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November 21, 2017

via Electronic Mail

The Honorable Robert G. Torricelli
Office of the Special Master
RGTSpecialMaster@aol.com

Re: Five-Year Summary Report for In-Situ Chromium Mass Removal from the S-3 Sand
Study Area 7
Jersey City, New Jersey

Dear Senator Torricelli:

Attached please find the "Five Year Summary Report for the In-Situ Chromium Mass Removal from the S-3 Sand" report that has been prepared by Honeywell's consultant, Cornerstone Environmental Group, LLC. This report summarizes the in-situ chromium treatment program conducted over the last few years. It was prepared to meet the requirements of paragraph 5(a) of Deep Overburden and Bedrock Groundwater Mass Removal Consent Decree, *Interfaith Community Organization v. Honeywell,* No. 95-2097, (D. N.J. May 18, 2010) ("Mass Removal Consent Decree"), and Section 5 of the Operations Work Plan for In-situ Chromium Mass Removal (Cornerstone, revised February 20, 2012).

While Honeywell has questioned the value of the in-situ approach from the outset, we have nonetheless completed all the requirements to close out the extensive program.

We note that the groundwater extraction and treatment system (GWET) currently in place continues to effectively prevent hexavalent chromium from migrating offsite. Pump and treat technology has been successfully used for a variety of contaminants in the remediation world and is a very reliable, commercial solution.

Should you have any questions please contact the undersigned at (973) 455-2175.

Sincerely,

William J. Hague
Global Director, Remediation
Design and Construction

WJH:sgf

Encl: 11/13/17 Cornerstone Environmental Report: Five-Year Summary Report for In-Situ Chromium Mass Removal from the S-3 Sand

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FIVE-YEAR SUMMARY REPORT
FOR
IN-SITU CHROMIUM MASS REMOVAL
FROM THE S-3 SAND

STUDY AREA 7
JERSEY CITY, NEW JERSEY

Prepared for

Honeywell

November 13, 2017

Prepared by

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1 INTRODUCTION

This Five-Year Summary Report has been prepared in accordance with paragraph 5(a) of the Deep Overburden and Bedrock Groundwater Mass Removal Consent Decree, *Interfaith Community Organization v. Honeywell,* No. 95-2097, (D. N.J. May 18, 2010) ("Mass Removal Consent Decree"), and Section 5 of the Operations Work Plan for In-situ Chromium Mass Removal (Cornerstone, revised February 20, 2012). The report provides a summary of the 39 reductant injection events and associated monitoring during the five-year program which ran from May 2012 through September 2017, and the results of an effectiveness evaluation that has been conducted based on the collected monitoring data.

The objective of the injection program was to supplement the downgradient groundwater containment system in order to "reduce hexavalent chromium present in the Deep Overburden Groundwater to trivalent chromium." *See* Mass Removal Consent Decree at paragraph 4.a. Specifically, the goal of the program was for Honeywell to use "reasonable efforts to inject reductant at a cumulative annual rate that is equivalent, based on stoichiometry, to an amount sufficient to reduce 10 tons of hexavalent chromium per year." *Id.*, paragraph 4.b. The program was designed to conclude at the earlier of five years after the first injection or "when an amount of reductant stohciometrically sufficient to reduce 50 tons of hexavalent chromium has been injected into the S3 Sands." *Id.* at paragraph 6.a. As discussed below, the program has been successful in meeting this goal.

As noted in the Operations Work Plan, the deep overburden plume originated on Study Area 5 and has flowed under portions of Study Areas 7 and 6 North. The plume is fully contained and is being prevented from discharge to the Hackensack River by the Federal Court Ordered-approved downgradient Ground Water Extraction and Treatment (GWET) system that began operation in December 2008. The extracted groundwater is treated and discharged under an approved permit.

2 INJECTION EVENTS

2.1 Injection Locations and Sequence

The Operations Work Plan identified four potential injection wells to deliver the reductant to the S-3 Sand formation. Three were located west of Route 440 on SA-6 North (088-IW-1, 088-IW-02, and 087-IW-01), and one groundwater monitoring well (117-MW-I4S) was located on the Home Depot property east of Route 440. However, during pre-injection yield testing it was discovered that well 117-MW-I4S would not be capable of the desired injection rate of 10 gpm. A subsurface investigation was then conducted east of Route 440 with the objective of identifying a suitable alternate injection well location. The results of this investigation indicated that the S-3 Sand formation is not present east of Route 440 and thus installation of an injection well in this area was not feasible. Based on these findings, the requirement for an injection well east of Route 440 was officially removed by the First Amendment to the Deep Overburden and Bedrock Groundwater Mass Removal Consent Decree (paragraph 3) dated December 9, 2013.

During pre-injection sampling it was also discovered that hexavalent chromium was not present in one of the proposed injection wells (087-IW-01) on SA-6 North. Confirmatory sampling indicated that the lack of hexavalent chromium was likely due to a localized area of reducing conditions (as evidenced by low ORP) possibly related to historic activities on the MUA property. As a result, this well was removed from the program and wells 115-PW-21 and 115-DP-1 were used as temporary injection wells until a replacement injection well could be installed. The replacement injection well (088-IW-03) was installed on the west side of the JCIA property in May 2013 as described in Cornerstone's Memorandum dated March 6, 2013.

As a result of these activities, a total of five injection wells were used during the program, however the majority of the injections have been in the three wells (88-IW-01, 088-IW-02, and 088-IW-03) located on the former JCIA property as shown on **Figure 2-1**.

2.2 Injected Volumes, Rates, and Pressures

A total of 39 injection events were conducted from May 2012 through September 2017 as shown on **Table 2-1**. The events were spaced approximately 6 weeks apart from March through November and thus 5 to 8 events were conducted each year depending on the weather in the early spring and late fall. On a few occasions, events were rescheduled by

a few weeks to facilitate access to the injection wells during the various remedial activities underway on SA-6 north.

The reductant used was calcium polysulfide (CaSx) which, as shown on **Table 2-2**, was obtained from three different suppliers during the program, each with its own product name. For the first four events, CaSx was procured by the chemical supplier Coyne Environmental Services (Coyne), from the Tessenderlo-Kerley Inc. (TKI) facility in Fresno California under the product name Calmet®. For events 5 through 26 Coyne obtained the material from the Graus Chemicals facility located in Glendale Arizona under the name of "Calcium Polysulfide" and then "Remotox". For the final 13 events Thatcher Group, Inc. provided calcium polysulfide from their facility in Salt Lake City.

As shown on **Table 2-1**, the volume of CaSx shipped to the site during each event ranged from 3,704 to 4,350 gallons with an average of 4,181 gallons over the 39 events. Immediately prior to CaSx injection, approximately 300 gallons of clean water from the adjacent JCMUA fire hydrant was injected into the well to reduce the precipitation of solids within the well screen. During each event, the entire tanker truck load of CaSx was injected into the subsurface within one working day. In accordance with the Operations Work Plan, a volume of clean water calculated to be approximately twice the volume of CaSx, was then injected into the well over the course of the next two days to help distribute the CaSx within the S-3 Sand formation.

Injection rates of both CaSx and water varied from approximately 6 to 12 gpm with the target rate being 10 gpm. Early in the program injection was possible using only gravity flow driven by the height of the water in the well or the head of the CaSx in the tanker. In later years it was necessary to pressurize the tanker to bring the flow rate up to near 10 gpm. In these instances, pressures at the wellhead ranged from 2 to 17 psi as shown on **Table 2-1**.

2.3 Stoichiometric Mass Calculations

For each event, three replicate samples from each batch were used to determine the sulfide content of the material in accordance with the Operations Work Plan. The geometric mean of these data was then calculated as shown on **Table 2-2** and used to estimate the mass of hexavalent chromium stochiometrically equivalent to the injected volume of CaSx. This calculation was conducted in accordance with the chemical reactions provided in Appendix C of the Operations Work Plan. As shown on **Table 2-3**, the stoichiometric equivalent mass reduced per event ranged from 0.96 tons to 1.58 tons with an average of 1.29 tons per event. After 39 events, the stoichiometric equivalent of 50.38 tons of hexavalent chromium has been treated, which meets the goal of the program. **Figure 2-2** provides a graph of the cumulative hexavalent chromium mass treated to date.

2.4 Injection Event Reporting

Following each injection event a short, written summary of both the operations and the analytical results was provided to the Parties' technical representatives. In accordance with the Consent Decree, a two-year summary report was also prepared and submitted to the Parties in March 2014.

3 GROUNDWATER MONITORING RESULTS

Groundwater quality monitoring of injection wells, selected monitoring wells, and the two downgradient GWET pumping wells was conducted in accordance with the Operations Work Plan. In general, sampling rounds were conducted several days prior to an injection event. The results are provided in **Attachment I** and are color coded to indicate which injection event immediately followed the sampling round.

3.1 Baseline Hexavlent Chromium Distribution in S-3 Sand

A baseline groundwater quality sampling round was conducted in May 2012, just prior to the first injection event, and the results used to reassess the internal distribution of hexavalent chromium within the Deep Overburden plume. The maximum hexavalent chromium concentrations in groundwater from this round are shown on **Figure 3-1.** As noted in the Two Year Summary Report for In-situ Chromium Mass Removal (Cornerstone, March 2014), these data indicate that hexavalent chromium concentrations within the deep overburden plume had not substantially changed since they were mapped six years earlier in 2006.

3.2 Injection Well Data

Sampling of the three injection wells was conducted to assess how long the reductant remains in the groundwater at the point of contact. In general, injection wells were sampled once prior to the first injection event and then just prior to each injection event as shown on **Tables B-1 through B-10** in **Attachment I**. Initially, samples were analyzed in the lab for total and hexavalent chromium, sulfate, calcium and iron. However, after the first year of sampling, it was evident that the water quality in the vicinity of the injection wells was being overwhelmed by the presence of residual CaSx, and thus it was agreed that the analysis of iron would be discontinued after the 2013 injection season (Comments on Two-year Summary Report, Ben Ross April 8, 2014), and that the laboratory analysis of all parameters from injection well samples would be discontinued after August 2014 (e-mail message from Ben Ross dated August 15, 2014). The field-measured parameters of pH, specific conductivity, ORP, dissolved oxygen, and turbidity were continued throughout the five year injection program.

Chromium: Pre-injection hexavalent chromium concentrations in injection wells 088-IW-1, 088-IW-02 and 088-IW-03 ranged from 72 ppm to 536 ppm. Post-injection concentrations in each well were non-detect, indicating a complete reduction of

hexavalent to trivalent chromium. The presence of significant concentrations of total chromium in unfiltered samples (in some cases greater than 1 mg/L) is further evidence of the presence of trivalent chromium produced via hexavalent chromium reduction.

Sulfate: Post-injection sulfate concentrations were variable from well to well and from injection to injection in the same well. For example, sulfate concentrations increased from 315 ppm to 1,390 ppm after the initial injection in well 088-IW-02, yet essentially remained flat after the two subsequent injections. Sulfate is produced as byproduct in the polysulfide reaction with hexavalent chromium. After injections, concentrations typically plateau or even decrease over time as a result of the precipitation of $CaSO_4(s)$ or loss of sulfate by sulfate reducing bacteria. As a result of the transient nature of its post-injection concentrations, sulfate was determined not to be a reliable indicator of the presence of CaSx in groundwater.

Calcium: Calcium concentrations rose sharply after each injection and in all injection wells. Increases ranged from approximately double to over two orders of magnitude. In each case, the post-injection spike was followed by a steady decline in concentrations prior to the subsequent injection. Based on these results, calcium is likely a reliable indicator of the presence of CaSx in groundwater and was therefore continued as a parameter in the downgradient monitoring wells.

Iron: Post-injection concentrations of total iron declined after the first injection event in each well due to the reduction of ferrous iron to iron sulfide. Rebound of iron concentrations between injections was minimal and thus only minor additional declines were observed after subsequent injections. Iron is therefore considered a marginal indicator of the presence of CaSx.

