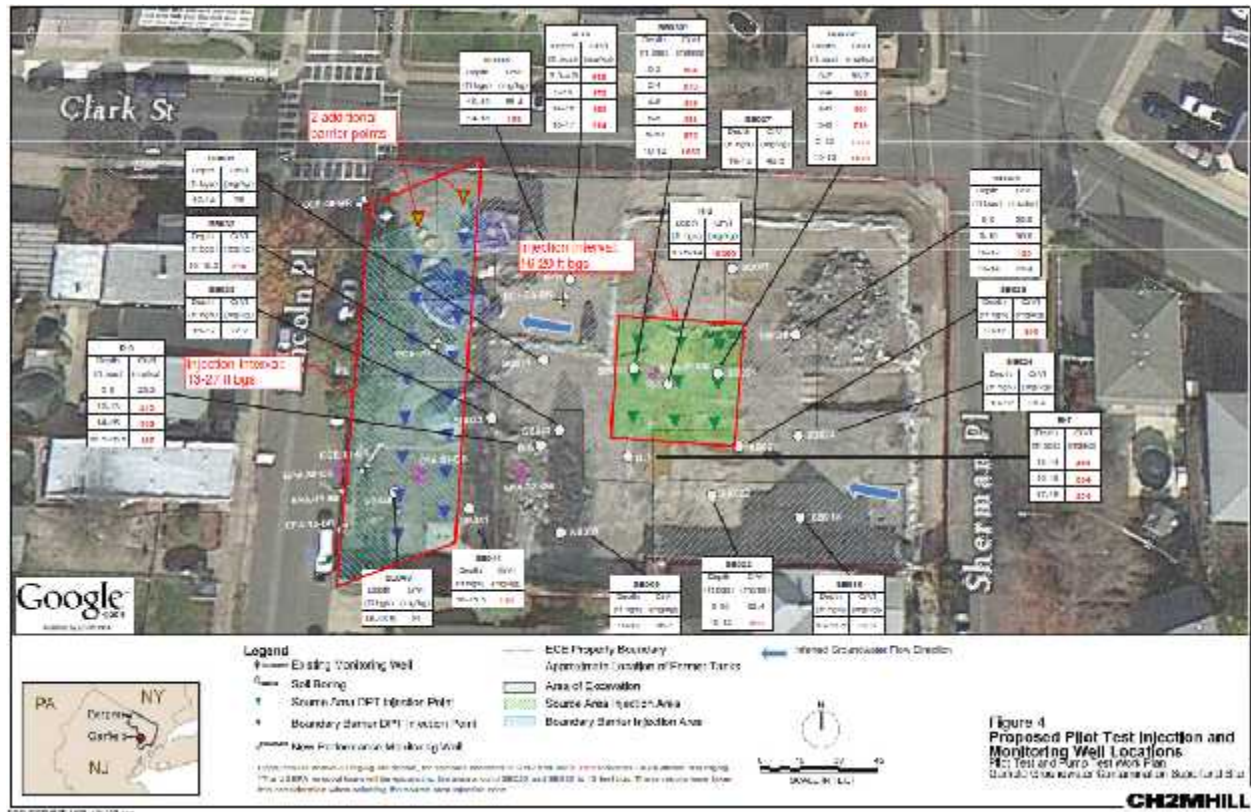
Water Source: Fire Hydrant

Proposed Scope of Work: Vironex proposed to prepare, batch, mix and inject a total of 36,200 gallons of a 60% solution of EVO, Magnesium Sulfate and Water under low pressure and low flow conditions into 25 total locations across the site. Vironex was to provide 3,453 gallons of 60% SRS-SD and 1,347 pounds of Magnesium Sulfate. Vironex proposed to use a 2 foot, top down injection tool for distribution. While injecting at the Reactive Barrier, Vironex proposed a 10 foot to 27 foot injection zone, injecting 1,700 gallons per point at 18 locations. While in the Source Area Vironex proposed a 10 foot to 20 foot injection zone, 1,000 gallons per point at 9 locations.

Project Summary: While injecting into the Reactive Barrier, Vironex encountered difficult drilling; refusal was met between 17 feet and 24 feet causing the injection zones to be adjusted. Vironex switched from a top down 2.25 inch injection tool with pre strung tooling to a 1.5 inch injection tool with an injection cap. Certain locations specified in the injection field logs were offset in the event there was surfacing or refusal was met before an acceptable zone was achieved to start injections.

While injecting into the Source Area, Vironex continued with the 1.5 inch injection tooling. The injection zones again were adjusted due to shallow refusal. Due to the difficult drilling encountered throughout this site, there were a total of 7 injection tools that were lost or broken.

Site Map



Injection Summary

	Date	Time On-Site	Time Off-Site	Lunch Break (hrs)	Total EVO Injected (gal)	Total Magnesium Sulfate Injected (lbs)	Total Water Injected (gal)	Total Solution Volume Injected (gal)	DPT Injection Points Completed
	Running Total >				3,448	1,374	25,254	28,701	29.1
Monday	6/23/2014	10:15 AM	5:00 PM	0.75	-	-	-	-	-
Tuesday	6/24/2014	7:00 AM	5:15 PM	0	115	42	802	916	0.7
Wednesday	6/25/2014	7:00 AM	5:15 PM	0	359	131	2,515	2,875	2.0
Thursday	6/26/2014	7:00 AM	6:00 PM	0	367	135	2,573	2,940	2.1
Friday	6/27/2014	7:00 AM	6:15 PM	0	445	162	2,604	3,049	2.2
Saturday	6/28/2014	7:00 AM	6:30 PM	0	490	179	3,429	3,919	2.8
Sunday	6/29/2014	7:00 AM	5:40 PM	0	503	184	3,520	4,023	2.9
Monday	6/30/2014	7:00 AM	6:10 PM	0	441	162	3,088	3,529	2.5
Tuesday	7/1/2014	7:00 AM	6:00 PM	0	467	209	3,821	4,288	6.0
Wednesday	7/2/2014	7:00 AM	3:00 PM	0	261	170	2,902	3,162	7.9
				Injected	3,448	1,374	25,254	28,701	29

Project Photographs



Vironex Injection Platform



Vironex Direct Push Rig



Injection Manifold



Safety Shower & Eyewash Station



EVO in Secondary Containment



Batch Tank



Magnesium Sulphate



Field Computer for Data Entry



Completed Injection Locations

Appendix – Injection Logs

CH2M HILL
EVO Injections
Garfield Superfund Site, NJ

Vironex Field Data Sheet													
Injection Point ID	Start Date	Start Time	End Date	End Time	Depth	Start Up Pressure (psi)	Average Pressure (psi)	Average Flow Rate (gpm)	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total Gal	Notes
IP-01	6/25/14	1:42 PM	6/25/14	2:58 PM	15' - 17'	25	7	3.0	25	9.1	175	200	
	6/25/14	3:10 PM	6/25/14	4:08 PM	13' - 15'	8	7	3.5	25	9.1	175	200	
IP-01a	6/29/14	10:18 AM	6/29/14	1:15 PM	13' - 15'	30	20	2.0	38	13.7	263	300	
	6/29/14	1:27 PM	6/29/14	5:26 PM	15' - 17'	25	10	3.5	63	22.9	438	500	
	6/30/14	7:41 AM	6/30/14	8:15 AM	15' - 17'	15	15	4.5	19	6.9	131	150	Location complete.
Total H ₂ O 1181	Total EVO 169	Total Epsom Salt 62	Total Solution 1350	Additional Notes: Hit refusal at 17'. Offset location. Put extra volume into IP-04 due to shallow refusal on IP-01.									
IP-02	6/27/14	7:55 AM	6/27/14	8:40 AM	21' - 19'	25	20	2.5	9	3.4	66	75	
	6/27/14	9:36 AM	6/27/14	11:05 AM	21' - 19'	20	19	2.3	42	15.3	125	167	
	6/27/14	11:29 AM	6/27/14	11:48 AM	19' - 17'	10	7	1.0	5	1.9	16	21	
	6/27/14	12:26 PM	6/27/14	3:26 PM	19' - 17'	16	10	2.0	38	13.7	263	300	
	6/27/14	3:35 PM	6/27/14	5:48 PM	17' - 15'	16	14	3.0	32	11.7	224	256	
	6/28/14	8:10 AM	6/28/14	8:24 AM	17' - 15'	15	15	3.0	6	2.0	39	44	
	6/28/14	8:42 AM	6/28/14	12:04 PM	15' - 13'	2	2	2.0	43	15.8	302	345	Location complete.
Total H ₂ O 1034	Total EVO 175	Total Epsom Salt 64	Total Solution 1208	Additional Notes: Bottom up. Refusal at 21'.									
IP-03	6/27/14	2:00 PM	6/27/14	4:25 PM	13' - 15'	35	25	2.5	38	13.7	263	300	
	6/27/14	4:34 PM	6/27/14	5:48 PM	15' - 17'	25	20	3.0	26	9.6	185	211	
	6/28/14	8:10 AM	6/28/14	8:24 AM	15' - 17'	20	20	3.0	6	2.2	43	49	
	6/28/14	8:30 AM	6/28/14	10:44 AM	17' - 19'	15	15	3.0	35	12.8	245	280	
	6/28/14	10:47 AM	6/28/14	1:38 PM	19' - 21'	35	20	2.5	35	12.8	245	280	
	6/28/14	1:45 PM	6/28/14	3:27 PM	21' - 23'	45	20	3.5	35	12.8	245	280	Refusal at 23'. Location complete.
Total H ₂ O 1225	Total EVO 175	Total Epsom Salt 64	Total Solution 1400	Additional Notes:									
IP-04	6/26/14	8:15 AM	6/26/14	11:56 AM	13' - 15'	5	5	2.0	25	9.1	175	200	Surfacing through the annulus.
	6/26/14	12:04 PM	6/26/14	1:49 PM	15' - 17'	28	16	2.0	25	9.1	175	200	
	6/26/14	2:18 PM	6/26/14	3:36 PM	17' - 19'	25	12	2.5	25	9.1	175	200	
	6/26/14	3:43 PM	6/26/14	5:13 PM	19' - 21'	40	20	2.5	25	9.1	175	200	
	6/26/14	5:30 PM	6/26/14	5:48 PM	20' - 22'	28	20	2.8	5	2.0	38	43	
	6/27/14	7:50 AM	6/27/14	8:40 AM	20' - 22'	30	25	2.5	20	7.2	137	157	
	6/27/14	9:36 AM	6/27/14	9:56 AM	20' - 22'	27	24	2.5	13	4.6	38	50	
	6/27/14	10:43 AM	6/27/14	11:48 AM	19' - 21'	7	7	2.0	18	6.6	54	72	Surfacing through the annulus. Lowered flow rate.
	6/27/14	12:26 PM	6/27/14	1:16 PM	19' - 21'	16	15	2.0	9	3.1	60	68	Surfacing through the annulus. Abandoned location.
IP-04a	6/29/14	4:28 PM	6/29/14	5:27 PM	19' - 21'	30	25	3.0	17	6.4	122	139	Refusal at 21'. Location complete.
Total H ₂ O 1148	Total EVO 181	Total Epsom Salt 66	Total Solution 1329	Additional Notes: Extra volume into this location due to shallow refusal on IP-01.									

