IN SITU METALS IMMOBILIZATION - PILOT TESTING WORK PLAN

West of 4th Site - Site Unit 1

Prepared for: West of 4th Group

Project No. 050067 • December 21, 2017 Final

Aspect CONSULTING

earth + water

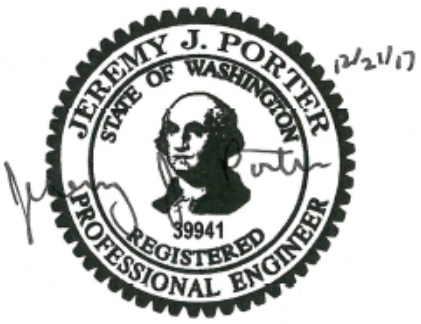
IN SITU METALS IMMOBILIZATION – PILOT TESTING WORK PLAN

West of 4th Site - Site Unit 1

Prepared for: West of 4th Group

Project No. 050067 • December 21, 2017 Final

Aspect Consulting, LLC



Jeremy Porter, PE
Senior Associate Engineer
jporter@aspectconsulting.com

Adam Griffin, PE
Senior Engineer
agriffin@aspectconsulting.com

V:\050067 Art Brass Plating\Pilot Study\Metals\Pilot Test Work Plan\Final\SU1 Metals Pilot Test Work Plan_FINAL_20171221.docx

Contents

List of Tables

List of Figures

List of Appendices

Acronyms

ABP	Art Brass Plating
AO	Agreed Order
ARI	Analytical Resources Inc.
Aspect	Aspect Consulting, LLC
AS/SVE	air sparging/soil vapor extraction
ASTM	American Society for Testing and Materials
BDC	Blaser Die Casting
bgs	below ground surface
CAP	cleanup action plan
CI	Capital Industries
COCs	constituents of concern
CSM	conceptual site model
CUL	cleanup level
CVOC	chlorinated volatile organic compound
D&M	Dames and Moore
DR	dose-response
Ecology	Washington Department of Ecology
EGL	Environmental Geochemistry Lab
EPA	U.S. Environmental Protection Agency
FS	feasibility study
HASP	Health and Safety Plan
HSA	hollow-stem auger
IDW	investigative-derived waste
µg/L	micrograms per liter
mL	milliliters
PCULs	proposed cleanup levels

PGG	Pacific Groundwater Group
PLPs	potentially liable parties
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RI	remedial investigation
ROI	radius of influence
ROW	right-of-way
SAP	Sampling Analysis Plan
SDSs	safety data sheets
s.u.	standard unit
SU1	Site Unit 1
SU2	Site Unit 2
W4	West of 4th
WAC	Washington Administrative Code

1 Introduction

1.1 Purpose

The *In Situ* Metals Immobilization – Pilot Testing Work Plan (Work Plan) for the West of 4th (W4) Site, Site Unit 1 has been prepared by Aspect Consulting, LLC (Aspect) on behalf of potentially liable parties (PLPs) [Art Brass Plating (ABP), Blaser Die Casting (BDC), Capital Industries (CI), and Burlington Environmental) [1],] identified by the Washington State Department of Ecology (Ecology) in Agreed Order (AO) No. DE10402 for the W4 Site (the Site). The AO requires the four PLPs (the W4 Group) to complete a feasibility study (FS), and prepare a Draft Cleanup Action Plan (CAP) for the W4 Site.

The W4 Site has been divided into two site units, Site Unit 1 (SU1; ABP and Stericycle) and Site Unit 2 (SU2; BDC, CI and Stericycle), as described in the AO. Figure 1 shows the ABP Facility locations of the four PLPs and the SU1 and SU2 boundaries.

The SU1 FS (Aspect, 2016) developed and evaluated remedial alternatives to address contaminated media at SU1 in accordance with Washington Administrative Code (WAC) 173-340-350(8). Ecology did not agree with the preferred remedy identified for chlorinated volatile organic compounds (CVOCs) in the SU1 FS. Upon further discussion with Ecology, pilot testing of technologies was determined to be an appropriate step to reduce the uncertainties associated with treatment of CVOCs in downgradient groundwater. The use of pH neutralization to immobilize dissolved metals in SU1 groundwater was included in seven of the nine remedial alternatives evaluated in the Final FS (Aspect, 2016). A pH neutralization pilot test is planned to be conducted concurrent with the CVOC pilot test to evaluate the effectiveness of potential amendments and better define the remedy in the CAP. As discussed in the Final FS, pilot testing of pH neutralization is necessary for full-scale design, and will reduce uncertainty in performance and cost of the technology.

This Work Plan describes the pilot study activities proposed to evaluate engineered *in situ* pH neutralization to treat dissolved plating metals (nickel, cadmium, copper, and zinc) present in SU1 source area groundwater. The pilot testing location is shown on Figure 2. Pilot testing will assess the effectiveness and cost of using pH neutralization at immobilizing plating metals in groundwater—specifically, the pilot test will focus on nickel in Water Table Interval groundwater. The pilot test results will be used to refine the description and evaluation of remedial alternatives presented in the SU1 FS and to select the preferred remedy.

[1] Burlington Environmental, LLC is a wholly owned subsidiary of PSC Environmental Services, LLC, which is a wholly owned subsidiary of Stericycle Environmental Solutions, Inc., hereafter referred to in this document as “Stericycle” for simplicity.

1.2 Report Organization

This report is organized as follows:

- **Section 1** describes the purpose and organization of the Work Plan.
- **Section 2** contains background information about SU1 relevant to pilot testing, description of the Site, and proposed cleanup levels.
- **Section 3** presents a conceptual site model (CSM) as a basis for pilot testing design including geology, hydrogeology, nature and extent of metals contamination, and fate and transport mechanisms for metals in groundwater.
- **Section 4** describes the pilot testing activities. Activities will be conducted in three phases. The Field-Scale Pilot Test, Phase III, is only conceptually designed in this Work Plan. The final design will be based on results of Phases I and II and will be reported separately in a Field Implementation Work Plan.
- **Section 5** presents the project organization and plans required for the pilot test.
- **Section 6** presents the schedule and reporting of pilot test activities.
- **Section 7** provides references used in the preparation of this report.

The text is followed by tables and figures that support the text and illustrate the proposed pilot testing activities.

Appendices to this report provide supporting information referenced within the text. These include existing boring and well construction logs, nickel concentration and geochemistry trends in groundwater, typical well construction diagrams, historical groundwater and soil analytical results, and the basis for alkaline reagent selection.

2 Background

2.1 Site Description

SU1 is located in the Georgetown neighborhood of Seattle (Figure 1). SU1 extends from 4th Avenue South to the Duwamish Waterway (the Waterway), a distance of about 2,200 feet, and is generally flat with a gradual slope to the west (Figures 2 and 3). SU1 includes a mixture of commercial, industrial, and residential land uses.

A remedial investigation (RI) was completed to characterize SU1 conditions and collect the information needed to prepare this FS, as documented in the Remedial Investigation Report, Art Brass Plating (hereafter: ABP RI Report; Aspect, 2012). Additional characterization data for SU1 and SU2 are available in the RI reports prepared by CI (Farallon, 2012), BDC (PGG, 2012), and Stericycle (PSC, 2003). Exploration locations from these activities are depicted on Figure 2. The Site Conceptual Model Technical Memo (Aspect, 2014a) identifies the sources of constituents of concern (COCs), nature and extent of contamination, and known and potential exposure pathways and receptors.

Constituents of concern (COCs) in SU1 include CVOCs, plating metals, and nonplating metals (redox-sensitive metals).

This Work Plan is focused on plating metals (cadmium, copper, nickel, and zinc) in groundwater in SU1, adjacent to the ABP Facility. The ABP Facility is the property located at 5516 3rd Avenue South. The nature and extent of plating metals in the pilot study location is discussed further in Section 3.3.

2.2 Proposed Cleanup Levels

The W4 joint deliverable, *Revised Preliminary Site Cleanup Standards* (Farallon, 2014), outlined the preliminary cleanup standards for the Site. The proposed cleanup levels (PCULs) for COCs are based on potential exposure pathways. As presented in the Final FS, Site groundwater is not considered a current or potential future drinking water source; therefore, drinking water standards are not included in PCULs. Since 2014, PCULs have been updated as standards change. Table 1 provides the PCULs, as updated and submitted to Ecology on January 27, 2017.

2.3 Air Sparging Interim Action

In September 2008, ABP installed an air sparging/soil vapor extraction (AS/SVE) system to remove CVOCs from soil vapor, soil, and groundwater at and around the ABP Facility. The objectives of the AS/SVE system were to prevent vapor intrusion at the ABP Facility and the adjacent 220 Findlay office building, and to reduce soil and groundwater concentrations of CVOCs to levels that significantly reduce the restoration time frame and are protective of the indoor air pathway.

The AS/SVE system operated continuously (except for periodic shutdowns for monitoring and maintenance) between September 2008 and November 2011. In November 2011, the AS system was shut down to conduct a rebound analysis. Since October 2012, the AS system has operated on an approximate six-month on-off pulsing schedule while the SVE system remains on continuously. The AS has been shut off since October 1, 2015, pending final remedy selection and will remain off during the pilot testing activities described in this Work Plan.

3 Conceptual Site Model

The CSM was initially developed during the ABP RI and has been continually modified as additional data has been gathered. Subsequent to the ABP RI Report in 2012, additional data gaps were identified focusing on the nature and extent of plating metals in SU1 groundwater in the vicinity of the ABP Facility. The RI Data Gaps and Supplemental Work Plan (Aspect, 2014b) was developed to address these data gaps (hereafter Supplemental Investigation). Results of this work were reported in the Final FS and serve as a primary component of the CSM for pilot testing (Aspect, 2016). This section summarizes the CSM related to plating metals to develop the basis of design for

pilot testing. As additional data are collected during pilot study activities, this CSM will be revisited and updated as necessary.

3.1 Geology

The geologic units encountered in borings completed in the vicinity of ABP include a Younger Alluvium and Older Alluvium. The upper portion of the Younger Alluvium has been modified and is referred to as the Fill Unit. A description of these units is provided below. Available boring logs from the pilot study vicinity are included in Appendix A.

Fill Unit

The Fill Unit consists of heterogeneous layers of gravelly sand, silt, and silty sand with scattered bits of inert debris such as glass shards and brick fragments. This unit extends up to a depth of 8 feet. In some cases, the boundary between the Fill Unit and the Younger Alluvium is difficult to distinguish. Therefore, these units are generally grouped together.

Younger Alluvium

The Younger Alluvium (Qyal) represents channel and overbank/floodplain deposits from the Duwamish River (Booth and Herman, 1998). Based on borings in the vicinity of the ABP Facility, the Younger Alluvium consists of two subunits, a sandy silt or silty sand unit overlying a slightly silty fine-medium sand unit. Scattered bits of wood and organic debris are also present. This unit is typically found within a few feet above or below the current sea level and extends to a depth of approximately 25 to 30 feet beneath the ABP Facility. West of ABP (starting near 2nd Avenue South) and in the pilot study location, the Younger Alluvium extends to a depth of approximately 55 feet.

Older Alluvium

The Older Alluvium (Qoal) represents materials deposited in an estuarine and deltaic environment. Based on borings in the vicinity of the ABP Facility, the Older Alluvium consists of interbedded sequences of silty fine sand and sandy silt. While not observed in ABP borings, this unit can also contain discontinuous gravel lenses and locally abundant shells and some wood (Booth and Herman, 1998).

3.2 Hydrogeology

Groundwater at the Site is encountered at a depth of 3 to 10 feet below grade. Groundwater flow is towards the Waterway, which is west-southwest of the ABP Facility.

3.2.1 Hydrostratigraphy

A nomenclature for hydrostratigraphic units has been adopted for Site characterization (groundwater monitoring and sampling intervals) and directly corresponds to the lithologic units described in Section 3.1 (PSC, 2003). This nomenclature is maintained in describing groundwater at the Site and consists of:

- **Water Table Interval.** This interval includes monitoring wells screened above 20 feet below ground surface (bgs) and reconnaissance groundwater samples collected above 20 feet bgs.

- **Shallow Interval.** This interval includes monitoring wells screened below 20 feet and above 40 feet bgs, and reconnaissance groundwater samples collected between 21 feet and 40 feet bgs.
- **Intermediate Interval.** This interval includes monitoring wells and reconnaissance groundwater samples screened below 40 feet bgs.

The focus of the pilot testing are the highest concentrations of plating metals present in the Water Table Interval.

3.3 Nature and Extent of Metals Contamination

Soil borings installed during the RI determined the extent of plating metals in soils in the vicinity of the ABP Facility (Aspect, 2012). Additionally, the Supplemental Investigation included three additional borings SB-53, SB-54, and SB-55 installed in September 2014 to further characterize the extent of plating metals in soils and fate and transport mechanisms (Aspect, 2016). The extent of nickel in vadose soil (less than 6 feet bgs) and saturated soil (greater than 6 feet bgs) is shown on Figures 4 and 5, respectively. The historical soil data presented is also included in Appendix B.

Plating metals (cadmium, copper, nickel, and zinc) exceed groundwater PCULs for protection of surface water. The horizontal extent of plating metals impacts appears limited to approximately 400 feet downgradient of the ABP Facility with the greatest extent in the Water Table Interval. Of the plating metals, nickel exhibits the greatest extent and is therefore the driver for the extent of remedial actions for plating metals in groundwater. The extent of plating metals in groundwater is presented on Figures 6 through 9. The historical groundwater data presented is also included in Appendix C.

3.3.1 Fate and Transport of Metals

As part of 2014 Supplemental Investigation, three soil borings were advanced along a transect beginning near the ABP Facility and in the principal groundwater flow direction downgradient (SPO-53, SPO-54, and SPO-55, respectively). Cores were retrieved and characterized for metals concentrations, sulfide, and pH. In addition to the bulk chemistry, select samples from these cores were also analyzed by acid-base accounting, sequential extraction, and evaluation of mineral saturation indices. The results, as they relate to plating metals fate and transport, were summarized in the FS (Aspect, 2016):

- Metal oxide/hydroxide precipitation reduces plating metal mobility via surface sorption and precipitation mechanisms. Modeling predicts that nickel concentrations will not exceed the PCUL protective of surface water (8.2 micrograms per liter [µg/L]) at the Waterway for approximately 500 years based solely on this attenuation mechanism. An analysis of copper and zinc data indicate these metals undergo similar attenuation mechanisms as those modeled with nickel, and these plating metals are attenuated near the source area.
- Metal sulfide precipitation reduces plating metal mobility. Modeling predicts nickel concentrations will not exceed the PCUL protective of surface water at the Waterway for at least 1,000 years. An analysis of copper and zinc data indicate these metals

undergo similar attenuation mechanisms as those modeled with nickel, and these plating metals are attenuated near the source area.

- Subsurface processes neutralize and buffer acidic groundwater, limiting the mobility of dissolved metals. Analyses indicate that a net neutralization potential remains downgradient of the source area and deeper in the soil column. Reactive transport modeling predicts that low pH conditions at the ABP Facility will attenuate within a few decades.
- Model simulations predict that, with all three processes operating (metal oxide/hydroxide precipitation, metal sulfide precipitation, and net neutralization potential), elevated nickel concentrations will not be transported downgradient and the plume will shrink over time. Sensitivity analyses indicate that even if sulfate reduction rates are three orders of magnitude lower than the base case, nickel concentrations in groundwater discharging to surface water will not exceed the cleanup level (CUL) of 8.2 µg/L for at least 1,000 years.

This work also established an association between the presence of plating metals dissolved in groundwater and acidic pH of groundwater. The acidic conditions in groundwater is attenuating with time as shown on Figure 10. With this attenuation of pH (through aquifer neutralization), dissolved plating metals are also decreasing with time and attenuation distance, as shown on Figure 11. Nickel attenuation is also evident on trend charts presented in Appendix D.

The purpose of pilot testing described in this work plan is to enhance immobilization of plating metals in groundwater using an alkaline reagent to neutralize pH of groundwater, and promote precipitation of dissolved metals to insoluble forms.

4 Pilot Testing Activities

Pilot testing will be conducted to assess the effectiveness and cost of an *in situ* pH-adjustment to immobilize plating metals in ABP source area groundwater. The results will be used to refine the conceptual design of the preferred remedial approach for the CAP. The pilot test is designed based on the following objectives:

1. **Reduce dissolved plating metals concentrations in groundwater.** Acidic groundwater and associated plating metal concentrations are attenuating (Figure 11), pilot testing will evaluate the ability to enhance attenuation through an engineered *in situ* pH neutralization.
2. **Determine an appropriate alkaline reagent and dosing for *in situ* field application.** Different alkaline reagents and dosages will be evaluated using ABP source area soils and groundwater in the laboratory to determine the most appropriate reagents and dosages for field application.
3. **Evaluate the ability to deliver and distribute alkaline reagent in Water Table Interval groundwater.** This objective will be evaluated based on the ability to

achieve targeted injection volumes and reagent dosing, and observe pH reagent breakthrough.

4. **Estimate design parameters for scaling the technology.** The proposed field-scale pilot study will target a small portion of the total acidity of the aquifer and somewhat temporary in nature (i.e., acidity will rebound in the aquifer portion influenced by pilot-scale injections). However, the design parameters determined from pilot testing would support design of a full-scale application capable of consuming a significant portion of the acidity and immobilizing a greater portion of the plating metals groundwater plume.

These objectives will serve as the basis for performance evaluation during the pilot study. The following sections described the planned pilot study activities.

4.1 Phase I – Field Data Collection

The first phase of pilot testing will consist of field data collection in the pilot testing location. This consists of collecting soil and groundwater samples necessary for bench-scale pilot testing (Phase II), and the installation of well infrastructure necessary for field-scale pilot testing (Phase III).

4.1.1 Well Installation

Two injection wells and three monitoring wells will be installed on the west side of the ABP Facility in their parking lot in the proposed locations shown on Figure 12:

- **Injection Wells.** Two new injection wells (IW-1 & IW-2) will be installed on the west side of the ABP Facility, and as close to the ABP building as possible (estimated to be 3 to 4 feet west of building) allowing a sufficient downgradient monitoring footprint. The injection wells will be used for injections of the selected alkaline reagent for field-scale pilot testing.

  Although reagents could be injected via either permanent injection wells or through temporary direct-push methods, permanent injection wells can be used in full scale implementation and will be used for the pilot test. Permanent injection wells can more efficiently introduce reagents to the subsurface and easily allow for multiple injections at the same location, which may be needed to ultimately achieve target pH in the aquifer.

- **Performance monitoring wells.** Three new monitoring wells (PSW-6, PSW-7, & PSW-8) will be installed to supplement MW-3 to create a monitoring network in the Water Table Interval. PSW-6 and PSW-7 will be installed within the design radius of influence (ROI) and will serve as dose-response (DR) monitoring wells, with MW-3. PSW-8 will be installed outside of the design ROI and will serve as a downgradient monitoring well.

  The locations of the DR wells are intended to provide monitoring data during the injection operation; specifically, injection at one injection well would be conducted with the goal of achieving breakthrough of the injection solution and the desired pH change at the DR well.

The new injection and monitoring wells will be screened in the Water Table Interval between approximately 10 and 20 feet bgs. The screen interval of 10 to 20 feet bgs is based on the observed minimum groundwater elevation at MW-3 and the desire to have the injection well screens fully submerged during field pilot testing. Existing monitoring well MW-3-30 will provide monitoring data in the Shallow Interval during field-scale pilot testing activities.

The two new injection wells will be constructed of 4-inch PVC casing and 4-inch stainless-steel wire-wrapped screens to increase well efficiency during field-scale pilot injections and allow long-term use, if deemed necessary. The three new monitoring wells will be constructed of 2-inch Schedule 40 polyvinyl chloride (PVC) and 10-slot PVC with 10-foot screened sections. Example completion logs for both monitoring and injection wells are included in Appendix E.

Monitoring and injection wells will be installed and developed by a WA-licensed driller using hollow-stem auger (HSA) drilling methods and surge and purge development methods.

Monitoring wells will be installed as outlined above at locations depicted on Figure 12. Locations are subject to access based on the field locates and utility clearance. As-built monitoring well construction details, locations, and drilling observations will be summarized in the Field Implementation Work Plan, provided at the conclusion of Phase II. Investigative-derived waste (IDW) generated during drilling will be containerized and transported from the pilot study location to the ABP Facility for temporary storage and, ultimately, characterized and disposed at an approved off-Site disposal facility. All proposed well locations are within 3rd Avenue South right-of-way (ROW). A City of Seattle street-use permit will be obtained, and the activities coordinated with ABP operations.

4.1.2 Soil Sampling

Soil core samples will be collected from the two injection well locations during drilling using a split-spoon sample device. Soil core samples will be collected continuously between 10 and 20.5 feet. This interval is below the water table and has been selected based on elevated nickel concentrations reported in the ABP RI Report (Figure 5) and low pH measured during the Supplemental Investigation (Aspect, 2016).

Sampling over the 10.5-foot interval will be completed in seven 18-inch segments with a Dames and Moore (D&M) sampler. Prior to each drive, the D&M sampler will be loaded with three 6-inch stainless steel rings or liners. One of the three 6-inch sample cores from each segment will be sacrificed in the field to record lithology and measure soil pH. Soil descriptions, field screening results, and other relevant details (e.g., staining, debris, odors, etc.) will be recorded on a boring log form. The other two cores will be capped, taped with vinyl duct tape, then placed in Mylar bags with oxygen adsorbing packets to preserve the redox condition as much as possible. Fourteen 6-inch cores from each injection well boring (total of twenty-eight from both injection well borings) will be stored on dry ice immediately for use in bench-scale pilot testing. These handling procedures are consistent with sampling procedures established for the Supplemental RI Investigation (Aspect, 2014b).

All core samples will be delivered to Anchor QEA's Environmental Geochemistry Lab (EGL) in Portland, Oregon, for bench-scale pilot testing described in Section 4.2. Based on review of soil pH data from the injection well borings, soil cores will be selected for the bench-scale pilot testing.

4.1.3 Groundwater Sampling

Groundwater monitoring data will be collected during Phase I for use in Phase II and serve as baseline conditions for performance evaluation of field-scale pilot testing (Phase III). This monitoring event will include baseline groundwater elevation gauging, and samples will be collected for the analytes presented in Table 2. This groundwater sampling will occur after well installation and development and include all new wells in addition to existing wells, MW-1, MW-3, MW-3-30, and MW-8 (Table 5). Samples will be collected using low-flow sampling methods in accordance with project standard operating procedures (PGG, 2017; Aspect, 2008) and analyzed by Analytical Resources Inc. (ARI) Laboratories in Tukwila, WA.

Additionally, 2.5 gallons of groundwater will be collected from MW-3 to be used for bench-scale pilot testing (Phase II). Although the new well locations are expected to have similar chemistry, MW-3 groundwater will be used because of the known chemistry and COC concentrations. The sample will be unfiltered and unpreserved groundwater and collected in 2.5-gallon plastic carboys. The carboy will be sealed inside a Mylar bag with oxygen adsorbing packets, labeled, and preserved on wet ice inside a cooler, and shipped to Anchor QEA's EGL following chain-of-custody protocols.

4.2 Phase II – Bench-Scale Pilot Testing

The second phase of pilot testing will consist of bench-scale pilot testing using Site soils and groundwater collected in Phase I. The Phase II results will be presented in a Field Implementation Work Plan and will serve as the primary basis of design for the field-scale pilot testing (Phase III). The specific objectives of bench-scale pilot testing are as follows:

- Determine total specific acidity of aquifer (soils and groundwater) and required dosing to achieve greater than pH 6 in field-scale pilot test;
- Demonstrate plating metals precipitation through pH adjustment;
- Compare performance of alkaline reagents as pH adjustment; and
- Collect design parameters (i.e., calculate dosing, evaluate secondary effects of elevated pH on metals mobility) necessary for implementation of field-scale pilot test.

Bench-scale testing will consist of three programs: Sample Processing, Titration Batch Testing, and Treatment Batch Testing, which are described in the following sections.

4.2.1 Sample Processing

Soil cores and groundwater collected from well MW-3 during Phase I will be received at Anchor QEA's EGL under chain-of-custody protocols. Upon receipt of groundwater, the MW-3 groundwater will be stored in an anaerobic chamber until batch testing. The soil cores will be stored in a freezer upon receipt and until processing.

Soil cores collected from between 10 to 17.5 feet will be opened and homogenized in a clean steel bowl. This interval has been selected based on low soil pH results from boring SPO-53 completed in 2014 approximately 20 feet northeast of well IW-1. Field pH reading from the IWs will be reviewed to confirm this is the appropriate interval to homogenize. If the data indicate the interval should be adjusted, Aspect will contact Ecology prior to homogenizing the soils.

Therefore, 10 6-inch cores from each boring will be used to create two discrete soil homogenates—one homogenate for each injection well boring. The eight remaining cores from the 17.5 to 20.5-foot interval from both injection well borings will be retained and frozen at Anchor QEA EGL laboratory. All soil processing will be completed inside an anaerobic chamber to prevent additional contact with atmospheric oxygen.

Groundwater analytical will be collected from MW-3 at the time of sample collection (Section 4.1.3). The Anchor QEA laboratory will submit one aqueous sample for plating metals (Table 2) prior to beginning laboratory testing. After soil homogenization, Anchor QEA will measure soil pH using a pH electrode in potassium chloride suspension (Thomas, 1996). An aliquot of each of the homogenized soil samples will be collected and submitted to ARI Laboratory for analysis of:

- Total metals (cadmium, copper, iron, manganese, nickel, and zinc) by U.S. Environmental Protection Agency (EPA) Method 200.7/6010C.
- Total sulfide (SM 4500).
- Total carbon, total organic carbon, and total inorganic carbon by difference (Plumb 1981).
- Total Sulfur (by combustion, e.g., American Society for Testing and Materials [ASTM] E1915).

Soil processing, laboratory, and analytical methods will be conducted in accordance with the Sampling Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) presented in the Revised Remedial Investigation Data Gaps and Supplemental Work Plan for Site Unit 1 (Aspect 2014b).

These results will be communicated to Ecology for comment prior to proceeding to the batch testing. This communication will also identify which homogenate will be used during batch testing and selection rationale, which will be based on field and laboratory measurements.

4.2.2 Titration Batch Testing

The second program of bench-scale testing will consist of simple titration tests conducted with 200 milliliters (mL) of groundwater only, and then a slurry of soil and groundwater in 250-mL glass flasks (Table 3). Each titration test with the slurry will be set up using a 1:10 solid to solution ratio (20 grams of soil aliquot and 200 mL of groundwater). The alkaline reagent solution will be added incrementally to adjust the pH by approximately one standard unit (s.u.). Because of the presence of solids, pH will be allowed to stabilize at each increment. The volume of alkaline reagent will be recorded at each increment and a titration curve will be developed from each batch test. These titration curves will be used to determine the dosing for the Treatment Batch Testing.

Titration tests will be conducted using solutions of the following alkaline reagents:

- Sodium Bicarbonate (Batch-1)
- Sodium Hydroxide (Batch-2)
- Sodium Polysulfide (Batch-3)

These alkaline reagents have been applied *in situ* at other sites to increase pH and immobilize dissolved metals. The basis of selection of these reagents, including case studies from other sites, is presented in Appendix F.