Field-measured Parameters: Data from the field-measured indicator parameters are shown on **Tables B-6 through B-10**. Of these, ORP appears to be the most reliable indicator of the presence of CaSx (reducing conditions) in groundwater. ORP values typically declined from several hundred mV to less than (minus) -400 mV. Groundwater pH is also a reasonably good indicator since the injected calcium polysulfide has a pH of between 11 and 12. Thus, an increase in pH provides a qualitative indication of calcium polysulfide influence at a specific location. Both ORP and pH indicate that reducing conditions have been established around each of the injection wells and that these conditions will persist for some time, facilitating the reduction of additional hexavalent chromium in groundwater moving into the region from upgradient.

3.3 Monitoring Well Data

Four selected monitoring wells and two GWET extraction wells were identified in the Operations Work Plan to assess the downgradient impact of the injection events. These wells are shown on **Figure 3-2** and were sampled once prior to the first injection event and then semi-annually. Data from monitoring well sampling is shown on **Tables A-1 through A-10** in **Attachment I** and further discussed below.

Well 090-MW-09: Monitoring well 090-MW-09 was originally identified to monitor downgradient impacts from injections east of Route 440. However, since injections were not conducted east of Route 440 this well was deleted from the monitoring program.

Well 088-MW-G19T: This well is located approximately 400 feet downgradient of injection well 088-IW-01 on the former JCIA property. Hexavalent chromium concentrations increased from 777 ppm in the baseline round to over 1,000 ppm throughout the rest of the injection program, with the highest value of 1,390 reported during the final semi-annual round in June 2017. This may be the result of a slight shift in groundwater flow direction within the plume or the result of typical variability during sample collection. In either case, the data do not indicate that reducing conditions from the injections have reached this location to date. Parameters used to indicate the presence of the CaSx reductant, such as ORP, calcium, and pH, were relatively consistent throughout the five year program in this well. One exception is the reported negative ORP in June 2016. However, based on the continued elevated hexavalent chromium (1,280 ppm) on this date, the reported ORP value is likely due to instrument error.

Well 087-MW-O29D: Parameters used to indicate the presence of the CaSx reductant, such as ORP, calcium, and pH, were consistent throughout the reporting period in this well. Hexavalent chromium concentrations were also generally consistent ranging from 149 ppm to 235 ppm without a clear trend.

Well 115-DP-1 This is a former depressurization well located approximately 25 feet upgradient from 115-PW-21. (Well 115-PW-21 was used as a temporary injection well on August 20, 2012.) Hexavalent chromium concentrations are shown on **Table A-2** and declined by an order of magnitude from the baseline value of 389 ppm in May 2012 to 39.3 ppm in December 2012, approximately four months after the injection in 115-PW-21. This decline was likely due to the nearby CaSx injection since the ORP also declined from a baseline of +276 mV to -153 mV. Hexavalent chromium concentrations then rebounded to 1,470 ppm in June 2013 along with a rise in OPR to +340 mV, and continued to be quite variable throughout the remainder of the injection program. These variable post-injection results may be due to the influence of groundwater within the overlying S-2 formation since well 115-DP-1 has a 25-foot long screen which extends approximately 20 feet above the top of the S-3 Sand.

GWET Wells: Hexavalent chromium concentrations in the discharge of the three GWET pumping wells from the beginning of pumping in December 2008 through October 2017 are shown on **Figure 3-3**. GWET well PW-2 was replaced in January 2016 with well PW-3 located 125 feet east of PW-2. The plot indicates that there has not been a discernable change in the slope of the downward trend line as a result of the CaSx injection program. In PW-1, concentrations declined from 150 ppm to 40 ppm in the first 3.5 years of pumping (prior to the injections) and then continued on an asymptotic curve to present. The trend in PW-2 was similar until its replacement in 2016. The first 21

months of data from PW-3 indicate a steep decline in concentration which mimics the early years of pumping from PW-1 and PW-2. **Figure 3-4** illustrates calcium concentrations in PW-1 and PW-2/PW-3 during the injection program. These plots are generally flat and do not indicate a clear upward trend to suggest the presence of CaSx in the GWET wells. Data in the Appendix II tables for sulfate and iron concentrations are also consistent throughout the injection period indicating that the CaSx injections have not impacted groundwater quality at the GWET wells.

3.4 Plume Travel Time Assessment

The rate of transport of CaSx in groundwater within the S-3 Sand formation will be a fraction of the advective rate of (clean) groundwater due to dispersion and chemical reactions with hexavalent chromium that will retard the movement of the reductant relative to the flowing groundwater. The seepage rate of groundwater within the S-3 sand is estimated to be 0.75 feet per day which, for the 5.4 years since the beginning of the injection program on May 20, 2012, equates to approximately 1,400 feet. This is based on the Darcy's Law relationship:

Vs = k i / ne; where:

Vs = groundwater seepage velocity (ft/d)
k = hydraulic conductivity of the S-3 sand = 140 ft/day (HydroQual 2004)
i = hydraulic gradient = 1 ft over 800 ft = 0.00125 ft/ft (Cornerstone 2013)
Ne = effective porosity = 0.25 (assumed typical value for lacustrine deposits)

The fact that indicators of CaSx have not been detected in monitoring well 087-MW-G19T, located about 400 feet downgradient of injection well 088-IW-01, nor in the GWET wells located about 1,200 feet downgradient indicates that the movement of the reductant has been significantly retarded through chemical reactions relative to groundwater flow.

4 EFFECTIVENESS EVALUATION

4.1 Program Practicability

During the majority of the five year mass removal program, the area in the vicinity of the injection wells was undergoing various remedial activities. These conditions provided access to the injection wells for the calcium polysulfide tanker trucks and the drilling rigs that were needed for periodic well development. Thus, under these conditions it was feasible for the mass removal program to achieve its objective of injecting large quantities of reductant into the deep overburden plume. However, conducting a similar effort during or after the planned residential redevelopment will not be practicable since access to the injection wells will be limited.

More importantly is that despite the successful implementation of 39 injections, monitoring well data show that the impact on downgradient water quality has been negligible. This underscores the vast quantity of hexavalent chromium present within the deep plume. As discussed in the Technical Support Document: Proposed Supplemental Mass Removal within the Deep Overburden Plume (HydroQual, December 5, 2008), the estimated mass of hexavalent chromium within the Deep Overburden plume was 991 tons, or approximately 20 times more than that treated by the injections. The report also identifies the issue of matrix diffusion, in which hexavalent chromium has become sorbed into the low permeability layers and then slowly diffuses out into the more permeable flow zones, such as the S-3 Sand. Thus, treated groundwater in the S-3 Sand would soon become recontaminated with hexavalent chromium from the adjacent low permeability layers as it moves downgradient from the injection wells.

The historic inability of other mass-removal efforts, such as pumping, to have a measurable impact on hexavalent chromium concentrations within the plume supports this scenario. For example, the plot on **Figure 3-5** illustrates that the combined pumping from prior depressurization wells and the on-going GWET wells has removed and treated approximately 85 tons of hexavalent chromium from the subsurface, yet groundwater concentrations within the deep overburden plume have not declined. These issues were evaluated at length in the above-referenced Technical Support Document which concluded the following:

- "Chromium concentrations in the groundwater will remain well above drinking water standards for more than 100 years, no matter what mass removal actions are implemented."

- "Additional mass-removal efforts within the Deep Overburden plume are not necessary."

- "Honeywell has agreed to undertake a limited, fixed-duration effort to reduce the elevated chromium concentrations within the central portion of the plume…… H(h)owever, it will not replace the need for, or shorten the time required to operate, the court-approved GWET remedy."

In summary, the results of the injection program have verified the conclusions of the Technical Support Document that continued in-situ injections or other mass removal approaches will be both ineffective and impracticable to implement. In short, a truly impactful mass removal program is simply not feasible at this site, especially as redevelopment begins to limit access.

4.2 Program Cost Effectiveness

As of this writing, the cost to implement the five-year mass removal program has been approximately 1.2 million dollars. Since there has not been a measurable improvement in groundwater quality resulting from implementation of this program, a quantitative cost-effectiveness comparison is not feasible. However, considering that only a small percentage of the estimated total mass within the plume has been addressed, and that chromium within the low permeability layers will be even more difficult to access in the future, this technology is clearly not a cost-effective means of groundwater remediation at this site. In summary, there is no measurable benefit, just a 1.2 million dollar cost.

4.3 Necessity of Additional Remedial Activities.

Based on the monitoring data compiled during the five-year mass removal injection program and the results of the technical analysis and transport modeling documented in the 2008 Technical Support Document, it is clear that source control is neither effective nor feasible for the Deep Overburden plume. This is due to both the large mass of hexavalent chromium present within the deep overburded plume and the diffusion-limited migration rate from low-permeability sediments.

It is recommended therefore that no further in-situ mass-removal efforts be undertaken and that the court-approved Ground Water Extraction and Treatment remedy alone be continued to provide downgradient containment of the plume. Groundwater extraction is a well-proven technology that creates a hydraulic barrier to groundwater flow, preventing it from reaching the River. And, located at the downgradient edge of the plume, it will not be impacted by the proposed redevelopment.

In addition to providing a downgradient barrier to flow, the GWET system removes chromium mass. As shown on **Figure 3-5**, the current GWET pumping wells remove approximately 4 to 5 tons of hexavalent chromium per year. Finally, unlike the injection program, pumping from the GWET wells removes mass from the entire vertical column including the Intermediate Zone and the Upper Bedrock Zone.

4.4 Conclusions

The results of the In-situ Chromium Mass Removal/S-3 Injection program discussed above support the following conclusions.

- The Mass Removal/S-3 Injection program has been successful in injecting over 163,000 gallons of calcium polysulfide into the S-3 Sand formation during 39 events over a period of approximately 5.5 years.

- The injections have met the performance objective set forth in the 2010 Mass Removal Consent Decree and the Final Operations Work Plan (Cornerstone 2012) by treating the stoichiometric equivalent of more than 50 tons of hexavalent chromium.

- Monitoring data indicate that CaSx has not reached downgradient monitoring wells or the GWET pumping wells. However, reducing conditions have been established in and around the injection well locations which have the continuing capacity to reduce hexavalent chromium in groundwater entering these areas from upgradient.

- The stoichiometric equivalent 50 tons of hexavalent chromium treated by the mass removal program account for only 5% of the nearly 1,000 tons estimated within the deep overburden plume.

- To date, the combination of various pump-and-treat operations and the Mass Removal/S-3 Injection program has removed or reduced an estimated 135 tons of hexavalent chromium within the subsurface. This represents approximately 13% of the estimated hexavalent chromium within the Deep Overburden Plume. Despite this effort, there has not been a detectable decrease in downgradient hexavalent chromium concentrations which currently remain thousands of times greater than the NJ Ground Water Quality standard.

References

HydroQual, 2008. Technical Support Document – Proposed Supplemental Mass Removal within the Deep Overburden Plume. December 5, 2008.

Cornerstone, 2012. Operations Work Plan for In-situ Chromium Mass Removal (Reductant Injection into the S-3 Sand). February 20, 2012.

Cornerstone, 2014. Two-year Summary Report for In-situ Chromium Mass Removal from the S-3 Sand. March 4, 2014.