CH2M HILL
EVO Injections
Garfield Superfund Site, NJ

Injection Point ID	Start Date	Start Time	End Date	End Time	Depth	Start Up Pressure (psi)	Average Pressure (psi)	Average Flow Rate (gpm)	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total Gal	Notes
IP-05b	6/28/14	4:15 PM	6/28/14	6:01 PM	13' - 15'	25	20	2.0	27	9.9	190	217	
	6/29/14	7:46 AM	6/29/14	8:11 AM	13' - 15'	22	22	2.5	8	2.9	55	63	
	6/29/14	8:17 AM	6/29/14	10:27 AM	15' - 17'	25	20	3.0	35	12.8	245	280	
	6/29/14	10:38 AM	6/29/14	12:18 PM	17' - 19'	7	7	2.8	35	12.8	245	280	
	6/29/14	12:28 PM	6/29/14	2:34 PM	18' - 20'	7	7	2.8	38	13.7	263	300	Refusal at 20'.
	6/29/14	2:38 PM	6/29/14	3:37 PM	16' - 18'	5	5	3.0	28	10.1	193	220	
	6/29/14	3:40 PM	6/29/14	3:56 PM	16' - 14'	10	10	3.5	5	1.8	35	40	Location complete.
Total H ₂ O 1225	Total EVO 175	Total Epsom Salt 64	Total Solution 1400	Additional Notes: Hit refusal at 5' on IP-05 and IP-05a.									
IP-06	6/25/14	8:53 AM	6/25/14	10:38 AM	15' - 17'		15	2.5	25	9.1	175	200	
	6/25/14	10:50 AM	6/25/14	12:07 PM	17' - 19'		20	2.8	25	9.1	175	200	
	6/25/14	12:15 PM	6/25/14	12:58 PM	18' - 20'		13	3.0	13	4.6	88	100	Hit refusal at 20'. 100 gal into this interval per client request.
IP-06a	6/30/14	8:21 AM	6/30/14	10:23 AM	15' - 17'	15	15	3.0	38	13.7	263	300	
	6/30/14	10:28 AM	6/30/14	1:04 PM	17' - 19'	25	15	3.0	50	18.3	350	400	
	6/30/14	1:15 PM	6/30/14	3:30 PM	19' - 21'	40	20	2.0	25	9.1	175	200	Location complete.
Total H ₂ O 1225	Total EVO 175	Total Epsom Salt 64	Total Solution 1400	Additional Notes:									
IP-07	6/24/14	1:19 PM	6/24/14	2:00 PM	15' - 17'		25	0.5	2	0.7	14	16	Clogged injection tool. Ceased pumping and removed tooling.
	6/26/14	2:42 PM	6/26/14	3:05 PM	21' - 19'	5	4	1.5	5	1.8	35	40	Bottom up injection. Surfacing from annulus.
IP-07a	6/26/14	4:00 PM	6/26/14	5:12 PM	21' - 19'	20	10	2.0	18	6.6	126	144	
	6/26/14	5:28 PM	6/26/14	5:44 PM	19' - 17'	10	3	1.0	2	0.8	16	18	Surfacing through the annulus.
	6/27/14	8:05 AM	6/27/14	8:37 AM	19' - 17'	3	3	1.5	5	1.8	35	40	Surfaced from annulus again.
	6/27/14	9:36 AM	6/27/14	11:22 AM	19' - 17'	2	2	1.0	22	8.0	66	88	Surfaced from annulus again. Abandoned location.
IP-07b	6/30/14	8:45 AM	6/30/14	11:00 AM	24' - 22'	45	40	1.5	25	9.1	175	200	
	6/30/14	11:06 AM	6/30/14	2:00 PM	22' - 20'	40	40	1.5	25	9.1	175	200	
	6/30/14	2:08 PM	6/30/14	3:30 PM	20' - 18'	35	35	1.5	13	4.6	88	100	
	6/30/14	3:40 PM	6/30/14	4:07 PM	18' - 16'	20	15	1.5	7	2.5	47	54	Surfacing from annulus. Remaining volume into IP-08c.
Total H ₂ O 777	Total EVO 124	Total Epsom Salt 45	Total Solution 900	Additional Notes: Lowered flow rate to .5 GPM, however surfacing continued through the annulus. Multiple offsets at this location due to refusal and surfacing. Remaining 500 gallons injected into IP-08c.									
IP-08b	6/28/14	1:08 PM	6/28/14	5:35 PM	15' - 17'	15	15	1.8	35	12.8	245	280	
	6/29/14	7:48 AM	6/29/14	8:47 AM	15' - 17'	5	5	1.5	9	3.4	66	75	Refusal at 17'. Surfacing from annulus.
IP-08c	6/30/14	4:03 PM	6/30/14	6:01 PM	17' - 19'	10	10	3.0	37	13.5	258	295	
	7/1/14	7:40 AM	7/1/14	8:21 AM	17' - 19'	15	15	4.0	31	11.4	219	250	
	7/1/14	8:23 AM	7/1/14	10:58 AM	19' - 21'	17	15	3.5	63	22.9	438	500	
	7/1/14	11:02 AM	7/1/14	1:10 PM	20' - 22'	20	20	4.0	63	22.9	438	500	Refusal at 22'. Location complete.
Total H ₂ O 1663	Total EVO 238	Total Epsom Salt 87	Total Solution 1900	Additional Notes: Hit refusal 3 times at 3'. Refusal on IP-08 at 3' and IP-08a at 5'. Additional 500 gallons injected from IP-07.									