4.2.3 Treatment Batch Testing

The Treatment Batch Testing will consist of test reactors set up in 500-mL clear glass bottles, each containing Site soil homogenate, alkaline reagent, and Site groundwater (Table 4). The amount of alkaline reagent to achieve the target pH (ranging in 6 – 10 s.u.) will be determined from the Titration Batch Tests. Each batch includes a test targeting a pH of 6; however, additional batches are included that evaluate a pH of 8 (for Batches 1, 2, and 3) and pH 10 (for Batches 2 and 3) to evaluate changes in chemistry at higher pH.

The program of treatment batch tests includes one control (Control-1) and two duplicates. All treatment and control reactors will be filled to zero headspace to minimize exposure to atmospheric air (oxygen) during the test interval.

All treatment and control reactors will be mixed on a roller table for gentle and continuous agitation for 14 days. Aqueous samples will be collected at 1 day, 3 days, 7 days, and 14 days from each of the reactors and submitted to ARI Laboratories for analysis (Table 4). After each sampling of the reactors, the pH will be measured and adjusted, if necessary, using the batch reagent to maintain the target pH.

Aqueous samples will be collected using grab sampling methods. These laboratory and analytical methods will be conducted in accordance with the SAP and QAPP presented in the ABP RI Work Plan and *Revised Remedial Investigation Data Gaps and Supplemental Work Plan for Site Unit 1* (Aspect 2008, 2014b).

At the conclusion of the Treatment Batch Testing, it may be determined that additional testing is warranted to evaluate a combination of reagents. If so, this would be proposed to Ecology at the conclusion of the single-reagent testing and subsequently evaluated in the laboratory prior to field pilot testing.

4.3 Phase III – Field-Scale Pilot Testing

This section presents a conceptual design for the field-scale pilot testing (Phase III). The final field-scale pilot testing design will depend on the results of Phases I and II and be presented in the Field Implementation Work Plan with the results of Phases I and II.

Field-scale pilot testing is designed based on the following objectives:

- Evaluate the ability to deliver and distribute the alkaline reagent to the Water Table Interval through permanent injection wells.

- Determine relationship of injection volume, injection pressure/flowrate, alkaline reagent dosing, and ROI.
- Demonstrate plating metal immobilization with the area of injection influence.
- Evaluate ability to manage secondary effects that may affect implementation—including heat and gas generation, and potential mobilization of other metals.
- Evaluate the permanence of plating metal immobilization.

Field-scale pilot testing will consist of an injection event, operational monitoring conducted during injections, and performance monitoring conducted post-injection. Reagent injections will be conducted at the two new injection wells (IW-1 and IW-2) screened in the Water Table Interval (Figure 12). A 10-foot ROI is targeted for each injection well and is a basis for the well infrastructure locations installed in Phase I. Achieving the design ROI of 10 feet will be determined by measuring the target pH at monitoring wells (MW-3 and PSW-4). The target pH of field-scale pilot testing will be determined based on Phase II results.

A soluble alkaline reagent will be used and will be delivered under low, non-fracturing pressures allowing porous distribution. A flow control valve may be added to maintain a low pressure. If reasonable injection rates can be achieved, injections will be performed using gravity flow into the injection wells to minimize the risk of reagent releases or formation fracturing. Pumping equipment will be on-hand to add pressure head, if necessary.

A conservative tracer will be used to evaluate the rate of groundwater flow in the pilot study area. It is anticipated that plating metal concentrations in the treatment area will ultimately increase after treatment due to migration of dissolved plating metals into the treatment area from upgradient. The tracer study will be used to evaluate to what degree increasing concentrations after treatment may be due to rebound (i.e., nonpermanent immobilization) or caused by contributions from upgradient groundwater.

If there are compatibility concerns with the selected tracer (e.g., due to elevated pH of the reagent solution), the tracer may be evaluated in the presence of the selected reagent during laboratory testing. The laboratory evaluation would consist of adding a measured amount of tracer to the selected reagent solution and analyzing the dissolved tracer concentration. Further, the pilot testing in the field will include measuring tracer concentration in the injection solution so that the actual, applied tracer concentration is known.

Injections will be accomplished using temporary mechanical equipment staged at the pilot test location. The final injection design to be included in the Field Implementation Work Plan will identify:

- Alkaline reagent selection, strength, and any handling and health & safety requirements.
- A process flow diagram of the engineered pilot injection system.
- ROI, injected volume, and acidity/neutralization calculations.
- The basis for and design of an applied conservative tracer.

A second injection event may be necessary to completely evaluate pilot testing objectives. A second injection event would address any modifications to the injection design based on the performance of the first injection. Conditions triggering a second injection event, and a description of how it would be implemented and monitored, will be discussed in the Field Implementation Work Plan.

The Field Implementation Work Plan will also present the details of operational monitoring (during injections) and performance monitoring. Performance monitoring will be initiated at the end of the pilot study injections. The analytes to be evaluated are listed in Table 2, and a draft performance monitoring plan is presented in Table 5, including monitoring locations, analysis, and frequency. This performance monitoring plan will be revised, if necessary, based on Phase I and II results, and included in the Field Implementation Work Plan. Monitoring methods will be performed in accordance with project standard operating procedures (PGG, 2017; Aspect, 2008).

4.3.1 Underground Injection Authorization

The proposed injection wells are considered Class V underground injection wells that are subject to the Underground Injection Control Program, WAC 173-218. The Site is being managed pursuant to Agreed Order No. DE10402, between Ecology and the W4 Group. In accordance with WAC 173-218-060(5)(b), a permit is not required when injection activity is performed under an agreed order. However, the injection wells will be registered with Ecology's UIC program using their online registration tool.

5 Project Organization and Plans

5.1 Project Organization

The project organization is led by Aspect, who will engage the necessary subcontractors to complete the planned activities. All team members are responsible for execution of work in accordance with the final Work Plan and Field Implementation Work Plan; key individuals and their roles on this project are as follows:

- **Project Manager – Jeremy Porter.** The project manager is responsible for the successful completion of all aspects of this project, including day-to-day management, production of reports, liaison with party and regulatory agencies, and coordination with the project team members. The project manager is also responsible for resolution of non-conformance issues, is the lead author on project plans and reports, and will provide regular, up-to-date progress reports and other requested information to project team and Ecology.
- **Field Manager – Adam Griffin.** The field manager is responsible for overseeing the pilot study outlined in this plan, including oversight and management of field personnel and subcontractors, ensuring conformance with final Work Plan and the Field Implementation Memo. The field manager will manage procurement of necessary field supplies, assure that monitoring equipment is operational and

calibrated in accordance with the specifications provided herein, and act as the Site Health and Safety Officer.

- **Geochemistry Lead (Anchor QEA) – Dimitri Vlassopoulos.** The geochemistry lead is a subcontractor to the Aspect team and provides senior technical geochemistry review and advising. Dimitri was the technical lead of the Supplemental Investigation activities and fate and transport evaluation of metals in groundwater (Aspect, 2016). Dimitri will provide review of all pilot testing activities, geochemistry support, and coordinate with Anchor QEA's EGL in Portland, Oregon, for Phase II activities.

- **Subcontractors.** Numerous subcontractors are necessary to complete the activities described in this Work Plan and the Field Implementation Work Plan, including Anchor QEA, EGL, ARI Laboratory, driller for well installation and soil sampling, IDW disposal, and a reagent vendor (to be determined in Field Implementation Work Plan). The subcontractors are responsible to conforming to the Work Plan and the agreed-to scope with Aspect.

5.2 QAPP

Monitoring and activities described in this Work Plan will be conducted in accordance with the Ecology-approved QAPP presented in the RI Work Plan (Aspect, 2008) and the Supplemental Investigation QAPP (Appendix C of Aspect, 2014b). Any exceptions associated with the final design of the field-scale pilot testing (Phase III) would be described in a supplemental QAPP presented in the Field Implementation Work Plan.

5.3 HASP

Work and public safety are of paramount importance during the planned pilot test activities and will be performed in accordance with the existing Health and Safety Plan (HASP). A subsequent update of the HASP will be presented in the Field Implementation Work Plan to include safety data sheets (SDSs) for the alkaline reagent, an assessment of hazards, and a description of controls necessary for safe implementation of the field-scale pilot test.

6 Schedule and Reporting

A detailed estimated schedule of pilot study activities is presented on Figure 13. The Phase I field data collection activities are estimated to occur in Q3 2017 and the Phase II Bench-Scale Pilot Testing activities are estimated to occur in Q4 2017. The Field Implementation Work Plan is estimated to be final in Q1 2018. The Phase III Field-Scale Pilot Testing activities would be initiated in late Q1 2018 and the completion of 1 year of performance monitoring in Q2 2019.

Reporting will consist of this Work Plan, a Field Implementation Work Plan, and a Pilot Study Completion Report. Data collected during the pilot study, including injection results and post-injection performance monitoring, and recommendations for modifications to the monitoring program (if warranted), will be included in quarterly

progress reports. This Work Plan presents a CSM for the pilot study area, details associated with Phases I and II and a conceptual design of Phase III. The final design of Field-Scale Pilot Testing will be submitted in the Field Implementation Work Plan and will include the following:

- Results of Phase I field data collection and Phase II bench-scale testing activities described in Section 4.1 and 4.2, including well construction logs, baseline monitoring results, and batch testing results.
- An updated CSM based on the results of the field data collection activities.
- Selection of a preferred alkaline reagent and target pH for Field-Scale Pilot Testing based on Phase II results.
- A comprehensive SAP, including injection design details introduced in Section 4.3 and the supplemental QAPP.
- The potential need of a second injection event to achieve pilot testing objectives as defined at the introduction of Section 4.
- A detailed operational monitoring plan and a final performance monitoring plan.
- An updated HASP.

The Pilot Study Completion Report will be prepared and submitted draft to Ecology within 45 days of receiving all analytical data critical to meeting study objectives. The Pilot Study Completion Report will include conclusions regarding the pilot testing and recommendations regarding full-scale application of engineered *in situ* pH neutralization for plating metals in groundwater.

7 References

Aspect Consulting, LLC (Aspect), 2008, Remedial Investigation Work Plan, Art Brass Plating, Agency Review Draft, September 25, 2008.

Aspect Consulting, LLC (Aspect), 2012, Remedial Investigation Report, Art Brass Plating, Agency Review Draft, September 27, 2012.

Aspect Consulting, LLC (Aspect), 2014a, Site Conceptual Model Technical Memorandum (Revised), W4 Joint Deliverable, December 15, 2014.

Aspect Consulting, LLC (Aspect), 2014b, Revised Remedial Investigation Data Gaps and Supplemental Work Plan for Site Unit 1, September 29, 2014.

Aspect Consulting, LLC (Aspect), 2016, Final Feasibility Study for Site Unit 1. August 11, 2016.

Booth and Herman, 1998, Duwamish Basin Groundwater Pathways Conceptual Model Report, Duwamish Industrial Area Hydrogeologic Pathways Project, Prepared for City of Seattle Office of Economic Development and King County Office of Budget and Strategic Planning, University of Washington and Hart Crowser, Seattle, Washington.

Farallon, 2012, Revised Draft Remedial Investigation Report, Capital Industries, October 2012.

Farallon, 2014, Revised Preliminary Site Cleanup Standards, W4 Joint Deliverable, September 12, 2014.

Pacific Groundwater Group (PGG), 2012, Revised Remedial Investigation, Blaser Die Casting, August 2, 2012.

Pacific Groundwater Group (PGG), 2017, FINAL West of 4th Groundwater Monitoring Program Plan 2017 through Draft Cleanup Action Plan, W4 Joint Deliverable. March 21, 2017.

PSC, 2003, Final Comprehensive Remedial Investigation Report For Philip Services Corporation’s Georgetown Facility, Philip Services Corporation, November 14, 2003.

8 Limitations

Work for this project was performed for the West of 4th Group (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

TABLES

Table 1. Proposed Cleanup Levels

Project No. 050067, Art Brass Plating, Seattle, WA

		Preliminary Cleanup Levels													
		Soil					Groundwater				Air		Surface Water		Sediment
Constituent of Concern	Carcinogen or Non-Carcinogen	Puget Sound Background Concentrations for Metals[1]	Soil Cleanup Level Protective of Direct Contact Pathway (Unrestricted Land Use)[2]	Soil Cleanup Level Protective of Direct Contact Pathway (Industrial Land Use)[2]	Soil Cleanup Level Protective of Air Quality based on Protection of Groundwater as Potable Drinking Water[3]	Soil Cleanup Level Protective of Groundwater Concentrations Protective of Surface Water Quality[4]	Groundwater Cleanup Level Protective of Air Quality Water Table Zone (Unrestricted Land Use)[5]	Groundwater Cleanup Level Protective of Air Quality Water Table Zone (Industrial Land Use)[5]	Groundwater Cleanup Level Protective of Surface Water[6]	Groundwater Cleanup Level Protective of Sediment[7]	Air Cleanup Level Protective of Inhalation Pathway (Unrestricted Land Use)[2]	Air Cleanup Level Protective of Inhalation Pathway (Industrial Land Use)[2]	Surface Water Cleanup Level Protective of Human Health[8]	Surface Water Cleanup Level Protective of Aquatic Life	Sediment Cleanup Level[9]
		(Milligrams/kilogram)					(Micrograms/liter)				(Micrograms/cubic meter)		(Micrograms/liter)		(Milligrams/kilogram)
Tetrachloroethene	Carcinogen	--	476	21,000	0.08	0.04	116	482	2.9	36,000	9.6	40	2.9	--	190
Trichloroethene	Carcinogen	--	12	1,750	0.03	0.006	6.9	37	0.7	4,760,000	0.37	2	0.7	194 [12]	8,950
cis-1,2-Dichloroethene	Non-Carcinogen	--	160	7,000	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	Non-Carcinogen	--	1,600	70,000	0.59	6	559	1,224	1,000	--	27.4	60	1,000	--	--
1,1-Dichloroethene	Non-Carcinogen	--	4,000	175,000	0.055	0.025	538	1,176	3.2	--	91.4	200	3.2	--	--
Vinyl chloride	Carcinogen	--	0.67	87.5	0.002	0.001	1.3	12.7	0.18	543,000	0.28	2.8	0.18	210 [13]	202
1,4-Dioxane	Carcinogen	--	10	1,310	0.004	0.32	2,551	25,510	78	--	0.5	5	78	--	--
Arsenic	Carcinogen	20	20	87.5	Not Applicable	0.082	Not Applicable	Not Applicable	0.14 / 5 [10]	241	Not Applicable	Not Applicable	0.14 / 5 [10]	36 [14]	7
Barium	Non-Carcinogen	--	16,000	700,000	Not Applicable	824	Not Applicable	Not Applicable	--	--	Not Applicable	Not Applicable	--	--	--
Cadmium	Non-Carcinogen	1	80	3,500	Not Applicable	1.2	Not Applicable	Not Applicable	8.8	760	Not Applicable	Not Applicable	--	8.8 [15]	5.1
Copper	Non-Carcinogen	36	3,200	140,000	Not Applicable	1.1	Not Applicable	Not Applicable	3.1 [11]	18,000	Not Applicable	Not Applicable	--	3.1 [15]	390
Iron	Non-Carcinogen	58,700	58,700	2,450,000	Not Applicable	--	Not Applicable	Not Applicable	--	--	Not Applicable	Not Applicable	1,000	--	--
Manganese	Non-Carcinogen	1,200	11,200	490,000	Not Applicable	--	Not Applicable	Not Applicable	100	--	Not Applicable	Not Applicable	100	--	--
Nickel	Non-Carcinogen	48	1,600	70,000	Not Applicable	11	Not Applicable	Not Applicable	8.2	2,200	Not Applicable	Not Applicable	100	8.2 [15]	15.9
Zinc	Non-Carcinogen	85	24,000	1,050,000	Not Applicable	101	Not Applicable	Not Applicable	81	6,600	Not Applicable	Not Applicable	1,000	81 [15]	410

Notes:

Preliminary cleanup levels presented represent the most stringent cleanup levels for the constituent of concern listed in the media indicated.

-- indicates no value is available. In the case of ARARs, the reference sources do not publish values for the noted chemicals. In the case of calculated values, one or more input parameters are not available.

"Not Applicable" is used where the constituent of concern will not affect the media of potential concern due to an incomplete pathway.

[1] Background metals values from Ecology Publication No. 94-115, Natural Background Soil Metals Concentrations in Washington State. Arsenic background from MTCA, Table 740-1 Method A Soil Cleanup Levels for Unrestricted Land Uses.

[2] Cleanup level is based on standard Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method B (unrestricted land use) or Method C (industrial land use) values from the Cleanup and Risk Calculations tables (CLARC).

[3] Soil cleanup levels for protection of air quality are calculated using MTCA Equation 747-1 where the potable Method B groundwater cleanup level was used as Cw. Concentrations of hazardous substances in soil that meet the potable groundwater protection standard currently are considered sufficiently protective of the air pathway for unrestricted and industrial land uses.

[4] Soil cleanup levels for protection of surface water quality are calculated using MTCA Equation 747-1 where the groundwater cleanup level protective of surface water in this table was used as Cw.

[5] Groundwater cleanup levels protective of the air pathway for unrestricted land use (residential and commercial sites) and industrial land use were derived using the following equation: GWcul = Aircul/GIVF.

[6] Human health and marine aquatic ecologic receptors were considered. Refer to the Surface Water Cleanup Levels Protective of Human Health and Aquatic Life in this table. The more stringent value of the two receptors has been listed for the Groundwater Cleanup Level Protective of Surface Water.

[7] Groundwater screening levels based on the transfer of contaminants from groundwater to sediment were calculated by dividing the sediment screening level by the associated partition coefficients. Koc and Kd values are from MTCA. Fraction of carbon assumed at 0.02 based on Lower Duwamish Waterway Feasibility Study (AECOM, 2012).

[8] The most stringent exposure pathway for human health receptors are for consumption of fish. Listed values are based on ARARs listed in CLARC except: (1) 1,4-dioxane is derived from MTCA Method B default values and values; (2) PCE, TCE, trans-DCE, vinyl chloride, nickel and zinc are based on EPA's revised CWA Human Health Criteria - Organism Only dated 11/15/16.

[9] Sediment has not been confirmed to be affected by groundwater discharge to surface water. Sediment cleanup levels were derived from the Lower Duwamish Waterway Superfund Site Record of Decisions (EPA, 2014), which does not contain values for nickel, TCE, PCE, or vinyl chloride. These constituents are not listed in the Sediment Management Standards (WAC 173-204) either. EPA Region 3 BTAG Marine

[10] Arsenic Cleanup level of 5 ug/L based on background concentrations for state of Washington (MTCA Table 720-1).

[11] The surface water cleanup level for copper had previously been tabulated as 2.4ug/L; however this value is based on an approach using site-specific water effects ratio which has not been determined. We have replaced this with 3.1 ug/L, National Recommended Water Quality Criteria published by EPA under 304 of the Federal Clean Water Act - Aquatic Life Criteria Table

[12] Oak Ridge Nation Laboratory (ORNL) Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota

[13] Peer Review Literature - DeRooij et al., 2004, *Euro Chlor Risk Assessment for the Marine Environment OSPARCOM Region – North Sea – Environmental Monitoring and Assessment*

[14] WAC- 173-201A-240

[15] National Recommended Water Quality Criteria published by EPA under 304 of the Federal Clean Water Act - Aquatic Life Criteria Table

Table updated August 14, 2015 based on revisions to AWQC; July 20, 2016 based on Ecology comments on the Draft FS Reports for SU1 and SU2 (clarify footnotes, add sediment values, add surface water CULs protective of aquatic life); and January 17, 2017 based on EPA's revisions to the Clean Water Act Human Health criteria (dated 11/15/16).

Table 2. Groundwater Analyte List

Project No. 050067, Art Brass Plating, Seattle, Washington

Analyte	Analytical Method
COCs	
Plating Metals (Cadmium, Copper, Nickel, Zinc)[1]	EPA 200.8
Redox- sensitive Metals (Arsenic, Barium, and Manganese)[1]	EPA 6010
General Chemistry	
Dissolved Cations (Aluminum, Calcium, Iron, Magnesium, Potassium, Sodium)[1]	EPA 6010
Alkalinity	EPA 310.1
Acidity	EPA 310.2
Total Organic Carbon (TOC)	EPA 415.1 (or SW-846 Method 9060)
Chloride	EPA 300.1
Sulfate	EPA 300.0
Field Parameters	
Total Dissolved Solids	Multimeter
Specific conductance	Multimeter
Dissolved oxygen	Multimeter
pH	Multimeter
ORP	Multimeter
Turbidity	Turbidometer

Notes

1. All analysis will be field-filtered using a 0.45 micron filter.

Table 3. Phase II - Titration Batch Tests

Project No. 050067, Art Brass Plating, Seattle, Washington

	Soil Mass (g)	Groundwater Volume (mL)	Reagent
Batch-1	0	200	Sodium Bicarbonate ($NaHCO_3$)
	20	200	
Batch-2	0	200	Sodium Hydroxide (NaOH)
	20	200	
Batch-3	0	200	Sodium Polysulfide (Na_2S_4)
	20	200	

Table 4. Phase II - Treatment Batch Test Matrix

Project No. 050067, Art Brass Plating, Seattle, Washington

						Aqueous Analysis[1]			
	Soil Mass (g)	**Groundwater Volume (mL)**	**Reagent**	**Reagent Dosing**	**Target pH (s.u.)**	**1 day**	**3 days**	**7 days**	**14 days**
Control-1	50	500	-			1,4	-	-	1,4
Batch-1A	50	500	Sodium Bicarbonate ($NaHCO_3$)	TBD based on Titration Batch Tests (Table 3)	6	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Batch- 1A (DUP)	50	500			6	1,4	1,4	1,4	1,4
Batch-1B	100	500			6	1,2,3,4	1,4	1,4	1,2,3,4
Batch-1C	50	500			8	1,2,3,4	1,4	1,4	1,2,3,4
Batch-2A	50	500	Sodium Hydroxide (NaOH)		6	1,2,3,4	1,4	1,4	1,2,3,4
Batch-2A (DUP)	50	500			6	1,4	1,4	1,4	1,2,3,4
Batch-2B	50	500			8	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Batch-2C	50	500			10	1,2,3,4	1,4	1,4	1,2,3,4
Batch-3A	50	500	Sodium Polysulfide (Na_2S_4)		6	1,2,3,4	1,4	1,4	1,2,3,4
Batch-3B	50	500			8	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
Batch-3C	50	500			10	1,2,3,4	1,4	1,4	1,2,3,4

Aqueous Analytes (see Table 2):

1 - Plating Metals

2 - Redox-sensitive Metals

3 - General Chemistry

4 - Field Parameters

Notes

The first baseline monitoring results will be reported in the *Field Implementation Work Plan* in addition to any changes to this Performance Monitoring Program.

IW - Injection wells

PSW - pilot monitoring wells

Table 5. Phase III - Pilot Study Groundwater Monitoring Program

Project No. 050067, Art Brass Plating, Seattle, Washington

Location	Baseline		Performance Monitoring (time elapsed post-injection)							
	Phase 1	Before Injection	0 days	Week 2	Week 4	Month 2	Month 3	Month 4	Month 6	Month 12
IW-1	1,2,3,4		1,2,3,4		1,2,3,4		1,2,3,4		1,2,3,4	1,2,3,4
IW-2	1,2,3,4		1,2,3,4		1,2,3,4		1,2,3,4		1,2,3,4	1,2,3,4
PSW-6	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
PSW-7	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
MW-3	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
PSW-8	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4
MW-3-30	1,3,4		1,3,4		1,3,4	1,3,4	1,3,4		1,3,4	1,3,4
MW-1 (upgradient)	1,3,4				1,3,4		1,3,4		1,3,4	1,3,4
MW-8 (downgradient)	1,3,4						1,3,4		1,3,4	1,3,4

Analytes (see Table 2):

1 - Plating Metals
2 - Redox-sensitive Metals
3 - General Chemistry
4 - Field Parameters

Notes:

The first baseline monitoring results will be reported in the *Field Implementation Work Plan* in addition to any changes to this Performance Monitoring Program

Tracer monitoring will be determined after the laboratory testing and the monitoring program included in the Field Implementation Work Plan.