Table 2-1
Summary of S-3 Injection Events

Event #	Injection Dates	Injection Well	Injection History	Volume CaSx Injected (gallons)	Volume Water Injected (gallons)	Average Injection Rate (gpm)	Pressurization Required (psi)
1	05/20/12	088-IW-01	First	4,291	9,135	9.0 to 10.9	0
2	07/01/12	088-IW-02	First	4,267	9,000	10.0	0
3	08/20/12	115-PW-21	First	4,350	9,440	12.0	0
4	10/01/12	115-DP-2	First	4,340	9,022	10-11.5	3 to 5
5	12/09/12	088-IW-02	Second	4,230	9,006	11-12.5	0 to 2
6	03/17/13	088-IW-01	Second	4,305	9,027	5.0 to 10.0	0
7	06/23/13	088-IW-03	First	4,320	9,007	7.0 to 11.5	0 to 4
8	08/18/13	088-IW-02	Third	4,171	8,400	10 to 12	0
9	09/22/13	088-IW-01	Third	4,242	8,500	7 to 10	0
10	10/20/13	088-IW-03	Second	3,954	7,950	6 to 9	4 to 7
11	12/08/13	088-IW-02	Fourth	4,080	8,200	10.0	2 to 7
12	03/30/14	088-IW-01	Fourth	4,300	8,400	12 to 14	3 to 8
13	04/27/14	088-IW-03	Third	4,130	8,250	7 to 9	4 to 8
14	06/01/14	088-IW-02	Fifth	4,200	8,400	11.0	0
15	07/13/14	088-IW-01	Fifth	4,240	8,500	3 to 4	12 to 15
16	08/24/14	088-IW-03	Fourth	4,210	8,400	9.0	5 to 7
17	09/21/14	088-IW-02	Sixth	4,250	8,500	13.0	3 to 5
18	10/29/14	088-IW-03	Fifth	3,844	7,700	11.0	8 to 10
19	3/22/2015	088-IW-01	Sixth	4,265	8,600	10.0	12 to 15
20	4/26/2015	088-IW-03	Sixth	4,065	8,160	11.0	10
21	5/31/2015	088-IW-02	Seventh	4,156	8,385	11.5	2 to 6
22	7/6/2015	088-IW-01	Seventh	4,290	8,699	6.0	15 to 17
23	8/16/2015	088-IW-03	Seventh	4,335	8,690	10.0	8 to 10
24	9/27/2015	088-IW-02	Eighth	4,339	8,700	12.0	8 to 10
25	11/2/2015	088-IW-03	Eighth	4,036	8,120	10.0	10 to 13
26	12/06/15	088-IW-01	Eighth	4,122	8,290	3.5	15
27	03/20/16	088-IW-02	Ninth	4,029	8,221	10.0	9.5 to 14.5
28	04/25/16	088-IW-03	Ninth	4,299	8,737	9.0	9.5 to 17.5
29	06/05/16	088-IW-01	Ninth	4,303	8,742	6.0	5 to 18.5
30	07/11/16	088-IW-02	Tenth	4,345	8,686	9.0	7.5 to 17.5
31	08/07/16	088-IW-03	Tenth	3,768	7,652	9.0	13.5 to 15.5
32	10/03/16	088-IW-01	Tenth	4,322	8,512	10.0	2 to 11
33	10/24/16	088-IW-02	Eleventh	4,303	8,468	10.0	2.5 to 10
34	11/29/16	088-IW-03	Eleventh	4,411	8,867	11.0	7 to 10
35	5/8/2017	088-IW-01	Eleventh	4,215	8,490	8.0	13
36	6/12/2017	088-IW-02	Twelfth	4,309	8,645	10.0	5
37	7/17/2017	088-IW-03	Twelfth	3,885	7,780	8.5	17.0
38a	8/28/2017	088-IW-01	Thirteenth	229	300	1.2	17.0
38b	8/28/2017	088-IW-02	Thirteenth	4,102	8,400	9.0	17.0
39	9/18/2017	088-IW-03	Thirteenth	4,262	8,550	10.5	18.0

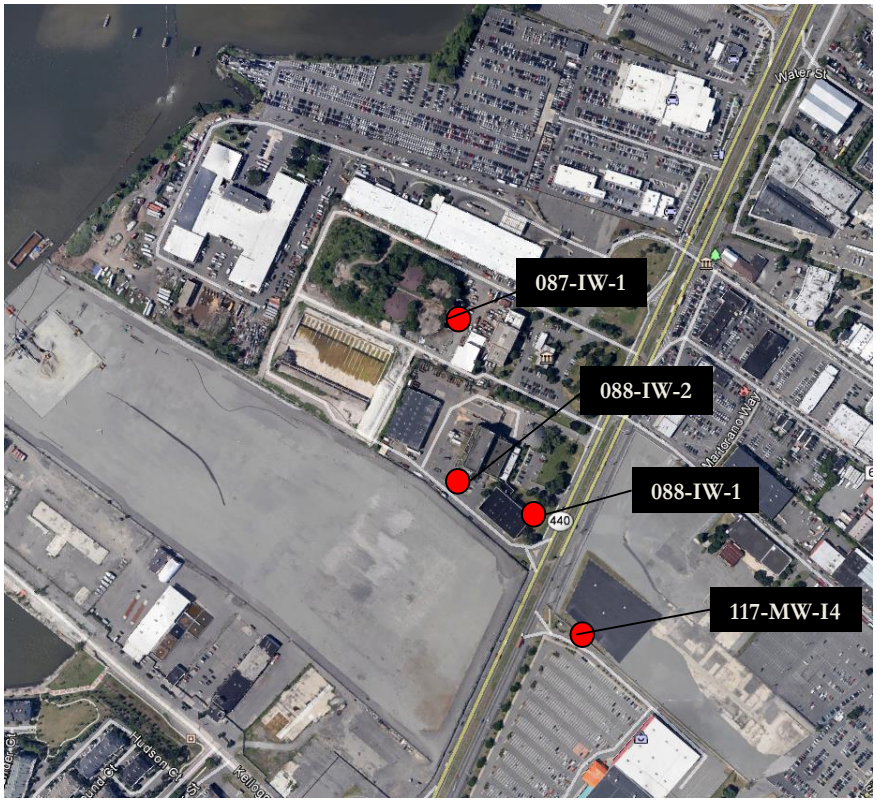
Table 2-2
Calculation of Percent Sulfide in CaSx Samples

Event	Product Name	CaSx Manufacturer	Sulfide % T-1	Sulfide % T-2	Sulfide % T-3	Sulfide % Geometric Mean
1	Calmet	TKI	5.10	4.91	5.01	5.01
2	Calmet	TKI	5.31	5.12	5.44	5.29
3	Calmet	TKI	5.19	5.25	5.19	5.21
4	Calmet	TKI	5.48	5.41	5.45	5.45
5	Calcium Polysulfide	Graus	6.48	6.48	6.56	6.51
6	Calcium Polysulfide	Graus	4.30	4.31	4.33	4.31
7	Calcium Polysulfide	Graus	3.84	3.84	4.06	3.91
8	Calcium Polysulfide	Graus	5.12	5.48	5.40	5.33
9	Calcium Polysulfide	Graus	5.08	4.88	4.92	4.96
10	Calcium Polysulfide	Graus	5.17	5.13	5.16	5.15
11	Calcium Polysulfide	Graus	5.18	5.13	5.11	5.14
12	Calcium Polysulfide	Graus	5.44	5.12	5.22	5.26
13	Calcium Polysulfide	Graus	5.07	5.06	5.50	5.21
14	REMOTOX	Graus	5.98	5.97	5.83	5.93
15	REMOTOX	Graus	4.98	5.06	5.14	5.06
16	REMOTOX	Graus	6.23	6.20	6.02	6.15
17	REMOTOX	Graus	6.21	6.13	5.80	6.04
18	REMOTOX	Graus	6.14	6.39	6.42	6.31
19	REMOTOX	Graus	5.42	5.59	5.42	5.48
20	REMOTOX	Graus	5.56	5.36	5.36	5.43
21	REMOTOX	Graus	6.47	6.66	6.47	6.54
22	REMOTOX	Graus	5.18	5.31	5.35	5.28
23	REMOTOX	Graus	5.31	5.30	5.23	5.28
24	REMOTOX	Graus	5.24	5.19	5.29	5.24
25	REMOTOX	Graus	5.95	5.90	5.91	5.92
26	REMOTOX	Graus	5.88	5.90	5.97	5.92
27	Calcium Polysulfide	Thatcher	4.32	4.32	4.32	4.32
28	Calcium Polysulfide	Thatcher	5.06	5.05	5.06	5.06
29	Calcium Polysulfide	Thatcher	5.17	5.19	5.16	5.17
30	Calcium Polysulfide	Thatcher	5.29	5.31	5.30	5.30
31	Calcium Polysulfide	Thatcher	5.32	5.17	5.20	5.23
32	Calcium Polysulfide	Thatcher	5.79	5.79	5.78	5.79
33	Calcium Polysulfide	Thatcher	5.55	5.55	5.55	5.55
34	Calcium Polysulfide	Thatcher	5.40	5.40	5.40	5.40
35	Calcium Polysulfide	Thatcher	5.38	5.45	5.47	5.43
36	Calcium Polysulfide	Thatcher	5.37	5.50	5.44	5.44
37	Calcium Polysulfide	Thatcher	5.33	5.38	5.38	5.36
38	Calcium Polysulfide	Thatcher	5.72	5.78	5.76	5.75
39	Calcium Polysulfide	Thatcher	5.33	5.37	5.36	5.35

TKI = Tessenderlo Kerley, Inc.
Graus = Graus Chemicals
T- Triplicate #

Table 2-3
Summary of Stoichiometriclly Equivalent Cr(VI) Mass Reduced

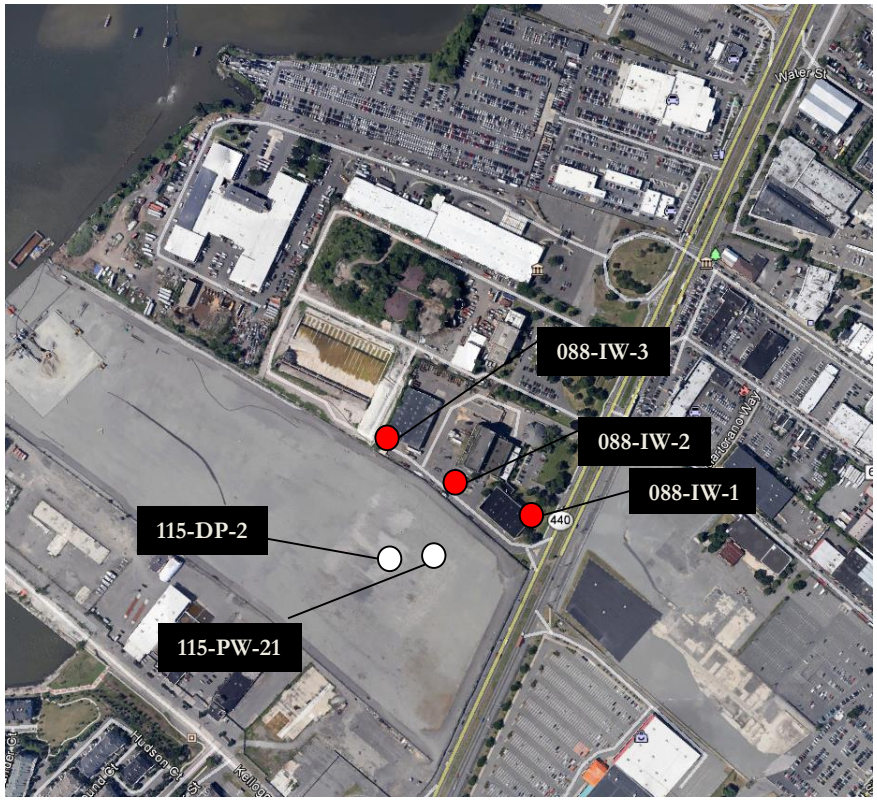
Event #	Injection Date	Injection Well	Mass CaSx Delivered (tons)	Volume CaSx Injected[(a)] (gallons)	Geometric mean Sulfide %	Stoichiometric Equivalent Mass Cr(VI) Reduced (tons)	Cumulative Stoich. Equiv. Mass Cr(VI) Reduced (tons)
1	5/20/12	088-IW-01	22.53	4,291	5.01%	1.22	1.22
2	7/1/12	088-IW-02	22.40	4,267	5.29%	1.28	2.50
3	8/20/12	115-PW-21	22.84	4,350	5.21%	1.29	3.79
4	10/1/12	115-DP-2	22.79	4,340	5.45%	1.34	5.13
5	12/9/12	088-IW-02	22.42	4,230	6.51%	1.58	6.71
6	3/17/13	088-IW-01	22.60	4,305	4.31%	1.05	7.76
7	6/23/13	088-IW-03	22.68	4,320	3.91%	0.96	8.72
8	08/18/13	088-IW-02	22.13	4,171	5.33%	1.28	9.99
9	09/22/13	088-IW-01	22.27	4,242	4.96%	1.19	11.19
10	10/20/13	088-IW-03	20.76	3,954	5.15%	1.16	12.34
11	12/08/13	088-IW-02	21.43	4,080	5.14%	1.19	13.53
12	03/30/14	088-IW-01	22.57	4,300	5.26%	1.28	14.82
13	04/27/14	088-IW-03	21.68	4,130	5.21%	1.22	16.04
14	06/01/14	088-IW-02	22.05	4,200	5.93%	1.41	17.45
15	07/13/14	088-IW-01	22.26	4,240	5.06%	1.22	18.67
16	08/24/14	088-IW-03	22.10	4,210	6.15%	1.47	20.14
17	09/21/14	088-IW-02	22.31	4,250	6.04%	1.46	21.60
18	10/29/14	088-IW-03	20.18	3,844	6.31%	1.38	22.97
19	3/22/2015	088-IW-01	22.39	4,265	5.48%	1.33	24.30
20	4/26/2015	088-IW-03	21.34	3,996	5.43%	1.25	25.55
21	5/31/2015	088-IW-02	21.82	4,086	6.54%	1.54	27.09
22	7/6/2015	088-IW-01	22.52	4,217	5.28%	1.29	28.38
23	8/16/2015	088-IW-03	22.76	4,262	5.28%	1.30	29.68
24	9/27/2015	088-IW-02	22.78	4,266	5.24%	1.29	30.97
25	11/2/2015	088-IW-03	21.19	3,968	5.92%	1.36	32.33
26	12/06/15	088-IW-01	21.64	4,052	5.92%	1.38	33.71
27	03/20/16	088-IW-02	21.15	3,961	4.32%	0.99	34.70
28	04/25/16	088-IW-03	22.57	4,227	5.06%	1.23	35.93
29	06/05/16	088-IW-01	22.59	4,230	5.17%	1.26	37.19
30	07/11/16	088-IW-02	22.81	4,272	5.30%	1.31	38.50
31	08/07/16	088-IW-03	19.78	3,704	5.23%	1.12	39.62
32	10/03/16	088-IW-01	22.69	4,249	5.79%	1.42	41.04
33	10/24/16	088-IW-02	22.59	4,230	5.55%	1.36	42.39
34	11/29/16	088-IW-03	23.16	4,337	5.40%	1.35	43.75
35	5/8/2017	088-IW-01	22.51	4,215	5.43%	1.32	45.07
36	6/12/2017	088-IW-02	23.01	4,309	5.44%	1.35	46.42
37	7/17/2017	088-IW-03	20.75	3,886	5.36%	1.20	47.62
38	8/28/2017	088-IW-02	23.13	4,331	5.75%	1.44	49.06
39	9/18/2017	088-IW-03	22.76	4,262	5.35%	1.32	50.38
		totals:	864	163,051			