CH2M HILL
EVO Injections
Garfield Superfund Site, NJ

Injection Point ID	Start Date	Start Time	End Date	End Time	Depth	Start Up Pressure (psi)	Average Pressure (psi)	Average Flow Rate (gpm)	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total Gal	Notes
IP-09	6/24/14	3:35 PM	6/24/14	4:35 PM	15' - 17'		5	1.5	13	4.6	88	100	
	6/25/14	8:00 AM	6/25/14	8:45 AM	15' - 17'		13	2.8	13	4.6	88	100	
	6/25/14	9:00 AM	6/25/14	11:10 AM	17' - 19'		10	2.5	25	9.1	175	200	
	6/25/14	11:15 AM	6/25/14	12:30 PM	19' - 21'	40	20	2.8	25	9.1	175	200	Minor surfacing around point. Reduced flow and continued.
	6/25/14	12:43 PM	6/25/14	2:20 PM	21' - 23'		15	2.8	25	9.1	175	200	
	6/25/14	2:33 PM	6/25/14	3:46 PM	23' - 25'	35	10	3.8	25	9.1	175	200	
	6/25/14	3:52 PM	6/25/14	4:52 PM	25' - 27'	30	10	3.5	22	8.0	153	175	
	6/26/14	8:12 AM	6/26/14	8:20 AM	25' - 27'	15	12	3.5	3	1.1	22	25	
	6/26/14	9:00 AM	6/26/14	9:52 AM	26' - 28'	35	35	4.0	25	9.1	175	200	Refusal at 28'. Location complete.
Total H ₂ O 1225	Total EVO 175	Total Epsom Salt 64	Total Solution 1400	Additional Notes: Injection point complete.									
IP-10	6/24/14	1:03 PM	6/24/14	3:16 PM	15' - 17'		10	2.0	25	9.1	175	200	
	6/24/14	3:35 PM	6/24/14	4:40 PM	17' - 19'		10	2.5	25	9.1	175	200	Refusal at 19'.
IP-10a	6/30/14	5:30 PM	6/30/14	6:01 PM	22' - 20'	45	25	3.0	13	4.6	88	100	
	7/1/14	7:50 AM	7/1/14	9:40 AM	22' - 20'	25	25	3.0	38	13.7	263	300	
	7/1/14	9:45 AM	7/1/14	11:15 AM	20' - 18'	20	20	3.5	38	13.7	263	300	
	7/1/14	11:19 AM	7/1/14	12:53 PM	18' - 16'	20	20	3.5	38	13.7	263	300	Location complete.
Total H ₂ O 1225	Total EVO 175	Total Epsom Salt 64	Total Solution 1400	Additional Notes:									
IP-11	6/26/14	10:55 AM	6/26/14	11:35 AM	15' - 17'	28	28	2.0	9	3.4	66	75	
	6/26/14	12:28 PM	6/26/14	1:32 PM	15' - 17'		22	2.0	16	5.7	109	125	
	6/26/14	1:36 PM	6/26/14	3:09 PM	17' - 19'	30	15	2.0	25	9.1	175	200	
	6/26/14	3:27 PM	6/26/14	5:10 PM	19' - 21'	15	10	2.0	25	9.1	175	200	
	6/26/14	5:18 PM	6/26/14	5:48 PM	21' - 23'	25	15	2.5	9	3.2	61	70	
	6/27/14	8:04 AM	6/27/14	8:40 AM	21' - 23'	12	12	2.5	10	3.5	67	76	
	6/27/14	9:36 AM	6/27/14	10:32 AM	21' - 23'	25	24	2.5	25	9.1	75	100	
	6/27/14	11:40 AM	6/27/14	11:48 AM	22' - 24'	25	25	2.5	3	1.2	10	13	
	6/27/14	12:26 PM	6/27/14	2:17 PM	22' - 24'	30	22	2.5	29	10.5	201	230	
	6/27/14	2:25 PM	6/27/14	4:29 PM	20' - 22'	20	17	2.5	28	10.3	197	225	Location complete.
Total H ₂ O 1136	Total EVO 178	Total Epsom Salt 65	Total Solution 1314	Additional Notes: Refusal at 24'.									
IP-12	6/28/14	8:10 AM	6/28/14	8:40 AM	15' - 17'	50	50	0.2	1	0.2	4	5	Clogged injection tool. Ceased pumping and removed tooling.
IP-12a	6/28/14	9:17 AM	6/28/14	11:16 AM	25' - 23'	10	10	3.0	34	12.6	241	275	
	6/28/14	11:20 AM	6/28/14	1:34 PM	23' - 21'	10	10	3.0	35	12.8	245	280	
	6/28/14	1:37 PM	6/28/14	4:25 PM	21' - 19'	7	7	2.0	40	14.6	280	320	Surfacing from annulus. Reduced flow rate.
	6/28/14	4:31 PM	6/28/14	6:01 PM	19' - 17'	15	15	2.5	17	6.3	120	137	
	6/29/14	7:46 AM	6/29/14	8:54 AM	19' - 17'	10	10	2.5	15	5.6	108	123	
	6/29/14	8:58 AM	6/29/14	11:30 AM	17' - 15'	5	5	1.5	33	11.9	228	260	Location complete.
Total H ₂ O 1225	Total EVO 175	Total Epsom Salt 64	Total Solution 1400	Additional Notes:									

CH2M HILL
EVO Injections
Garfield Superfund Site, NJ

Injection Point ID	Start Date	Start Time	End Date	End Time	Depth	Start Up Pressure (psi)	Average Pressure (psi)	Average Flow Rate (gpm)	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total Gal	Notes
IP-13	6/25/14	9:23 AM	6/25/14	11:01 AM	15' - 17'		7	2.5	25	9.1	175	200	
	6/25/14	11:10 AM	6/25/14	12:40 PM	17' - 19'		10	3.0	25	9.1	175	200	
	6/25/14	12:53 PM	6/25/14	1:47 PM	19' - 21'		12	3.5	25	9.1	175	200	
	6/25/14	2:00 PM	6/25/14	2:57 PM	21' - 23'		10	3.5	25	9.1	175	200	
	6/25/14	3:05 PM	6/25/14	3:42 PM	22' - 24'	15	12	3.0	13	4.6	88	100	Refusal at 24'. 100 gal into this interval per client request.
Total H ₂ O 788	Total EVO 113	Total Epsom Salt 41	Total Solution 900	Additional Notes: Extra volume injected into IP-14a. Remaining volume will be injected in the source area.									
IP-14	6/24/14	11:40 AM	6/24/14	1:52 PM	15' - 17'		20	1.5	25	9.1	175	200	
	6/24/14	2:18 PM	6/24/14	3:43 PM	17' - 19'		17	2.8	25	9.1	175	200	Hit refusal at 19'. Pulled tooling and abandoned location.
IP-14a	6/30/14	1:58 PM	6/30/14	4:10 PM	22' - 20'	25	22	3.0	50	18.3	350	400	
	6/30/14	4:17 PM	6/30/14	6:01 PM	20' - 18'	17	17	3.0	38	13.7	263	300	
	7/1/14	7:40 AM	7/1/14	9:55 AM	20' - 18'	20	20	3.8	63	22.9	438	500	Location complete. Additional 200 gallons injected from IP-13.
Total H ₂ O 1400	Total EVO 200	Total Epsom Salt 73	Total Solution 1600	Additional Notes: Hit refusal when trying to advance to the 19'-21' zone. Pulled tooling and abandoned location. Location will be offset. Additional 200 gallons injected from IP-13.									
IP-15	6/26/14	10:15 AM	6/26/14	11:33 AM	15' - 17'	45	30	3.0	25	9.1	175	200	
	6/26/14	11:45 AM	6/26/14	1:49 PM	17' - 19'	45	25	3.0	25	9.1	175	200	
	6/26/14	1:56 PM	6/26/14	2:17 PM	19' - 21'	30	20	3.0	25	9.1	175	200	
	6/26/14	2:28 PM	6/26/14	3:53 PM	21' - 23'	35	18	3.0	25	9.1	175	200	Began surfacing around annulus. Reduced flow to 2 GPM.
	6/26/14	4:11 PM	6/26/14	5:34 PM	23' - 25'	15	15	3.0	25	9.1	175	200	Refusal at 25'.
IP-15a	6/30/14	12:10 PM	6/30/14	1:28 PM	22' - 20'	15	15	3.0	25	9.1	175	200	
Total H ₂ O 1050	Total EVO 150	Total Epsom Salt 55	Total Solution 1200	Additional Notes: Refusal at 25'. Remaining 200 gallons will be injected in the source area.									
IP-16a	6/28/14	3:47 PM	6/28/14	6:01 PM	22' - 20'	40	25	3.5	41	14.9	286	327	
	6/29/14	7:46 AM	6/29/14	7:56 AM	22' - 20'	20	20	3.0	3	1.1	20	23	
	6/29/14	8:10 AM	6/29/14	10:27 AM	21' - 19'	10	10	3.5	44	16.0	306	350	
	6/29/14	10:40 AM	6/29/14	2:58 PM	19' - 17'	10	10	3.0	84	30.6	586	670	
	6/29/14	3:00 PM	6/29/14	5:27 PM	17' - 15'	10	10	3.0	50	18.3	350	400	
	6/30/14	7:41 AM	6/30/14	9:17 AM	17' - 15'	10	10	4.0	41	15.1	289	330	Location complete.
Total H ₂ O 1838	Total EVO 263	Total Epsom Salt 96	Total Solution 2100	Additional Notes: Hit refusal on first attempt with 2.25" inner hose tooling. Switched to 1.5" tooling. Injecting extra volume into this location due to multiple refusals at IP-27.									

CH2M HILL
EVO Injections
Garfield Superfund Site, NJ

Injection Point ID	Start Date	Start Time	End Date	End Time	Depth	Start Up Pressure (psi)	Average Pressure (psi)	Average Flow Rate (gpm)	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total Gal	Notes
IP-26	6/27/14	12:42 PM	6/27/14	3:17 PM	24' - 22'	30	20	2.5	38	13.7	263	300	
	6/27/14	3:26 PM	6/27/14	5:37 PM	22' - 20'	15	12	3.0	38	13.7	263	300	
	6/28/14	8:35 AM	6/28/14	10:43 AM	20' - 18'	15	12	3.0	33	12.1	232	265	
	6/28/14	10:38 AM	6/28/14	1:13 PM	18' - 16'	8	8	3.0	33	12.1	232	265	
	6/28/14	1:22 PM	6/28/14	3:05 PM	17' - 15'	10	10	3.0	34	12.3	236	270	Location complete.
Total H ₂ O 1225	Total EVO 175	Total Epsom Salt 64	Total Solution 1400	Additional Notes: Refusal at 24'.									
IP-27d	6/30/14	9:42 AM	6/30/14	11:05 AM	22' - 20'	17	13	3.0	25	9.1	175	200	
	6/30/14	11:09 AM	6/30/14	11:34 AM	20' - 18'	11	11	3.0	6	2.3	44	50	
	6/30/14	11:38 AM	6/30/14	11:54 AM	18' - 16'	10	10	3.5	6	2.3	44	50	
Total H ₂ O 263	Total EVO 38	Total Epsom Salt 14	Total Solution 300	Additional Notes: Hit refusal at 11' on first attempt. Refusal at 11' on IP-27a. Refusal at 10' on IP-27b. Refusal at 15' on IP27c and broke injection tool.									
						Average Pressure (psi)	Average Pressure (psi)	Average Flow Rate	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total (gal)	Points Complete (based on volume of 1400/point)
						20.8	15.7	2.6	3,051.5	1,115.6	20,850	23,901	17.1