IW - injection wells

PSW - pilot monitoring wells

FIGURES

Site Diagram

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	MAR-2017	BY: PPW	FIGURE: 1
	PROJECT NO. 050067	REVISED BY: DIM / RAP	

Exploration Locations

Symbol (Exploration Type)

- Monitoring Well
- Soil Boring/Probe
- Porewater

Color (Exploration Sampler)

- Art Brass Plating
- Blaser Die Casting
- Capital Industries
- Philip Services Corporation
- Other Companies

- Art Brass Plating Study Area
- Building Outlines (as presented on other figures)

An orange halo indicates multiple parties sampled from one location

PILOT TESTING LOCATION

FIGURE 3 EXTENT

OHIO AVE S

UTAH AVE S

1ST AVE S

AVE S

4TH AVE S

3RD AVE S

5TH AVE S

E MARGINAL WAY S (HIGHWAY 99)

S LUCILE ST

S FINDLAY ST

S ORCAS ST

S MEAD ST

S FIDALGO ST

S FIDALGO ST

N

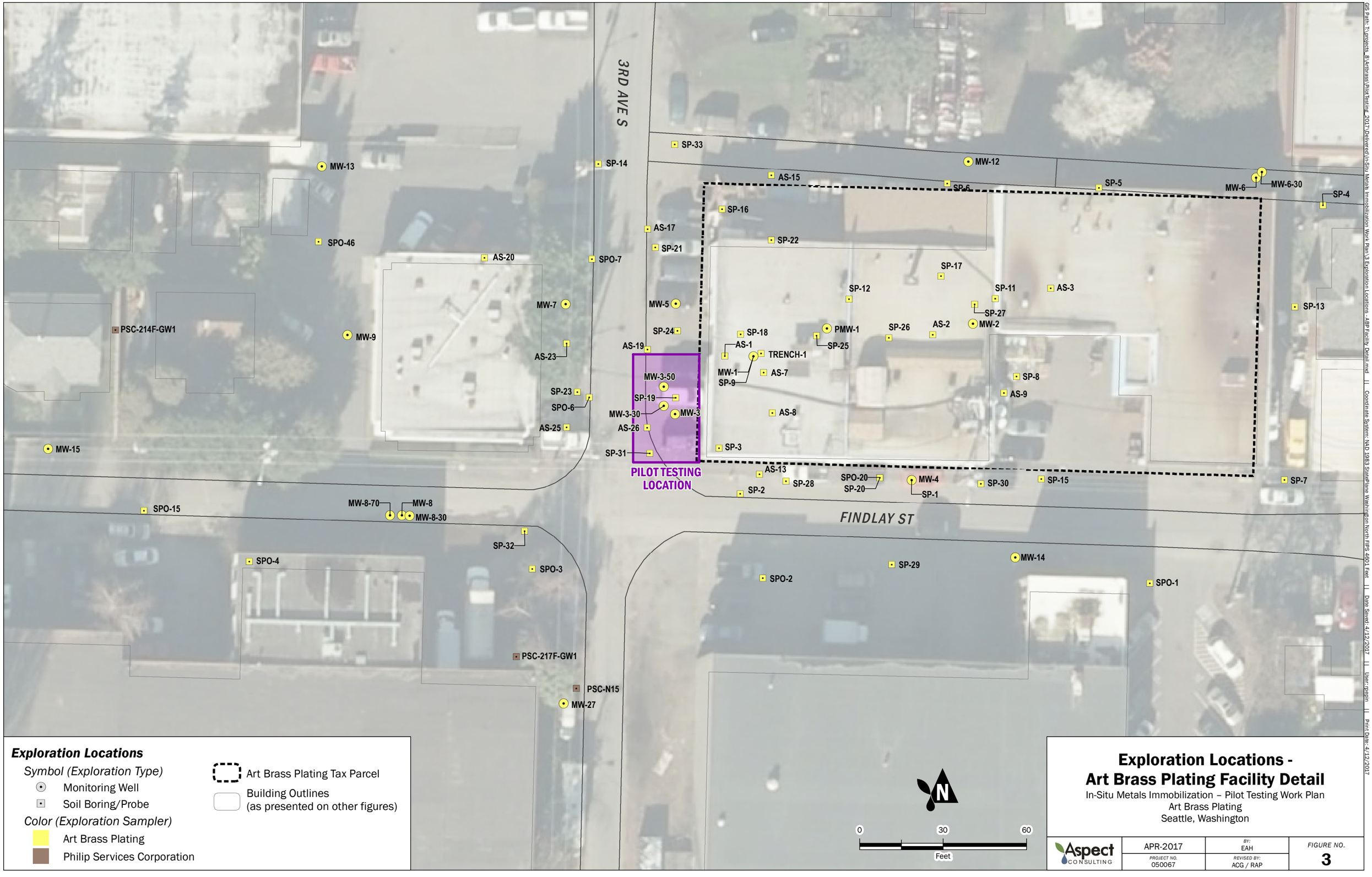
0 200 400

Feet

Site Map - Exploration Locations

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	APR-2017	BY: EAH	FIGURE NO. 2
	PROJECT NO. 050067	REVISED BY: DIM / RAP	



Exploration Locations

Symbol (Exploration Type)

- Monitoring Well
- Soil Boring/Probe

Color (Exploration Sampler)

- Art Brass Plating
- Philip Services Corporation

- Art Brass Plating Tax Parcel
- Building Outlines (as presented on other figures)

Exploration Locations - Art Brass Plating Facility Detail

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect Consulting			
	APR-2017	BY: EAH	FIGURE NO. 3
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

GIS Path: T:\projects_8\Art Brass Plat Testing_2017\Delivered\In-Situ Metals Immobilization Work Plan\3 Exploration Locations - ABP Facility Detail.mxd JJ Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet JJ Date Saved: 4/12/2017 JJ User: rpeplin JJ Print Date: 4/12/2017

SP-33_Ni
(3-4) 4.1
(5-6) 9.4

SP-18_Ni
(4-5) 57.2

SP-22_Ni
(3-4) 21.7
(5-6) 9.5

SPO-53_Ni
(0-3) 20
(3-6) 55

SPO-46_Ni
(3.5-4.5) 4.6

SP-21_Ni
(3-4) 5.1
(5-6) 8.8

SP-26_Ni
(3-4) 26.6
(5-6) 7.5

SP-27_Ni
(3-4) 9.7
(5-6) 8.7

SP-24_Ni
(3-4) 23.2
(5-6) 112

Former Plating Area

SP-25_Ni
(3-4) 22
(5-6) 520

SP-23_Ni
(3-4) 6.1
(5-6) 10.2

SP-19_Ni
(3-4.5) 17.3
(5-6) 10.1

SP-20_Ni
(2-3) 6.2

SP-31_Ni
(3-4) 4.4
(5-6) 7.9

SP-28_Ni
(3-4) 6.1
(5-6) 16.4

SP-30_Ni
(3-4) 23.2
(5-6) 14.6

SP-32_Ni
(3-4) 7.6
(5-6) 8.3

SPO-54_Ni
(0-3) 13
(3-6) 8

SP-29_Ni
(3-4) 4.4
(5-6) 6.4

SPO-55_Ni
(0-3) 40
(3-6) 12

3RD AVE S

ALLEY

SOUTH FINDLAY STREET

N

0 30 60
Feet

2014 Supplemental RI Investigation Boring

2012 RI Investigation Boring

Suspect Nickel Source Area

Building Footprints

Road Outlines

Estimated Area of Soil Exceeding State Background Screeing Level for Nickel (38 mg/kg)

Water Table Interval Groundwater Nickel Iso-concentration Line at 8.2 µg/L Screening Level based on Q3 2013 Data

Nickel in Soil at Sample Locations

SP-24_Ni
(3-4) 23.2
(5-6) 112

Nickel result in mg/kg*

sample depth interval in feet

Soil Sample Locations with No Detections Above State Background Screening Level (38 mg/kg)

Soil Sample Location with One or More Detection Above State Background Screening Level (38 mg/kg)

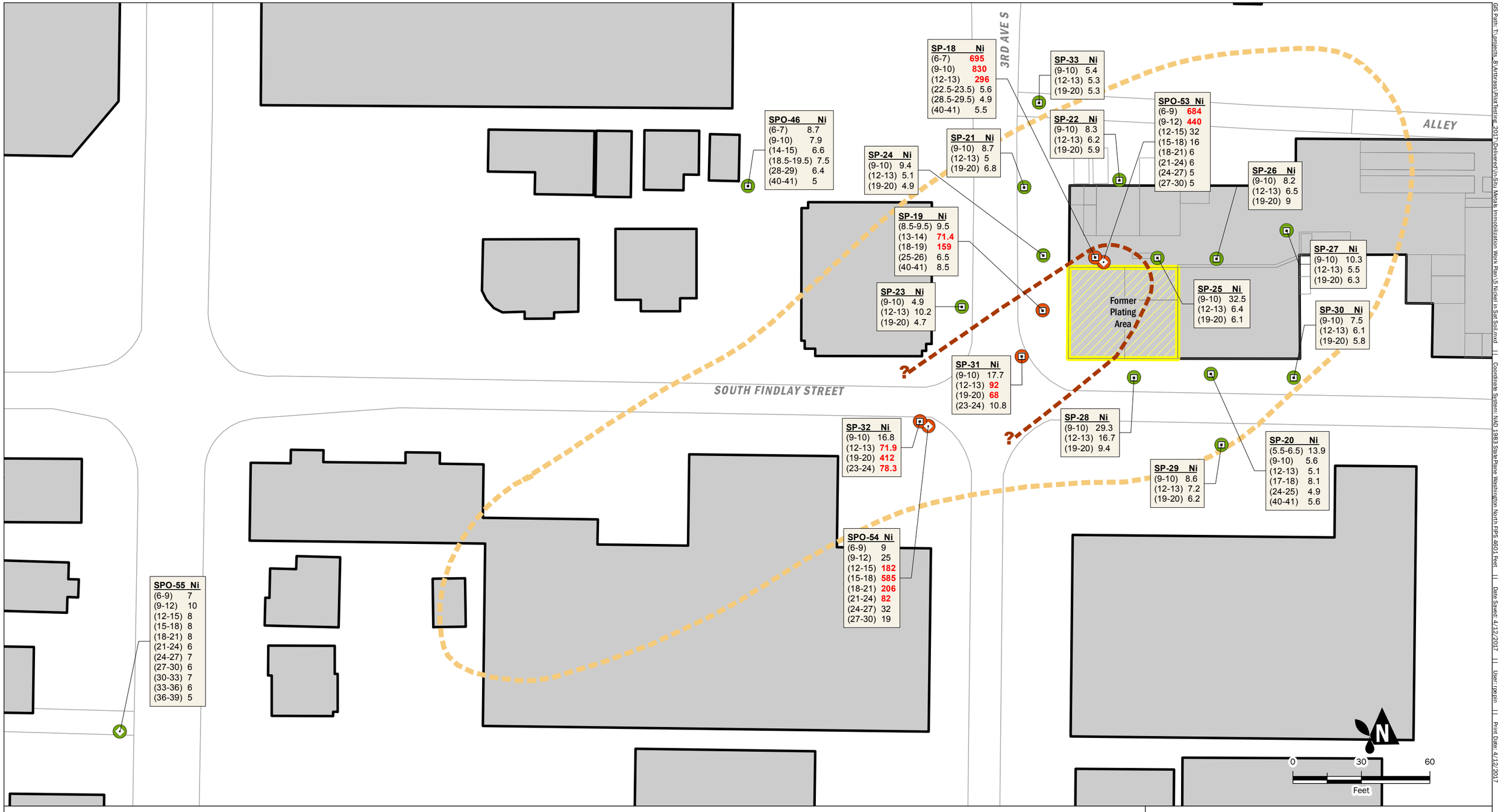
**RED TEXT* indicates exceedance of soil screening level

Nickel in Vadose Zone Soil (Sample Depth Six Feet or Less)

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	APR-2017	BY: PPW	FIGURE NO. 4
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

GIS Path: T:\projects_8\Artbrass\PilotTesting_2017\Delivered\InSitu Metals Immobilization Work Plan\4 Nickel in Vadose Soil.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 4/12/2017 || User: rpepin || Print Date: 4/12/2017



2014 Supplemental RI Investigation Boring

2012 RI Investigation Boring

Suspect Nickel Source Area

Building Footprints

Road Outlines

Estimated Area of Soil Exceeding State Background Screeing Level for Nickel (38 mg/kg)

Water Table Interval Groundwater Nickel Iso-concentration Line at 8.2 µg/L Screening Level based on Q3 2013 Data

Nickel in Soil at Sample Locations

SP-31 Ni
(9-10) 17.7
(12-13) 92
(19-20) 68
(23-24) 10.8

Soil Sample Locations with No Detections Above State Background Screening Level (38 mg/kg)

Soil Sample Location with One or More Detection Above State Background Screening Level (38 mg/kg)

*Nickel result in mg/kg**

sample depth interval in feet

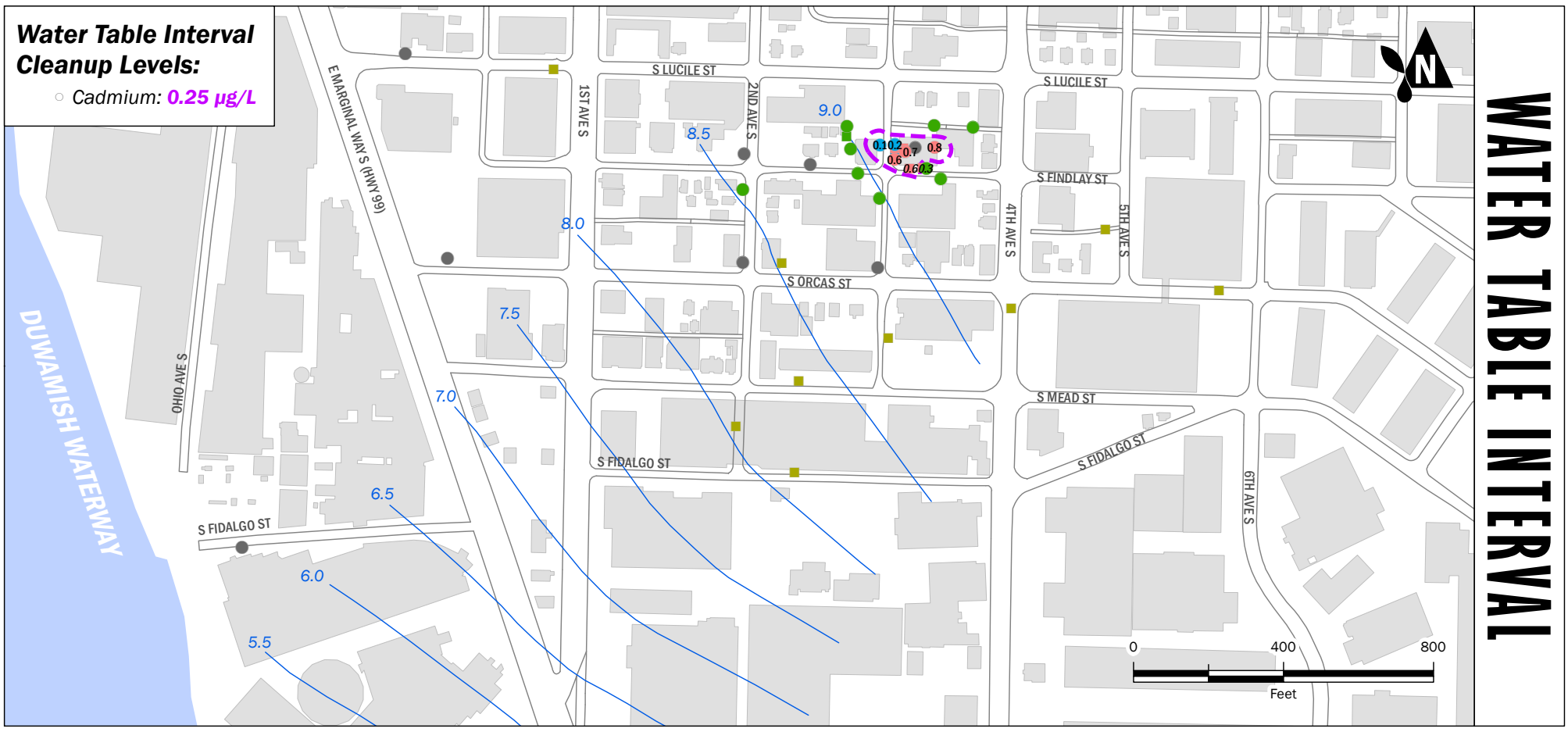
**RED TEXT* *indicates exceedance of soil screening level*

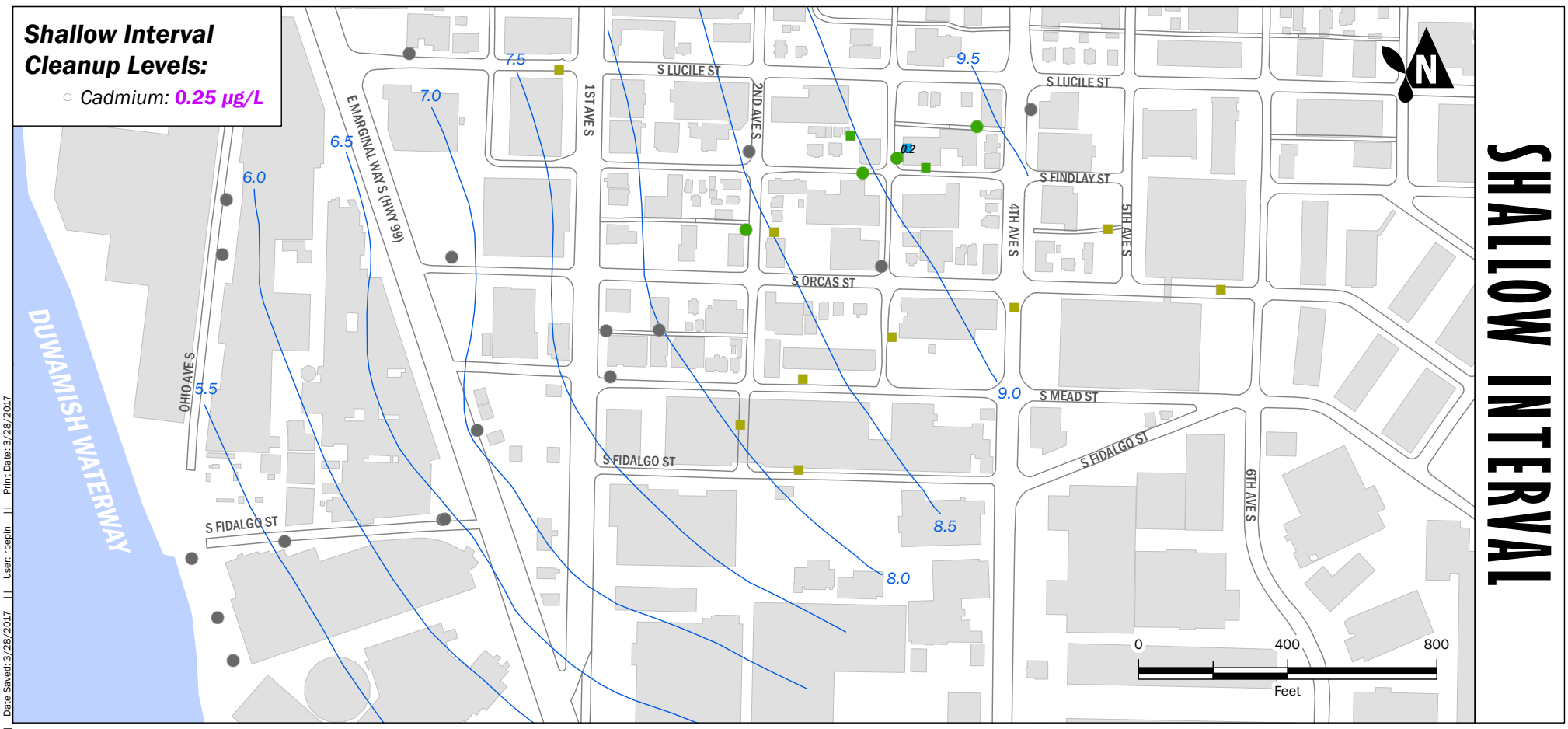
Nickel in Saturated Soil (Samples Deeper than Six Feet)

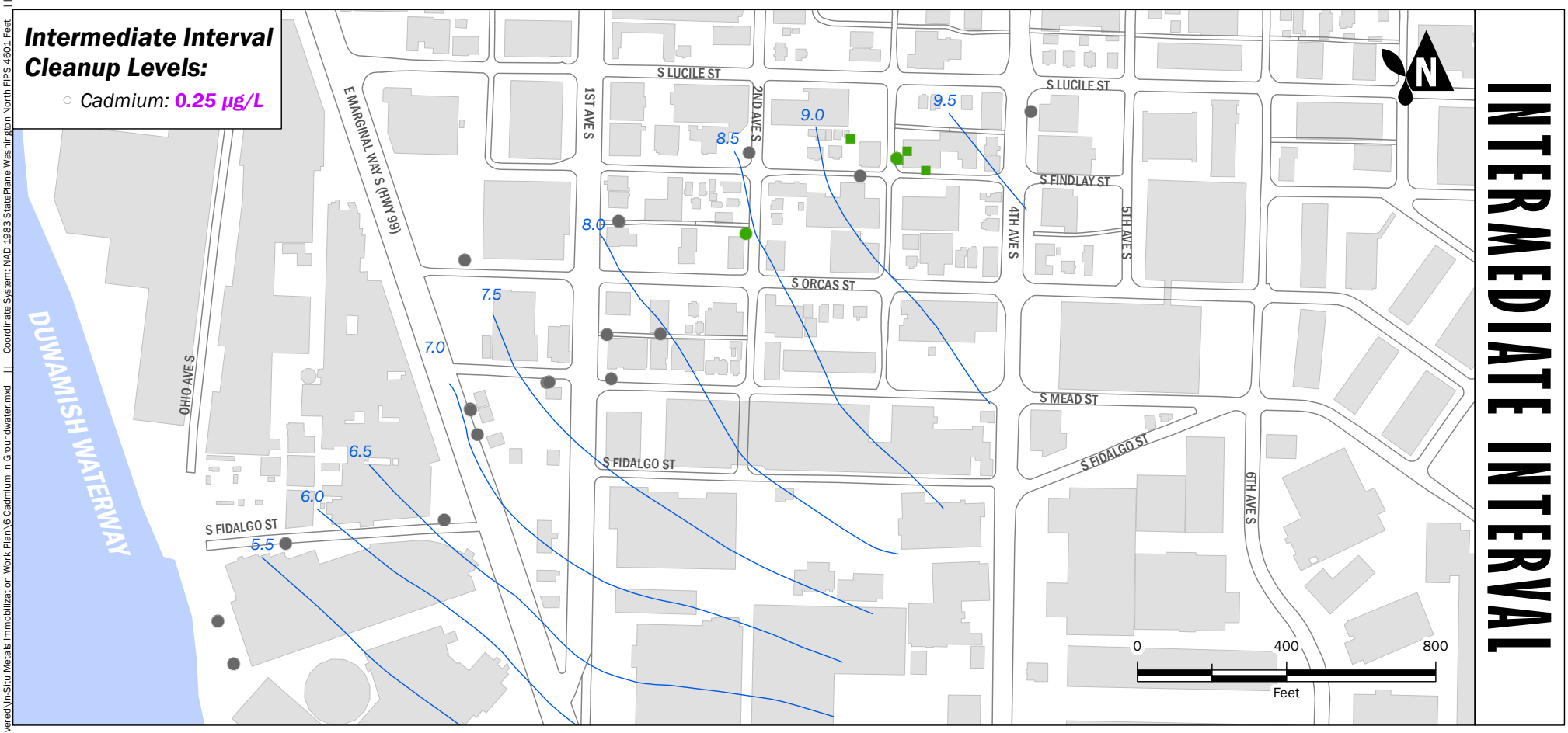
In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect Consulting	APR-2017	BY: PPW	FIGURE NO. 5
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

GIS Path: T:\projects_8\Artbrass Plat Testing_2017\Delivered\In Situ Metals Immobilization Work Plan\5 Nickel in Sat Soil.mxd _ Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet _ Date Saved: 4/12/2017 _ User: rjenkin _ Print Date: 4/12/2017







GIS Path: T:\projects_8\Artbrass\PilotTesting_2017\Delivered\In-Situ Metals Immobilization Work Plan\6 Cadmium in Groundwater.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 3/28/2017 || User: rpepin || Print Date: 3/28/2017

Groundwater Sample Locations:

- Well
- Geoprobe

Sample Location Symbol Color:

- Detected Above Screening Level
- Detected, No Exceedance
- Not Detected (Detection Limit > Screening Level)
- Not Detected, No Exceedance
- Well not Sampled for Given Analyte

Data Notes:

Geoprobe data shown on this map reflects the maximum concentration detected at that sample location in the given interval.

Well data shown on this map reflects the most recent sample collected at that well in the given interval.

Data Labels:

Locations with detections are labeled with the concentration (in µg/L).

0.8 100 Wells 0.8 100 Geoprobes

8.0 Half-foot Groundwater Elevation Contours from August, 2012 Site-Wide Monitoring Event (NAVD88 Vertical Datum)

Cadmium Isoconcentration Line (at Screening Level)

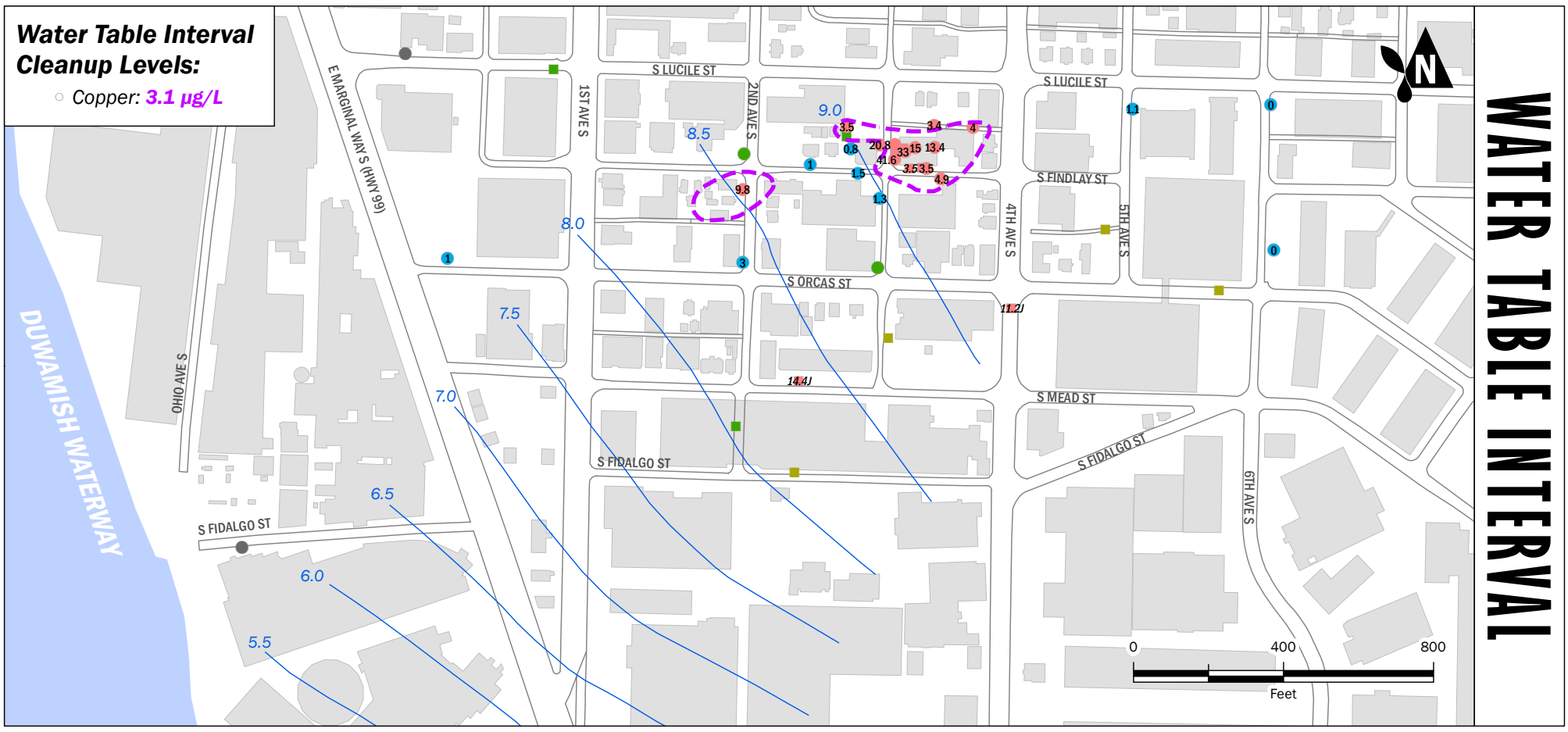
Nature and Extent of Dissolved Cadmium in Groundwater

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect Consulting	MAR-2017	BY: PPW	FIGURE NO. 6
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

Water Table Interval Cleanup Levels:

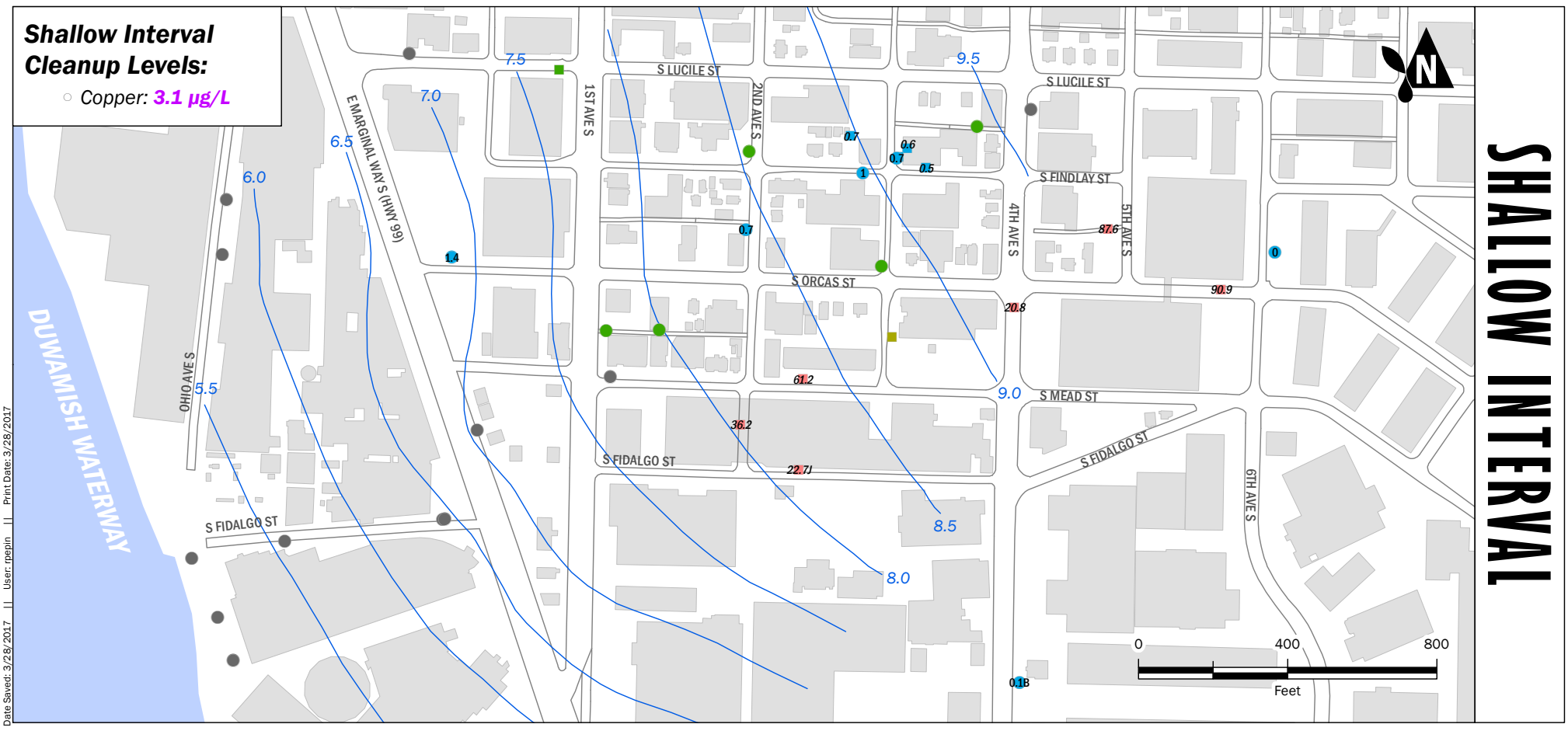
- Copper: **3.1 µg/L**



WATER TABLE INTERVAL

Shallow Interval Cleanup Levels:

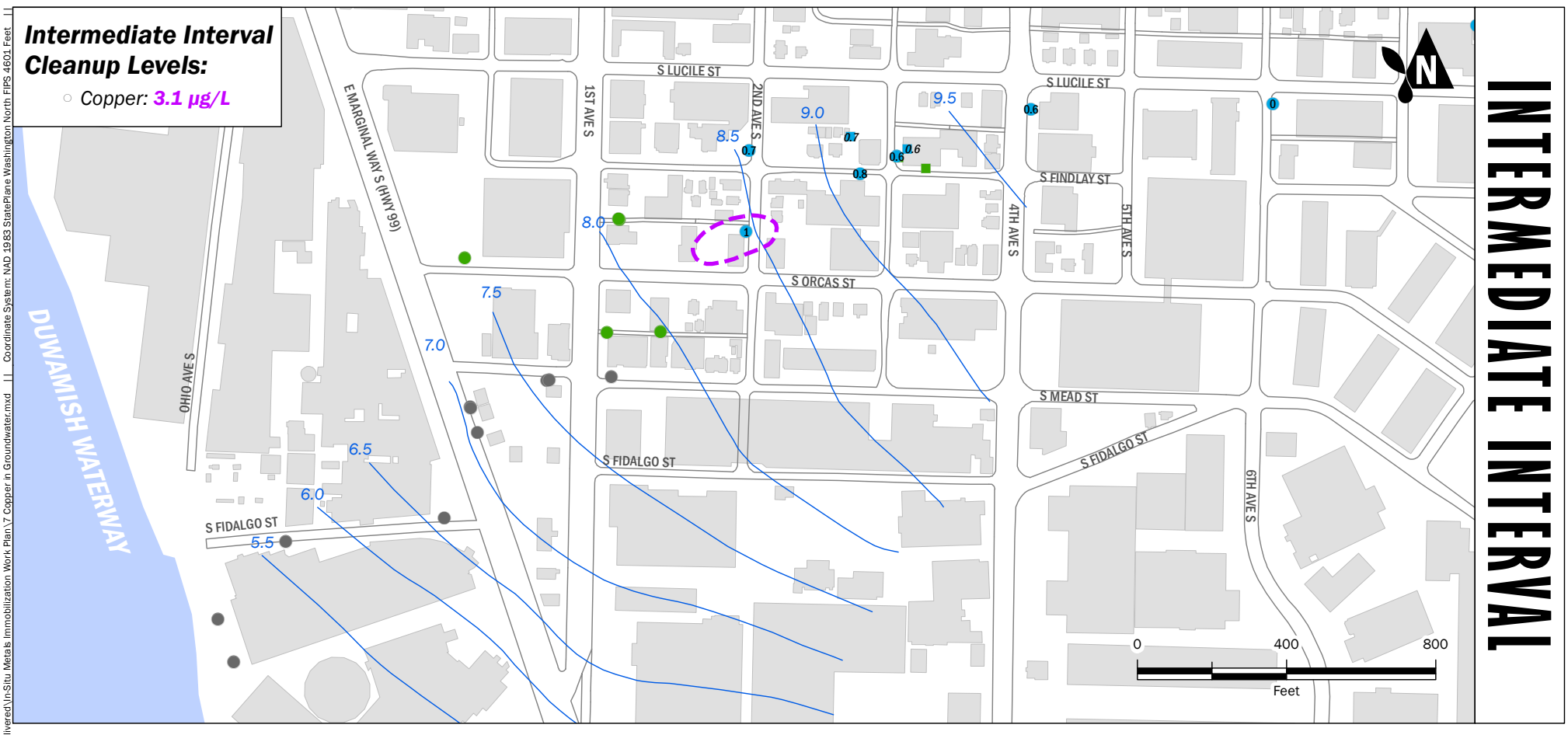
- Copper: **3.1 µg/L**



SHALLOW INTERVAL

Intermediate Interval Cleanup Levels:

- Copper: **3.1 µg/L**



INTERMEDIATE INTERVAL

Groundwater Sample Locations:

- Well
- Geoprobe

Sample Location Symbol Color:

- Detected Above Screening Level
- Detected, No Exceedance
- Not Detected (Detection Limit > Screening Level)
- Not Detected, No Exceedance
- Well not Sampled for Given Analyte

Data Notes:

Geoprobe data shown on this map reflects the maximum concentration detected at that sample location in the given interval.

Well data shown on this map reflects the most recent sample collected at that well in the given interval.

Data Labels:

Locations with detections are labeled with the concentration (in µg/L).

0.8 100 Wells 0.8 100 Geoprobes

- Copper Isoconcentration Line (at Screening Level)
- 8.0 Half-foot Groundwater Elevation Contours from August, 2012 Site-Wide Monitoring Event (NAVD88 Vertical Datum)

Nature and Extent of Dissolved Copper in Groundwater

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	MAR-2017	BY: PPW	FIGURE NO. 7
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

Date Saved: 3/28/2017 || User: rpepin || Print Date: 3/28/2017

GIS Path: T:\projects_8\Artbrass\PilotTesting_2017\Delivered\In-Situ Metals Immobilization Work Plan\7 Copper in Groundwater.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet ||

Water Table Interval Cleanup Levels:

- Nickel: **8.2 µg/L**

WATER TABLE INTERVAL

Shallow Interval Cleanup Levels:

- Nickel: **8.2 µg/L**

SHALLOW INTERVAL

Intermediate Interval Cleanup Levels:

- Nickel: **8.2 µg/L**

INTERMEDIATE INTERVAL

DUWAMISH WATERWAY
E MARGINAL WAY S (HWY 99)
1ST AVE S
2ND AVE S
4TH AVE S
5TH AVE S
6TH AVE S
OHIO AVE S
S LUCILE ST
S FINDLAY ST
S ORCAS ST
S MEAD ST
S FIDALGO ST
N
0 400 800
Feet

Groundwater Sample Locations:

- Well
- Geoprobe

Sample Location Symbol Color:

- Detected Above Screening Level
- Detected, No Exceedance
- Not Detected (Detection Limit > Screening Level)
- Not Detected, No Exceedance
- Well not Sampled for Given Analyte

Data Notes:

Geoprobe data shown on this map reflects the maximum concentration detected at that sample location in the given interval.

Well data shown on this map reflects the most recent sample collected at that well in the given interval.

Data Labels:

Locations with detections are labeled with the concentration (in µg/L).

0.8 100 Wells 0.8 100 Geoprobes

Ni Isoconcentration Line (at Screening Level)

8.0 Half-foot Groundwater Elevation Contours from August, 2012 Site-Wide Monitoring Event (NAVD88 Vertical Datum)

Nature and Extent of Dissolved Nickel in Groundwater

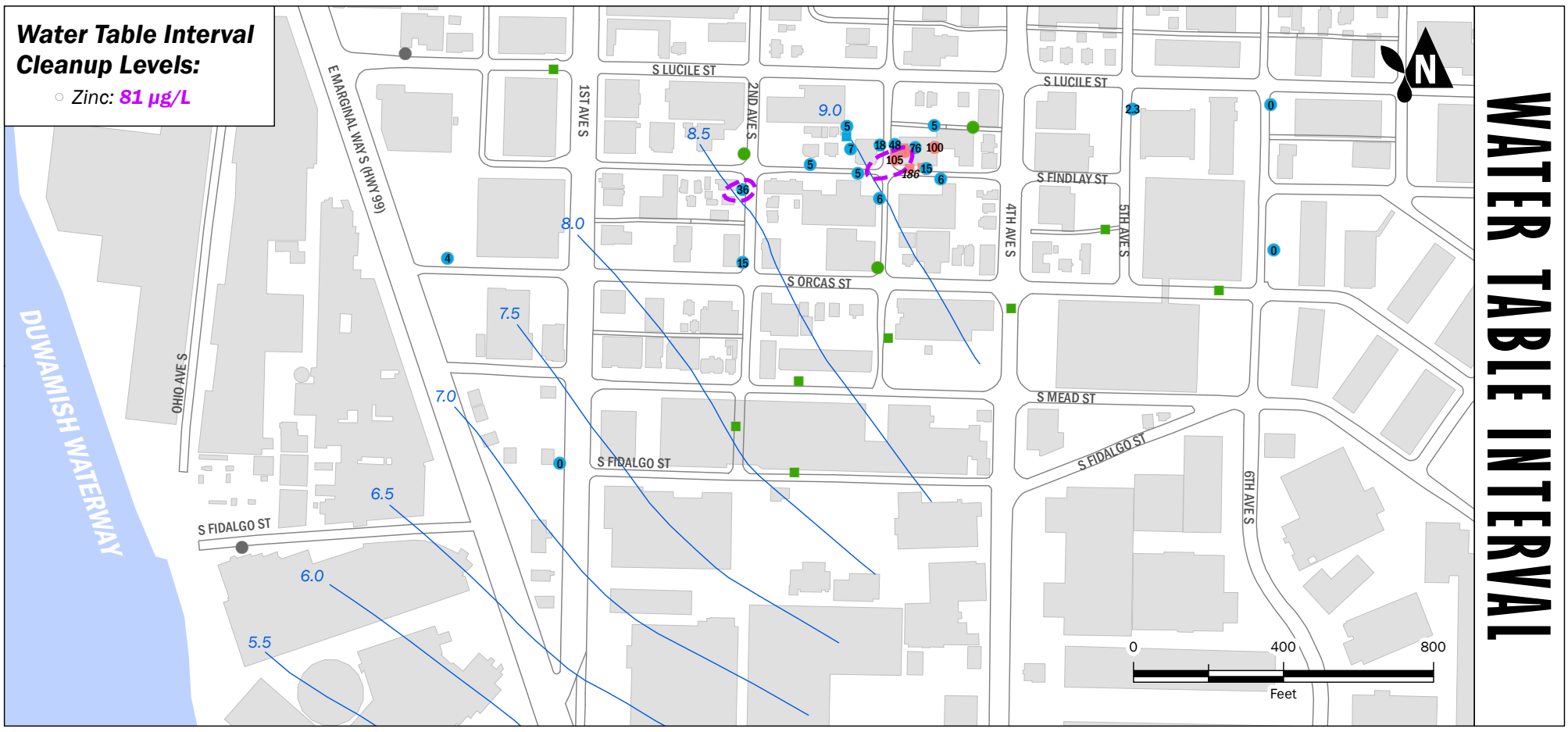
In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	MAR-2017	BY: PPW	FIGURE NO. 8
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

GIS Path: T:\projects_8\Artbrass\PilotTesting_2017\Delivered\In-Situ Metals Immobilization Work Plan\8 Nickel in Groundwater.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 3/28/2017 || User: rpepin || Print Date: 3/28/2017

Water Table Interval Cleanup Levels:

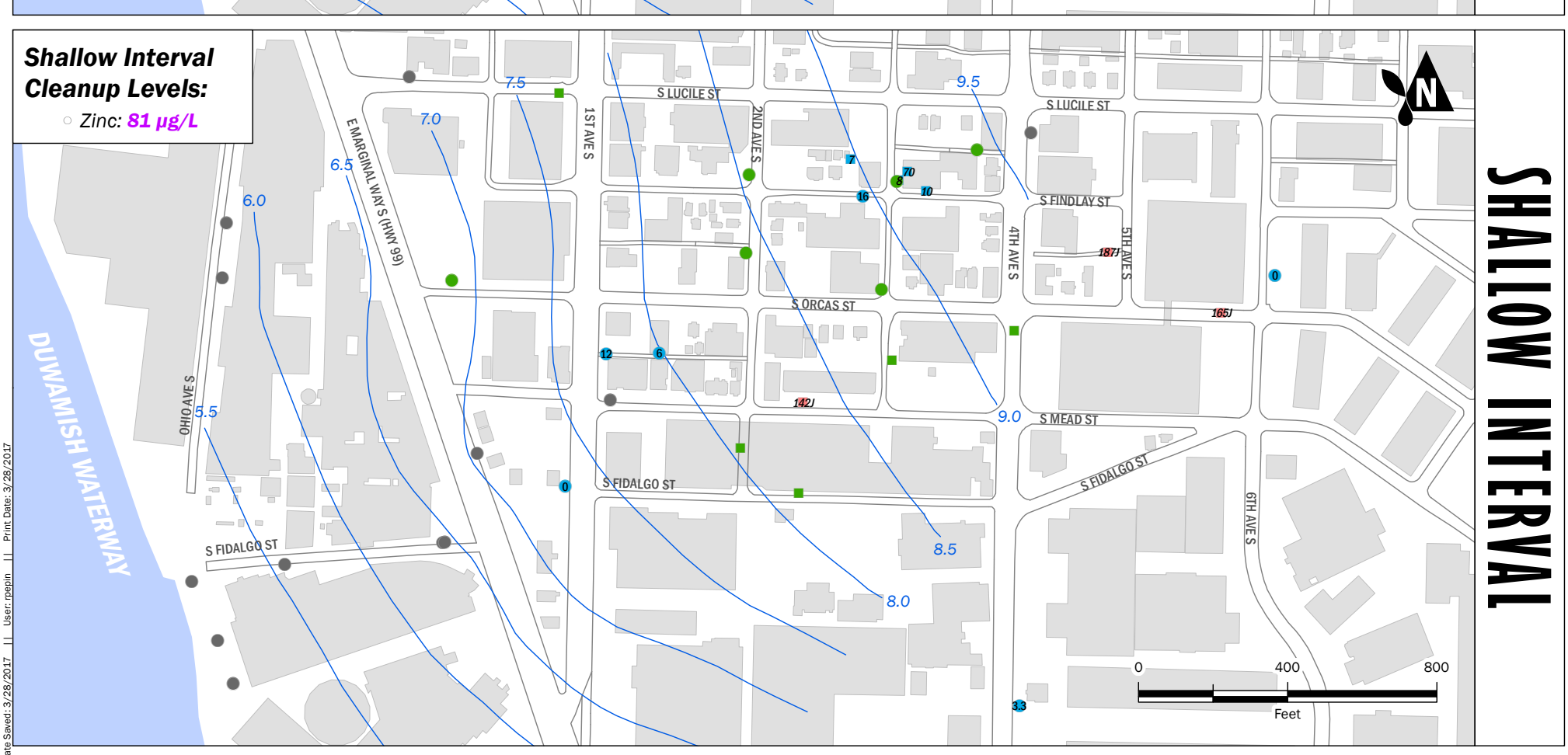
- Zinc: **81 µg/L**



WATER TABLE INTERVAL

Shallow Interval Cleanup Levels:

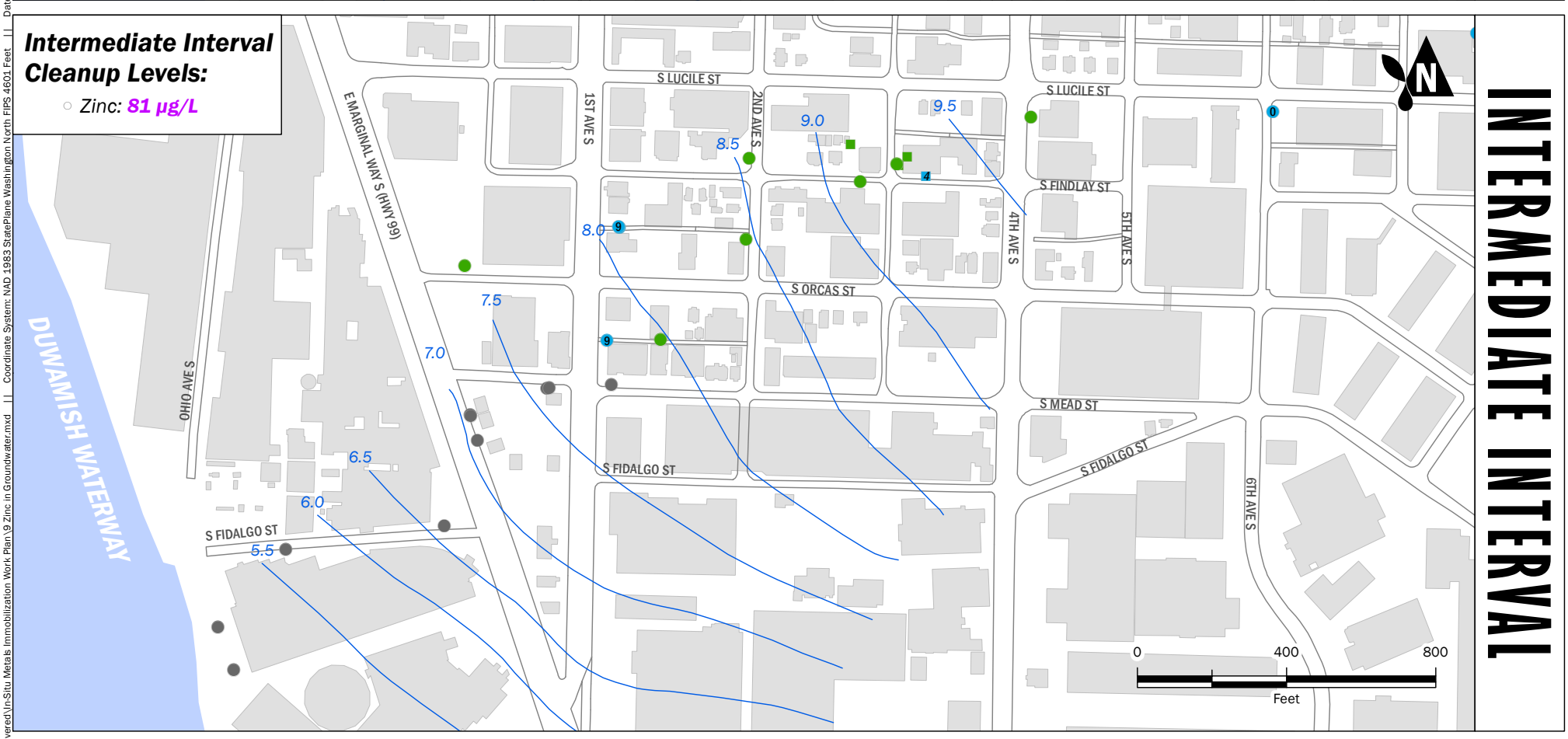
- Zinc: **81 µg/L**



SHALLOW INTERVAL

Intermediate Interval Cleanup Levels:

- Zinc: **81 µg/L**



INTERMEDIATE INTERVAL

Groundwater Sample Locations:

- Well
- Geoprobe

Sample Location Symbol Color:

- Detected Above Screening Level
- Detected, No Exceedance
- Not Detected (Detection Limit > Screening Level)
- Not Detected, No Exceedance
- Well not Sampled for Given Analyte

Data Notes:

Geoprobe data shown on this map reflects the maximum concentration detected at that sample location in the given interval.

Well data shown on this map reflects the most recent sample collected at that well in the given interval.

Data Labels:

Locations with detections are labeled with the concentration (in µg/L).

0.8 100 Wells 0.8 100 Geoprobes

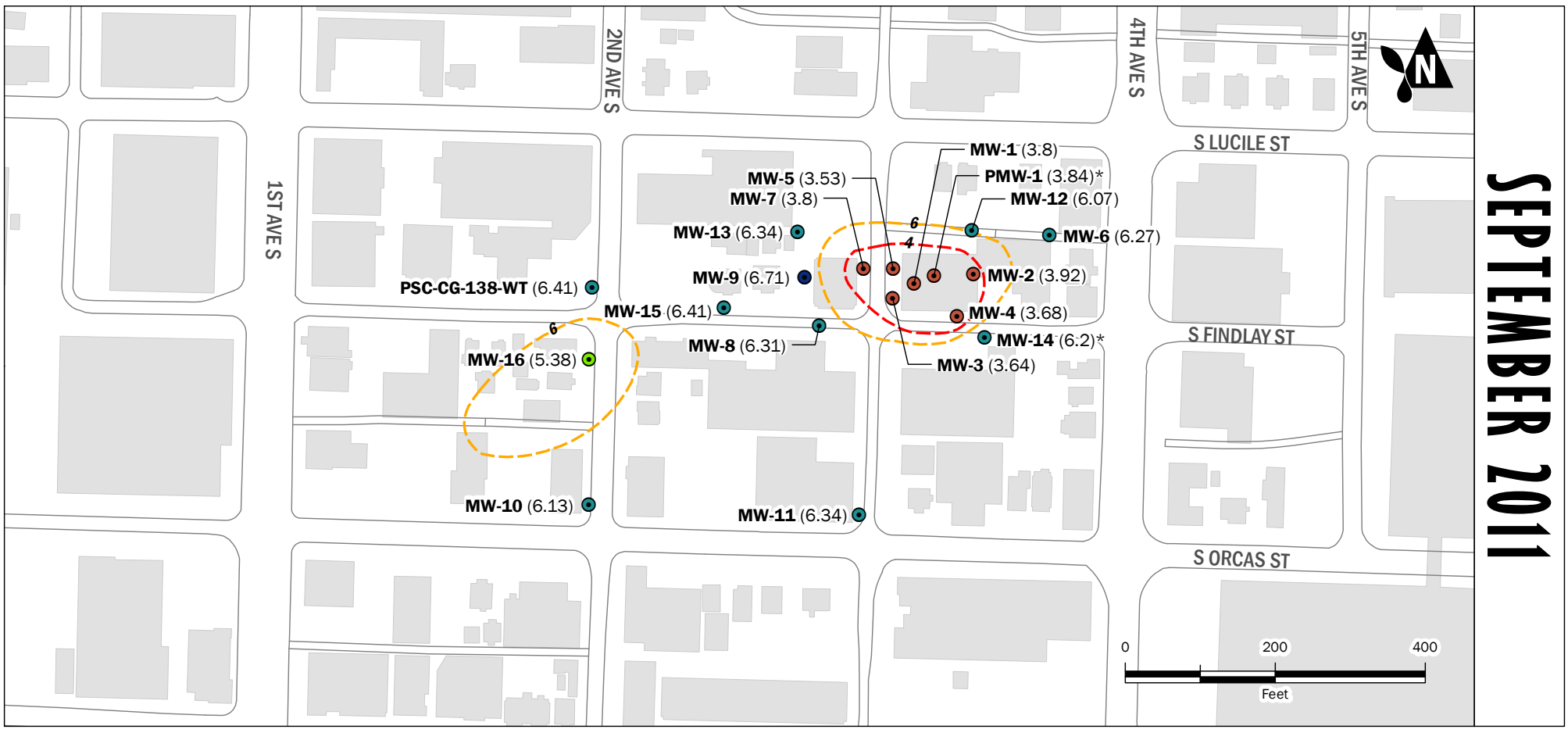
- Zinc Isoconcentration Line (at Screening Level)
- 8.0 Half-foot Groundwater Elevation Contours from August, 2012 Site-Wide Monitoring Event (NAVD88 Vertical Datum)

Nature and Extent of Dissolved Zinc in Groundwater

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	MAR-2017	BY: PPW	FIGURE NO. 9
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

GIS Path: T:\projects_8\Artbrass\PilotTesting_2017\Delivered\In-Situ Metals Immobilization Work Plan\9 Zinc in Groundwater.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 3/28/2017 || User: rpepin || Print Date: 3/28/2017



Field Measured pH at Well Location

- < 4.0
- 4.0 to < 4.5
- 4.5 to < 5.0
- 5.0 to < 5.5
- 5.5 to < 6.0
- 6.0 to < 6.5
- > 6.5
- pH of 4 Isocontour
- pH of 6 Isocontour
- Concentration Profile
  Presented on Figure 11

"" Denotes replacement data from November, 2011*

Groundwater pH in the Water Table Interval

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	APR-2017	BY: PPW	FIGURE NO. 10
	PROJECT NO. 050067	REVISED BY: ACG / RAP	

GIS Path: T:\projects_8\Artbrass\PilotTesting_2017\Delivered\In-Situ Metals Immobilization Work Plan\10 Groundwater pH Water Table.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 4/14/2017 || User: rpepin || Print Date: 4/14/2017