a - Originally Proposed Injection Wells

▲

○ Temporary injection well



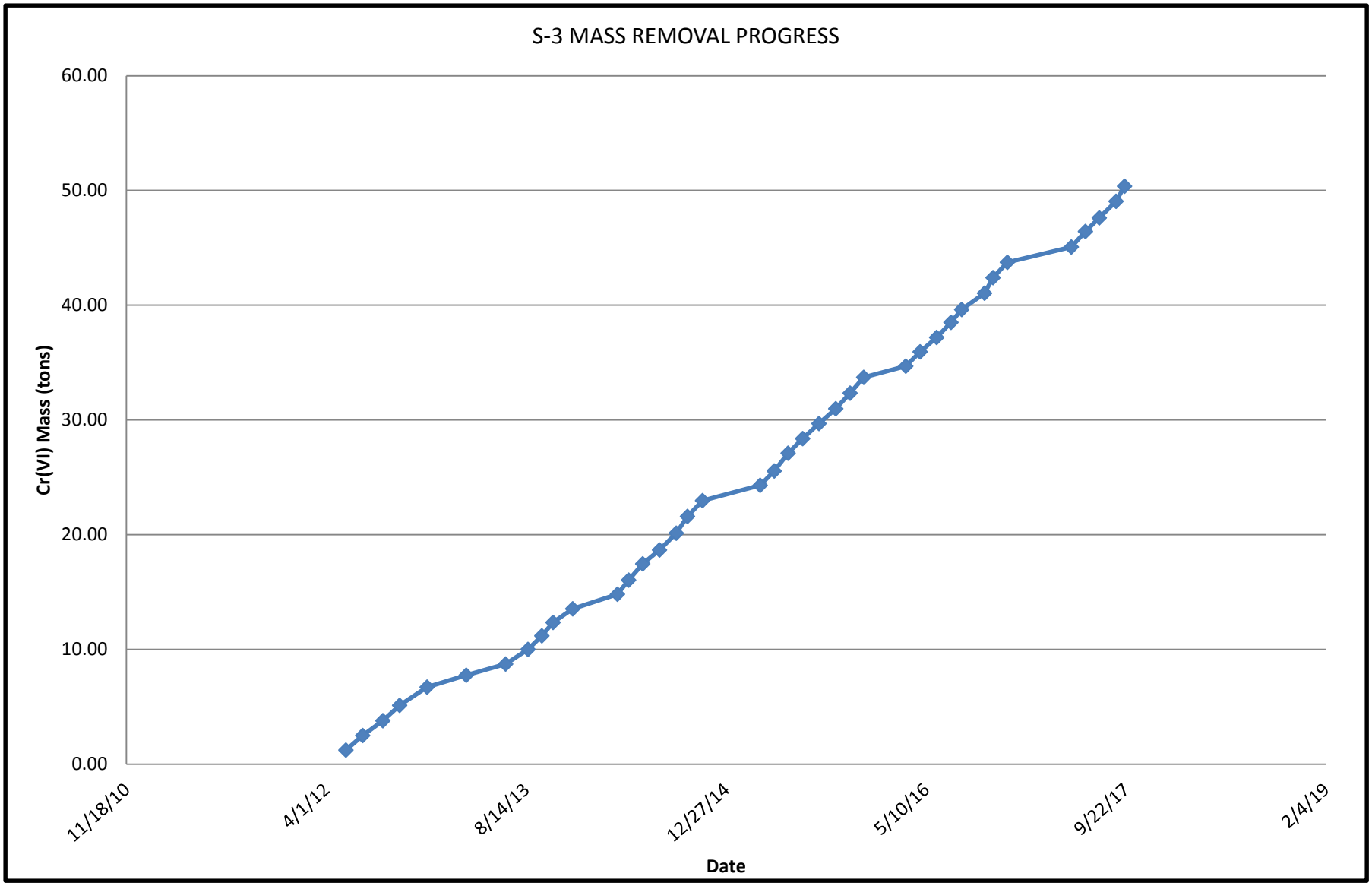
b - Actual Injection Well Locations

Figure 2-1

Originally Proposed v. Actual Injection Well Locations

Study Area 7, Jersey City, NJ

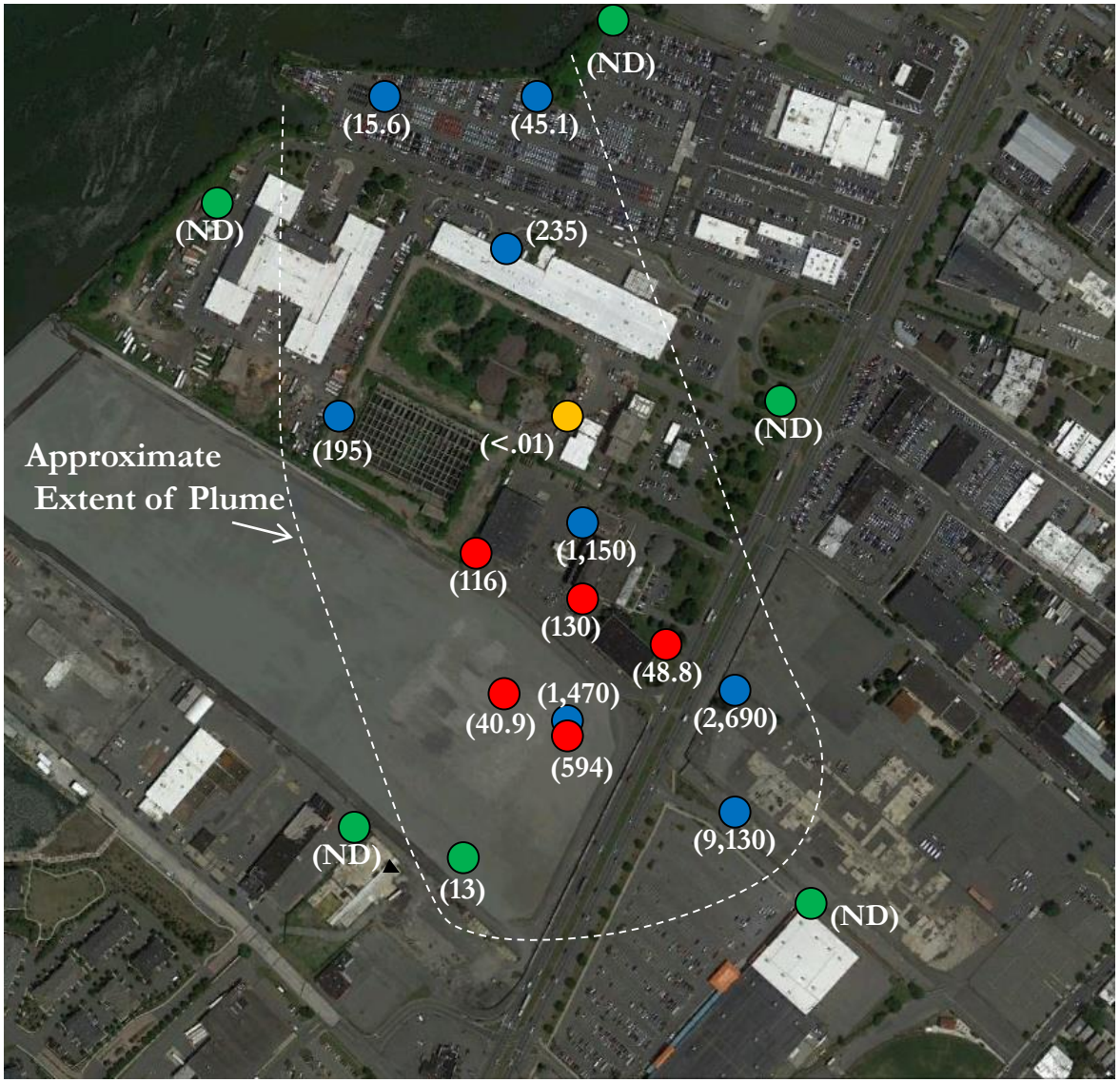
cornerstone
A TETRA TECH COMPANY



cornerstone
A TETRA TECH COMPANY

Cumulative Stoichiometrically Equivalent Cr(VI) Mass Treated by Injections

Figure 2-2



LEGEND

- Well used for injections
- Unused injection well
- S-3 injection program monitoring well
- LTMP monitoring well (sampled Dec. 2011)

Figure 3-1
Maximum Hexavalent Chromium Concentrations Prior to Injection (2012/2013)