CH2M HILL
EVO Injections
Garfield Superfund Site, NJ

Vironex Field Data Sheet													
Injection Point ID	Start Date	Start Time	End Date	End Time	Depth	Start Up Pressure (psi)	Average Pressure (psi)	Average Flow Rate (gpm)	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total Gal	Notes
IP-17b	7/1/14	4:31 PM	7/1/14	5:50 PM	14' - 16'	10	5	2.5	15.84	10.32	176	192	Refusal at 16'.
	7/2/14	7:39 AM	7/2/14	8:59 AM	14' - 16'	6	6	3.0	17.16	11.18	191	208	Location complete.
Total H ₂ O 176	Total EVO 16	Total Epsom Salt 10.3	Total Solution 192	Additional Notes:									
IP-18	7/1/14	3:43 PM	7/1/14	5:19 PM	20' - 18'	30	30	2.0	17	10.8	184	200	
	7/1/14	5:40 PM	7/1/14	5:50 PM	18' - 16'	20	18	2.5	1	0.8	14	15	
	7/2/14	7:39 AM	7/2/14	9:32 AM	18' - 16'	30	30	2.0	15	9.9	170	185	Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-19	7/1/14	1:45 PM	7/1/14	2:35 PM	13' - 15'	25	20	3.0	17	10.8	184	200	
	7/1/14	3:40 PM	7/1/14	5:04 PM	14' - 16'	22	15	3.0	17	10.8	184	200	Refusal at 16'. Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-20a	7/1/14	5:37 PM	7/1/14	5:50 PM	15' - 13'	10	8	2.5	3	1.7	28	31	Refusal at 15'.
	7/2/14	7:39 AM	7/2/14	10:10 AM	15' - 13'	17	15	3.0	30	19.8	339	369	Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-21	7/1/14	10:25 AM	7/1/14	2:40 PM	15' - 13'	25	15	2.0	33	21.5	367	400	Refusal at 15'. Minor surfacing from annulus. Lowered flow rate.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes: Refusal at 15'.									
IP-22	7/2/14	8:01 AM	7/2/14	10:28 AM	16' - 14'	22	20	3.0	33	21.5	367	400	Refusal at 16'. Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-23	7/1/14	2:15 PM	7/1/14	4:46 PM	14' - 16'	10	5	2.5	33	21.5	367	400	Refusal at 16'. Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-24a	7/2/14	9:47 AM	7/2/14	12:03 PM	16' - 14'	15	12	3.5	33	21.5	367	400	Refusal at 16'. Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									

CH2M HILL
EVO Injections
Garfield Superfund Site, NJ

Injection Point ID	Start Date	Start Time	End Date	End Time	Depth	Start Up Pressure (psi)	Average Pressure (psi)	Average Flow Rate (gpm)	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total Gal	Notes
IP-25	7/2/14	10:15 AM	7/2/14	12:22 PM	16' - 14'	22	20	3.0	33	21.5	367	400	Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-28	7/2/14	11:31 AM	7/2/14	12:40 PM	18' - 16'	10	10	3.0	17	10.8	184	200	Refusal at 18'.
	7/2/14	12:44 PM	7/2/14	1:43 PM	16' - 14'	15	15	3.0	17	10.8	184	200	Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-29	7/2/14	11:31 AM	7/2/14	1:13 PM	20' - 18'	10	10	3.8	17	10.8	184	200	Refusal at 18'.
	7/2/14	1:16 PM	7/2/14	2:05 PM	18' - 16'	10	10	4.0	17	10.8	184	200	Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
IP-30	7/2/14	12:32 PM	7/2/14	1:25 PM	14' - 16'	25	17	2.8	17	10.8	184	200	
	7/2/14	1:30 PM	7/2/14	2:18 PM	16' - 18'	15	15	4.0	17	10.8	184	200	Location complete.
Total H ₂ O 367	Total EVO 33	Total Epsom Salt 21.5	Total Solution 400	Additional Notes:									
						Average Pressure (psi)	Average Pressure (psi)	Average Flow Rate	EVO Injected (gal)	Epsom Salt Injected (lbs)	H ₂ O Injected (gal)	Amended Total (gal)	Points Complete (based on volume of 400/point)
						17.5	14.8	2.9	396.0	258.0	4,404	4,800	12.0

Pilot Test Injection Field Parameters

Attachment 6: Table 1
Pilot Test Injection Field Parameters
Results of In Situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, New Jersey