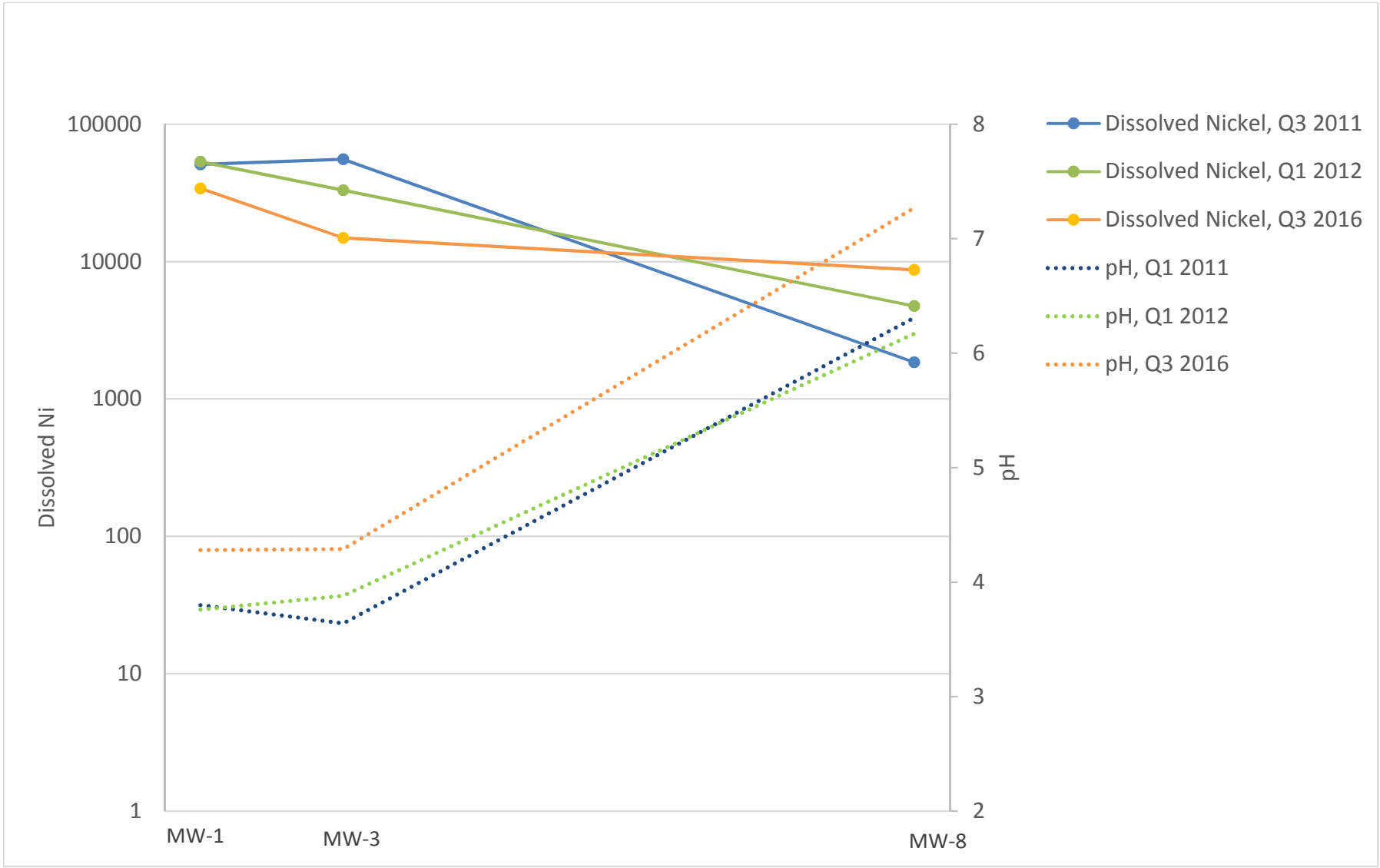


Figure 11

Nickel Attenuation in Groundwater

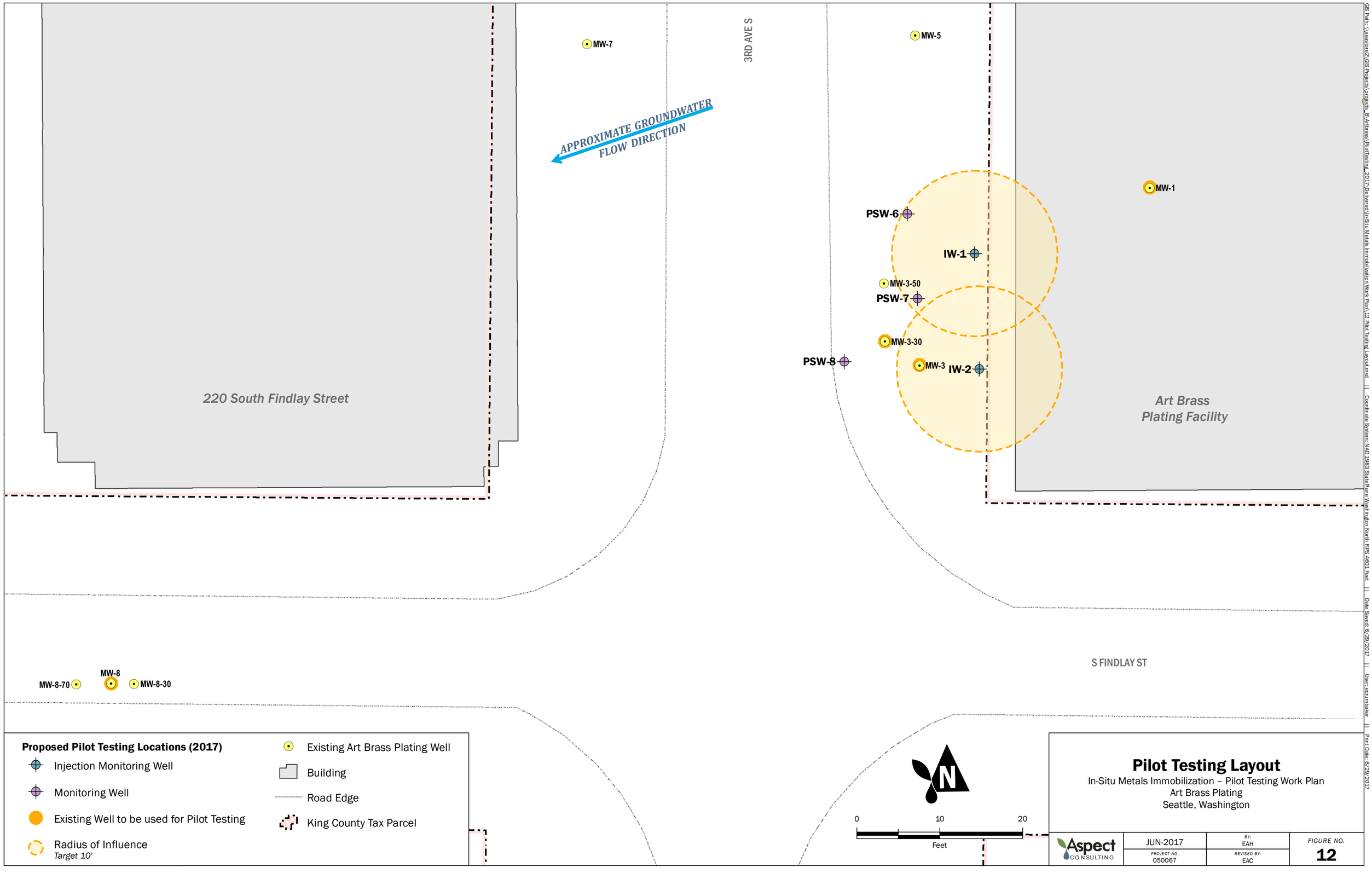
In-Situ Metals Immobilization - Pilot Test Work Plan

Art Brass Plating, Seattle, WA

Aspect Consulting

12/21/2017

V:\050067 Art Brass Plating\Pilot Study\Metals\Pilot Test Work Plan\Final\Figures\11 Nickel Attenuation in GW.xlsx

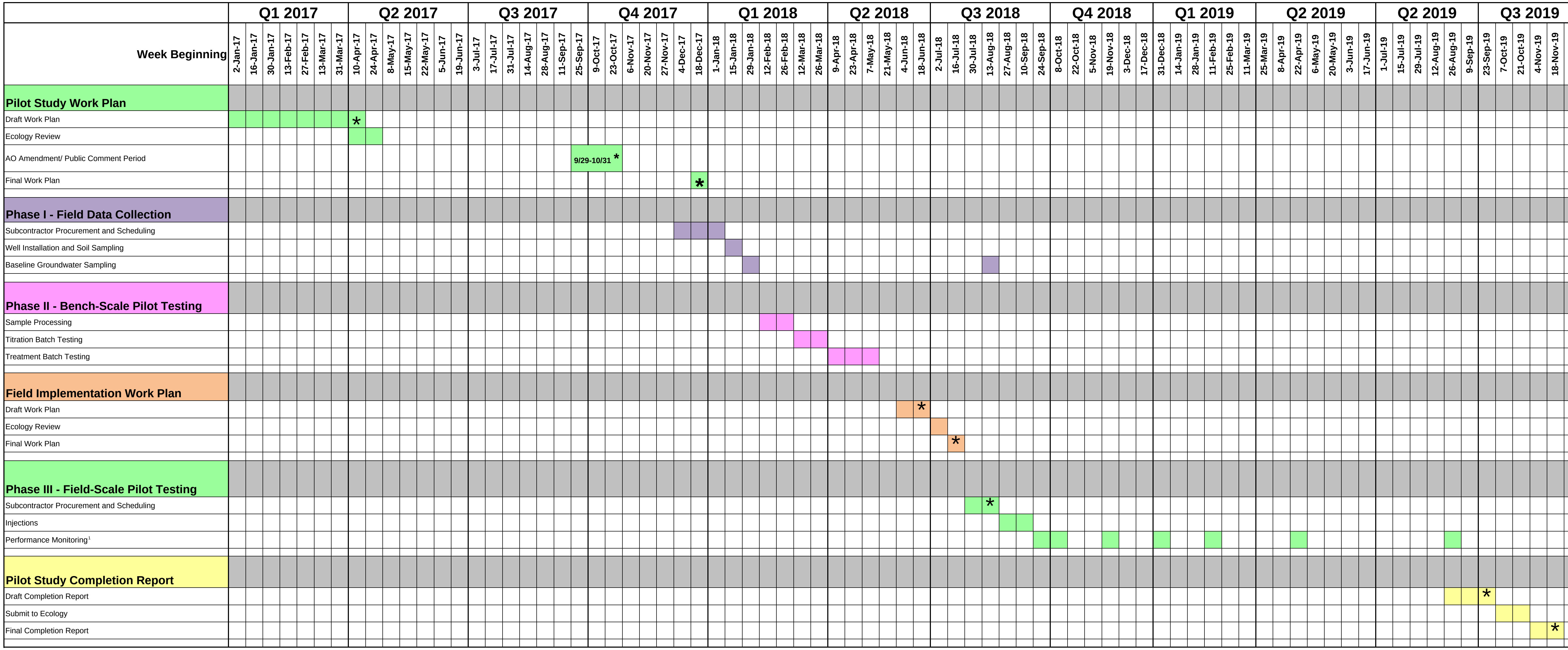


Pilot Testing Layout

In-Situ Metals Immobilization – Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	JUN-2017	BY: EAH	FIGURE NO. 12
	PROJECT NO. 050067	REVISED BY: EAC	

GIS Path: \\seastore2\GIS Projects\projects_S\Arthrass\PilotTesting_2017\Delivered\In-Situ Metals Immobilization Work Plan\12 Pilot Testing Layout.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 6/29/2017 || User: acrumbaker || Print Date: 6/29/2017



* - Indicates Project Milestone

1 - Based on Draft Performance Monitoring Plan presented. Final Performance Monitoring Plan will be presented in the Field Implementation Work Plan .

Aspect Consulting
12/21/2017
V:\050067 Art Brass Plating\Pilot Study\Metals\Pilot Test Work Plan\Final\Figures\13 Schedule_rev.xlsx

Figure 13
Anticipated Pilot Testing Schedule
In-Situ Metals Immobilization - Pilot Test Work Plan
Art Brass Plating, Seattle, WA

APPENDIX A

Boring and Well Construction Logs

Coarse-Grained Soils - More than 50% [1] Retained on No. 200 Sieve	Gravels - More than 50% [1] of Coarse Fraction Retained on No. 4 Sieve	≦5% Fines [5]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≧15% Fines [5]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% [1] or More of Coarse Fraction Passes No. 4 Sieve	≦5% Fines [5]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≧15% Fines [5]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% [1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT [2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50
	Consistency	**SPT [2] blows/foot**
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

FC = Fines Content
GS = Grain Size
MC = Moisture Content
AL = Atterberg Limits
C = Consolidation
DD = Dry Density
K = Permeability
Str = Shear Strength
Env = Environmental
PiD = Photoionization Detector

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

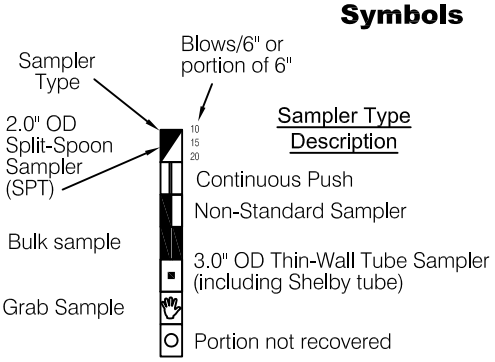
[3] Estimated Percentage

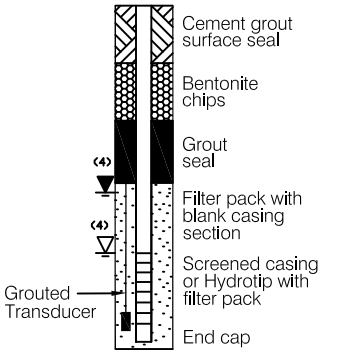
Percentage by Weight	Modifier
<5	Trace
5 to 15	Slightly (sandy, silty, clayey, gravelly)
15 to 30	Sandy, silty, clayey, gravelly)
30 to 49	Very (sandy, silty, clayey, gravelly)

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of groundwater — ATD = At time of drilling; Static water level (date); BGS = below ground surface
(5) Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

Aspect consulting earth+water
www.aspectconsulting.com
a limited liability company

Exploration Log Key

DATE:
DESIGNED BY:
DRAWN BY:
REVISED BY:
PROJECT NO.
FIGURE NO. A-1

Q:_ACAD Standards\Standard Details\Exploration Log Key A1.dwg

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
050067	MW-1	1 of 1

Project Name: Art Brass
Ground Surface Elev: 16.37
Location: Seattle, Washington
Driller/Method: Holt / HSA
Depth to Water:
Sampling Method:
Start/Finish Date: 10/5/2005

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
0 / 16	Flush mount monument. Concrete surface seal.						See log SP-9 for soil description.	0
1 / 15								1
2 / 14	Bentonite chip seal. 2" PVC casing threaded connection.							2
3 / 13								3
4 / 12								4
5 / 11								5
6 / 10								6
7 / 9								7
8 / 8	2" PVC screen with 20 slot size at 13.75' - 3.75' interval.							8
9 / 7								9
10 / 6								10
11 / 5								11
12 / 4								12
13 / 3								13
14 / 2	Bottom of boring.							14
15 / 1								15
16 / 0								16
17 / -1								17
18 / -2								18
19 / -3								19

Sampler Type:
○ No Recovery

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

Logged by: DLC
Approved by: DLC
Figure No.

_ENV BORING LOG_ART_BRASS_MW.GPJ September 12, 2012

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
050067	MW-3	1 of 1

Project Name: Art Brass
Location: Seattle, Washington
Driller/Method: Holt / HSA
Sampling Method:

Ground Surface Elev: 15.01
Depth to Water:
Start/Finish Date: 10/5/2005

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
1 — 14	Flush mount monument. Concrete surface seal.						See log SP-3 for soil description.	1
2 — 13	Bentonite chip seal.							2
3 — 12	2" PVC casing, threaded connection.							3
4 — 11								4
5 — 10	10-20 silica sand filter pack at 14.5' to 3' interval.							5
6 — 9								6
7 — 8	▽							7
8 — 7	2" PVC screen with 20-slot size at 14.2' to 4.2' interval.							8
9 — 6								9
10 — 5								10
11 — 4								11
12 — 3								12
13 — 2								13
14 — 1	Bottom of boring.							14
15 — 0								15
16 — -1								16
17 — -2								17
18 — -3								18
19 — -4								19

Sampler Type:
○ No Recovery

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

Logged by: DLC
Approved by: DLC
Figure No.

_ENV BORING LOG_ART_BRASS_MW.GPJ September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	MW-3-30	1 of 1

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: Cascade Drilling Inc. / Limited Access Rig Hollow Stem Auger-short tower
Sampling Method: 3.25" Dames and Moore split barrel sampler with140 lb above ground hammer

Ground Surface Elev (ft amsl)
Depth to Water (ft BGS) 4.75
Start/Finish Date 3/26/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
0	Flush-mount monument set in concrete, thermos cap Concrete surface seal 0' to 2'							0
5	▼ 3/27/2012						No logging or sampling.	5
10	3/8" Medium Bentonite Chips 2' to 18'							10
15								15
20	#2/12 Silica sand filter pack 18' to 30'						From drill cuttings: wet, blackSAND (SP); trace silt, fine to medium sand.	20
25	Schedule 40 PVC 10-Slot screen 20' to 30'							25
30	Threaded PVC endcap						Bottom of boring at 30' BGS.	30

Sampler Type:
○ No Recovery

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

Logged by: AET
Approved by: JJP
Figure No.

_ENV BORING LOG_ARTBRASS MWS.GPJ September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	MW-5	1 of 1

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: ESN / Direct-Push Probe
Sampling Method: Continuous Core

Ground Surface Elev:
Depth to Water:
Start/Finish Date: 6/24/2006

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
0							Asphalt over dry brown sandy GRAVEL.	0
1	Flushmount monument. Concrete surface seal.						Damp, brown, fine to medium SAND with silty interbeds.	1
2	Bentonite chip seal						Damp, dark brown SILT with organics.	2
3							Damp, medium brown, silty to slightly silty fine to medium SAND with trace organics.	3
4								4
5	▽		MW-5-5 (CA)				Wet, gray and tan mottled sandy SILT to silty SAND. Very fine sand.	5
6								6
7							Becomes gray.	7
8								8
9								9
10	10/20 sand							10
11							Wet, dark gray, fine to medium SAND with trace organics.	11
12	2" PVC slot screen from 14' to 4'							12
13								13
14								14
15								15
16							Bottom of Boring = 16 feet.	16
17							After continuous core soil samples were collected, the boring was widened with a 6-inch auger to install the 2-inch well.	17
18								18
19								19
20								20
21								21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29

Sampler Type:
- ◯ No Recovery
- ▯ Continuous Core

PID - Photoionization Detector (Headspace Measurement)
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: RRH
Approved by: DLC
Figure No.

_ENV BORING LOG ARTBRASSENVBOR.GPJ September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	MW-7	1 of 1

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: NW Probe / Direct Push Probe Rig
Sampling Method: Continuous Core

Ground Surface Elev (ft amsl)
Depth to Water (ft BTOC)
Start/Finish Date 3/18/2008

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
	8-inch flushmount monument; locking thermos cap; concrete seal 0'-1'						Gravel surface Hand cleared for utilities to 2'	
	Hydrated bentonite chips 1'-3'						Moist, brown, slightly silty, fine to medium SAND (SP)	
	2-inch diameter, schedule 40 PVC casing, threaded connection, 0'-4'	S1		0			Very moist, tan and gray mottled SILT (ML); trace sand	
5								5
	prepacked 20/40 colorado silica sand filter pack, 3'-14'							
	2-inch diameter, schedule 40 PVC screen, 10-slot, 4'-14'	S2		0			Wet, gray, SILT (ML)	
10								10
		S3	MW-7-10 CA	5			Wet, black with red and white SAND (SP); trace organics; sand is fine to medium, angular	
	Threaded PVC endcap						Bottom of boring at 14 feet	
15								15

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: EJM
Approved by: JJP
Figure No.

_ENV BORING LOG_ARTBRASS MWS.GPJ September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	MW-8	1 of 2

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: NW Probe / Direct-Push Probe
Sampling Method: Continuous

Ground Surface Elev (ft amsl) 15
Depth to Water (ft BGS) 5.29
Start/Finish Date 5/8/2007

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
	8" Flush-Mounted Monument; Locking Thermos Cap; Concrete 0-1'	S-1		<4			Moist, dark brown SILT (ML); abundant organics	
	Hydrated Bentonite Chips 1-4'						Moist, brown, slightly silty SAND (SP-SM); abundant organics; sand is fine	
	2" PVC Casing 0-15'						very moist	
5 / 10	Threaded PVC Connection; 5/10/2007	S-2		<4			Very moist, tan and gray mottled SILT (ML); trace organics	5
	10-20 Colorado Silica Sand 4-15'						Wet, tan and gray mottled, silty SAND (SM); occasional silt interbeds; sand is fine	
10 / 5	10-Slot PVC Well Screen, 5-15'; Prepacked in 20-40 Colorado Silica Sand	S-3		<4			Wet, black with red and white SAND (SP); sand is fine to medium, angular	10
		S-4		<4				
15 / 0	2" PVC Sump-Cap							15
		S-5		<4				
20 / -5	Hydrated Bentonite Chips 15-48'							20
		S-6		<4			1/4-inch gray, clayey SILT interbeds at 23 to 23.5 feet	
		S-7	Water sample collected at 20-24 feet	<4				

Sampler Type:
- ◯ No Recovery
- ▌▌ Continuous Core

PID - Photoionization Detector (Headspace Measurement)
- ▼ Static Water Level
- ▽ Water Level (ATD)

Logged by: RRH
Approved by: DLH
Figure No.

_ENV BORING LOG_ART BRASS 05-07.GPJ_September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	MW-8	2 of 2

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: NW Probe / Direct-Push Probe
Sampling Method: Continuous

Ground Surface Elev (ft amsl) 15
Depth to Water (ft BGS) 5.29
Start/Finish Date 5/8/2007

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
30 -15	Hydrated Bentonite Chips 15-48'	S-7		<4			SILT and silty SAND interbeds	30
		S-8	Water sample collected at 28-32 feet	<4				
		S-9		<4			organic silt interbeds	
35 -20			No soil sample 36 to 40 feet					35
40 -25			Water sample collected at 36-40 feet				Wet, black SAND (SP); trace organics; sand is fine to medium	40
		S-10		<4				
45 -30			No soil sample 44 to 48 feet					45
			Water sample collected at 44-48 feet				Bottom of boring at 48 feet; monitoring well installed	

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: RRH
Approved by: DLH
Figure No.

_ENV BORING LOG_ART BRASS 05-07.GPJ_September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	MW-9	1 of 1

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: NW Probe / Direct Push Probe Rig
Sampling Method: Continuous Core

Ground Surface Elev (ft amsl)
Depth to Water (ft BTOC)
Start/Finish Date 3/18/2008

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
	8-inch flushmount monument; locking thermos cap; concrete seal 0'-1'						Asphalt surface Hand cleared for utilities to 2'	
	Hydrated bentonite chips 1'-3'						Moist, brown, slightly silty, fine to medium SAND (SP)	
	2-inch diameter, schedule 40 PVC casing, threaded connection, 0'-4'	S1		0			Very moist, tan and gray mottled SILT (ML); trace sand	
5								5
	prepacked 20/40 colorado silica sand filter pack, 3'-14'							
	2-inch diameter, schedule 40 PVC screen, 10-slot, 4'-14'	S2		0			Wet, gray, SILT (ML)	
10								10
		S3	MW-9-10 CA	0			Wet, black with red and white SAND (SP); trace organics; sand is fine to medium, angular	
	Threaded PVC endcap						Bottom of boring at 14 feet	
15								15

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector (Headspace Measurement)

- Static Water Level
- Water Level (ATD)

Logged by: EJM
Approved by: JJP
Figure No.

_ENV BORING LOG_ARTBRASS MWS.GPJ September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	MW-16	1 of 1

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: NW Probe / Direct Push Probe
Sampling Method: Continuous Core

Ground Surface Elev:
Depth to Water:
Start/Finish Date: 3/18/2009

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
	8" flushmount monument, 2" J-plug well cap, concrete seal, 0'-1'						Hand cleared to 3' bgs. Slightly moist, brown, slightly silty, gravelly SAND (SP).	
	2" diameter schedule 40 PVC casing, threaded connection, 0'-5'							
	Hydrated bentonite chips, 1'-4'						Slightly moist, dark brown to brown, silty to very silty SAND (SM), with scattered organics; fine sand.	
5	#2/12 monterray sand filter pack, 4'-15'	S1						5
							Moist, with orange and gray mottling.	
	2" diameter, schedule 40 PVC screen, 10-slot, 5'-15'						Wet.	
		S2					Wet, gray, sandy SILT (ML); fine sand.	
10								10
		S3						
							Wet, dark gray SAND (SP); fine to medium sand.	
15	Threaded PVC endcap							15
							Bottom of boring at 15 feet. Well installed using 4" HSA.	

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: EJM
Approved by: DLC
Figure No.

_ENV BORING LOG ART BRASS-MW70.GPJ September 12, 2012

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
050067	PMW-1	1 of 1

Project Name: Art Brass Plating
Location: Seattle, WA
Driller/Method: ESN / Direct-Push Probe
Sampling Method: Continuous Core

Ground Surface Elev:
Depth to Water:
Start/Finish Date: 6/24/2006

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID	Drive/ Recovery	Material Type	Description	Depth (ft)
1–7	Flushmount monument. Concrete surface seal. Bentonite chip seal							1–7
8							Wet, dark gray-black, fine to medium SAND.	8
9–11	Prepack 3/4" PVC screen with 10"-slot size at 14' to 4' interval.						Wet, gray, silty, fine SAND with trace organics.	9–11
12			PMW-1-12 (CA)				Wet, dark gray, fine to medium SAND.	12
13								13
14							Bottom of Boring = 14'	14
15–29								15–29

Sampler Type:
- No Recovery
- Sample not recovered.
- Continuous Core

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: RRH
Approved by: DLC
Figure No.