Study Area 7, Jersey City, NJ

cornerstone environmental

LEGEND

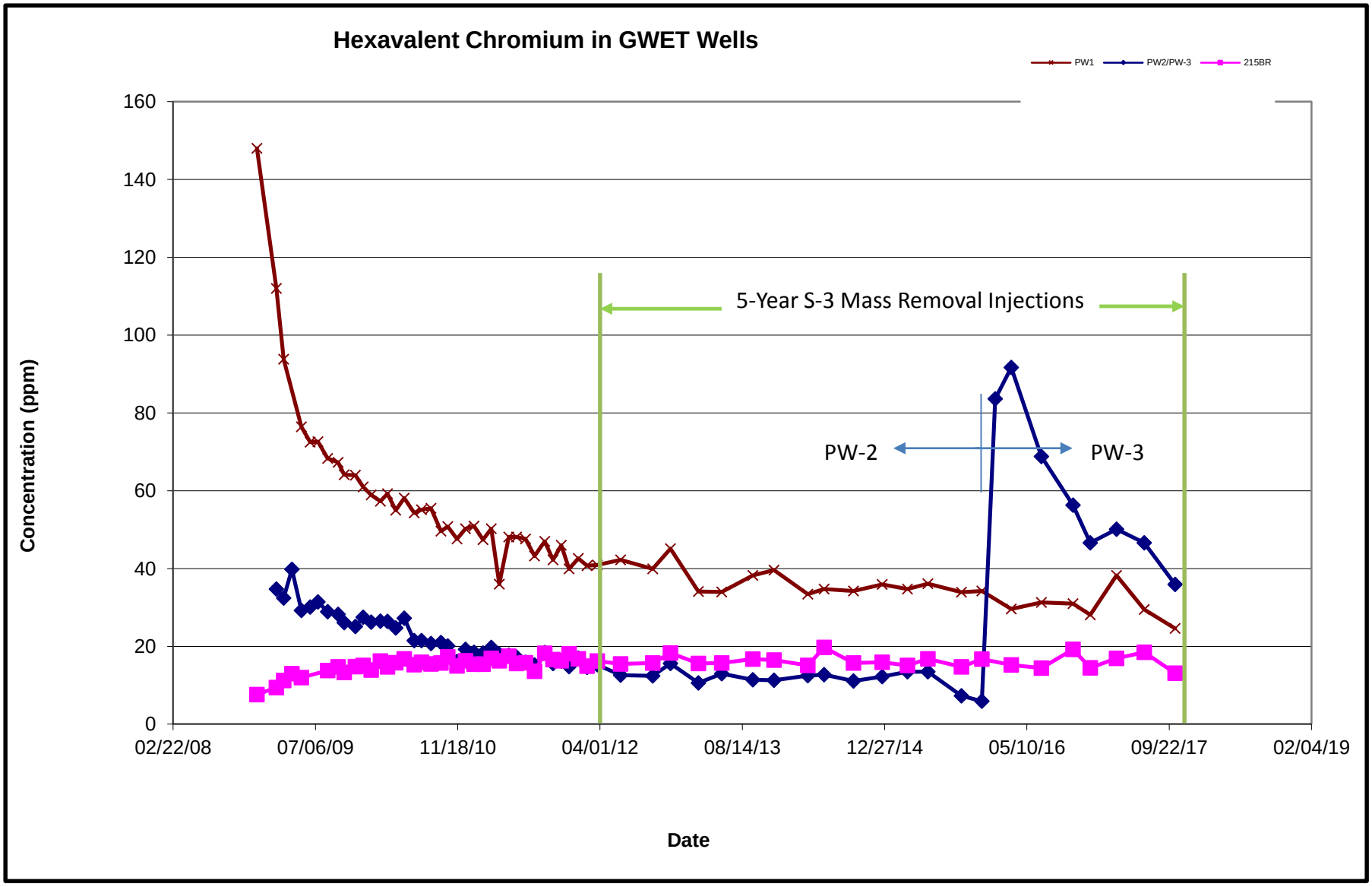
Monitoring Well

Figure 3-2

Monitoring Well Locations

Study Area 7, Jersey City, NJ

cornerstone environmental



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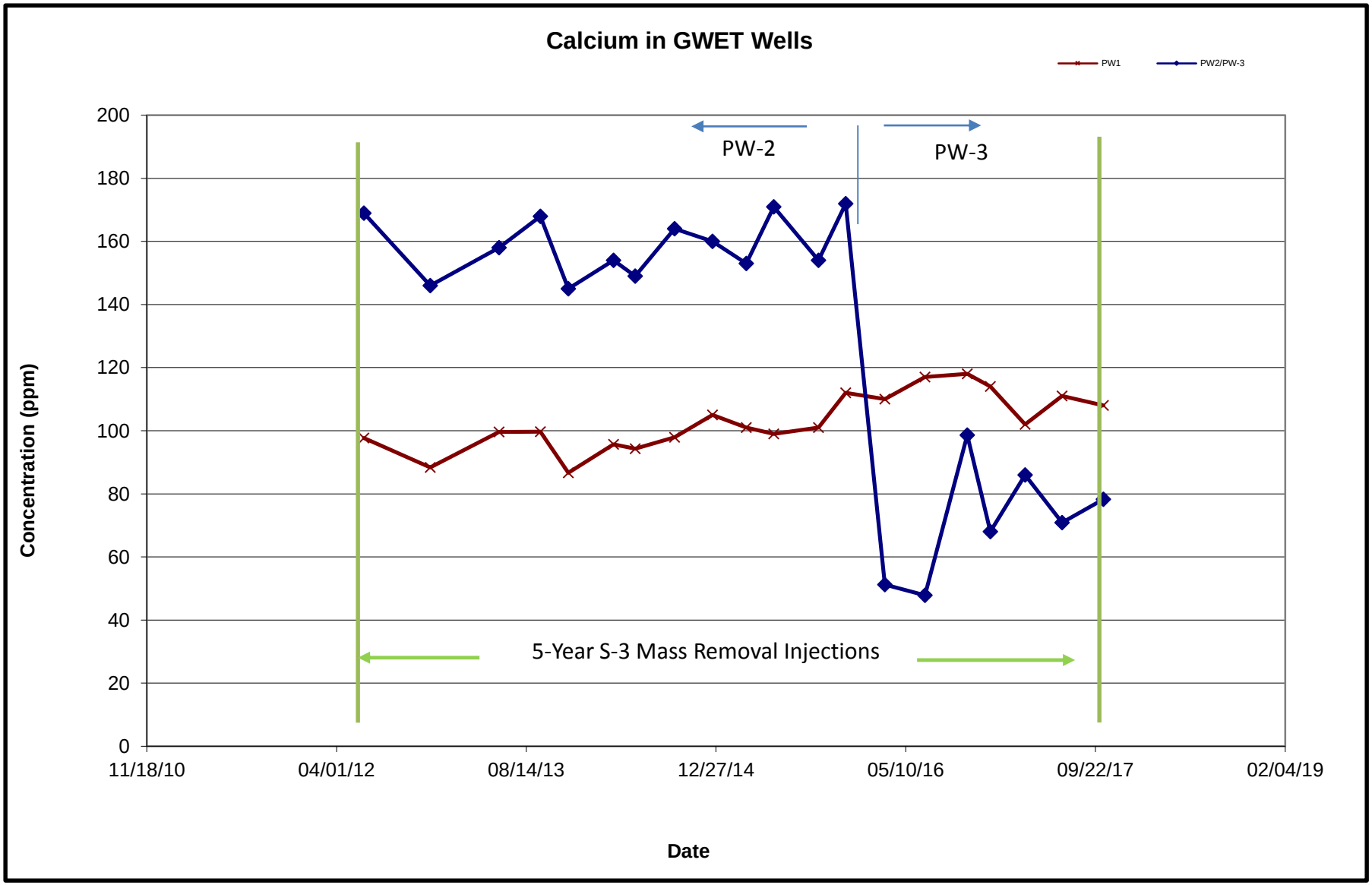
Hexavalent Chromium Concentrations in GWET Well Discharge (ppm)

Figure 3-3



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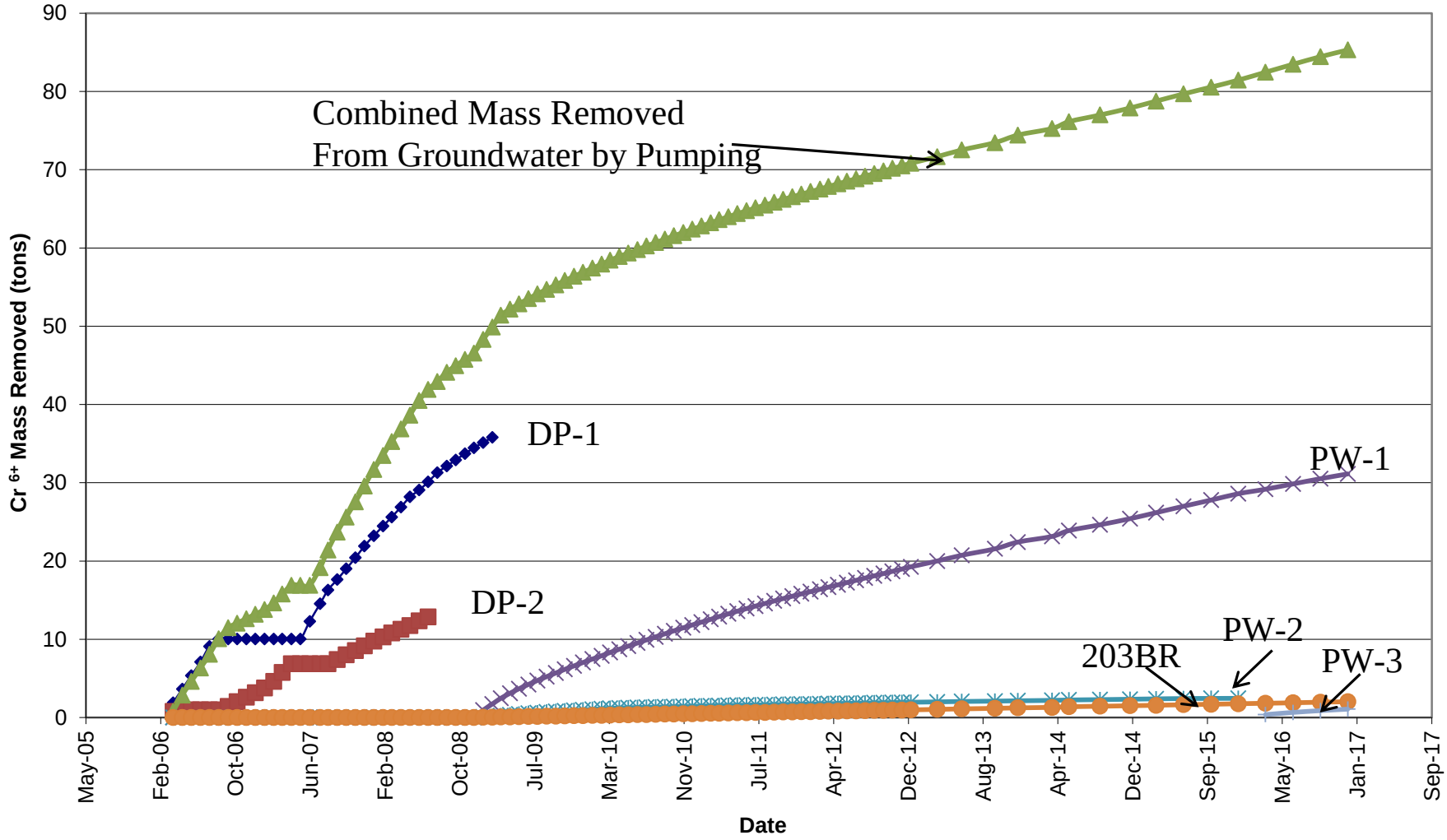
Calcium Concentrations in GWET Well Discharge (ppm)

Figure 3-4



cornerstone
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Cumulative Cr(VI) Mass Removed From Groundwater by Pumping

Figure 3-5

ATTACHMENT I

GROUNDWATER MONITORING DATA

Table A1
Results of Pre-injection Monitoring of Monitoring Wells

Total Chromium in Unfiltered Samples (ppm)

Event #	Sample Date	087-PW-1	087-PW-2	115-DP-1	088-MW-G19T	087-MW-O29D	087-PW-3
1	5/16/2012	46.9	16.2	307	762	180	---
2	6/28/2012	NR	NR	NR	889	NR	---
3	7/31/2012	NR	NR	NR	989	NR	---
5	12/9/2012	37.9	14.8	359	985	171	---
6	3/17/2013	39.8	13.5	NR	NR	NR	---
7	6/3/2013	48.5	28.0	1,670	967	233	---
9	9/22/2013	39.9	13.5	NR	NR	NR	---
11	12/8/2013	34.2	10.6	20.8	1,150	182	---
12	3/30/2014	36.9	16.4	NR	NR	NR	---
14	6/1/2014	35.5	14.5	15.5	982	188	---
17	9/21/2014	37.6	19.3	NR	NR	NR	---
18A	12/20/2014	341	127.0	1,230	927	175	---
19	3/22/2015	347	15.1	NR	NR	NR	---
21	5/31/2015	32.6	15.6	31.5	1,010	173	---
24	9/27/2015	33.8	8.5	NR	NR	NR	---
26	12/3/2015	34.2	8.4	515	974	166	---
26a	1/20/2016	NR	---	NR	NR	NR	83.8
27	3/20/2016	30.4	---	NR	NR	NR	84.3
30	6/30/2016	31.7	---	26.1	1,180	182	37.1
33	10/19/2016	30.2	---	NR	NR	NR	58.5
34	12/19/2016	27.6	---	659	890	127	38.0
36	6/12/2017	26.7	---	28.3	1,120	142	38.5
39	10/13/2017	25.5	---	NR	NR	NR	39.3

---- well not in service

NR: Not Required; the sampling frequency for monitoiring wells in the S-3 Mass Removal Program is semi-annual .