Well ID	Date	Time	DTW (ft BTIC)	Temp (°C)	Cond. (us/cm)	DO (mg/L)	pH	ORP (eV)	Observations	Injection Point
EPA-13-OB	6/24/2014	8:33	12.47	14.35	593	5.09	7.38	72.6	yellow	Pre-Injection
	7/2/2014	10:40	12.27	14.29	668	0.60	6.81	273.0	slight yellow, milky color	Post-Injection
EPA-29-OB	6/24/2014	8:44	10.58	11.85	602	11.85	5.06	365.3		Pre-Injection
	7/1/2014	10:30	10.52	12.26	1212	NR	3.35	416.20		IP-21
	7/1/2014	11:00	10.62	11.71	1397	NR	3.18	490.40		IP-21
	7/1/2014	11:30	10.64	11.62	1509	NR	3.01	508.00		IP-21
	7/1/2014	12:00	10.62	11.57	1541	NR	3.02	511.50		IP-21
	7/1/2014	12:30	10.62	11.82	1595	NR	2.98	516.00		IP-21
	7/1/2014	13:00	10.61	11.69	1633	2.43	2.92	524.70		IP-21
	7/1/2014	13:30	10.58	11.64	1668	2.34	2.89	526.70		IP-21
	7/1/2014	14:00	10.62	11.60	1696	2.09	2.87	528.80		IP-21, IP-19
	7/1/2014	14:30	10.61	11.58	1733	2.06	2.84	532.90		IP-21, IP-19, IP-23
	7/1/2014	15:00	10.58	11.56	1788	1.90	2.80	535.50		IP-23
	7/1/2014	15:30	10.56	11.55	1830	1.82	2.78	534.10		IP-23
	7/1/2014	16:00	9.73	11.61	885	5.03	4.40	433.00		IP-18, IP-19, IP-23
	7/1/2014	16:30	9.63	11.64	2472	4.85	6.13	312.70		IP-17B, IP-18, IP-19, IP-23
	7/1/2014	17:00	9.73	11.66	3552	4.10	6.35	242.90		IP-17B, IP-18, IP-19
	7/1/2014	17:30	10.20	11.64	3408	4.37	6.37	210.40		IP-17B, IP-18
	7/1/2014	18:00	10.16	11.63	3353	4.37	6.35	204.40		IP-17B, IP-18, IP-20A
	7/2/2014	11:00	10.57	12.34	1495	1.17	3.29	391.00		IP-24A, IP-25
	7/2/2014	11:30	10.05	11.90	1557	0.79	3.15	458.80		IP-24A, IP-25, IP-28, IP-29
	7/2/2014	12:00	10.17	NR	NR	NR	NR	NR		IP-24A, IP-25, IP-28, IP-29
	7/2/2014	12:30	9.77	11.63	2078	1.04	4.62	317.60		IP-28, IP-29, IP-30
	7/2/2014	13:00	9.18	11.64	2529	1.24	5.12	257.30		IP-28, IP-29, IP-30
	7/2/2014	13:30	9.22	11.65	2516	1.26	5.19	230.00		IP-28, IP-29, IP-30
	7/2/2014	14:00	9.38	11.64	2474	1.30	5.29	218.80		IP-29, IP-30
	7/2/2014	14:30	10.10	11.60	2432	1.32	5.25	216.30		
	7/2/2014	14:30	10.10	11.60	2432	1.32	5.25	216.30		Post-Injection
EPA-30-OB	6/24/2014	8:36	12.36	13.99	887	5.77	6.48	182.3		Pre-Injection
	7/2/2014	10:20	12.15	15.43	1023	3.04	5.60	297.2		Post-Injection
EPA-31-OB	6/24/2014	9:00	12.75	13.38	1174	8.36	6.23	353.4		Pre-Injection
	6/24/2014	12:30	12.75	13.17	1009	4.02	6.06	321.3	Dark yellow color	IP-14
	6/24/2014	13:45	12.78	13.21	1012	1.83	6.06	327.8		IP-07, IP-10, I P-14
	6/24/2014	14:35	12.80	13.20	1035	1.58	6.07	328.9		IP-10
	6/24/2014	16:20	12.79	13.21	1010	1.24	6.04	327.7		IP-09, IP-10
	6/24/2014	16:50	12.78	13.21	1009	1.17	6.04	326.9		
	6/25/2014	8:32	12.81	13.90	1232	2.68	5.95	302.1		IP-09
	6/25/2014	12:12	12.65	13.30	1249	2.56	5.86	339.8		IP-07, IP-09, IP-13
	6/25/2014	13:50	12.64	13.30	1235	2.58	5.89	342.6		IP-07, IP-09, IP-13
	6/25/2014	14:30	12.63	13.30	1236	2.43	5.92	342.8		IP-07, IP-09, IP-13
	6/25/2014	15:00	12.61	13.30	1239	2.56	5.91	343.7		IP-07, IP-09, IP-13
	6/25/2014	15:30	12.56	13.29	1251	2.57	5.93	343.8		IP-07, IP-09, IP-13
	6/25/2014	16:00	12.57	13.30	1240	2.58	5.93	341.5		IP-01, IP-09
	6/25/2014	16:30	12.56	13.30	1249	2.55	5.92	345.0	Heavy rain at night	IP-09
	6/26/2014	8:00	12.57	13.93	1283	3.59	6.02	296.4		IP-04
	6/26/2014	8:30	12.56	13.56	1271	3.55	5.99	324.0		IP-04, IP-09
	6/26/2014	9:00	12.52	13.37	1273	2.79	6.00	335.9		IP-04, IP-09
	6/26/2014	9:30	12.52	13.38	1273	2.51	6.01	334.9		IP-04, IP-09
	6/26/2014	10:00	12.55	13.35	1242	2.36	5.95	342.3		IP-04
	6/26/2014	10:30	12.55	13.34	1237	2.27	5.95	343.8		IP-04, IP-15
	6/26/2014	11:00	12.56	13.34	1244	2.23	5.97	343.6		IP-04, IP-11, IP-15
	6/26/2014	11:30	12.56	13.35	1247	2.28	5.98	342.9		IP-04, IP-11, IP-15
	6/26/2014	12:00	12.56	13.34	1245	2.28	5.99	341.9		IP-04, IP-15
	6/26/2014	12:30	12.56	13.34	1252	2.25	6.00	345.1		IP-04, IP-11, IP-15
	6/26/2014	13:00	12.56	13.35	1245	2.24	5.98	343.9		IP-04, IP-11, IP-15
	6/26/2014	13:30	12.56	13.35	1246	2.25	5.98	343.7		IP-04, IP-11, IP-15
	6/26/2014	14:00	12.55	13.34	1244	2.23	5.98	347.1		IP-04, IP-11, IP-15
	6/26/2014	14:30	12.53	13.35	1244	2.31	5.98	346.5		IP-04, IP-11, IP-15
	6/26/2014	15:00	12.53	13.35	1235	2.36	5.95	350.0		IP-04, IP-07, IP-11, IP-15
	6/26/2014	15:30	12.52	13.35	1228	2.19	5.96	347.6		IP-04, IP-11, IP-15
	6/26/2014	16:00	12.46	13.34	1224	2.13	5.94	350.0		IP-04, IP-07A, IP-11, IP-15
	6/26/2014	16:30	12.42	13.35	1227	2.27	5.95	348.0		IP-04, IP-07A, IP-11, IP-15
	6/26/2014	17:00	12.41	13.35	1228	2.23	5.95	349.1		IP-04, IP-07A, IP-11, IP-15
	6/26/2014	17:30	12.41	13.35	1228	2.16	5.94	349.1		IP-04, IP-07A, IP-11, IP-15
	6/26/2014	18:00	12.42	13.36	1244	2.27	5.99	347.2		IP-04
	6/27/2014	8:30	11.97	13.86	1197	2.85	5.61	291.2		IP-02, IP-04, IP-07, IP-11
	6/27/2014	9:00	12.42	13.45	1300	4.59	5.80	321.9	DO begins to increase then dropping later	IP-02, IP-04
	6/27/2014	9:30	12.23	13.35	1177	4.01	5.72	333.5		IP-02, IP-04, IP-07A, IP-11
	6/27/2014	10:00	12.24	13.33	1181	3.30	5.61	335.6		IP-02, IP-04, IP-07A, IP-11
	6/27/2014	10:30	12.38	13.34	1223	4.04	5.70	334.3		IP-02, IP-04, IP-07A, IP-11
	6/27/2014	11:00	Color changed to milky white. Purged 4.5 gallons total						Color Change and conductivity changing more significantly	IP-02, IP-04, IP-07A, IP-11
	6/27/2014	11:30	12.35	13.29	1390	4.03	5.89	342.3		IP-02, IP-04
	6/27/2014	12:00	12.43	13.32	1401	4.10	5.84	345.4		IP-02, IP-04
	6/27/2014	12:30	12.28	13.30	1383	4.10	5.87	347.0		IP-02, IP-04, IP-11, IP-26
	6/27/2014	13:00	12.28	13.31	1370	3.86	5.85	348.1		IP-02, IP-04, IP-11, IP-26
	6/27/2014	13:30	12.27	13.32	1408	3.98	5.87	349.6		IP-02, IP-11, IP-26
	6/27/2014	14:00	12.28	13.32	1433	4.15	5.90	351.0		IP-02, IP-03, IP-11, IP-26
	6/27/2014	14:30	12.25	13.34	1457	4.49	5.93	353.0		IP-02, IP-03, IP-11, IP-26
	6/27/2014	15:00	12.26	13.34	1474	4.54	5.95	353.5		IP-02, IP-03, IP-11, IP-26
	6/27/2014	15:30	12.23	13.34	1466	4.60	5.96	354.5		IP-02, IP-03, IP-11, IP-26
	6/27/2014	16:00	12.25	13.35	1468	4.39	5.96	354.7		IP-02, IP-03, IP-11, IP-26
	6/27/2014	16:30	12.25	13.35	1470	4.27	5.96	354.4		IP-02, IP-03, IP-11, IP-26
	6/27/2014	17:00	12.25	13.35	1482	4.43	5.97	355.0		IP-02, IP-03, IP-26
	6/28/2014	8:40	12.35	13.87	1485	3.73	6.03	304.1		IP-02, IP-03, IP-12, IP-26
	6/28/2014	9:00	12.35	13.66	1562	4.90	6.06	318.4		IP-02, IP-03, IP-26
	6/28/2014	9:30	12.25	13.42	1554	4.65	6.03	330.1		IP-02, IP-03, IP-12A, IP-26
	6/28/2014	10:00	12.25	13.40	1534	4.59	5.99	341.2		IP-02, IP-03, IP-12A, IP-26
	6/28/2014	10:30	12.25	13.40	1517	3.98	5.99	344.9		IP-02, IP-03, IP-12A, IP-26
	6/28/2014	11:00	12.09	13.40	1539	4.16	6.01	348.0		IP-02, IP-03, IP-12A, IP-26
	6/28/2014	11:30	12.03	13.41	1563	4.88	6.09	348.5		IP-02, IP-03, IP-12A, IP-26
	6/28/2014	12:00	12.00	13.41	1549	4.24	6.10	347.6		IP-02, IP-03, IP-12A, IP-26
	6/28/2014	12:30	12.20	13.42	1534	4.58	6.09	346.8		IP-03, IP-12, IP-26
	6/28/2014	13:00	12.18	13.40	1570	4.63	6.04	348.6		IP-03, IP-12, IP-26
	6/28/2014	13:30	12.11	13.40	1555	4.28	6.05	350.0		IP-03, IP-08, IP-12, IP-26
	6/28/2014	14:00	11.88	13.41	1566	4.50	6.06	352.5		IP-03, IP-08, IP-12, IP-26
	6/28/2014	14:30	12.01	13.42	1622	4.99	6.13	351.0		IP-03, IP-08, IP-12, IP-26
	6/28/2014	15:00	11.89	13.43	1627	4.41	6.12	348.7		IP-03, IP-08, IP-12, IP-26
	6/28/2014	15:30	12.03	13.43	1619	4.36	6.13	350.3		IP-08B, IP-12
	6/28/2014	16:00	12.00	13.42	1625	4.14	6.10	348.1		IP-08B, IP-12, IP-16A
	6/28/2014	16:30	12.00	13.41	1541	4.28	6.11	348.9		IP-05, IP-08B, IP-12, IP-16A
	6/28/2014	17:00	12.00	13.41	1543	4.02	6.12	348.7		IP-05, IP-08B, IP-12, IP-16A
	6/28/2014	17:30	12.08	13.42	1558	4.14	6.10	350.9		IP-05, IP-08B, IP-12, IP-16A
	6/29/2014	7:40	12.30	13.84	1365	4.83	6.06	298.3		IP-05, IP-08B, IP-12, IP-16A
	6/29/2014	8:00	12.26	13.53	1359	4.97	6.03	326.6		IP-05, IP-08B, IP-12, IP-16A
	6/29/2014	8:30	12.25	13.60	1370	3.61	6.05	335.6		IP-05, IP-08B, IP-12, IP-16A
	6/29/2014	9:00	12.25	13.47	1374	3.51	6.05	338.9		IP-05

Attachment 6: Table 1
Pilot Test Injection Field Parameters
Results of In Situ Reduction Pilot Test
Garfield Groundwater Contamination Superfund Site, New Jersey