ENV BORING LOG ARTBRASSENVBOR.GPJ September 12, 2012

APPENDIX B

Historical Soil Analytical Results

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	MW-5 6/24/06 (5 ft.)	MW-5 6/24/06 (9 ft.)	MW-5 6/24/06 (12-16 ft.)	MW-7 3/18/08 (10 ft.)	MW-8 3/12/08 (30 ft.)	MW-8 11/17/08 (70-71.5 ft.)	MW-9 3/18/08 (10 ft.)	PMW-1 6/24/06 (12 ft.)	SP-18 2/22/12 (4-5 ft.)	SP-18 2/22/12 (6-7 ft.)	SP-18 2/22/12 (9-10 ft.)	SP-18 2/22/12 (12-13 ft.)	SP-18 2/22/12 (22.5-23.5 ft.)	SP-18 2/22/12 (28.5-29.5 ft.)	SP-18 2/22/12 (40-41 ft.)	SP-19 2/21/12 (3-4.5 ft.)	SP-19 2/21/12 (5-6 ft.)	SP-19 2/21/12 (8.5-9.5 ft.)	SP-19 2/21/12 (13-14 ft.)	SP-19 2/21/12 (18-19 ft.)	SP-19 2/21/12 (25-26 ft.)	SP-19 2/21/12 (40-41 ft.)	SP-20 2/22/12 (2-3 ft.)
Metals																							
Cadmium in mg/kg									0.1 U	0.1 U	0.2	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Copper in mg/kg									11.3	76.9	20.8	17.1	6.5	7.4	25.5	9.5	20.8	19.4	10.2	17.6	18.2	32.6	13.2
Iron in mg/kg									10,700	13,400	11,800	11,500	11,800	8,150	9,210	9,830	9,890	13,900	9,990	11,200	11,200	18,600	9,720
Manganese in mg/kg									90.9 J	170 J	79.4 J	67.9 J	76.4 J	64.8 J	81.2 J	61.6	67.6	85.9	74.1	81.5	93.0	169	66.4 J
Nickel in mg/kg									57.2	695	830	296	5.6	4.9	5.5	17.3	10.1	9.5	71.4	159	6.5	8.5	6.2
Zinc in mg/kg									18	49	32	21	18	15	19	16	29	28	23	24	19	25	18
Conventional Chemistry Parameters																							
Total Organic Carbon in Percent				0.071	0.311	0.153	0.196		0.129	0.094	0.333	0.339	0.101	0.214	0.089	0.120	0.190	0.350	0.297	0.250	0.165	0.170	0.327
Total Solids in Percent									84.80	78.50	76.20	75.60	81.10	78.80	76.20	81.90	79.20	77.80	80.30	79.10	78.70	77.00	80.10
Total Suspended Solids in Percent				83	73.2	76.5	82.5																
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,1,1-Trichloroethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U	0.0009 U	0.0008 U	0.0009 U	0.0011 U	0.0009 U	0.0009 U	0.0009 U	0.001 U	0.001 U	0.0012 U	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
1,1,2,2-Tetrachloroethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,1,2-Trichloroethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,1-Dichloroethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U	0.0009 U	0.0008 U	0.0013	0.0019	0.0023	0.0029	0.0009 U	0.001 U	0.001 U	0.0012 U	0.0012 U	0.0009 U	0.0011 J	0.0011 U	0.0009 U
1,1-Dichloroethene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U	0.0009 U	0.0008 U	0.0009 U	0.0011 U	0.0009 U	0.0009 U	0.0009 U	0.001 U	0.001 U	0.0012 U	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
1,1-Dichloropropene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,2,3-Trichlorobenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,2,3-Trichloropropane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,2,4-Trichlorobenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,2,4-Trimethylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,2-Dibromo-3-chloropropane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,2-Dibromoethane (EDB) in mg/kg	0.005 U	0.005 U	0.005 U					0.005 U															
1,2-Dichlorobenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,2-Dichloroethane (EDC) in mg/kg	0.02 U	0.02 U	0.02 U					0.02 U	0.0009 U	0.0008 U	0.0009 U	0.0011 U	0.0009 U	0.0009 U	0.0009 U	0.001 U	0.001 U	0.0012 U	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
1,2-Dichloropropane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,3,5-Trimethylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,3-Dichlorobenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,3-Dichloropropane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
1,4-Dichlorobenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
2,2-Dichloropropane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
2-Chlorotoluene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
4-Chlorotoluene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Benzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Bromobenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Bromodichloromethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Bromoform in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Bromomethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Carbon tetrachloride in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Chlorobenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Chloroethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U	0.0009 U	0.0008 U	0.0009 U	0.0011 U	0.0009 U	0.0009 U	0.0009 U	0.001 U	0.001 U	0.0012 U	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
Chloroform in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Chloromethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
cis-1,2-Dichloroethene (DCE) in mg/kg	0.05 U	0.075	0.05 U					12	0.047	0.071	1.4	0.13	0.0012	0.0011	0.0009 U	0.001 U	0.001 U	0.0051	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
cis-1,3-Dichloropropene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Dibromochloromethane in mg/kg	0.02 U	0.02 U	0.02 U					0.02 U															
Dibromomethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Dichlorodifluoromethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Ethylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Hexachlorobutadiene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Isopropylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Methylene chloride in mg/kg	0.02 U	0.02 U	0.02 U					0.02 U															
n-Butylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
n-Propylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
p-Isopropyltoluene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
sec-Butylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Styrene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
tert-Butylbenzene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Tetrachloroethene (PCE) in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U	0.0009 U	0.0008 U	0.0028	0.0007 J	0.0009 U	0.0009 U	0.0009 U	0.001 U	0.001 U	0.0012 U	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
Toluene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
trans-1,2-Dichloroethene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U	0.0009 U	0.0008 J	0.018	0.006	0.0009 U	0.0009 U	0.0009 U	0.001 U	0.001 U	0.0008 J	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
trans-1,3-Dichloropropene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Trichloroethene (TCE) in mg/kg	0.02 U	0.074	0.12					11	0.014	0.032	12	3	0.0009 U	0.0009 U	0.0009 U	0.0016	0.0051	0.055	0.0079	0.016	0.0011 U	0.0011 U	0.0009 U
Trichlorofluoromethane in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Vinyl chloride in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U	0.0009 U	0.0008 U	0.0009 U	0.0011 U	0.0009 U	0.0021	0.0009 U	0.001 U	0.001 U	0.0012 U	0.0012 U	0.0009 U	0.0011 U	0.0011 U	0.0009 U
Xylenes (total) in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															
Naphthalene in mg/kg	0.05 U	0.05 U	0.05 U					0.05 U															

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	SP-20 2/22/12 (5.5-6.5 ft.)	SP-20 2/22/12 (9-10 ft.)	SP-20 2/22/12 (12-13 ft.)	SP-20 2/22/12 (17-18 ft.)	SP-20 2/22/12 (24-25 ft.)	SP-20 2/22/12 (40-41 ft.)	SP-21 4/17/12 (3 ft.)	SP-21 4/17/12 (3-4 ft.)	SP-21 4/17/12 (5-6 ft.)	SP-21 4/17/12 (6 ft.)	SP-21 4/17/12 (9 ft.)	SP-21 4/17/12 (9-10 ft.)	SP-21 4/17/12 (12 ft.)	SP-21 4/17/12 (12-13 ft.)	SP-21 4/17/12 (19-20 ft.)	SP-21 4/17/12 (20 ft.)	SP-22 4/17/12 (3 ft.)	SP-22 4/17/12 (3-4 ft.)	SP-22 4/17/12 (5-6 ft.)	SP-22 4/17/12 (6 ft.)	SP-22 4/17/12 (9 ft.)	SP-22 4/17/12 (9-10 ft.)	SP-22 4/17/12 (12 ft.)
Metals																							
Cadmium in mg/kg	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U			0.1 U		0.1 U	0.1 U			0.5	0.1 U			0.1 U	
Copper in mg/kg	18.1	8.5	7.6	9.0	7.2	16.9		9.3	18.0			18.4		7.3	9.3			27.4	18.9			15.0	
Iron in mg/kg	9,350	9,860	8,820	9,770	8,750	9,880																	
Manganese in mg/kg	66.8 J	70.2 J	66.3 J	88.0 J	77.5 J	96.5 J																	
Nickel in mg/kg	13.9	5.6	5.1	8.1	4.9	5.6		5.1	8.8			8.7		5.0	6.8			21.7	9.5			8.3	
Zinc in mg/kg	31	19	17	21	16	20		15	25			27		18	23			223	26			23	
Conventional Chemistry Parameters																							
Total Organic Carbon in Percent	0.324	0.619	0.103	0.062	0.034	0.161																	
Total Solids in Percent	75.70	78.20	81.40	84.20	79.90	79.00																	
Total Suspended Solids in Percent																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in mg/kg																							
1,1,1-Trichloroethane in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.001 U			0.0008 U	0.0008 U		0.001 U			0.0009 U	0.0009 U			0.0009 U	0.0008 U		0.0007 U
1,1,2,2-Tetrachloroethane in mg/kg																							
1,1,2-Trichloroethane in mg/kg																							
1,1-Dichloroethane in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.006	0.0009 U	0.001 U			0.0008 U	0.0005 J		0.0005 J			0.0012	0.0009 U			0.0009 U	0.0008 U		0.0011
1,1-Dichloroethene in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.001 U			0.0008 U	0.0008 U		0.001 U			0.0009 U	0.0009 U			0.0009 U	0.0008 U		0.0007 U
1,1-Dichloropropene in mg/kg																							
1,2,3-Trichlorobenzene in mg/kg																							
1,2,3-Trichloropropane in mg/kg																							
1,2,4-Trichlorobenzene in mg/kg																							
1,2,4-Trimethylbenzene in mg/kg																							
1,2-Dibromo-3-chloropropane in mg/kg																							
1,2-Dibromoethane (EDB) in mg/kg																							
1,2-Dichlorobenzene in mg/kg																							
1,2-Dichloroethane (EDC) in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.001 U			0.0008 U	0.0008 U		0.001 U			0.0009 U	0.0009 U			0.0009 U	0.0008 U		0.0007 U
1,2-Dichloropropane in mg/kg																							
1,3,5-Trimethylbenzene in mg/kg																							
1,3-Dichlorobenzene in mg/kg																							
1,3-Dichloropropane in mg/kg																							
1,4-Dichlorobenzene in mg/kg																							
2,2-Dichloropropane in mg/kg																							
2-Chlorotoluene in mg/kg																							
4-Chlorotoluene in mg/kg																							
Benzene in mg/kg																							
Bromobenzene in mg/kg																							
Bromodichloromethane in mg/kg																							
Bromoform in mg/kg																							
Bromomethane in mg/kg																							
Carbon tetrachloride in mg/kg																							
Chlorobenzene in mg/kg																							
Chloroethane in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.001 U			0.0008 U	0.0008 U		0.001 U			0.0009 U	0.0009 U			0.0009 U	0.0008 U		0.0007 U
Chloroform in mg/kg																							
Chloromethane in mg/kg																							
cis-1,2-Dichloroethene (DCE) in mg/kg	0.0029	0.0008 J	0.0023	0.0011	0.0069	0.0009 U	0.001 U			0.0004 J	0.0021		0.0009 J			0.0012	0.0017			0.0031	0.12		0.0062
cis-1,3-Dichloropropene in mg/kg																							
Dibromochloromethane in mg/kg																							
Dibromomethane in mg/kg																							
Dichlorodifluoromethane in mg/kg																							
Ethylbenzene in mg/kg																							
Hexachlorobutadiene in mg/kg																							
Isopropylbenzene in mg/kg																							
Methylene chloride in mg/kg																							
n-Butylbenzene in mg/kg																							
n-Propylbenzene in mg/kg																							
p-Isopropyltoluene in mg/kg																							
sec-Butylbenzene in mg/kg																							
Styrene in mg/kg																							
tert-Butylbenzene in mg/kg																							
Tetrachloroethene (PCE) in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.001 U			0.0008 U	0.0008 U		0.001 U			0.0009 U	0.0009 J			0.0009 U	0.0008 U		0.0007 U
Toluene in mg/kg																							
trans-1,2-Dichloroethene in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.001 U			0.0008 U	0.0008 U		0.001 U			0.0009 U	0.0009 U			0.0009 U	0.0059		0.0007 U
trans-1,3-Dichloropropene in mg/kg																							
Trichloroethene (TCE) in mg/kg	0.0021	0.0025	0.012	0.0021	0.0014	0.0009 U	0.0016			0.0038	0.0018		0.007			0.004	0.04			0.015	2.4		0.036
Trichlorofluoromethane in mg/kg																							
Vinyl chloride in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0032 J	0.0009 U	0.001 U			0.0008 U	0.0008 U		0.001 U			0.0009 U	0.0009 U			0.0009 U	0.0008 U		0.0007 U
Xylenes (total) in mg/kg																							
Naphthalene in mg/kg																							

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	SP-22 4/17/12 (12-13 ft.)	SP-22 4/17/12 (19-20 ft.)	SP-22 4/17/12 (20 ft.)	SP-23 4/17/12 (3 ft.)	SP-23 4/17/12 (3-4 ft.)	SP-23 4/17/12 (5-6 ft.)	SP-23 4/17/12 (6 ft.)	SP-23 4/17/12 (9 ft.)	SP-23 4/17/12 (9-10 ft.)	SP-23 4/17/12 (12 ft.)	SP-23 4/17/12 (12-13 ft.)	SP-23 4/17/12 (19-20 ft.)	SP-23 4/17/12 (20 ft.)	SP-24 4/16/12 (3 ft.)	SP-24 4/16/12 (3-4 ft.)	SP-24 4/16/12 (5-6 ft.)	SP-24 4/16/12 (6 ft.)	SP-24 4/16/12 (9 ft.)	SP-24 4/16/12 (9-10 ft.)	SP-24 4/16/12 (12 ft.)	SP-24 4/16/12 (12-13 ft.)	SP-24 4/16/12 (19-20 ft.)	SP-24 4/16/12 (20 ft.)
Metals																							
Cadmium in mg/kg	0.1 U	0.1 U			0.1 U	0.1 U			0.1 U		0.1 U	0.1 U			0.2	0.1			0.1 U		0.1 U	0.1 U	
Copper in mg/kg	9.3	7.7			14.9	20.5			6.8		6.0	5.3			23.8	19.7			21.4		7.0	6.3	
Iron in mg/kg																							
Manganese in mg/kg																							
Nickel in mg/kg	6.2	5.9			6.1	10.2			4.9		10.2	4.7			23.2	112			9.4		5.1	4.9	
Zinc in mg/kg	20	19			17	27			17		16	15			41	31			28		18	17	
Conventional Chemistry Parameters																							
Total Organic Carbon in Percent																							
Total Solids in Percent																							
Total Suspended Solids in Percent																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in mg/kg																							
1,1,1-Trichloroethane in mg/kg			0.0009 U	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0011 U	0.0009 U			0.0009 U	0.001 U		0.0009 U			0.0009 U
1,1,2,2-Tetrachloroethane in mg/kg																							
1,1,2-Trichloroethane in mg/kg																							
1,1-Dichloroethane in mg/kg			0.0013	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0012	0.0009 U			0.0009 U	0.001 U		0.002			0.0032
1,1-Dichloroethene in mg/kg			0.0009 U	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0011 U	0.0009 U			0.0009 U	0.0005 J		0.0009 U			0.0009 U
1,1-Dichloropropene in mg/kg																							
1,2,3-Trichlorobenzene in mg/kg																							
1,2,3-Trichloropropane in mg/kg																							
1,2,4-Trichlorobenzene in mg/kg																							
1,2,4-Trimethylbenzene in mg/kg																							
1,2-Dibromo-3-chloropropane in mg/kg																							
1,2-Dibromoethane (EDB) in mg/kg																							
1,2-Dichlorobenzene in mg/kg																							
1,2-Dichloroethane (EDC) in mg/kg			0.0009 U	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0011 U	0.0009 U			0.0009 U	0.001 U		0.0009 U			0.0009 U
1,2-Dichloropropane in mg/kg																							
1,3,5-Trimethylbenzene in mg/kg																							
1,3-Dichlorobenzene in mg/kg																							
1,3-Dichloropropane in mg/kg																							
1,4-Dichlorobenzene in mg/kg																							
2,2-Dichloropropane in mg/kg																							
2-Chlorotoluene in mg/kg																							
4-Chlorotoluene in mg/kg																							
Benzene in mg/kg																							
Bromobenzene in mg/kg																							
Bromodichloromethane in mg/kg																							
Bromoform in mg/kg																							
Bromomethane in mg/kg																							
Carbon tetrachloride in mg/kg																							
Chlorobenzene in mg/kg																							
Chloroethane in mg/kg			0.0009 U	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0011 U	0.0009 U			0.0009 U	0.001 U		0.0009 U			0.0009 U
Chloroform in mg/kg																							
Chloromethane in mg/kg																							
cis-1,2-Dichloroethene (DCE) in mg/kg			0.0012	0.0008 U			0.0009 U	0.0021		0.0016			0.0026	0.0009 U			0.0009 U	0.025		0.0075			0.0017
cis-1,3-Dichloropropene in mg/kg																							
Dibromochloromethane in mg/kg																							
Dibromomethane in mg/kg																							
Dichlorodifluoromethane in mg/kg																							
Ethylbenzene in mg/kg																							
Hexachlorobutadiene in mg/kg																							
Isopropylbenzene in mg/kg																							
Methylene chloride in mg/kg																							
n-Butylbenzene in mg/kg																							
n-Propylbenzene in mg/kg																							
p-Isopropyltoluene in mg/kg																							
sec-Butylbenzene in mg/kg																							
Styrene in mg/kg																							
tert-Butylbenzene in mg/kg																							
Tetrachloroethene (PCE) in mg/kg			0.0009 U	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0011 U	0.0009 U			0.0009 U	0.001 U		0.0009 U			0.0009 U
Toluene in mg/kg																							
trans-1,2-Dichloroethene in mg/kg			0.0009 U	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0011 U	0.0009 U			0.0009 U	0.011		0.0009 U			0.0009 U
trans-1,3-Dichloropropene in mg/kg																							
Trichloroethene (TCE) in mg/kg			0.011	0.0013			0.0023	0.004		0.017			0.016	0.0019			0.0013	4.2		0.0086			0.0007 J
Trichlorofluoromethane in mg/kg																							
Vinyl chloride in mg/kg			0.0009 U	0.0008 U			0.0009 U	0.001 U		0.0009 U			0.0011 U	0.0009 U			0.0009 U	0.001 U		0.0009 U			0.0018
Xylenes (total) in mg/kg																							
Naphthalene in mg/kg																							

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	SP-25 4/16/12 (3 ft.)	SP-25 4/16/12 (3-4 ft.)	SP-25 4/16/12 (5-6 ft.)	SP-25 4/16/12 (6 ft.)	SP-25 4/16/12 (9 ft.)	SP-25 4/16/12 (9-10 ft.)	SP-25 4/16/12 (12 ft.)	SP-25 4/16/12 (12-13 ft.)	SP-25 4/16/12 (19-20 ft.)	SP-25 4/16/12 (20 ft.)	SP-26 4/17/12 (3 ft.)	SP-26 4/17/12 (3-4 ft.)	SP-26 4/17/12 (5-6 ft.)	SP-26 4/17/12 (6 ft.)	SP-26 4/17/12 (9 ft.)	SP-26 4/17/12 (9-10 ft.)	SP-26 4/17/12 (12 ft.)	SP-26 4/17/12 (12-13 ft.)	SP-26 4/17/12 (19-20 ft.)	SP-26 4/17/12 (20 ft.)	SP-27 4/17/12 (3 ft.)	SP-27 4/17/12 (3-4 ft.)	SP-27 4/17/12 (5-6 ft.)
Metals																							
Cadmium in mg/kg		0.3	0.2			0.1 U		0.1 U	0.1 U			0.2	0.2			0.1 U		0.1 U	0.1 U			0.1 U	0.1 U
Copper in mg/kg		23.3	15.6			15.2		8.6	7.3			21.9	12.9			16.9		8.5	34.4			23.6	20.5
Iron in mg/kg																							
Manganese in mg/kg																							
Nickel in mg/kg		22.0	520			32.5		6.4	6.1			26.6	7.5			8.2		6.5	9.0			9.7	8.7
Zinc in mg/kg		70	32			25		20	19			56	65			25		21	26			33	29
Conventional Chemistry Parameters																							
Total Organic Carbon in Percent																							
Total Solids in Percent																							
Total Suspended Solids in Percent																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in mg/kg																							
1,1,1-Trichloroethane in mg/kg	0.001 U			0.001 U	0.0007 U		0.0009 U			0.0009 U	0.0008 U			0.0008 U	0.001 U		0.0009 U			0.0008 U	0.0012 U		
1,1,2,2-Tetrachloroethane in mg/kg																							
1,1,2-Trichloroethane in mg/kg																							
1,1-Dichloroethane in mg/kg	0.001 U			0.001 U	0.0004 J		0.0009 U			0.0009 U	0.0008 U			0.0008 U	0.001 U		0.0009 U			0.0008 U	0.0012 U		
1,1-Dichloroethene in mg/kg	0.001 U			0.001 U	0.001		0.0009 U			0.0009 U	0.0008 U			0.0008 U	0.001 U		0.0009 U			0.0008 U	0.0012 U		
1,1-Dichloropropene in mg/kg																							
1,2,3-Trichlorobenzene in mg/kg																							
1,2,3-Trichloropropane in mg/kg																							
1,2,4-Trichlorobenzene in mg/kg																							
1,2,4-Trimethylbenzene in mg/kg																							
1,2-Dibromo-3-chloropropane in mg/kg																							
1,2-Dibromoethane (EDB) in mg/kg																							
1,2-Dichlorobenzene in mg/kg																							
1,2-Dichloroethane (EDC) in mg/kg	0.001 U			0.001 U	0.0007 U		0.0009 U			0.0009 U	0.0008 U			0.0008 U	0.001 U		0.0009 U			0.0008 U	0.0012 U		
1,2-Dichloropropane in mg/kg																							
1,3,5-Trimethylbenzene in mg/kg																							
1,3-Dichlorobenzene in mg/kg																							
1,3-Dichloropropane in mg/kg																							
1,4-Dichlorobenzene in mg/kg																							
2,2-Dichloropropane in mg/kg																							
2-Chlorotoluene in mg/kg																							
4-Chlorotoluene in mg/kg																							
Benzene in mg/kg																							
Bromobenzene in mg/kg																							
Bromodichloromethane in mg/kg																							
Bromoform in mg/kg																							
Bromomethane in mg/kg																							
Carbon tetrachloride in mg/kg																							
Chlorobenzene in mg/kg																							
Chloroethane in mg/kg	0.001 U			0.001 U	0.0007 U		0.0009 U			0.0009 U	0.0008 U			0.0008 U	0.001 U		0.0009 U			0.0008 U	0.0012 U		
Chloroform in mg/kg																							
Chloromethane in mg/kg																							
cis-1,2-Dichloroethene (DCE) in mg/kg	0.11			0.051	1.7		0.0006 J			0.0008 J	0.039			0.0017	0.032		0.0005 J			0.0008 U	0.0012 U		
cis-1,3-Dichloropropene in mg/kg																							
Dibromochloromethane in mg/kg																							
Dibromomethane in mg/kg																							
Dichlorodifluoromethane in mg/kg																							
Ethylbenzene in mg/kg																							
Hexachlorobutadiene in mg/kg																							
Isopropylbenzene in mg/kg																							
Methylene chloride in mg/kg																							
n-Butylbenzene in mg/kg																							
n-Propylbenzene in mg/kg																							
p-Isopropyltoluene in mg/kg																							
sec-Butylbenzene in mg/kg																							
Styrene in mg/kg																							
tert-Butylbenzene in mg/kg																							
Tetrachloroethene (PCE) in mg/kg	0.001 U			0.001 U	0.0022 J		0.0009 U			0.0009 U	0.0008 U			0.0008 U	0.001 U		0.0009 U			0.0008 U	0.0012 U		
Toluene in mg/kg																							
trans-1,2-Dichloroethene in mg/kg	0.0022			0.001 U	0.021		0.0009 U			0.0009 U	0.002			0.0008 U	0.0081		0.0009 U			0.0008 U	0.0012 U		
trans-1,3-Dichloropropene in mg/kg																							
Trichloroethene (TCE) in mg/kg	0.13			0.0095	1.9		0.0009 U			0.0007 J	0.0008 U			0.0038	0.052		0.0009 U			0.0008 U	0.0056		
Trichlorofluoromethane in mg/kg																							
Vinyl chloride in mg/kg	0.001 U			0.001 U	0.0007 U		0.0009 U			0.0009 U	0.0008 U			0.0008 U	0.001 U		0.0009 U			0.0008 U	0.0012 U		
Xylenes (total) in mg/kg																							
Naphthalene in mg/kg																							

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	SP-27 4/17/12 (6 ft.)	SP-27 4/17/12 (9 ft.)	SP-27 4/17/12 (9-10 ft.)	SP-27 4/17/12 (12 ft.)	SP-27 4/17/12 (12-13 ft.)	SP-27 4/17/12 (19-20 ft.)	SP-27 4/17/12 (20 ft.)	SP-28 4/17/12 (3 ft.)	SP-28 4/17/12 (3-4 ft.)	SP-28 4/17/12 (5-6 ft.)	SP-28 4/17/12 (6 ft.)	SP-28 4/17/12 (9 ft.)	SP-28 4/17/12 (9-10 ft.)	SP-28 4/17/12 (12 ft.)	SP-28 4/17/12 (12-13 ft.)	SP-28 4/17/12 (19-20 ft.)	SP-28 4/17/12 (20 ft.)	SP-29 4/13/12 (3 ft.)	SP-29 4/13/12 (3-4 ft.)	SP-29 4/13/12 (5-6 ft.)	SP-29 4/13/12 (6 ft.)	SP-29 4/13/12 (9 ft.)	SP-29 4/13/12 (9-10 ft.)
Metals																							
Cadmium in mg/kg			0.1 U		0.1 U	0.1 U			0.1 U	0.1 U			0.1 U		0.1 U	0.1 U			0.1 U	0.1 U			0.1 U
Copper in mg/kg			18.8		10.5	9.7			13.3	16.5			15.3		4.8	9.2			9.5	13.8			19.9
Iron in mg/kg																							
Manganese in mg/kg																							
Nickel in mg/kg			10.3		5.5	6.3			6.1	16.4			29.3		16.7	9.4			4.4	6.4			8.6
Zinc in mg/kg			27		20	20			16	26			21		17	20			37	21			28
Conventional Chemistry Parameters																							
Total Organic Carbon in Percent																							
Total Solids in Percent																							
Total Suspended Solids in Percent																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in mg/kg																							
1,1,1-Trichloroethane in mg/kg	0.0008 U	0.0009 U		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0008 U		0.0009 U			0.0011 U	0.001 U			0.0009 U	0.0009 U	
1,1,2,2-Tetrachloroethane in mg/kg																							
1,1,2-Trichloroethane in mg/kg																							
1,1-Dichloroethane in mg/kg	0.0008 U	0.0009 U		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0006 J		0.0009 U			0.0027	0.001 U			0.0009 U	0.0009 U	
1,1-Dichloroethene in mg/kg	0.0008 U	0.0009 U		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0008 U		0.0009 U			0.0011 U	0.001 U			0.0009 U	0.0009 U	
1,1-Dichloropropene in mg/kg																							
1,2,3-Trichlorobenzene in mg/kg																							
1,2,3-Trichloropropane in mg/kg																							
1,2,4-Trichlorobenzene in mg/kg																							
1,2,4-Trimethylbenzene in mg/kg																							
1,2-Dibromo-3-chloropropane in mg/kg																							
1,2-Dibromoethane (EDB) in mg/kg																							
1,2-Dichlorobenzene in mg/kg																							
1,2-Dichloroethane (EDC) in mg/kg	0.0008 U	0.0009 U		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0008 U		0.0009 U			0.0011 U	0.001 U			0.0009 U	0.0009 U	
1,2-Dichloropropane in mg/kg																							
1,3,5-Trimethylbenzene in mg/kg																							
1,3-Dichlorobenzene in mg/kg																							
1,3-Dichloropropane in mg/kg																							
1,4-Dichlorobenzene in mg/kg																							
2,2-Dichloropropane in mg/kg																							
2-Chlorotoluene in mg/kg																							
4-Chlorotoluene in mg/kg																							
Benzene in mg/kg																							
Bromobenzene in mg/kg																							
Bromodichloromethane in mg/kg																							
Bromoform in mg/kg																							
Bromomethane in mg/kg																							
Carbon tetrachloride in mg/kg																							
Chlorobenzene in mg/kg																							
Chloroethane in mg/kg	0.0008 U	0.0009 U		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0008 U		0.0009 U			0.0011 U	0.001 U			0.0009 U	0.0009 U	
Chloroform in mg/kg																							
Chloromethane in mg/kg																							
cis-1,2-Dichloroethene (DCE) in mg/kg	0.0007 J	0.011		0.0045			0.0021	0.0009 U			0.0007 U	0.0015		0.0021			0.0051	0.001 U			0.0009 U	0.0009 U	
cis-1,3-Dichloropropene in mg/kg																							
Dibromochloromethane in mg/kg																							
Dibromomethane in mg/kg																							
Dichlorodifluoromethane in mg/kg																							
Ethylbenzene in mg/kg																							
Hexachlorobutadiene in mg/kg																							
Isopropylbenzene in mg/kg																							
Methylene chloride in mg/kg																							
n-Butylbenzene in mg/kg																							
n-Propylbenzene in mg/kg																							
p-Isopropyltoluene in mg/kg																							
sec-Butylbenzene in mg/kg																							
Styrene in mg/kg																							
tert-Butylbenzene in mg/kg																							
Tetrachloroethene (PCE) in mg/kg	0.0008 U	0.0009 U		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0008 U		0.0009 U			0.0011 U	0.001 U			0.0009 U	0.0009 U	
Toluene in mg/kg																							
trans-1,2-Dichloroethene in mg/kg	0.0008 U	0.001		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0008 U		0.0009 U			0.0011 U	0.001 U			0.0009 U	0.0009 U	
trans-1,3-Dichloropropene in mg/kg																							
Trichloroethene (TCE) in mg/kg	0.012	2		0.036			0.021	0.0009 U			0.0011	0.0023		0.007			0.0011 U	0.001 U			0.0022	0.0009 U	
Trichlorofluoromethane in mg/kg																							
Vinyl chloride in mg/kg	0.0008 U	0.0009 U		0.0009 U			0.0008 U	0.0009 U			0.0007 U	0.0008 U		0.0009 U			0.0011 U	0.001 U			0.0009 U	0.0009 U	
Xylenes (total) in mg/kg																							
Naphthalene in mg/kg																							