Note: only event dates with at least one sample result shown

Table A2
Results of Pre-injection Monitoring of Monitoring Wells

		Hexavalent Chromium in Unfiltered Samples (ppm)					
Event #	Sample Date	087-PW-1	087-PW-2	115-DP-1	088-MW-G19T	087-MW-O29D	087-PW-3
1	5/16/2012	43.9	15.1	389.0	777	189	---
2	6/28/2012	NR	NR	NR	933	NR	---
3	7/31/2012	NR	NR	NR	897	NR	---
5	12/9/2012	45.1	15.6	39.3	1,150	235	---
6	3/13/2013	34.1	10.6	NR	NR	NR	---
7	6/3/2013	34.0	13.0	1,470	1,050	177	---
9	9/22/2013	38.2	11.4	NR	NR	NR	---
11	12/8/2013	39.6	11.3	19.0	1,230	192	---
12	3/30/2014	33.4	12.5	NR	NR	NR	---
14	6/1/2014	34.7	12.7	14.9	1,070	188	---
17	9/21/2014	34.2	11.1	NR	NR	NR	---
18A	12/20/2014	35.9	12.2	1,300	1,080	190	---
19	3/22/2015	34.7	13.5	NR	NR	NR	---
21	5/31/2015	36.1	13.5	31.1	1,110	207	---
24	9/27/2015	33.9	7.30	NR	NR	NR	---
26	12/3/2015	34.2	5.90	387	1,100	185	---
26a	1/20/2016	NR	---	NR	NR	NR	83.6
27	3/20/2016	29.6	---	NR	NR	NR	91.7
request*	4/11/2016	NR	---	NR	NR	NR	76.6
request*	5/26/2016	NR	---	NR	NR	NR	64.9
request*	6/29/2016	NR	---	NR	NR	NR	58.4
30	6/30/2016	31.3	---	30.6	1,280	181	68.8
33	10/19/2016	31.0	---	NR	NR	NR	56.3
34	12/19/2016	28.1	---	583	977	149	46.6
36	6/12/2017	29.5	---	31.9	1,390	149	46.6
39	10/13/2017	24.6	---	NR	NR	NR	35.9

---- well not in service

NR: Not Required; the sampling frequency for monitoiring wells in the S-3 Mass Removal Program is semi-annual .

* additional sampling at request of Plaintiffs

Note: only event dates with at least one sample result shown

Table A3
Results of Pre-injection Monitoring of Monitoring Wells

		Sulfate in Unfiltered Samples (ppm)					
Event #	Sample Date	087-PW-1	087-PW-2	115-DP-1	088-MW-G19T	087-MW-O29D	087-PW-3
1	5/16/2012	320	613	749	843	604	---
2	6/28/2012	NR	NR	NR	1,030	NR	---
3	7/31/2012	NR	NR	NR	1,020	NR	---
5	12/9/2012	307	671	202	1,020	688	---
7	6/3/2013	268	654	2,130	1,090	662	---
9	9/22/2013	292	664	NR	NR	NR	---
11	12/8/2013	291	701	137	1,140	614	---
12	3/30/2014	283	205	NR	NR	NR	---
26	12/3/2015	NR	1,040	NR	NR	NR	---
26a	1/20/2016	NR	---	NR	NR	NR	344
27	3/20/2016	NR	---	NR	NR	NR	NR
30	6/30/2016	NR	---	NR	NR	NR	NR
33	10/19/2016	NR	---	NR	NR	NR	NR
34	12/19/2016	NR	---	NR	NR	NR	NR
36	6/12/2017	NR	---	NR	NR	NR	NR
39	10/13/2017	NR	---	NR	NR	NR	NR

---- well not in service

NR: Not Required; the sampling frequency for monitoiring wells in the S-3 Mass Removal Program is semi-annual .

Note: only event dates with at least one sample result shown

Table A4
Results of Pre-injection Monitoring of Monitoring Wells

Calcium in Unfiltered Samples (ppm)

Event #	Sample Date	087-PW-1	087-PW-2	115-DP-1	088-MW-G19T	087-MW-O29D	087-PW-3
1	5/16/2012	97.7	169	112	287	48.2	---
2	6/28/2012	NR	NR	NR	293	NR	---
3	7/31/2012	NR	NR	NR	284	NR	---
5	12/9/2012	88.4	146	370	336	52.1	---
7	6/3/2013	99.6	158	473	317	53.1	---
9	9/22/2013	99.7	168	NR	NR	NR	---
11	12/8/2013	86.7	145	37.3	307	52.4	---
12	3/30/2014	95.7	154	NR	NR	NR	---
13	4/27/2014	NR	NR	NR	NR	NR	---
14	6/1/2014	94.3	149	30.9	287	56.2	---
17	9/21/2014	97.9	164	NR	NR	NR	---
18A	12/20/2014	105	160	506	331	49.8	---
19	3/22/2015	101	153	NR	NR	NR	---
21	5/31/2015	99	171	39.1	311	44.2	---
24	9/27/2015	101	154	NR	NR	NR	---
26	12/3/2015	112	172	275	318	44.2	---
26a	1/20/2016	NR	---	NR	NR	NR	35.2
27	3/20/2016	110	---	NR	NR	NR	51.2
request*	4/11/2016	NR	---	NR	NR	NR	54.3
request*	5/26/2016	NR	---	NR	NR	NR	77.2
request*	6/29/2016	NR	---	NR	NR	NR	86.7
30	6/30/2016	117	---	40	414	51	47.8
33	10/19/2016	118	---	NR	NR	NR	196.0
34	12/19/2016	114	---	333	273	38.1	68.0
36	6/12/2017	111	---	39.9	293	44.0	70.9
39	10/13/2017	108	---	NR	NR	NR	78.3

---- well not in service

NR: Not Required; the sampling frequency for monitoiring wells in the S-3 Mass Removal Program is semi-annual .

* additional sampling at request of Plaintiffs

Note: only event dates with at least one sample result shown

Table A5
Results of Pre-injection Monitoring of Monitoring Wells

		Iron in Unfiltered Samples (ppm)					
Event #	Sample Date	087-PW-1	087-PW-2	115-DP-1	088-MW-G19T	087-MW-O29D	087-PW-3
1	5/16/2012	<.5	< .5	0.764	<2	1.12	---
2	6/28/2012	NR	NR	NR	<10	NR	---
3	7/31/2012	NR	NR	NR	4.79	NR	---
5	12/9/2012	<0.1	<0.1	0.954	NR	<0.5	---
7	6/3/2013	0.709	1.21	<5.0	<5.0	1.19	---
9	9/22/2013	0.345	<0.1	NR	NR	NR	---
11	12/8/2013	<0.1	<0.1	0.535	<2.0	<1.0	---
12	3/30/2014	<0.1	0.165	NR	NR	NR	---
26	12/3/2015	NR	NR	NR	NR	NR	---
26a	1/20/2016	NR	---	NR	NR	NR	NR
27	3/20/2016	NR	---	NR	NR	NR	NR
30	6/30/2016	NR	---	NR	NR	NR	NR
33	10/19/2016	NR	---	NR	NR	NR	NR
34	12/19/2016	NR	---	NR	NR	NR	NR
36	6/12/2017	NR	---	NR	NR	NR	NR
39	10/13/2017	NR	NR	NR	NR	NR	NR

---- well not in service

NR: Not Required; the sampling frequency for monitoiring wells in the S-3 Mass Removal Program is semi-annual .

Note: only event dates with at least one sample result shown

Table A6
Results of Pre-injection Monitoring of Monitoring Wells

Field pH (pH units)

Event #	Sample Date	090-MW-09	115-DP-1	088-MW-G19T	087-MW-O29D
1	5/16/2012	6.84	7.29	7.72	7.73
2	5/28/2012	NR	NR	7.83	NR
3	7/31/2012	NR	NR	7.41	NR
5	12/9/2012	7.36	7.97	7.47	7.35
7	6/3/2013	6.94	6.99	7.74	7.75
11	12/8/2013	6.82	8.00	7.83	7.78
14	6/1/2014	NR	8.76	8.02	8.22
18A	12/20/2014	NR	6.85	7.61	7.68
21	5/31/2015	NR	8.20	7.80	7.91
26	12/3/2015	NR	7.04	7.44	7.46
30	6/30/2016	NR	8.5	8.7	8.50
request*	9/29/2016	NR	NR	7.7	7.79
34	12/19/2016	NR	6.8	7.6	7.75
36	6/12/2017	NR	7.63	7.44	7.56
39	10/13/2017	NR	NR	NR	NR

NR: Not Required; the sampling frequency in the S-3 Mass Removal Program is semi-annual .
Note: only event dates with at least one sample result shown
* additional sampling at request of Plaintiffs

Table A7
Results of Pre-injection Monitoring of Monitoring Wells

Field Specific Conductivity (ms/cm)

Event #	Sample Date	090-MW-09	115-DP-1	088-MW-G19T	087-MW-O29D
1	5/16/2012	12.2	5.45	7.56	5.09
2	6/28/2012	NR	NR	7.21	NR
3	7/31/2012	NR	NR	7.66	NR
5	12/9/2012	11.7	3.03	8.10	4.85
6	3/13/2013	NR	NR	NR	NR
7	6/3/2013	10.9	11.1	8.29	4.91
11	12/8/2013	13.9	3.03	8.53	4.73
14	6/1/2014	NR	3.44	9.47	5.29
18A	12/20/2014	NR	13.0	10.7	5.73
21	5/31/2015	NR	3.03	8.09	4.20
26	12/3/2015	NR	5.40	9.6	4.99
30	6/30/2016	NR	4.0	11.4	5.15
request*	9/29/2016	NR	NR	9.4	4.39
34	12/19/2016	NR	4.51	4.82	2.41
36	6/12/2017	NR	3.47	9.40	4.47
39	10/13/2017	NR	NR	NR	NR

NR: Not Required; the sampling frequency in the S-3 Mass Removal Program is semi-annual .
Note: only event dates with at least one sample result shown
* additional sampling at request of Plaintiffs

Table A8
Results of Pre-injection Monitoring of Monitoring Wells

Field Redox Potential (mv)

Event #	Sample Date	090-MW-09	115-DP-1	088-MW-G19T	087-MW-O29D
1	5/16/2012	347	276	251	244
2	6/28/2012	NR	NR	184	NR
3	7/31/2012	NR	NR	187	NR
5	12/9/2012	300	-153	104	-7.0
7	6/3/2013	343	340	255	242
11	12/8/2013	289	181	244	199
14	6/1/2014	NR	242	231	237
18A	12/20/2014	NR	300	248	215
21	5/31/2015	NR	260	237	209
26	12/3/2015	NR	145	148	144
30	6/30/2016	NR	202.0	-55.0	0.0
request*	9/29/2016	NR	NR	162.0	201
34	12/19/2016	NR	309	224	227
36	6/12/2017	NR	208	233	211
39	10/13/2017	NR	NR	NR	NR

NR: Not Required; the sampling frequency in the S-3 Mass Removal Program is semi-annual .
Note: only event dates with at least one sample result shown
* additional sampling at request of Plaintiffs

Table A9
Results of Pre-injection Monitoring of Monitoring Wells

Field Dissolved Oxygen (mg/L)

Event #	Sample Date	090-MW-09	115-DP-1	088-MW-G19T	087-MW-O29D
1	5/16/2012	0.46	2.25	0.43	0.67
2	6/28/2012	NR	NR	0.00	NR
3	7/31/2012	NR	NR	0.00	NR
5	12/9/2012	0.99	1.22	1.02	1.07
7	6/3/2013	0.36	5.05	1.31	0.36
11	12/8/2013	0.85	0.00	0.33	0.33
14	6/1/2014	NR	3.96	0.00	0.00
18A	12/20/2014	NR	0.00	0.00	0.00
21	5/31/2015	NR	15.85**	10.88**	5.73
26	12/3/2015	NR	0.00	0.00	0.00
30	6/30/2016	NR	0.00	0.00	0.00
request*	9/29/2016	NR	NR	0.00	0.00
34	12/19/2016	NR	4.48	5.15	0.00
36	6/12/2017	NR	0.00	0.00	0.00
39	10/13/2017	NR	NR	NR	NR

** Instrument error suspected.

NR: Not Required; the sampling frequency in the S-3 Mass Removal Program is semi-annual .