Well ID	Date	Time	DTW (ft BTIC)	Temp (°C)	Cond. (us/cm)	DO (mg/L)	pH	ORP (eV)	Observations	Injection Point
	6/29/2014	13:00	12.04	13.46	1347	3.56	6.09	367.7		IP-01A, IP-05B, IP-16A
	6/29/2014	13:30	12.04	13.46	1348	3.42	6.08	368.6		IP-01A, IP-05B, IP-16A
	6/29/2014	14:00	12.04	13.46	1347	3.27	6.08	368.0		IP-01A, IP-05B, IP-16A
	6/29/2014	14:30	12.00	13.46	1345	3.23	6.09	365.4		IP-01A, IP-05B, IP-16A
	6/29/2014	15:00	11.98	13.47	1341	3.21	6.06	368.6		IP-01A, IP-05B, IP-16A
	6/29/2014	15:30	11.95	13.47	1346	3.00	6.09	369.3		IP-01A, IP-05B, IP-16A
	6/29/2014	16:00	11.96	13.47	1345	2.90	6.09	369.5		IP-01A, IP-05B, IP-16A
	6/29/2014	16:30	11.15	13.42	1379	2.76	6.11	363.8		IP-01A, IP-04A, IP-16A
	6/29/2014	16:45	9.80	13.37	1302	2.42	6.07	358.9	rapid water table increase	IP-01A, IP-04A, IP-16A
	6/29/2014	17:00	9.32	13.41	1435	2.44	6.09	345.1		IP-01A, IP-04A, IP-16A
	6/29/2014	17:30	11.20	13.60	1427	2.51	6.07	352.5		IP-04A, IP-16A
	6/30/2014	7:40	12.15	14.00	1211	6.90	5.86	341.2		IP-01A, IP-07B, IP-16A
	6/30/2014	8:00	12.05	14.00	1211	6.10	5.87	346.1		IP-01A, IP-07B, IP-16A
	6/30/2014	8:30	12.03	13.57	1211	4.66	5.87	364.2		IP-01A, IP-07B, IP-16A
	6/30/2014	9:00	11.96	13.50	1199	4.35	5.89	376.2		IP-01A, IP-07B, IP-16A
	6/30/2014	10:15	11.92	13.49	1192	4.36	5.91	380.3		IP-06A, IP-07B, IP-27D
	6/30/2014	10:45	11.91	13.50	1197	4.34	5.91	381.1		IP-06A, IP-07B, IP-27D
	6/30/2014	11:00	11.91	13.49	1199	4.35	5.92	380.4		IP-06A, IP-07B, IP-27D
	6/30/2014	11:30	11.91	13.49	1210	4.33	5.90	381.5		IP-06A, IP-07B, IP-27D
	6/30/2014	12:00	11.91	13.49	1198	4.19	5.91	381.8		IP-06A, IP-07B, IP-27D
	6/30/2014	12:30	11.92	13.49	1208	4.25	5.90	382.9		IP-06A, IP-07B, IP-15A
	6/30/2014	13:00	11.92	13.49	1210	4.27	5.90	383.2		IP-06A, IP-07B, IP-15A
	6/30/2014	13:30	11.93	13.50	1217	4.17	5.91	383.9		IP-06A, IP-07B, IP-15A
	6/30/2014	14:00	11.91	13.50	1215	4.10	5.90	348.1		IP-06A, IP-07B, IP-14A
	6/30/2014	14:30	11.90	13.50	1201	4.00	5.91	385.1		IP-06A, IP-07B, IP-14A
	6/30/2014	15:00	11.88	13.50	1211	3.97	5.90	385.6		IP-06A, IP-07B, IP-14A
	6/30/2014	15:30	11.87	13.50	1198	3.88	5.92	386.2		IP-06A, IP-07B, IP-14A
	6/30/2014	16:00	11.86	13.51	1207	3.82	5.90	385.3		IP-07, IP-08, IP-14
	6/30/2014	16:30	11.84	13.51	1206	3.69	5.90	386.4		IP-08C, IP-14
	6/30/2014	17:00	11.83	13.51	1206	3.63	5.90	386.0		IP-08C, IP-14
	6/30/2014	17:30	11.86	13.51	1208	3.62	5.90	385.7		IP-08C, IP-10A, IP-14
	7/2/2014	9:20	12.42	14.16	1122	2.99	5.86	244.9		Post-Injection
EPA-32-OB	6/24/2014	8:57	12.74	13.16	924	7.17	5.28	381.2		Pre-Injection
	7/2/2014	9:40	12.43	13.86	891	2.72	5.11	289.0		Post-Injection

Attachment 7
pH Titration Results

Benchsheet

Soil Buffering Capacity

Garfield, NJ Superfund Site

Analyst: DRV BDate/Time: 7/31/14 @ 15:20**Moisture Content**

Sample	Tin Tare	Tin + Soil _{wet}	Tin + Soil _{dry}	MC (% _{wet} basis)	MC (% _{dry} basis)
SO-B-14-16	1.2846	14.4717	13.1614	10%	11%

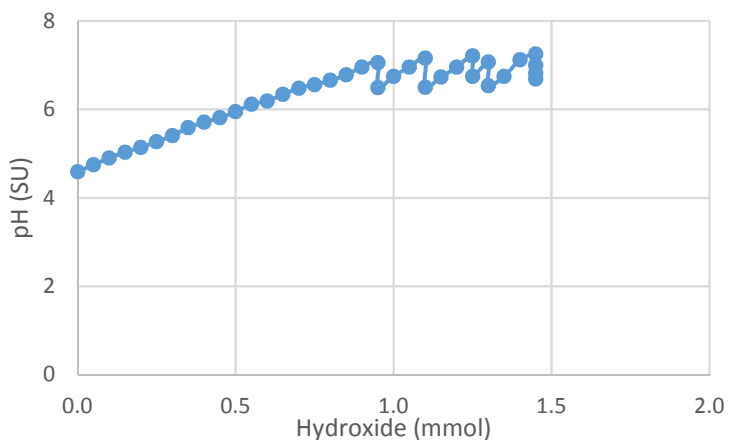
Base Titration Test

Soil Sample: SO-B-14-16
 Water Sample: DI Water
 Base: NaOH

Wet Mass (g): 100
 Volume (mL): 100
 Strength (N): 1

Dry Mass (g): 90.06
 Base ID: 3-OR-19-04

Time (hrs)	NaOH (μ L)	OH- mmol	pH
-	0	0.0	4.59
-	50	0.1	4.75
-	100	0.1	4.90
-	150	0.2	5.03
-	200	0.2	5.14
-	250	0.3	5.27
-	300	0.3	5.41
-	350	0.4	5.59
-	400	0.4	5.71
-	450	0.5	5.81
-	500	0.5	5.95
-	550	0.6	6.12
-	600	0.6	6.19
-	650	0.7	6.34
-	700	0.7	6.48
-	750	0.8	6.56
-	800	0.8	6.66
-	850	0.9	6.78
-	900	0.9	6.96
0	950	1.0	7.06
4	950	1.0	6.49
-	1000	1.0	6.75
-	1050	1.1	6.96
-	1100	1.1	7.16
16	1100	1.1	6.50
-	1150	1.2	6.73
-	1200	1.2	6.96
-	1250	1.3	7.21
23	1250	1.3	6.75
-	1300	1.3	7.07
51	1300	1.3	6.54
-	1350	1.4	6.75
-	1400	1.4	7.12
-	1450	1.5	7.25
74	1450	1.5	7.00
97	1450	1.5	6.82
122	1450	1.5	6.69



Target pH: 7

Needed Base: 0.0161 mmol/g dry soil



CH2MHILL

PROJECT NUMBER
431007

BORING NUMBER
B

SHEET 1 OF 1

Soil Boring Log

PROJECT : Garfield Groundwater Contamination Superfund Site		LOCATION: Garfield, NJ	
ELEVATION :		DRILLING CONTRACTOR : Parratt Wolff	
DRILLING METHOD AND EQUIPMENT USED : <u>Geoprobe</u>			
WATER LEVELS : <u>12.5' BGS</u>		START : <u>7/30</u>	END : <u>7/30</u>
LOGGER : <u>Ba/45</u>			
DEPTH BELOW SURFACE (FT) <u>EPA-19-05</u>		SOIL DESCRIPTION	
INTERVAL (FT)		RECOVERY (FT)	
		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	
		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.	
		PID (ppm): Breathing Zone Above Hole	
		0-14 - discrete sample - no recovery - targeted	
		14-16' BGS	
14' 10' 2'		silty SAND, (M), trace f-gravel, dark reddish brown (7.5 YR 3/3), wet at 14.5', stiff/hard	
		0 piz	
		SO-B-14-16 - required 2 runs to fill up volume	

Attachment 8
IDW Manifest and Bill of Lading

**FREEHOLD CARTAGE INC.**P.O. BOX 5010 • FREEHOLD, NJ 07728-5010
(732) 462-1001 • FAX (732) 308-0924**BILL OF LADING**
FCI EPA ID NO. NJD054126164**S 416958**350 Pigeon Point Road
New Castle, DE 19720
Phone: (302) 658-2005
Fax: (302) 658-6229175 Bartow Mun. Airport
Bartow, FL 33830
Phone: (863) 533-4599
Fax: (863) 533-16135533 Dunham Road
Maple Heights, OH 44137
Phone: (330) 835-3473
Fax: (330) 835-3732108 Monahan Avenue
Dunmore, PA 18512
Phone: (570) 342-7232
Fax: (570) 342-7367132 Myrtle Beach Hwy.
Sumter, SC 29153
Phone: (803) 773-2611
Fax: (803) 773-2942

SHIPPER NAME/ADDRESS <i>US EPA 125 CLARK STREET FREEHOLD NJ 07728</i>		PHONE <i>800 623 8253</i>		APPOINTMENT TIME :	
		(AREA CODE) <i>Sumter 9790</i>			
FICI REP. LOADING (PRINT)		PROCEDURE <i>802</i>	EQUIP. SPOTTED	EQUIP. REMOVED	TIME AT SHIPPER (MILITARY TIME ONLY) <i>12:45</i>
COMMENTS OR DELAYS AT SHIPPER		TRACTOR <i>6114</i>		TRAILER <i>4334</i>	
				ARRIVAL TIME :	
				DEPARTURE TIME :	
				EQUIPMENT USED	

BROKER:

PO#:

WO#:

MANIFEST / DOCUMENT NO. *013831738 J516*

(X) HM	PROPER U.S. D.O.T. SHIPPING NAME	U.S. D.O.T. HAZARDOUS CLASS	NA/UN/NO.	PACKING GROUP	NO. CONT.	CONT. TYPE	NET QUANTITY	UNIT MEASURE	WASTE NO.	FORM
X	1 <i>REG UN 3052 EQUIPMENT ANY HAZARDOUS SUBSTANCE</i>	<i>9</i>	<i>UN3052 PG11</i>	<i>2</i>	<i>DM</i>	<i>70</i>	<i>G</i>	<i>0007</i>	<i>L</i>	
	2									
	3									

SPECIAL HANDLING INSTRUCTIONS INCLUDING CONTAINER EXEMPTION NUMBER.