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	SP-29 4/13/12 (12 ft.)	SP-29 4/13/12 (12-13 ft.)	SP-29 4/13/12 (19-20 ft.)	SP-29 4/13/12 (20 ft.)	SP-30 4/17/12 (3 ft.)	SP-30 4/17/12 (3-4 ft.)	SP-30 4/17/12 (5-6 ft.)	SP-30 4/17/12 (6 ft.)	SP-30 4/17/12 (9 ft.)	SP-30 4/17/12 (9-10 ft.)	SP-30 4/17/12 (12 ft.)	SP-30 4/17/12 (12-13 ft.)	SP-30 4/17/12 (19-20 ft.)	SP-30 4/17/12 (20 ft.)	SP-31 4/17/12 (3 ft.)	SP-31 4/17/12 (3-4 ft.)	SP-31 4/17/12 (5-6 ft.)	SP-31 4/17/12 (6 ft.)	SP-31 4/17/12 (9 ft.)	SP-31 4/17/12 (9-10 ft.)	SP-31 4/17/12 (12 ft.)	SP-31 4/17/12 (12-13 ft.)	SP-31 4/17/12 (19-20 ft.)
Metals																							
Cadmium in mg/kg		0.1 U	0.1 U			0.1 U	0.1 U			0.1 U		0.1 U	0.1 U			0.1 U	0.1 U			0.1 U		0.1 U	0.1 U
Copper in mg/kg		13.8	8.2			13.1	16.3			15.8		9.1	7.7			9.0	18.4			11.6		8.7	9.0
Iron in mg/kg																							
Manganese in mg/kg																							
Nickel in mg/kg		7.2	6.2			23.2	14.6			7.5		6.1	5.8			4.4	7.9			17.7		92.0	68.0
Zinc in mg/kg		23	20			30	30			24		21	20			15	28			21		20	18
Conventional Chemistry Parameters																							
Total Organic Carbon in Percent																							
Total Solids in Percent																							
Total Suspended Solids in Percent																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in mg/kg																							
1,1,1-Trichloroethane in mg/kg	0.0009 U			0.0009 U	0.001 U			0.001 U	0.001 U		0.0009 U			0.001 U	0.0009 U			0.0009 U	0.0009 U		0.001 U		
1,1,2,2-Tetrachloroethane in mg/kg																							
1,1,2-Trichloroethane in mg/kg																							
1,1-Dichloroethane in mg/kg	0.0009 U			0.0016	0.001 U			0.001 U	0.001 U		0.0009 U			0.0011	0.0009 U			0.0009 U	0.0009 U		0.001 U		
1,1-Dichloroethene in mg/kg	0.0009 U			0.0009 U	0.001 U			0.001 U	0.001 U		0.0009 U			0.001 U	0.0009 U			0.0009 U	0.0009 U		0.001 U		
1,1-Dichloropropene in mg/kg																							
1,2,3-Trichlorobenzene in mg/kg																							
1,2,3-Trichloropropane in mg/kg																							
1,2,4-Trichlorobenzene in mg/kg																							
1,2,4-Trimethylbenzene in mg/kg																							
1,2-Dibromo-3-chloropropane in mg/kg																							
1,2-Dibromoethane (EDB) in mg/kg																							
1,2-Dichlorobenzene in mg/kg																							
1,2-Dichloroethane (EDC) in mg/kg	0.0009 U			0.0009 U	0.001 U			0.001 U	0.001 U		0.0009 U			0.001 U	0.0009 U			0.0009 U	0.0009 U		0.001 U		
1,2-Dichloropropane in mg/kg																							
1,3,5-Trimethylbenzene in mg/kg																							
1,3-Dichlorobenzene in mg/kg																							
1,3-Dichloropropane in mg/kg																							
1,4-Dichlorobenzene in mg/kg																							
2,2-Dichloropropane in mg/kg																							
2-Chlorotoluene in mg/kg																							
4-Chlorotoluene in mg/kg																							
Benzene in mg/kg																							
Bromobenzene in mg/kg																							
Bromodichloromethane in mg/kg																							
Bromoform in mg/kg																							
Bromomethane in mg/kg																							
Carbon tetrachloride in mg/kg																							
Chlorobenzene in mg/kg																							
Chloroethane in mg/kg	0.0009 U			0.0009 U	0.001 U			0.001 U	0.001 U		0.0009 U			0.001 U	0.0009 U			0.0009 U	0.0009 U		0.001 U		
Chloroform in mg/kg																							
Chloromethane in mg/kg																							
cis-1,2-Dichloroethene (DCE) in mg/kg	0.0005 J			0.0025	0.001 U			0.001 U	0.0009 J		0.0014			0.0025	0.0009 U			0.0009 U	0.0008 J		0.001 U		
cis-1,3-Dichloropropene in mg/kg																							
Dibromochloromethane in mg/kg																							
Dibromomethane in mg/kg																							
Dichlorodifluoromethane in mg/kg																							
Ethylbenzene in mg/kg																							
Hexachlorobutadiene in mg/kg																							
Isopropylbenzene in mg/kg																							
Methylene chloride in mg/kg																							
n-Butylbenzene in mg/kg																							
n-Propylbenzene in mg/kg																							
p-Isopropyltoluene in mg/kg																							
sec-Butylbenzene in mg/kg																							
Styrene in mg/kg																							
tert-Butylbenzene in mg/kg																							
Tetrachloroethene (PCE) in mg/kg	0.0009 U			0.0009 U	0.001 U			0.001 U	0.001 U		0.0009 U			0.001 U	0.0009 U			0.0009 U	0.0009 U		0.001 U		
Toluene in mg/kg																							
trans-1,2-Dichloroethene in mg/kg	0.0009 U			0.0009 U	0.001 U			0.001 U	0.001 U		0.0009 U			0.001 U	0.0009 U			0.0009 U	0.0009 U		0.001 U		
trans-1,3-Dichloropropene in mg/kg																							
Trichloroethene (TCE) in mg/kg	0.0024			0.0012	0.001 U			0.0007 J	0.0007 J		0.0021			0.001 U	0.0006 J			0.0061	0.0086		0.0073		
Trichlorofluoromethane in mg/kg																							
Vinyl chloride in mg/kg	0.0009 U			0.0009 U	0.001 U			0.001 U	0.001 U		0.0009 U			0.001 U	0.0009 U			0.0009 U	0.0009 U		0.001 U		
Xylenes (total) in mg/kg																							
Naphthalene in mg/kg																							

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	SP-31 4/17/12 (20 ft.)	SP-31 4/17/12 (23-24 ft.)	SP-32 4/13/12 (3 ft.)	SP-32 4/13/12 (3-4 ft.)	SP-32 4/13/12 (5-6 ft.)	SP-32 4/13/12 (6 ft.)	SP-32 4/13/12 (9 ft.)	SP-32 4/13/12 (9-10 ft.)	SP-32 4/13/12 (12 ft.)	SP-32 4/13/12 (12-13 ft.)	SP-32 4/13/12 (19-20 ft.)	SP-32 4/13/12 (20 ft.)	SP-32 4/13/12 (23-24 ft.)	SP-33 4/16/12 (3 ft.)	SP-33 4/16/12 (3-4 ft.)	SP-33 4/16/12 (5-6 ft.)	SP-33 4/16/12 (6 ft.)	SP-33 4/16/12 (9 ft.)	SP-33 4/16/12 (9-10 ft.)	SP-33 4/16/12 (12 ft.)	SP-33 4/16/12 (12-13 ft.)	SP-33 4/16/12 (19-20 ft.)	SP-33 4/16/12 (20 ft.)
Metals																							
Cadmium in mg/kg		0.2		0.1 U	0.1 U			0.1 U		0.1 U	0.1 U		0.1 U		0.1 U	0.1 U			0.1 U		0.1 U	0.1 U	
Copper in mg/kg		16.1 J		20.0	16.7			9.9		9.9	7.8		14.0 J		8.1	19.9			8.0		7.0	7.7	
Iron in mg/kg																							
Manganese in mg/kg																							
Nickel in mg/kg		10.8		7.6	8.3			16.8		71.9	412		78.3		4.1	9.4			5.4		5.3	5.3	
Zinc in mg/kg		24		65	27			20		20	19		21		15	32			20		18	18	
Conventional Chemistry Parameters																							
Total Organic Carbon in Percent																							
Total Solids in Percent																							
Total Suspended Solids in Percent																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in mg/kg																							
1,1,1-Trichloroethane in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0009 U		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
1,1,2,2-Tetrachloroethane in mg/kg																							
1,1,2-Trichloroethane in mg/kg																							
1,1-Dichloroethane in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0009 U		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
1,1-Dichloroethene in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0009 U		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
1,1-Dichloropropene in mg/kg																							
1,2,3-Trichlorobenzene in mg/kg																							
1,2,3-Trichloropropane in mg/kg																							
1,2,4-Trichlorobenzene in mg/kg																							
1,2,4-Trimethylbenzene in mg/kg																							
1,2-Dibromo-3-chloropropane in mg/kg																							
1,2-Dibromoethane (EDB) in mg/kg																							
1,2-Dichlorobenzene in mg/kg																							
1,2-Dichloroethane (EDC) in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0009 U		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
1,2-Dichloropropane in mg/kg																							
1,3,5-Trimethylbenzene in mg/kg																							
1,3-Dichlorobenzene in mg/kg																							
1,3-Dichloropropane in mg/kg																							
1,4-Dichlorobenzene in mg/kg																							
2,2-Dichloropropane in mg/kg																							
2-Chlorotoluene in mg/kg																							
4-Chlorotoluene in mg/kg																							
Benzene in mg/kg																							
Bromobenzene in mg/kg																							
Bromodichloromethane in mg/kg																							
Bromoform in mg/kg																							
Bromomethane in mg/kg																							
Carbon tetrachloride in mg/kg																							
Chlorobenzene in mg/kg																							
Chloroethane in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0009 U		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
Chloroform in mg/kg																							
Chloromethane in mg/kg																							
cis-1,2-Dichloroethene (DCE) in mg/kg	0.0005 J		0.0009 U			0.0007 U	0.012		0.0031			0.0056		0.0008 U			0.001 U	0.0006 J		0.0009 U			0.0009 U
cis-1,3-Dichloropropene in mg/kg																							
Dibromochloromethane in mg/kg																							
Dibromomethane in mg/kg																							
Dichlorodifluoromethane in mg/kg																							
Ethylbenzene in mg/kg																							
Hexachlorobutadiene in mg/kg																							
Isopropylbenzene in mg/kg																							
Methylene chloride in mg/kg																							
n-Butylbenzene in mg/kg																							
n-Propylbenzene in mg/kg																							
p-Isopropyltoluene in mg/kg																							
sec-Butylbenzene in mg/kg																							
Styrene in mg/kg																							
tert-Butylbenzene in mg/kg																							
Tetrachloroethene (PCE) in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0009 U		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
Toluene in mg/kg																							
trans-1,2-Dichloroethene in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0007 J		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
trans-1,3-Dichloropropene in mg/kg																							
Trichloroethene (TCE) in mg/kg	0.022		0.0019			0.0072	0.01		0.0086			0.0026		0.0025			0.0033	0.017		0.0014			0.0009 U
Trichlorofluoromethane in mg/kg																							
Vinyl chloride in mg/kg	0.0008 U		0.0009 U			0.0007 U	0.0009 U		0.0009 U			0.0009 U		0.0008 U			0.001 U	0.0009 U		0.0009 U			0.0009 U
Xylenes (total) in mg/kg																							
Naphthalene in mg/kg																							

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

Appendix B - Historical Soil Analytical Results

Art Brass Plating 050067

Chemical Name	SPO-46 2/21/12 (3.5-4.5 ft.)	SPO-46 2/21/12 (6-7 ft.)	SPO-46 2/21/12 (9-10 ft.)	SPO-46 2/21/12 (14-15 ft.)	SPO-46 2/21/12 (18.5-19.5 ft.)	SPO-46 2/21/12 (23-24 ft.)	SPO-46 2/21/12 (28-29 ft.)	SPO-46 2/21/12 (33-34 ft.)	SPO-46 2/21/12 (40-41 ft.)
Metals									
Cadmium in mg/kg	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U		0.1 U		0.1 U
Copper in mg/kg	8.9	16.8	16.2	7.7	9.4		8.5		7.3
Iron in mg/kg	9,880	15,500	11,600	9,160	11,000		10,300		9,190
Manganese in mg/kg	68.6	97.6	75.4	72.5	83.8		86.4		79.1
Nickel in mg/kg	4.6	8.7	7.9	6.6	7.5		6.4		5.0
Zinc in mg/kg	16	25	23	18	21		17		15
Conventional Chemistry Parameters									
Total Organic Carbon in Percent	0.050	0.106	0.370	0.100	0.063		0.068		0.057
Total Solids in Percent	81.40	80.00	79.70	78.90	80.20		83.30		79.90
Total Suspended Solids in Percent									
Volatile Organic Compounds (VOC)									
1,1,1,2-Tetrachloroethane in mg/kg									
1,1,1-Trichloroethane in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.001 U		0.0009 U	0.0009 U
1,1,2,2-Tetrachloroethane in mg/kg									
1,1,2-Trichloroethane in mg/kg									
1,1-Dichloroethane in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.0026		0.0015	0.0028
1,1-Dichloroethene in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.001 U		0.0009 U	0.0009 U
1,1-Dichloropropene in mg/kg									
1,2,3-Trichlorobenzene in mg/kg									
1,2,3-Trichloropropane in mg/kg									
1,2,4-Trichlorobenzene in mg/kg									
1,2,4-Trimethylbenzene in mg/kg									
1,2-Dibromo-3-chloropropane in mg/kg									
1,2-Dibromoethane (EDB) in mg/kg									
1,2-Dichlorobenzene in mg/kg									
1,2-Dichloroethane (EDC) in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.001 U		0.0009 U	0.0009 U
1,2-Dichloropropane in mg/kg									
1,3,5-Trimethylbenzene in mg/kg									
1,3-Dichlorobenzene in mg/kg									
1,3-Dichloropropane in mg/kg									
1,4-Dichlorobenzene in mg/kg									
2,2-Dichloropropane in mg/kg									
2-Chlorotoluene in mg/kg									
4-Chlorotoluene in mg/kg									
Benzene in mg/kg									
Bromobenzene in mg/kg									
Bromodichloromethane in mg/kg									
Bromoform in mg/kg									
Bromomethane in mg/kg									
Carbon tetrachloride in mg/kg									
Chlorobenzene in mg/kg									
Chloroethane in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.001 U		0.0009 U	0.0009 U
Chloroform in mg/kg									
Chloromethane in mg/kg									
cis-1,2-Dichloroethene (DCE) in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.0023		0.0012	0.0027
cis-1,3-Dichloropropene in mg/kg									
Dibromochloromethane in mg/kg									
Dibromomethane in mg/kg									
Dichlorodifluoromethane in mg/kg									
Ethylbenzene in mg/kg									
Hexachlorobutadiene in mg/kg									
Isopropylbenzene in mg/kg									
Methylene chloride in mg/kg									
n-Butylbenzene in mg/kg									
n-Propylbenzene in mg/kg									
p-Isopropyltoluene in mg/kg									
sec-Butylbenzene in mg/kg									
Styrene in mg/kg									
tert-Butylbenzene in mg/kg									
Tetrachloroethene (PCE) in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.001 U		0.0009 U	0.0009 U
Toluene in mg/kg									
trans-1,2-Dichloroethene in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.001 U		0.0009 U	0.0009 U
trans-1,3-Dichloropropene in mg/kg									
Trichloroethene (TCE) in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.001 U		0.0009 U	0.0009 U
Trichlorofluoromethane in mg/kg									
Vinyl chloride in mg/kg	0.0009 U	0.0009 U	0.0009 U	0.0009 U		0.0082		0.0009 U	0.0019
Xylenes (total) in mg/kg									
Naphthalene in mg/kg									

Notes

J - Analyte was positively identified. The reported result is an estimate.
U - Analyte was not detected at or above the reported result.

APPENDIX C

Historical Groundwater Analytical Results

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-1 10/18/05	MW-1 8/1/08	MW-1 12/18/08	MW-1 3/23/09	MW-1 6/22/09	MW-1 9/17/09	MW-1 12/15/09	MW-1 3/23/10	MW-1 6/17/10	MW-1 9/21/10	MW-1 12/15/10	MW-1 3/14/11	MW-1 9/16/11	MW-1 12/14/11	MW-1 4/3/12	MW-1 6/13/12	MW-1 9/21/12	MW-1 12/12/12	MW-1 3/19/13	MW-1 6/18/13	MW-1 9/27/13	MW-1 12/10/13	MW-1 3/21/14
Metals																							
Dissolved Aluminum in ug/L																							
Dissolved Cadmium in ug/L															0.9		0.5		0.3		0.6		0.7
Dissolved Calcium in ug/L																							
Dissolved Chromium (Total) in ug/L			1 U																				
Dissolved Copper in ug/L			38.3	75.2				77.9		109		77.8	34.7		48.6		36.9		21.8		18		33
Dissolved Iron in ug/L																							
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L				1 U																			
Dissolved Magnesium in ug/L																							
Dissolved Manganese in ug/L																							
Dissolved Nickel in ug/L			86,900	118,000				97,000		38,800		58,100	51,000 J		53,400		57,800		51,200		23,800		49,100
Dissolved Potassium in ug/L																							
Dissolved Silicon in ug/L																							
Dissolved Sodium in ug/L																							
Dissolved Zinc in ug/L			280	278				124		130		132	71		181		139		80		110		150
Iron, Ferrous, Fe+2 in ug/L		8,010		7,980		2,180																	
Total Antimony in ug/L																							
Total Arsenic in ug/L				0.5				0.2		0.4													
Total Barium in ug/L				48.5				21.3		25.7													
Total Beryllium in ug/L																							
Total Cadmium in ug/L				1.7											0.9		0.5		0.4		0.6		0.7
Total Calcium in ug/L															122,000								
Total Chromium (Total) in ug/L			4																				
Total Copper in ug/L			42.6												50.4		37.8		23.5		20		32.2
Total Iron in ug/L		14,600		7,830		2,720		920		590					2,770								
Total Lead in ug/L																							
Total Magnesium in ug/L															46,300								
Total Manganese in ug/L		921		4,420		2,450		2,440		2,390					2,270								
Total Mercury in ug/L				0.10 U																			
Total Nickel in ug/L			88,500												53,300		52,800		55,600		24,000		46,000
Total Potassium in ug/L															19,200								
Total Selenium in ug/L																							
Total Silicon in ug/L															50,500 J								
Total Silver in ug/L				0.2 U																			
Total Sodium in ug/L															92,000								
Total Thallium in ug/L																							
Total Zinc in ug/L			280												176		137		85		120		143
TCLP Metals																							
Total Mercury in ug/L				0.10 U																			
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3		121		1.0 U		1.0 U									1.0 U								
Bicarbonate in mg/L as CaCO3				1.0 U		1.0 U									1.0 U								
Carbonate in mg/L as CaCO3				1.0 U		1.0 U									1.0 U								
Chloride in mg/L				124		69.2									75.0								
Cyanide (total) in mg/L				0.005 U																			
Dissolved Calcium in ug/L																							
Dissolved Potassium in ug/L																							
Dissolved Sodium in ug/L																							
Ethane in ug/L		1.9 U		1.2 U		1.2 U																	
Ethene in ug/L		1.1 U		1.1 U		1.1 U																	
Hydroxide in mg/L as CaCO3				1.0 U		1.0 U									1.0 U								
Methane in ug/L		73.1 U		0.7 U		0.7 U																	
Nitrate + Nitrite in mg-N/L		0.03 J																					
Nitrate as Nitrogen in mg-N/L		0.03 J		0.1 U		0.1 U																	
Nitrite as Nitrogen in mg-N/L		0.01 UJ		0.1 U		0.1 U																	
ortho-Phosphorus in mg/L															0.1 UJ								
pH in pH units				3.53		3.75																	
Sulfate in mg/L		274		1,270		741									678								
Sulfide in mg/L															0.061								
Total Calcium in ug/L															122,000								
Total Organic Carbon in mg/L				3.93		1.87									2.30								
Total Potassium in ug/L															19,200								
Total Sodium in ug/L															92,000								
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L	1.0 U																						
1,1,1-Trichloroethane in ug/L	1.0 U	1 U	1 U	10 U	1.0 U	10 U	1.0 U	1.0 U	0.6 UJ	0.6 U	0.6 U	6.0 U	0.2 U	0.2 U	0.2 U	0.4 U	5.0 U	0.4 U	1.0 U	1.0 U	1.0 U	0.40 U	1.0 U
1,1,2,2-Tetrachloroethane in ug/L	1.0 U																						
1,1,2-Trichloroethane in ug/L	1.0 U																						
1,1-Dichloroethane in ug/L	1.0 U	2.1	2.1	10 U	2.8	10 U	1.4	1.7	1.0 J	0.6 U	1.2	6.0 U	0.4	0.3	0.9	1.2	5.0 U	0.98	1.0 U	1.0 U	1.2	1.2	1.0 U
1,1-Dichloroethene in ug/L	1.0 U	7.2	1 U	10 U	1.0 U	10 U	1.0 U	1.0 U	0.6 UJ	0.6 U	0.6 U	6.0 U	0.2 U	0.2 U	0.2 U	0.5	5.0 U	0.4 U	1.0 U	1.0 U	1.0 U	0.40 U	1.0 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-1 10/18/05	MW-1 8/1/08	MW-1 12/18/08	MW-1 3/23/09	MW-1 6/22/09	MW-1 9/17/09	MW-1 12/15/09	MW-1 3/23/10	MW-1 6/17/10	MW-1 9/21/10	MW-1 12/15/10	MW-1 3/14/11	MW-1 9/16/11	MW-1 12/14/11	MW-1 4/3/12	MW-1 6/13/12	MW-1 9/21/12	MW-1 12/12/12	MW-1 3/19/13	MW-1 6/18/13	MW-1 9/27/13	MW-1 12/10/13	MW-1 3/21/14
1,1-Dichloropropene in ug/L	1.0 U																						
1,2,3-Trichlorobenzene in ug/L	1.0 U																						
1,2,3-Trichloropropane in ug/L	1.0 U																						
1,2,4-Trichlorobenzene in ug/L	1.0 U																						
1,2,4-Trimethylbenzene in ug/L	1.0 U																						
1,2-Dibromo-3-chloropropane in ug/L	1.0 U																						
1,2-Dibromoethane (EDB) in ug/L	0.01 U																						
1,2-Dichlorobenzene in ug/L	1.0 U																						
1,2-Dichloroethane (EDC) in ug/L	1.0 U	1 U	1 U	10 U	1.0 U	10 U	1.0 U	1.0 U	0.6 UJ	0.6 U	0.6 U	6.0 U	0.2 U	0.2 U	0.1 J	0.4 U	5.0 U	0.4 U	1.0 U	1.0 U	1.0 U	0.40 U	1.0 U
1,2-Dichloropropane in ug/L	1.0 U																						
1,3,5-Trimethylbenzene in ug/L	1.0 U																						
1,3-Dichlorobenzene in ug/L	1.0 U																						
1,3-Dichloropropane in ug/L	1.0 U																						
1,4-Dichlorobenzene in ug/L	1.0 U																						
2,2-Dichloropropane in ug/L	1.0 U																						
2-Chlorotoluene in ug/L	1.0 U																						
4-Chlorotoluene in ug/L	1.0 U																						
Benzene in ug/L	1.0 U																						
Bromobenzene in ug/L	1.0 U																						
Bromodichloromethane in ug/L	1.0 U																						
Bromoform in ug/L	1.0 U																						
Bromomethane in ug/L	1.0 U																						
Carbon tetrachloride in ug/L	1.0 U																						
Chlorobenzene in ug/L	1.0 U																						
Chloroethane in ug/L	1.0 U	1 U	1 U	10 U	1.0 U	10 U	1.0 U	1.0 U	0.6 UJ	0.6 U	0.6 U	6.0 U	0.2 U	0.2 U	0.2 U	0.4 U	5.0 U	0.4 U	1.0 U	1.0 U	1.0 U	0.40 U	1.0 U
Chloroform in ug/L	1.0 U																						
Chloromethane in ug/L	1.0 U																						
cis-1,2-Dichloroethene (DCE) in ug/L	1,700	3,000	480	290	270	140	64	110	61 J	43	96	150	43	31	88	800	890	87	37	27	57	150	350
cis-1,3-Dichloropropene in ug/L	1.0 U																						
Dibromochloromethane in ug/L	1.0 U																						
Dibromomethane in ug/L	1.0 U																						
Dichlorodifluoromethane in ug/L	1.0 U																						
Ethylbenzene in ug/L	1.0 U																						
Hexachlorobutadiene in ug/L	1.0 U																						
Isopropylbenzene in ug/L	1.0 U																						
Methylene chloride in ug/L	1.0 U																						
n-Butylbenzene in ug/L	1.0 U																						
n-Propylbenzene in ug/L	1.0 U																						
p-Isopropyltoluene in ug/L	1.0 U																						
sec-Butylbenzene in ug/L	1.0 U																						
Styrene in ug/L	1.0 U																						
tert-Butylbenzene in ug/L	1.0 U																						
Tetrachloroethene (PCE) in ug/L	1.0 U	1 U	1 U	10 U	1.0 U	10 U	1.0 U	1.0 U	0.6 UJ	0.6 U	0.6 U	6.0 U	0.2 U	0.2 U	0.2 U	0.4 U	5.0 U	0.4 U	1.0 U	1.0 U	1.0 U	0.40 U	1.0 U
Toluene in ug/L	1.0 U																						
trans-1,2-Dichloroethene in ug/L	1.0 U	43	6	10 U	3.4	10 U	1.0 U	1.3	0.8 J	0.6	1.1	6.0 U	0.7	0.3	1.5	14	20	1.3	1.0 U	1.0 U	1.0	2.9	8.6
trans-1,3-Dichloropropene in ug/L	1.0 U																						
Trichloroethene (TCE) in ug/L	2,800	4,200	740	520	530	360	140	250	110 J	68	140	210	50	47	92	260	270	93	55	42	53	60	110
Trichlorofluoromethane in ug/L	1.0 U																						
Vinyl chloride in ug/L	0.2 U	3.7	1 U	10 U	1.0 U	10 U	1.0 U	1.0 U	0.6 UJ	0.6 U	0.6 U	6.0 U	0.2 U	0.2 U	0.2 U	0.3 J	5.0 U	0.4 U	1.0 U	1.0 U	1.0 U	0.40 U	1.0 U
Xylenes (total) in ug/L	1.0 U																						
Naphthalene in ug/L	1.0 U																						
Total Chlorinated Ethenes in umol/L	39	64	11	7.2	6.9	4.4	1.8	3.1	1.5	0.98	2.1	3.3	0.84	0.69	1.6	10	12	1.6	0.83	0.62	1.0	2.1	4.6
Field Parameters																							
Dissolved Oxygen in mg/L			2.20	1.80	0.32	1.50	2.20	2.12	4.28	4.03	6.86	7.58	6.91	7.20	0.94	0.69	0.69	6.49	9.07	8.02	4.13	1.30	1.35
ORP in mVolts			267.2 R	258 R	782 R	140	278	163	227	122	190.2	292.1	444.8	422	58.2	311.8	320.1	448.6	360.7	421.2	189.1	344.8	396.5
pH in pH Units			3.39	3.40	2.55	3.73	3.77	3.97	4.04	3.53	6.00 R	4.71 R	3.80	3.77	3.76	3.79	3.81	3.94	3.81	3.91	3.90	3.73	3.96
Specific Conductance in us/cm			1,905	2,327	1,427	1,663	1,473	1,307	933	1,493	2,152	1,587	1,192	1,388	1,769	2,209	1,132	1,269	989	984	1,228	997	1,350
Temperature in deg C			17.58	15.7	16.58	18.1	16.75	15.59	15.99	17.8	16.76	14.21	17.1	16.4	14.5	15.3	17.2	16.1	14.8	16.2	17.4	16.7	15.0
Turbidity in NTU													63.6	15.2	26.6	5.02	14.2	3.29	7.08	17.9	14.8	8.89	4.86