Note: only event dates with at least one sample result shown

* additional sampling at request of Plaintiffs

Table A10
Results of Pre-injection Monitoring of Monitoring Wells

Field Turbidity (NTU)

Event #	Date	090-MW-09	115-DP-1	088-MW-G19T	087-MW-O29D
1	5/16/2012	0	0	74	0
2	6/28/2012	NR	NR	64	NR
3	7/31/2012	NR	NR	157	NR
5	12/9/2012	177	0	650	708
7	6/3/2013	53	0	48	12
11	12/8/2013	10	20	0	12
14	6/1/2014	NR	8	128	230
18A	12/20/2014	NR	0	185	55
21	5/31/2015	NR	0	138	8
26	12/3/2015	NR	3	0	80
30	6/30/2016	NR	1	0	49
request*	9/29/2016	NR	NR	79	21
34	12/19/2016	NR	0	66	43
36	6/12/2017	NR	3	53	4
39	10/13/2017	NR	NR	NR	NR

NR: Not Required; the sampling frequency in the S-3 Mass Removal Program is semi-annual .
Note: only event dates with at least one sample result shown
* additional sampling at request of Plaintiffs

Table B1
Results of Pre-injection Monitoring of Injection Wells

		Total Chromium in Unfiltered Samples (ppm)			
Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	72.40	255.0	0.047	NR
2	6/28/2012	0.52	111.0	0.026	NR
3	7/31/2012	0.14	4.33	0.019	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	0.155	4.19	NR	NR
5	12/9/2012	0.059	2.82	NR	NR
6	3/13/2013	1.36	4.18	NR	NR
7	6/3/2013	<0.050	36.2	NR	98.6
8	8/18/2013	<10	5.4	NR	0.114
9	9/22/2013	<.01	<.01	NR	<.01
10	10/20/2013	<.1	0.198	NR	<.02
11	12/8/2013	<.1	1.61	NR	<.01
12	3/30/2014	<.02	<.02	NR	<.02
13	4/27/2014	<.01	0.300	NR	<.01
14	6/1/2014	<.01	0.174	0.0225	<.01
15	7/13/2014	<.01	<.01	NR	<.01
16	8/24/2014	<0.050	0.03	NR	<.02
17	9/21/2014	NR	NR	NR	NR
18	10/26/2014	NR	NR	NR	NR
18A	12/20/2014	0.0397	NR	NR	NR
19	3/22/2015	0.251	NR	NR	NR
20	4/26/2015	NR	NR	NR	NR
21	5/31/2015	NR	NR	0.0666	NR
22	7/6/2015	NR	NR	NR	NR
23	8/16/2015	NR	NR	NR	NR
24	9/27/2015	NR	NR	NR	NR
25	11/2/2015	NR	NR	NR	NR
26	12/7/2015	0.068	NR	NR	NR
27	3/20/2016	NR	NR	NR	NR
28	4/25/2016	NR	NR	NR	NR
29	6/5/2016	NR	NR	NR	NR
30	7/11/2016	NR	0.073	NR	NR
31	8/7/2016	NR	NR	NR	NR
32	10/3/2016	NR	NR	NR	NR
33	10/24/2016	NR	NR	NR	NR
34	11/29/2016	NR	NR	NR	NR
35	5/8/2017	NR	NR	NR	NR
36	6/12/2017	NR	NR	NR	NR
37	7/17/2017	NR	NR	NR	NR
38	8/28/2017	NR	NR	NR	NR
39	9/18/2017	NR	NR	NR	NR

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Sixth	Fifth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B2
Results of Pre-injection Monitoring of Injection Wells

		Hexavalent Chromium in Unfiltered Samples (ppm)			
Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	48.8	94.2	<0.010	NR
2	6/28/2012	<0.55	130.0	<0.005	NR
3	7/31/2012	<.55	<.55	<0.0055	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	<0.55	<0.55	NR	NR
5	12/9/2012	<0.14	<0.14	NR	NR
6	3/13/2013	<0.28	<0.55	NR	NR
7	6/3/2013	<2.2	<0.5	NR	116
8	8/18/2013	<.0055	<.0055	NR	<.0055
9	9/22/2013	<.0055	<.0055	NR	<.0055
10	10/20/2013	<.0055	<.0055	NR	<.0055
11	12/8/2013	<.025	<.025	NR	<.025
12	3/30/2014	<.028	<.028	NR	<.028
13	4/27/2014	<.028	<.028	NR	<.028
14	6/1/2014	<.0055	<.0055	<0.0055	<.0055
15	7/13/2014	<.028	<.0055	NR	<.0055
16	8/24/2014	<.028	<.028	NR	<.028
17	9/21/2014	NR	NR	NR	NR
18	10/26/2014	NR	NR	NR	NR
18A	12/20/2014	<0.0055	NR	NR	NR
19	3/22/2015	<0.020	NR	NR	NR
20	4/26/2015	NR	NR	NR	NR
21	5/31/2015	NR	NR	<0.0055	NR
22	7/6/2015	NR	NR	NR	NR
23	8/16/2015	NR	NR	NR	NR
24	9/27/2015	NR	NR	NR	NR
25	11/2/2015	NR	NR	NR	NR
26	12/7/2015	<0.0055	NR	NR	NR
27	3/20/2016	NR	NR	NR	NR
28	4/25/2016	NR	NR	NR	NR
29	6/5/2016	NR	NR	NR	NR
30	7/11/2016	NR	<0.55	NR	NR
31	8/7/2016	NR	NR	NR	NR
32	10/3/2016	NR	NR	NR	NR
33	10/24/2016	NR	NR	NR	NR
34	11/29/2016	NR	NR	NR	NR
35	5/8/2017	NR	NR	NR	NR
36	6/12/2017	NR	NR	NR	NR
37	7/17/2017	NR	NR	NR	NR
38	8/28/2017	NR	NR	NR	NR
39	9/18/2017	NR	NR	NR	NR

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
* reported concentration questionable due to matrix interference
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B3
Results of Pre-injection Monitoring of Injection Wells

		Sulfate in Unfiltered Samples (ppm)			
Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	147	95.7	49.6	NR
2	6/28/2012	861	315	50.6	NR
3	7/31/2012	474	1,390	40.3	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	<400	479	NR	NR
5	12/9/2012	244	227	NR	NR
6	3/13/2013	224	290	NR	NR
7	6/3/2013	108	341	NR	259
8	8/18/2013	138	275	NR	152
9	9/22/2013	149	155	NR	251
10	10/20/2013	<100	344	NR	317
11	12/8/2013	<100	403	NR	<160
12	3/30/2014	<500	<500	NR	<500
13	4/27/2014	<100	357	NR	469
14	6/1/2014	<50	358	NR	<50
15	7/13/2014	<100	<100	NR	188
16	8/24/2014	<100	461	NR	804
17	9/21/2014	NR	NR	NR	NR
18	10/26/2014	NR	NR	NR	NR
18A	12/20/2014	NR	NR	NR	NR
19	3/22/2015	NR	NR	NR	NR
20	4/26/2015	NR	NR	NR	NR
21	5/31/2015	NR	NR	NR	NR
22	7/6/2015	NR	NR	NR	NR
23	8/16/2015	NR	NR	NR	NR
24	9/27/2015	NR	NR	NR	NR
25	11/2/2015	NR	NR	NR	NR
26	12/7/2015	NR	NR	NR	NR
27	3/20/2016	NR	NR	NR	NR
28	4/25/2016	NR	NR	NR	NR
29	6/5/2016	NR	NR	NR	NR
30	7/11/2016	NR	NR	NR	NR
31	8/7/2016	NR	NR	NR	NR
32	10/3/2016	NR	NR	NR	NR
33	10/24/2016	NR	NR	NR	NR
34	11/29/2016	NR	NR	NR	NR
35	5/8/2017	NR	NR	NR	NR
36	6/12/2017	NR	NR	NR	NR
37	7/17/2017	NR	NR	NR	NR
38	8/28/2017	NR	NR	NR	NR
39	9/18/2017	NR	NR	NR	NR

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B4
Results of Pre-injection Monitoring of Injection Wells

		Calcium in Unfiltered Samples (ppm)			
Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	34.7	51.2	73.0	NR
2	6/28/2012	7,760	<50	69.3	NR
3	7/31/2012	2,900	14,300	603	NR
3A	8/16/2012	#N/A	NR	NR	NR
4	10/1/2012	1,400	1,800	NR	NR
5	12/9/2012	827	970	NR	NR
6	3/13/2013	586	2,060	NR	NR
7	6/3/2013	3,320	432	NR	61.5
8	8/18/2013	1,490	250	NR	3,010
9	9/22/2013	1,650	6,680	NR	1,550
10	10/20/2013	6,220	1,210	NR	1,150
11	12/8/2013	6,060	1,100	NR	7,670
12	3/30/2014	2,490	3,260	NR	1,580
13	4/27/2014	2,390	1,600	NR	1,160
14	6/1/2014	978	750	76.6	896
15	7/13/2014	5,500	5,230	NR	1,270
16	8/24/2014	4,620	1,030	NR	1,000
17	9/21/2014	NR	NR	NR	NR
18	10/26/2014	NR	NR	NR	NR
18A	12/20/2014	100.0	NR	NR	NR
19	3/22/2015	NR	NR	NR	NR
20	4/26/2015	NR	NR	NR	NR
21	5/31/2015	NR	NR	94.4	NR
22	7/6/2015	NR	NR	NR	NR
23	8/16/2015	NR	NR	NR	NR
24	9/27/2015	NR	NR	NR	NR
25	11/2/2015	NR	NR	NR	NR
26	12/7/2015	88.7	NR	NR	NR
27	3/20/2016	NR	NR	NR	NR
28	4/25/2016	NR	NR	NR	NR
29	6/5/2016	NR	NR	NR	NR
30	7/11/2016	NR	4,220	NR	NR
31	8/7/2016	NR	NR	NR	NR
32	10/3/2016	NR	NR	NR	NR
33	10/24/2016	NR	NR	NR	NR
34	11/29/2016	NR	NR	NR	NR
35	5/8/2017	NR	NR	NR	NR
36	6/12/2017	NR	NR	NR	NR
37	7/17/2017	NR	NR	NR	NR
38	8/28/2017	NR	NR	NR	NR
39	9/18/2017	NR	NR	NR	NR

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B5
Results of Pre-injection Monitoring of Injection Wells

		Iron in Unfiltered Samples (ppm)			
Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	5.060	4.070	0.516	NR
2	6/28/2012	<5.0	1.900	0.502	NR
3	7/31/2012	4.68	<0.5	NR	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	0.835	0.255	NR	NR
5	12/9/2012	0.504	0.517	NR	NR
6	3/13/2013	0.854	0.277	NR	NR
7	6/3/2013	<0.5	0.478	NR	0.509
8	8/18/2013	0.126	<0.1	NR	<0.1
9	9/22/2013	<0.1	<0.1	NR	0.114
10	10/20/2013	<0.5	<0.1	NR	0.126
11	12/8/2013	<0.2	0.268	NR	<0.2
12	3/30/2014	<0.2	<0.2	NR	<0.2
13	4/27/2014	NR	NR	NR	NR
14	6/1/2014	NR	NR	NR	NR
15	7/13/2014	NR	NR	NR	NR
16	8/24/2014	NR	NR	NR	NR
17	9/21/2014	NR	NR	NR	NR
18	10/26/2014	NR	NR	NR	NR
18A	12/20/2014	NR	NR	NR	NR
19	3/22/2015	NR	NR	NR	NR
20	4/26/2015	NR	NR	NR	NR
21	5/31/2015	NR	NR	NR	NR
22	7/6/2015	NR	NR	NR	NR
23	8/16/2015	NR	NR	NR	NR
24	9/27/2015	NR	NR	NR	NR
25	11/2/2015	NR	NR	NR	NR
26	12/7/2015	NR	NR	NR	NR
27	3/20/2016	NR	NR	NR	NR
28	4/25/2016	NR	NR	NR	NR
29	6/5/2016	NR	NR	NR	NR
30	7/11/2016	NR	NR	NR	NR
31	8/7/2016	NR	NR	NR	NR
32	10/3/2016	NR	NR	NR	NR
33	10/24/2016	NR	NR	NR	NR
34	11/29/2016	NR	NR	NR	NR
35	5/8/2017	NR	NR	NR	NR
36	6/12/2017	NR	NR	NR	NR
37	7/17/2017	NR	NR	NR	NR
38	8/28/2017	NR	NR	NR	NR
39	9/18/2017	NR	NR	NR	NR