SHIPPER'S CERTIFICATION: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation, U.S. EPA and the State. The materials described above were consigned to the Transporter named. The consignee can and will accept the shipment and has a valid permit to do so if required. I certify that the foregoing is true and correct to the best of my knowledge.

Payment to the contractor for waste removal does not constitute payment to the carrier and if the contractor does not pay the carrier, the shipper is obligated to pay the agreed rate offered to the contractor.

PLEASE PRINT NAME/TITLE <i>David Roemer / Ecology / US EPA</i>	SHIPPER'S SIGNATURE <i>[Signature]</i>	DATE LOADED <i>11 / 04 / 14</i>
I HAVE READ THE ABOVE AND UNDERSTAND AND AGREE TO ALL OF ITS CONTENT.		MO. DAY YR.

CONSIGNEE NAME/ADDRESS <i>Eq Detroit, Inc 1923 FREEHOLD STREET DETROIT MI 48211</i>		PHONE		APPOINTMENT TIME :	
		(AREA CODE)			
FICI REP. UNLOADING (PRINT)		PROCEDURE	EQUIP. SPOTTED	EQUIP. REMOVED	TIME AT CONSIGNEE (MILITARY TIME ONLY) :
COMMENTS OR DELAYS AT CONSIGNEE		TRACTOR		TRAILER	
				ARRIVAL TIME :	
				DEPARTURE TIME :	
				EQUIPMENT USED	
PLEASE PRINT NAME/TITLE		CONSIGNEE SIGNATURE <i>X</i>		DATE UNLOADED / /	
				MO. DAY YR.	

AR H-0257	MD HWH-167	MO H-1490	OH UPW-0190713-OH	TX 40705
CT CT-HW-307	2001-OPV-2335	ND WH-429	OK UPW-0190713-OH	WI 11602
DE DE-HW-203	ME ME-HWT-47	NH TNH-0047	ONTARIO, CANADA A 840943	WV UPW-0190713-OH
DE-SW-203	ME-WOT-47	NJ S-2265	PA PA-AH-0067	
IL UPW-0190713-OH	MI UPW-0190713-OH	15939	QUEBEC, CANADA QC-6ML-047	
MA MA-294	MN UPW-0190713-OH	NY NJ-113	RI RI-535	

White - FCI Original
Yellow - FCI Billing
Blue - FCI Office/ Customer
Green - Retained by TSDF
Gold - Retained by Generator**S 416958**

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator ID Number NJN-000-206-317	2. Page 1 of 1	3. Emergency Response Phone 800-633-8253 contract 8790	4. Manifest Tracking Number 013831738 JJK		
5. Generator's Name and Mailing Address United States Env. Protection Agency 200 Broadway 19th Floor, New York, NY 10007-1866				Generator's Site Address (if different than mailing address) United States Env. Protection Agency Willard Street and Pierre Avenue Garfield, NJ 07026			
Generator's Phone: 212 637-3735 Attn: Kathryn Flynn							
6. Transporter 1 Company Name Freehold Cartage, Inc.				U.S. EPA ID Number NJD 054 126 164			
7. Transporter 2 Company Name				U.S. EPA ID Number			
8. Designated Facility Name and Site Address EQ Detroit, Inc. 1823 Frederick Street Detroit, MI 48211				U.S. EPA ID Number MID 980 591 556			
Facility's Phone: 313-347-1300							
9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers		11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes	
		No.	Type				
X	1. RQ, UN3082, Environmentally hazardous substances, liquid, N.O.S. (chromium), 9, PGIII	2	DM	70	G	D007	
	2.						
	3.						
	4.						
14. Special Handling Instructions and Additional Information 1. G140087DET chromium contaminated groundwater ERG# 171 CESI JOB: ROAN-TFORT-4187-23881							
15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.							
Generator's/Offor's Printed/Typed Name Kathryn Flynn				Signature <i>Kathryn Flynn</i>		Month Day Year 11 18 14	
16. International Shipments <input type="checkbox"/> Import to U.S. <input type="checkbox"/> Export from U.S. Port of entry/exit: _____ Transporter signature (for exports only): _____ Date leaving U.S.: _____							
17. Transporter Acknowledgment of Receipt of Materials							
Transporter 1 Printed/Typed Name Jeff Amburg				Signature <i>Jeff Amburg</i>		Month Day Year 11 18 14	
Transporter 2 Printed/Typed Name				Signature		Month Day Year	
18. Discrepancy							
18a. Discrepancy Indication Space <input type="checkbox"/> Quantity <input type="checkbox"/> Type <input type="checkbox"/> Residue <input type="checkbox"/> Partial Rejection <input type="checkbox"/> Full Rejection							
Manifest Reference Number:							
18b. Alternate Facility (or Generator)				U.S. EPA ID Number			
Facility's Phone:							
18c. Signature of Alternate Facility (or Generator)						Month Day Year	
19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)							
1.		2.		3.		4.	
20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a							
Printed/Typed Name				Signature		Month Day Year	

**FREEHOLD CARTAGE INC.**P.O. BOX 5010 • FREEHOLD, NJ 07728-5010
(732) 462-1001 • FAX (732) 308-0924**BILL OF LADING**
FCI EPA ID NO. NJD054126164**S 540856**350 Pigeon Point Road
New Castle, DE 19720
Phone: (302) 658-2005
Fax: (302) 658-6229175 Bartow Mun. Airport
Bartow, FL 33830
Phone: (863) 533-4599
Fax: (863) 533-16135533 Dunham Road
Maple Heights, OH 44137
Phone: (330) 835-3473
Fax: (330) 835-3732108 Monahan Avenue
Dunmore, PA 18512
Phone: (570) 342-7232
Fax: (570) 342-7367132 Myrtle Beach Hwy.
Sumter, SC 29153
Phone: (803) 773-2611
Fax: (803) 773-2942

SHIPPER NAME/ADDRESS US EPA 125 Clark St. Garfield NJ 07026		PHONE 212-637-3735 (AREA CODE) 898		TRAILER 4731		APPOINTMENT TIME 11/11/00 0206317	
FCI REP. LOADING (PRINT) C. Roberts	PROCEDURE LTC	EQUIP. SPOTTED -	EQUIP. REMOVED -	TIME AT SHIPPER (MILITARY TIME ONLY) :		ARRIVAL TIME :	
COMMENTS OR DELAYS AT SHIPPER				EQUIPMENT USED			

BROKER: Capital Env.	MANIFEST / DOCUMENT NO. 01271128130
PO #:	WO #:

(X) HM	PROPER U.S. D.O.T. SHIPPING NAME	U.S. D.O.T. HAZARDOUS CLASS	NA/UN/NO.	PACKING GROUP	NO. CONT.	CONT. TYPE	NET QUANTITY	UNIT MEASURE	WASTE NO.	FORM
1	See Manifest				03	DM	165	L		
2										
3										

SPECIAL HANDLING INSTRUCTIONS INCLUDING CONTAINER EXEMPTION NUMBER.

SHIPPER'S CERTIFICATION: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation, U.S. EPA and the State. The materials described above were consigned to the Transporter named. The consignee can and will accept the shipment and has a valid permit to do so if required. I certify that the foregoing is true and correct to the best of my knowledge.

Payment to the contractor for waste removal does not constitute payment to the carrier and if the contractor does not pay the carrier, the shipper is obligated to pay the agreed rate offered to the contractor.

PLEASE PRINT NAME/TITLE David Rame	SHIPPER'S SIGNATURE X	DATE LOADED 04/02/15 MO. DAY YR.
I HAVE READ THE ABOVE AND UNDERSTAND AND AGREE TO ALL OF ITS CONTENT.		

CONSIGNEE NAME/ADDRESS EA 1923 Frederick St. Detroit MI 48211		PHONE 313-923-0080 (AREA CODE)		TRAILER		APPOINTMENT TIME 11/09/00 091566	
FCI REP. UNLOADING (PRINT)	PROCEDURE	EQUIP. SPOTTED	EQUIP. REMOVED	TIME AT CONSIGNEE (MILITARY TIME ONLY) :		ARRIVAL TIME :	
COMMENTS OR DELAYS AT CONSIGNEE				EQUIPMENT USED			

PLEASE PRINT NAME/TITLE	CONSIGNEE SIGNATURE X	DATE UNLOADED / / MO. DAY YR.
-------------------------	--------------------------	-------------------------------------

AR H-0257	MD HWH-167	MO H-1490	OH UPW-0190713-OH	TX 40705
CT CT-HW-307	2001-OPV-2335	ND WH-429	OK UPW-0190713-OH	WI 11602
DE DE-HW-203	ME ME-HWT-47	NH TNH-0047	ONTARIO, CANADA A 840943	WV UPW-0190713-OH
DE-SW-203	ME-WOT-47	NJ S-2265	PA PA-AH-0067	
IL UPW-0190713-OH	MI UPW-0190713-OH	15939	QUEBEC, CANADA QC-6ML-047	
MA MA-294	MN UPW-0190713-OH	NY NJ-113	RI RI-535	

White - FCI Original
Yellow - FCI Billing
Blue - FCI Office/Customer
Green - Retained by TSDF
Gold - Retained by Generator**S 540856**

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator ID Number NJN-000-206-317		2. Page 1 of		3. Emergency Response Phone 800-633-8253 contract 8790		4. Manifest Tracking Number 012711281 JJK				
		5. Generator's Name and Mailing Address United States Env. Protection Agency 200 Broadway 19th Floor, New York, NY 10007-1566 Generator's Phone: 212 637-3735 Attn: Kathryn Flynn						Generator's Site Address (if different than mailing address) United States Env. Protection Agency Willard Street and Pierre Avenue Garfield, NJ 07026				
		6. Transporter 1 Company Name Freehold Cartage, Inc.						U.S. EPA ID Number NJD 004 126 164				
		7. Transporter 2 Company Name						U.S. EPA ID Number				
		8. Designated Facility Name and Site Address EQ Detroit, Inc. 1923 Frederick Street Detroit, MI 48211 Facility's Phone: 313-347-1300						U.S. EPA ID Number MID 980 991 556				
GENERATOR	9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))				10. Containers No. Type		11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
	X	1. RQ, UN3082, Environmentally hazardous substances, liquid, N.O.S. (chromium), 9, PGIII				03 DM		165	G	D007		
		2.										
		3.										
		4.										
14. Special Handling Instructions and Additional Information 1. G140087/DET chromium contaminated groundwater ERG# 171 CESI JOB: ROAN-TFORT-4187-24326												
15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.												
Generator's/Offeror's Printed/Typed Name						Signature		Month		Day Year		
INT'L	16. International Shipments <input type="checkbox"/> Import to U.S. <input type="checkbox"/> Export from U.S. Port of entry/exit: _____ Transporter signature (for exports only): _____ Date leaving U.S.: _____											
	17. Transporter Acknowledgment of Receipt of Materials											
TRANSPORTER	Transporter 1 Printed/Typed Name						Signature		Month		Day Year	
	Transporter 2 Printed/Typed Name						Signature		Month		Day Year	
DESIGNATED FACILITY	18. Discrepancy											
	18a. Discrepancy Indication Space <input type="checkbox"/> Quantity <input type="checkbox"/> Type <input type="checkbox"/> Residue <input type="checkbox"/> Partial Rejection <input type="checkbox"/> Full Rejection Manifest Reference Number: _____											
	18b. Alternate Facility (or Generator) U.S. EPA ID Number _____											
	Facility's Phone: _____											
	18c. Signature of Alternate Facility (or Generator) _____ Month _____ Day _____ Year _____											
19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)												
1.			2.			3.			4.			
20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a												
Printed/Typed Name						Signature		Month		Day Year		

**FREEHOLD CARTAGE INC.**P.O. BOX 5010 • FREEHOLD, NJ 07728-5010
(732) 462-1001 • FAX (732) 308-0924**BILL OF LADING**
FCI EPA ID NO. NJD054126164**S 509458**350 Pigeon Point Road
New Castle, DE 19720
Phone: (302) 658-2005
Fax: (302) 658-6229175 Bartow Mun. Airport
Bartow, FL 33830
Phone: (863) 533-4599
Fax: (863) 533-16135533 Dunham Road
Maple Heights, OH 44137
Phone: (330) 835-3473
Fax: (330) 835-3732108 Monahan Avenue
Dunmore, PA 18512
Phone: (570) 342-7232
Fax: (570) 342-7367132 Myrtle Beach Hwy.
Sumter, SC 29153
Phone: (803) 773-2611
Fax: (803) 773-2942

SHIPPER NAME/ADDRESS USE PA Willard St + Pierre Ave Freehold NJ 07726		PHONE 732-637-3735 (AREA CODE) TRACTOR 678 TRAILER 4731		APPOINTMENT TIME 08:00	
FCI REP. LOADING (PRINT) C. Roberts	PROCEDURE LTL	EQUIP. SPOTTED —	EQUIP. REMOVED	TIME AT SHIPPER 08:00	(MILITARY TIME ONLY) 08:55
COMMENTS OR DELAYS AT SHIPPER				EQUIPMENT USED	

BROKER: Capital Env.		MANIFEST / DOCUMENT NO. 0127114495X
PO #:	WO #:	

(X) HM	PROPER U.S. D.O.T. SHIPPING NAME	U.S. D.O.T. HAZARDOUS CLASS	NA/UN/NO.	PACKING GROUP	NO. CONT.	CONT. TYPE	NET QUANTITY	UNIT MEASURE	WASTE NO.	FORM
1	See Manifest				109 DM		495 55 @ L			
2					107 DM		3,000 P			
3										

SPECIAL HANDLING INSTRUCTIONS INCLUDING CONTAINER EXEMPTION NUMBER.

SHIPPER'S CERTIFICATION: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation, U.S. EPA and the State. The materials described above were consigned to the Transporter named. The consignee can and will accept the shipment and has a valid permit to do so if required. I certify that the foregoing is true and correct to the best of my knowledge.

Payment to the contractor for waste removal does not constitute payment to the carrier and if the contractor does not pay the carrier, the shipper is obligated to pay the agreed rate offered to the contractor.

PLEASE PRINT NAME/TITLE Andy Watson / Field Engineer	SHIPPER'S SIGNATURE X [Signature]	DATE LOADED 08/06/14 MO. DAY YR.
I HAVE READ THE ABOVE AND UNDERSTAND AND AGREE TO ALL OF ITS CONTENT.		

CONSIGNEE NAME/ADDRESS 1923 Frederick St. Dunmore PA 17821		PHONE 717-923-0080 (AREA CODE) TRACTOR TRAILER		APPOINTMENT TIME :	
FCI REP. UNLOADING (PRINT)	PROCEDURE	EQUIP. SPOTTED	EQUIP. REMOVED	TIME AT CONSIGNEE :	(MILITARY TIME ONLY) :
COMMENTS OR DELAYS AT CONSIGNEE				EQUIPMENT USED	

PLEASE PRINT NAME/TITLE	CONSIGNEE SIGNATURE X	DATE UNLOADED / / MO. DAY YR.
-------------------------	--------------------------	-------------------------------------

AR H-0257	MD HWH-167	MO H-1490	OH UPW-0190713-OH	TX 40705
CT CT-HW-307	2001-OPV-2335	ND WH-429	OK UPW-0190713-OH	WI 11602
DE DE-HW-203	ME ME-HWT-47	NH TNH-0047	ONTARIO, CANADA A 840943	WV UPW-0190713-OH
DE DE-SW-203	ME ME-WOT-47	NJ S-2265	PA PA-AH-0067	
IL UPW-0190713-OH	MI UPW-0190713-OH	15939	QUEBEC, CANADA QC-6ML-047	
MA MA-294	MN UPW-0190713-OH	NY NJ-113	RI RI-535	

White - FCI Original
Yellow - FCI Billing
Blue - FCI Office/ Customer
Green - Retained by TSDF
Gold - Retained by Generator**S 509458**

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator ID Number NJN-000-206-317	2. Page 1 of 1	3. Emergency Response Phone 800-633-8253 ext 8790	4. Manifest Tracking Number 012711444 JJK		
5. Generator's Name and Mailing Address United States Env. Protection Agency 200 Broadway 19th Floor, New York, NY 10007-1866				Generator's Site Address (if different than mailing address) United States Env. Protection Agency Willard Street and Pierre Avenue Garfield, NJ 07026			
Generator's Phone: 212 637-3735 Attn: Kathryn Flynn							
6. Transporter 1 Company Name Freehold Cartage, Inc.				U.S. EPA ID Number NJD 054 126 164			
7. Transporter 2 Company Name				U.S. EPA ID Number			
8. Designated Facility Name and Site Address EQ Detroit, Inc. 1923 Frederick Street Detroit, MI 48211				U.S. EPA ID Number MID 980 991 556			
Facility's Phone: 313-347-1300							
GENERATOR	9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	X	1. RQ, UN3082, Environmentally hazardous substances, liquid, N.O.S. (chromium), 9, PGIII	09	DM	495	G	D007
		2. RCRA Nonhazardous, DOT Non Regulated soil and PPE	07	DM	3,000	P	None
		3.					
		4.					
14. Special Handling Instructions and Additional Information 1. G140087DET chromium contaminated groundwater ERG# 171 2. G140086DET NH soil and PPE CESI JOB: ROAN-TFORT 4187 23422							
15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.							
Generator's/Offor's Printed/Typed Name Kathryn Flynn				Signature <i>Kathryn Flynn</i>		Month Day Year 8 6 11	
TRANSPORTER INT'L	16. International Shipments <input type="checkbox"/> Import to U.S. <input type="checkbox"/> Export from U.S. Port of entry/exit: _____ Transporter signature (for exports only): _____ Date leaving U.S.: _____						
	17. Transporter Acknowledgment of Receipt of Materials						
	Transporter 1 Printed/Typed Name Shawn Roberts		Signature <i>Shawn Roberts</i>		Month Day Year 08 12 11		
DESIGNATED FACILITY	Transporter 2 Printed/Typed Name		Signature		Month Day Year		
	18. Discrepancy						
	18a. Discrepancy Indication Space <input type="checkbox"/> Quantity <input type="checkbox"/> Type <input type="checkbox"/> Residue <input type="checkbox"/> Partial Rejection <input type="checkbox"/> Full Rejection						
	Manifest Reference Number: _____						
	18b. Alternate Facility (or Generator)				U.S. EPA ID Number		
Facility's Phone: _____							
18c. Signature of Alternate Facility (or Generator)						Month Day Year	
19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)							
1.		2.		3.		4.	
20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a							
Printed/Typed Name				Signature		Month Day Year	