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B6
Results of Pre-injection Monitoring of Injection Wells
Field pH (pH units)

Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	8.08	7.46	7.21	NR
2	5/28/2012	10.98	7.53	7.42	NR
3	7/31/2012	10.56	10.38	6.96	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	10.95	11.19	NR	NR
5	12/9/2012	8.27	9.46	NR	NR
6	3/13/2013	10.81	11.35	NR	NR
7	6/3/2013	11.43	10.29	NR	7.66
8	8/18/2013	10.70	11.52	NR	10.90
9	9/22/2013	11.44	11.99	NR	11.66
10	10/20/2013	10.71	11.20	NR	10.74
11	12/8/2013	11.01	11.50	NR	10.94
12	3/30/2014	10.45	11.95	NR	10.90
13	4/27/2014	10.80	11.60	NR	10.90
14	6/1/2014	11.30	11.88	7.74	11.46
15	7/13/2014	9.42	9.90	NR	10.11
16	8/24/2014	10.60	11.05	NR	11.09
17	9/21/2014	NR	11.20	NR	NR
18	10/26/2014	NR	NR	NR	10.63
18A	12/20/2014	NR	NR	7.13	NR
19	3/22/2015	9.59	11.48	NR	10.94
20	4/26/2015	10.99	11.59	NR	10.63
21	5/31/2015	NR	NR	7.31	NR
22	7/6/2015	11.30	NR	NR	NR
23	8/18/2015	NR	NR	NR	11.69
24	9/27/2015	NR	11.15	NR	NR
25	11/2/2015	NR	NR	NR	11.19
26	12/7/2015	6.85	NR	NR	NR
27	3/20/2016	NR	13.17	NR	NR
28	4/25/2016	NR	NR	NR	12.50
29	6/5/2016	10.88	NR	NR	NR
30	7/11/2016	NR	12.19	NR	NR
31	8/7/2016	NR	NR	NR	11.04
32	10/3/2016	11.45	NR	NR	NR
33	10/24/2016	NR	11.21	NR	NR
34	11/29/2016	NR	NR	NR	11.33
35	5/8/2017	12.7	NR	NR	NR
36	6/12/2017	NR	12.68	NR	NR
37	7/17/2017	NR	NR	NR	10.5
38	8/28/2017	11.96	NR	NR	NR
39	9/18/2017	NR	NR	NR	12.51

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiff

Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	event
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B7
Results of Pre-injection Monitoring of Injection Wells
Field Specific Conductivity (ms/cm)

Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	1.78	1.7	2.81	NR
2	6/28/2012	32.7	1.4	2.11	NR
3	7/31/2012	14.2	47.0	2.33	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	7.1	10.0	NR	NR
5	12/9/2012	37.6	5.9	NR	NR
6	3/13/2013	5.47	9.8	NR	NR
7	6/3/2013	3.15	17.0	NR	3.0
8	8/18/2013	7.06	2.6	NR	16.9
9	9/22/2013	7.22	25.9	NR	8.1
10	10/20/2013	20.5	6.1	NR	6.9
11	12/8/2013	22.7	6.1	NR	27.1
12	3/30/2014	12.2	15.1	NR	9.3
13	4/27/2014	14.2	8.9	NR	7.3
14	6/1/2014	6.70	9.5	2.39	12.4
15	7/13/2014	22.3	31.4	NR	8.0
16	8/24/2014	17.0	21.0	NR	5.8
17	9/21/2014	NR	16.0	NR	NR
18	10/26/2014	NR	NR	NR	28.7
18A	12/20/2014	NR	NR	2.75	NR
19	3/22/2015	0.62	6.1	NR	14.1
20	4/26/2015	27.0	5.9	NR	11.1
21	5/31/2015	NR	NR	2.30	NR
22	7/6/2015	29.7	NR	NR	NR
23	8/18/2015	NR	NR	NR	23.5
24	9/27/2015	NR	20.3	NR	NR
25	11/2/2015	NR	NR	NR	2.45
26	12/7/2015	3.04	NR	NR	NR
27	3/20/2016	NR	14.5	NR	NR
28	4/25/2016	NR	NR	NR	24.2
29	6/5/2016	7.9	NR	NR	NR
30	7/11/2016	NR	31.3	NR	NR
31	8/7/2016	NR	NR	NR	23.0
32	10/3/2016	10.4	NR	NR	NR
33	10/24/2016	NR	15.2	NR	NR
34	11/29/2016	NR	NR	NR	21.5
35	5/8/2017	17.7	NR	NR	NR
36	6/12/2017	NR	8.3	NR	NR
37	7/17/2017	NR	NR	NR	21.7
38	8/28/2017	30.4	NR	NR	NR
39	9/18/2017	NR	NR	NR	28.9

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B8
Results of Pre-injection Monitoring of Injection Wells
Field Redox Potential (mv)

Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	93	230	-38	NR
2	6/28/2012	-533	140	-128	NR
3	7/31/2012	-498	-507	-49	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	-508	-510	NR	NR
5	12/9/2012	-497	-497	NR	NR
6	3/13/2013	-483	-505	NR	NR
7	6/3/2013	-478	-509	NR	245
8	8/18/2013	-500	-466	NR	-500
9	9/22/2013	-516	-536	NR	-516
10	10/20/2013	-509	-512	NR	-496
11	12/8/2013	-524	-514	NR	-521
12	3/30/2014	-462	-482	NR	-450
13	4/27/2014	-505	-515	NR	-505
14	6/1/2014	-505	-516	-81	-509
15	7/13/2014	-519	-519	NR	-500
16	8/24/2014	-502	-517	NR	-498
17	9/21/2014	NR	-500	NR	NR
18	10/26/2014	NR	NR	NR	-503
18A	12/20/2014	NR	NR	-75	NR
19	3/22/2015	-452	-504	NR	-501
20	4/26/2015	-511	-506	NR	-506
21	5/31/2015	NR	NR	-37	NR
22	7/6/2015	-498	NR	NR	NR
23	8/18/2015	NR	NR	NR	-506
24	9/27/2015	NR	-517	NR	NR
25	11/2/2015	NR	NR	NR	-489
26	12/7/2015	-30	NR	NR	NR
27	3/20/2016	NR	-474	NR	NR
28	4/25/2016	NR	NR	NR	-490
29	6/5/2016	-444	NR	NR	NR
30	7/11/2016	NR	31	NR	NR
31	8/7/2016	NR	NR	NR	-513
32	10/3/2016	-496	NR	NR	NR
33	10/24/2016	NR	-512	NR	NR
34	11/29/2016	NR	NR	NR	-522
35	5/8/2017	-514	NR	NR	NR
36	6/12/2017	NR	-456	NR	NR
37	7/17/2017	NR	NR	NR	-513
38	8/28/2017	-519	NR	NR	NR
39	9/18/2017	NR	NR	NR	-505

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B9
Results of Pre-injection Monitoring of Injection Wells
Field Dissolved Oxygen (mg/L)

Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	0.38	0.51	1.02	NR
2	6/28/2012	0.00	0.00	0.00	NR
3	7/31/2012	0.52	4.73	0.00	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	2.70	5.88	NR	NR
5	12/9/2012	5.16	0.43	NR	NR
6	3/13/2013	8.56	5.37	NR	NR
7	6/3/2013	0.24	0.42	NR	5.22
8	8/18/2013	0.38	0.28	NR	0.27
9	9/22/2013	2.19	2.29	NR	3.20
10	10/20/2013	0.48	0.96	NR	2.90
11	12/8/2013	1.95	1.36	NR	1.45
12	3/30/2014	NA	2.61	NR	2.95
13	4/27/2014	4.50	3.10	NR	2.80
14	6/1/2014	0.00	0.00	0.00	0.00
15	7/13/2014	0.48	0.38	NR	0.36
16	8/24/2014	0.86	0.52	NR	0.62
17	9/21/2014	NR	4.42	NR	NR
18	10/26/2014	NR	NR	NR	0.45
18A	12/20/2014	NR	NR	0.00	NR
19	3/22/2015	2.91	1.38	NR	1.19
20	4/26/2015	2.58	2.02	NR	2.84
21	5/31/2015	NR	NR	5.64	NR
22	7/6/2015	0.00	NR	NR	NR
23	8/18/2015	NR	NR	NR	3.35
24	9/27/2015	NR	0.00	NR	NR
25	11/2/2015	NR	NR	NR	0.00
26	12/7/2015	0.00	NR	NR	NR
27	3/20/2016	NR	0.0	NR	NR
28	4/25/2016	NR	NR	NR	0.00
29	6/5/2016	0.00	NR	NR	NR
30	7/11/2016	NR	0.00	NR	NR
31	8/7/2016	NR	NR	NR	3.8
32	10/3/2016	1.07	NR	NR	NR
33	10/24/2016	NR	0.00	NR	NR
34	11/29/2016	NR	NR	NR	0.00
35	5/8/2017	0.00	NR	NR	NR
36	6/12/2017	NR	0.00	NR	NR
37	7/17/2017	NR	NR	NR	0.00
38	8/28/2017	0.00	NR	NR	NR
39	9/18/2017	NR	NR	NR	0.00

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	

Table B10
Results of Pre-injection Monitoring of Injection Wells

		Field Turbidity (NTU)			
Event #	Sample Date	088-IW-01	088-IW-02	087-IW-01	088-IW-03
1	5/16/2012	15.2	39.4	0.0	NR
2	6/28/2012	>800	24.1	8.5	NR
3	7/31/2012	13.0	113.0	18.1	NR
3A	8/16/2012	NR	NR	NR	NR
4	10/1/2012	0.0	34.1	NR	NR
5	12/9/2012	0.0	0.0	NR	NR
6	3/13/2013	3.7	8.8	NR	NR
7	6/3/2013	545	1.0	NR	8.4
8	8/18/2013	0.0	3.2	NR	0.0
9	9/22/2013	2.4	8.4	NR	15.2
10	10/20/2013	0.0	0.0	NR	0.0
11	12/8/2013	0.0	42.2	NR	8.0
12	3/30/2014	1.4	16.3	NR	2.1
13	4/27/2014	0.0	1.2	NR	0.0
14	6/1/2014	7.8	38.0	4.4	4.6
15	7/13/2014	0	0.0	NR	0.0
16	8/24/2014	1.50	2.8	NR	0.0
17	9/21/2014	NR	0.0	NR	NR
18	10/26/2014	NR	NR	NR	0.0
18A	12/20/2014	NR	NR	4.800	NR
19	3/22/2015	120	50.0	NR	60.0
20	4/26/2015	0.0	69.0	NR	0.0
21	5/31/2015	NR	NR	0.00	NR
22	7/6/2015	0.0	NR	NR	NR
23	8/18/2015	NR	NR	NR	13.3
24	9/27/2015	NR	3.3	NR	NR
25	11/2/2015	NR	NR	NR	4.10
26	12/7/2015	4.90	NR	NR	NR
27	3/20/2016	NR	64.8	NR	NR
28	4/25/2016	NR	NR	NR	26.5
29	6/5/2016	7.20	NR	NR	NR
30	7/11/2016	NR	4.8	NR	NR
31	8/7/2016	NR	NR	NR	26.0
32	10/3/2016	4.40	NR	NR	NR
33	10/24/2016	NR	8.6	NR	NR
34	11/29/2016	NR	NR	NR	57.0
35	5/8/2017	0.0	NR	NR	NR
36	6/12/2017	NR	3.00	NR	NR
37	7/17/2017	NR	NR	NR	2.70
38	8/28/2017	0.00	NR	NR	NR
39	9/18/2017	NR	NR	NR	4.90

NR-Not Required; The selection of injection wells for sampling prior to each event was coordinated with Plaintiffs.
Sample collected just prior to following injection events in indicated well:

First	Second	Third	Fourth	Fifth	Sixth	Seventh
Eights	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	