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-1 6/12/14	MW-1 9/23/14	MW-1 12/18/14	MW-1 3/20/15	MW-1 9/25/15	MW-1 3/22/16	MW-1 9/21/16	MW-3 10/18/05	MW-3 8/1/08	MW-3 8/1/08 FD	MW-3 12/17/08	MW-3 3/27/09	MW-3 6/23/09	MW-3 9/17/09	MW-3 12/16/09	MW-3 3/22/10	MW-3 6/17/10	MW-3 9/24/10	MW-3 12/17/10	MW-3 3/18/11	MW-3 9/15/11	MW-3 12/13/11	MW-3 4/2/12
Metals																							
Dissolved Aluminum in ug/L		1,310																					
Dissolved Cadmium in ug/L		0.2			0.2		0.958																1.1
Dissolved Calcium in ug/L		38,900																					
Dissolved Chromium (Total) in ug/L											1 U												
Dissolved Copper in ug/L		12.8			14.2		43.9				7.5	11.0				38.7		136		134	122		55.2
Dissolved Iron in ug/L		50																					
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L												1 U											
Dissolved Magnesium in ug/L		13,200																					
Dissolved Manganese in ug/L		916																					
Dissolved Nickel in ug/L		26,300			30,300		34,100				119,000	38,800				42,800		78,100		64,000	55,600		33,100
Dissolved Potassium in ug/L		10,500																					
Dissolved Silicon in ug/L		45,000																					
Dissolved Sodium in ug/L		40,500																					
Dissolved Zinc in ug/L		57			59		128				33	56				410 J		440		430	269		160
Iron, Ferrous, Fe+2 in ug/L									12,800			6,820		11,600									
Total Antimony in ug/L																							
Total Arsenic in ug/L												0.6				1.2		0.9					
Total Barium in ug/L												48.3				43.1		31.3					
Total Beryllium in ug/L																							
Total Cadmium in ug/L		0.2										0.6											1.1
Total Calcium in ug/L																							79,300
Total Chromium (Total) in ug/L											1 U												
Total Copper in ug/L		15.8									6.8												57.2
Total Iron in ug/L									16,700	16,800		8,430		14,800		11,200		2,670					2,130
Total Lead in ug/L																							
Total Magnesium in ug/L																							27,300
Total Manganese in ug/L									365	361		3,240		4,700		3,300		2,570					1,480
Total Mercury in ug/L												0.10 U											
Total Nickel in ug/L		25,400									115,000												32,400
Total Potassium in ug/L																							16,000
Total Selenium in ug/L																							
Total Silicon in ug/L																							40,100 J
Total Silver in ug/L												0.2 U											
Total Sodium in ug/L																							113,000
Total Thallium in ug/L																							
Total Zinc in ug/L		59 J									33												159
TCLP Metals																							
Total Mercury in ug/L												0.10 U											
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3		1 U							108			1.0 U		1.0 U									1.0 U
Bicarbonate in mg/L as CaCO3		1 U												1.0 U									1.0 U
Carbonate in mg/L as CaCO3		1 U												1.0 U									1.0 U
Chloride in mg/L		45										37.0		65.1									36.5
Cyanide (total) in mg/L												0.005 U											0.005 U
Dissolved Calcium in ug/L		38,900																					
Dissolved Potassium in ug/L		10,500																					
Dissolved Sodium in ug/L		40,500																					
Ethane in ug/L									19.6 U			1.2 U		1.2 U									
Ethene in ug/L									1.1 U			1.1 U		1.1 U									
Hydroxide in mg/L as CaCO3		1 U												1.0 U									1.0 U
Methane in ug/L									562			0.7 U		0.7 U									
Nitrate + Nitrite in mg-N/L									0.01 UJ			0.173											
Nitrate as Nitrogen in mg-N/L		0.3							0.01 UJ			0.173		0.4									
Nitrite as Nitrogen in mg-N/L									0.01 UJ			0.010 U		0.1 U									
ortho-Phosphorus in mg/L		0.1 U																					0.1 UJ
pH in pH units												4.24		4.22									
Sulfate in mg/L		238							136			1,210		1,160									539
Sulfide in mg/L		0.05 U																					0.050 U
Total Calcium in ug/L																							79,300
Total Organic Carbon in mg/L		1.5 U										2.01		2.06									1.74
Total Potassium in ug/L																							16,000
Total Sodium in ug/L																							113,000
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L											2 U												
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L									1.0 U														
1,1,1-Trichloroethane in ug/L	1 U	1 U	2.0 U	1.0 U	1.0 U	1 U	2.00 U	1.0 U	1 U		1 U	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 UJ	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane in ug/L								1.0 U															
1,1,2-Trichloroethane in ug/L								1.0 U															
1,1-Dichloroethane in ug/L	1 U	1 U	2.0 U	1.0	1.0 U	1.1	2.00 U	3.2	3		1.6	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 J	1.0 U	0.3	0.2 U	0.2 U	0.2 U	0.2
1,1-Dichloroethene in ug/L	1 U	1 U	2.0 U	1.0 U	1.0 U	1 U	2.00 U	2.5	1.5		1 U	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 UJ	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-1 6/12/14	MW-1 9/23/14	MW-1 12/18/14	MW-1 3/20/15	MW-1 9/25/15	MW-1 3/22/16	MW-1 9/21/16	MW-3 10/18/05	MW-3 8/1/08	MW-3 8/1/08 FD	MW-3 12/17/08	MW-3 3/27/09	MW-3 6/23/09	MW-3 9/17/09	MW-3 12/16/09	MW-3 3/22/10	MW-3 6/17/10	MW-3 9/24/10	MW-3 12/17/10	MW-3 3/18/11	MW-3 9/15/11	MW-3 12/13/11	MW-3 4/2/12
1,1-Dichloropropene in ug/L								1.0 U															
1,2,3-Trichlorobenzene in ug/L								1.0 U															
1,2,3-Trichloropropane in ug/L								1.0 U															
1,2,4-Trichlorobenzene in ug/L								1.0 U															
1,2,4-Trimethylbenzene in ug/L								1.0 U															
1,2-Dibromo-3-chloropropane in ug/L								1.0 U															
1,2-Dibromoethane (EDB) in ug/L								0.01 U															
1,2-Dichlorobenzene in ug/L								1.0 U															
1,2-Dichloroethane (EDC) in ug/L	1 U	1 U	2.0 U	1.0 U	1.0 U	1 UJ	2.00 U	1.0 U	1 U		1 U	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 UJ	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane in ug/L								1.0 U															
1,3,5-Trimethylbenzene in ug/L								1.0 U															
1,3-Dichlorobenzene in ug/L								1.0 U															
1,3-Dichloropropane in ug/L								1.0 U															
1,4-Dichlorobenzene in ug/L								1.0 U															
2,2-Dichloropropane in ug/L								1.0 U															
2-Chlorotoluene in ug/L								1.0 U															
4-Chlorotoluene in ug/L								1.0 U															
Benzene in ug/L								1.0 U															
Bromobenzene in ug/L								1.0 U															
Bromodichloromethane in ug/L								1.0 U															
Bromoform in ug/L								1.0 U															
Bromomethane in ug/L								1.0 U															
Carbon tetrachloride in ug/L								1.0 U															
Chlorobenzene in ug/L								1.0 U															
Chloroethane in ug/L	1 U	1 U	2.0 U	1.0 U	1.0 U	1 U	2.00 U	1.0 U	1 U		1 U	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 UJ	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloroform in ug/L								1.0 U															
Chloromethane in ug/L								1.0 U															
cis-1,2-Dichloroethene (DCE) in ug/L	69	14	73	200	14	49	368	310	410		68	16	6.4	6.4	2.5	1.8	1.8 J	1.4	1.3	2.0	0.5	0.5	1.6
cis-1,3-Dichloropropene in ug/L								1.0 U															
Dibromochloromethane in ug/L								1.0 U															
Dibromomethane in ug/L								1.0 U															
Dichlorodifluoromethane in ug/L								1.0 U															
Ethylbenzene in ug/L								1.0 U															
Hexachlorobutadiene in ug/L								1.0 U															
Isopropylbenzene in ug/L								1.0 U															
Methylene chloride in ug/L								1.0 U															
n-Butylbenzene in ug/L								1.0 U															
n-Propylbenzene in ug/L								1.0 U															
p-Isopropyltoluene in ug/L								1.0 U															
sec-Butylbenzene in ug/L								1.0 U															
Styrene in ug/L								1.0 U															
tert-Butylbenzene in ug/L								1.0 U															
Tetrachloroethene (PCE) in ug/L	1 U	1 U	2.0 U	1.0 U	1.0 U	1 U	2.00 U	1.0 U	1 U		1 U	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 UJ	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene in ug/L								1.0 U															
trans-1,2-Dichloroethene in ug/L	1.6	1 U	2.0 U	4.2	1.0 U	1.4	8.07	4.2	5.6		1.6	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 UJ	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene in ug/L								1.0 U															
Trichloroethene (TCE) in ug/L	55	27	47	62	19	59	760	4,200	4,300		1,100	280	150	210	92	82	54 J	50	27	24	22	19	18
Trichlorofluoromethane in ug/L								1.0 U															
Vinyl chloride in ug/L	1 U	1 U	2.0 U	1.0 U	1.0 U	1 U	2.00 U	1.4	1.3		1 U	1.0 U	1.0 U	4.0 U	1.0 U	1 U	0.2 UJ	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Xylenes (total) in ug/L								1.0 U															
Naphthalene in ug/L								1.0 U															
Total Chlorinated Ethenes in umol/L	1.2	0.37	1.2	2.6	0.31	0.99	9.7	35	37		9.1	2.3	1.2	1.8	0.75	0.66	0.43	0.42	0.22	0.21	0.18	0.15	0.16
Field Parameters																							
Dissolved Oxygen in mg/L	6.74	7.86		0.98	7.33	0.79	0.89				0.27	0.62	0.06	0.62	0.84	0.67	2.44	3.66	6.58	5.03	3.53	4.90	1.08
ORP in mVolts	630.3	431.6		141.4	119.1	46.5	79.7				238.8 R	254 R	593 R	113	221	145.4	278.3	162.8	133.2	131.6	405.8	398.4	339.7
pH in pH Units	3.88	3.93		3.90	4.11	4.13	4.28				3.99	3.97	4.05	4.29	4.32	4.80	3.87	2.84	6.00 R	7.01 R	3.64	3.64	3.88
Specific Conductance in us/cm	917	737		1,075	866	887	1,137				2,517	1,968	1,611	2,212	1,467	1,658	1,749	1,893	1,600	2,075	1,520	1,452	1,345
Temperature in deg C	16.4	18.1		16.6	18.6	16.4	18.1				15.97	14.5	16.75	18.44	14.92	14.84	15.41	17.39	15.12	13.4	17.1	15.8	13.9
Turbidity in NTU	7.67	16.8		2.15	5.24	20.8	14.9														40.1	48.9	12.7

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-3 4/6/12	MW-3 4/2/12 FD	MW-3 4/6/12 FD	MW-3 6/14/12	MW-3 9/25/12	MW-3 12/11/12	MW-3 3/21/13	MW-3 6/18/13	MW-3 9/26/13	MW-3 12/10/13	MW-3 3/20/14	MW-3 6/12/14	MW-3 9/22/14	MW-3 12/18/14	MW-3 3/16/15	MW-3 9/21/15	MW-3 3/22/16	MW-3 9/22/16	MW-3-30 4/2/12	MW-3-30 6/14/12	MW-3-30 9/25/12	MW-3-30 12/11/12	MW-3-30 3/21/13
Metals																							
Dissolved Aluminum in ug/L													1,810										
Dissolved Cadmium in ug/L					1.1		0.8		1.1		0.6		0.4			0.5		0.286	0.1 U	0.1 U	0.1 U	0.1 U	
Dissolved Calcium in ug/L													30,600										
Dissolved Chromium (Total) in ug/L																							
Dissolved Copper in ug/L					55.4		66.0		88		41.6		27.6			72.6		27.7	0.8	0.9	1.0	0.5 U	0.5 U
Dissolved Iron in ug/L													50 U										
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L																							
Dissolved Magnesium in ug/L													9,390										
Dissolved Manganese in ug/L													527										
Dissolved Nickel in ug/L					63,300		33,900		18,000		20,500		13,600			16,400		14,900	18.1	0.9	0.8	30.7	29.3 J
Dissolved Potassium in ug/L													7,610										
Dissolved Silicon in ug/L													47,900										
Dissolved Sodium in ug/L													28,800										
Dissolved Zinc in ug/L					205		131		180		105		63			96		64.3	19	4 U	4 U	4 U	5
Iron, Ferrous, Fe+2 in ug/L																							
Total Antimony in ug/L	0.4		0.3																				
Total Arsenic in ug/L	0.8		0.7																				0.8
Total Barium in ug/L																							10.0
Total Beryllium in ug/L	3.2		3.3																				
Total Cadmium in ug/L	1.0		1.0		1.2		0.8		1.1		0.6		0.3						0.1 U	0.1 U	0.1 U	0.1	
Total Calcium in ug/L																			41,400				
Total Chromium (Total) in ug/L	2		1.1																				
Total Copper in ug/L	57.4		58.4		57.7		68.5		90		42.2		27.8						2.9	7.2	1.5	7.7	1.2
Total Iron in ug/L																			14,900				28,800
Total Lead in ug/L	4.6		3.7																				
Total Magnesium in ug/L																			45,500				
Total Manganese in ug/L																			1,450				898
Total Mercury in ug/L	0.1 U		0.1 U																				
Total Nickel in ug/L	29,000		29,700		59,700		35,000		15,800		20,800		69,500						7.8	7.8	2.5	36.1	22.2 J
Total Potassium in ug/L																			12,300				
Total Selenium in ug/L	0.7		0.9																				
Total Silicon in ug/L																			29,400 J				
Total Silver in ug/L	0.2 U		0.2 U																				
Total Sodium in ug/L																			44,900				
Total Thallium in ug/L	0.2 U		0.2 U																				
Total Zinc in ug/L	143		146		211		129		190		101		59 J						16	35	9	29	4 U
TCLP Metals																							
Total Mercury in ug/L	0.1 U		0.1 U																				
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3													1 U						132				
Bicarbonate in mg/L as CaCO3													1 U						132				
Carbonate in mg/L as CaCO3													1 U						1.0 U				
Chloride in mg/L													21.2						26.5				
Cyanide (total) in mg/L		0.005 U																					
Dissolved Calcium in ug/L													30,600										
Dissolved Potassium in ug/L													7,610										
Dissolved Sodium in ug/L													28,800										
Ethane in ug/L																							
Ethene in ug/L																							
Hydroxide in mg/L as CaCO3													1 U						1.0 U				
Methane in ug/L																							
Nitrate + Nitrite in mg-N/L																							
Nitrate as Nitrogen in mg-N/L													0.6										
Nitrite as Nitrogen in mg-N/L																							
ortho-Phosphorus in mg/L													0.1 U						0.1 UJ				
pH in pH units																							
Sulfate in mg/L													186						239				
Sulfide in mg/L													0.05 U						0.050				
Total Calcium in ug/L																			41,400				
Total Organic Carbon in mg/L													1.5 U						4.58				
Total Potassium in ug/L																			12,300				
Total Sodium in ug/L																			44,900				
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L																							
1,1,1-Trichloroethane in ug/L				1.0 U	1.0 U	0.4 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U					0.2 U
1,1,2,2-Tetrachloroethane in ug/L																							
1,1,2-Trichloroethane in ug/L																							
1,1-Dichloroethane in ug/L				1.0 U	1.0 U	0.62	1.0 U	1.0 U	0.32 J	1.1	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1.1	1.65					4.9
1,1-Dichloroethene in ug/L				1.0 U	1.0 U	0.4 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U					0.2 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-3 4/6/12	MW-3 4/2/12 FD	MW-3 4/6/12 FD	MW-3 6/14/12	MW-3 9/25/12	MW-3 12/11/12	MW-3 3/21/13	MW-3 6/18/13	MW-3 9/26/13	MW-3 12/10/13	MW-3 3/20/14	MW-3 6/12/14	MW-3 9/22/14	MW-3 12/18/14	MW-3 3/16/15	MW-3 9/21/15	MW-3 3/22/16	MW-3 9/22/16	MW-3-30 4/2/12	MW-3-30 6/14/12	MW-3-30 9/25/12	MW-3-30 12/11/12	MW-3-30 3/21/13
1,1-Dichloropropene in ug/L																							
1,2,3-Trichlorobenzene in ug/L																							
1,2,3-Trichloropropane in ug/L																							
1,2,4-Trichlorobenzene in ug/L																							
1,2,4-Trimethylbenzene in ug/L																							
1,2-Dibromo-3-chloropropane in ug/L																							
1,2-Dibromoethane (EDB) in ug/L																							
1,2-Dichlorobenzene in ug/L																							
1,2-Dichloroethane (EDC) in ug/L				1.0 U	1.0 U	0.4 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U					0.27
1,2-Dichloropropane in ug/L																							
1,3,5-Trimethylbenzene in ug/L																							
1,3-Dichlorobenzene in ug/L																							
1,3-Dichloropropane in ug/L																							
1,4-Dichlorobenzene in ug/L																							
2,2-Dichloropropane in ug/L																							
2-Chlorotoluene in ug/L																							
4-Chlorotoluene in ug/L																							
Benzene in ug/L																							
Bromobenzene in ug/L																							
Bromodichloromethane in ug/L																							
Bromoform in ug/L																							
Bromomethane in ug/L																							
Carbon tetrachloride in ug/L																							
Chlorobenzene in ug/L																							
Chloroethane in ug/L				1.0 U	1.0 U	0.4 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U					0.99
Chloroform in ug/L																							
Chloromethane in ug/L																							
cis-1,2-Dichloroethene (DCE) in ug/L				30	69	56	2.3	1.0 U	1.2	1.8	12	12	0.75 J	1.0	3.0	1.0 U	1.4	14.9					1.4
cis-1,3-Dichloropropene in ug/L																							
Dibromochloromethane in ug/L																							
Dibromomethane in ug/L																							
Dichlorodifluoromethane in ug/L																							
Ethylbenzene in ug/L																							
Hexachlorobutadiene in ug/L																							
Isopropylbenzene in ug/L																							
Methylene chloride in ug/L																							
n-Butylbenzene in ug/L																							
n-Propylbenzene in ug/L																							
p-Isopropyltoluene in ug/L																							
sec-Butylbenzene in ug/L																							
Styrene in ug/L																							
tert-Butylbenzene in ug/L																							
Tetrachloroethene (PCE) in ug/L				1.0 U	1.0 U	0.4 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U					0.2 U
Toluene in ug/L																							
trans-1,2-Dichloroethene in ug/L				1.0 U	2.0	1.3	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.59					0.2 U
trans-1,3-Dichloropropene in ug/L																							
Trichloroethene (TCE) in ug/L				32	79	64	20	14	21	23	21	29	14	16	16	11	13	82.6					2.1
Trichlorofluoromethane in ug/L																							
Vinyl chloride in ug/L				1.0 U	1.0 U	0.4 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U					3.2
Xylenes (total) in ug/L																							
Naphthalene in ug/L																							
Total Chlorinated Ethenes in umol/L				0.58	1.4	1.1	0.2	0.13	0.19	0.22	0.31	0.37	0.14	0.15	0.17	0.11	0.13	0.79					0.084
Field Parameters																							
Dissolved Oxygen in mg/L	1.20			0.60	0.39	5.31	7.05	5.36	1.84	0.36	1.19	4.21	4.06		0.93	5.05	1.39	0.20	0.47	0.34	0.33	0.31	1.88
ORP in mVolts	374.1			273.3	314	411.6	202.7	370.9	177.2	269	386.4	370.6	353.1		34.7	119.0	145.9	300.6	-98.4	-143.1	-129.2	-91.1	-92.2
pH in pH Units	3.80			3.83	4.13	3.95	3.93	4.00	3.78	3.89	4.15	4.12	4.64		4.45	4.23	4.58	4.29	6.65	6.61	7.17	6.76	6.75
Specific Conductance in us/cm	1,415			2,077	1,139	1,210	1,054	892	1,292	1,140	750.0	750	518.4		781	688	698	603	832	955	584.2	682	593.8
Temperature in deg C	13.6			14.7	16.9	15.8	13.4	15.4	17.8	15.8	13.6	15.5	18.8		14.7	18.8	14.1	19.3	15.3	15.4	16.1	15.3	14.3
Turbidity in NTU	23.1			24.1	16.7	25.5	117	10.2	11.6	11.4	11.2	50.2	4.07		14.9	141	89	42.1	44	90.2	18.0	217	50.6

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-3-30 9/26/13	MW-3-30 3/20/14	MW-3-30 9/22/14	MW-3-30 9/25/15	MW-3-30 9/22/16	MW-5 6/29/06	MW-5 7/29/08	MW-5 12/17/08	MW-5 3/27/09	MW-5 6/23/09	MW-5 9/15/09	MW-5 12/16/09	MW-5 3/22/10	MW-5 6/17/10	MW-5 9/24/10	MW-5 12/17/10	MW-5 3/17/11	MW-5 9/15/11	MW-5 12/13/11	MW-5 4/3/12	MW-5 6/12/12	MW-5 9/25/12	MW-5 12/12/12
Metals																							
Dissolved Aluminum in ug/L			50 U																				
Dissolved Cadmium in ug/L			0.1 U	0.1 U	0.100 U															0.3		0.4	
Dissolved Calcium in ug/L			21,100																				
Dissolved Chromium (Total) in ug/L								5 U															
Dissolved Copper in ug/L	0.5 U	0.7	0.5 U	0.5 U	21.2			30	34				58.1		69		6.7	53.4		16.6		13.1	
Dissolved Iron in ug/L			13,600																				
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L									1 U														
Dissolved Magnesium in ug/L			33,500																				
Dissolved Manganese in ug/L			744																				
Dissolved Nickel in ug/L	1.2	1.6	1.4	1.4	1.97			286	461				338		282		60.7	182		130		88.1	
Dissolved Potassium in ug/L			9,110																				
Dissolved Silicon in ug/L			29,500																				
Dissolved Sodium in ug/L			37,200																				
Dissolved Zinc in ug/L	4 U	4 U	4 U	4 U	4.00 U			250	380				330 J		250		26	170		58		98	
Iron, Ferrous, Fe+2 in ug/L																							
Total Antimony in ug/L																							
Total Arsenic in ug/L	0.8	0.7	0.6						2.0				1.7		0.5 U								
Total Barium in ug/L	11.6	9.0	11						40.9				24.8		20.0								
Total Beryllium in ug/L																							
Total Cadmium in ug/L									0.9											0.3		0.4	
Total Calcium in ug/L																				104,000			
Total Chromium (Total) in ug/L								4															
Total Copper in ug/L	1.4	1.6	1.4					43.5												15.8		12.8	
Total Iron in ug/L	33,300	18,000	29,300										8,850		2,680					2,250			
Total Lead in ug/L																							
Total Magnesium in ug/L																				32,200			
Total Manganese in ug/L	774	760	746						3,730				2,610		2,600					663			
Total Mercury in ug/L									0.10 U														
Total Nickel in ug/L	2.2	2.7	2.7					321												131		83.5	
Total Potassium in ug/L																				11,900			
Total Selenium in ug/L																							
Total Silicon in ug/L																				29,600 J			
Total Silver in ug/L									0.2 U														
Total Sodium in ug/L																				43,700			
Total Thallium in ug/L																							
Total Zinc in ug/L	4	4 U	4 UJ					266												51		88	
TCLP Metals																							
Total Mercury in ug/L									0.10 U														
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3			241																	1.0 U			
Bicarbonate in mg/L as CaCO3			241																	1.0 U			
Carbonate in mg/L as CaCO3			1 U																	1.0 U			
Chloride in mg/L			26.2																	102			
Cyanide (total) in mg/L									0.005 U														
Dissolved Calcium in ug/L			21,100																				
Dissolved Potassium in ug/L			9,110																				
Dissolved Sodium in ug/L			37,200																				
Ethane in ug/L																							
Ethene in ug/L																							
Hydroxide in mg/L as CaCO3			1 U																	1.0 U			
Methane in ug/L																							
Nitrate + Nitrite in mg-N/L																							
Nitrate as Nitrogen in mg-N/L			0.1 U																				
Nitrite as Nitrogen in mg-N/L																							
ortho-Phosphorus in mg/L			0.1 U																	0.1 UJ			
pH in pH units																							
Sulfate in mg/L			4.1																	372			
Sulfide in mg/L			0.05 U																	0.050 U			
Total Calcium in ug/L																				104,000			
Total Organic Carbon in mg/L			5.36																	1.85			
Total Potassium in ug/L																				11,900			
Total Sodium in ug/L																				43,700			
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L						1.0 U																	
1,1,1-Trichloroethane in ug/L	0.2 U	0.20 U	0.2 U			1.0 U	1 U	1 U	0.2 U	1.0 U	1.0 U	1.0 U	1 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U
1,1,2,2-Tetrachloroethane in ug/L						1.0 U																	
1,1,2-Trichloroethane in ug/L						1.0 U																	
1,1-Dichloroethane in ug/L	5.7	5.1	7.3			1.0 U	1.6	1.9	1.3	2.6	2.2	1.0 U	1.2	1.0 J	1.3	0.4	0.2	0.9	1.0	0.7	1.6	1.9	1.3
1,1-Dichloroethene in ug/L	0.2 U	0.20 U	0.2 U			1.0 U	1 U	1 U	0.2 U	1.0 U	1.0 U	1.0 U	1 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J	1.0 U	0.2 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-3-30 9/26/13	MW-3-30 3/20/14	MW-3-30 9/22/14	MW-3-30 9/25/15	MW-3-30 9/22/16	MW-5 6/29/06	MW-5 7/29/08	MW-5 12/17/08	MW-5 3/27/09	MW-5 6/23/09	MW-5 9/15/09	MW-5 12/16/09	MW-5 3/22/10	MW-5 6/17/10	MW-5 9/24/10	MW-5 12/17/10	MW-5 3/17/11	MW-5 9/15/11	MW-5 12/13/11	MW-5 4/3/12	MW-5 6/12/12	MW-5 9/25/12	MW-5 12/12/12
1,1-Dichloropropene in ug/L						1.0 U																	
1,2,3-Trichlorobenzene in ug/L						1.0 U																	
1,2,3-Trichloropropane in ug/L						1.0 U																	
1,2,4-Trichlorobenzene in ug/L						1.0 U																	
1,2,4-Trimethylbenzene in ug/L						1.0 U																	
1,2-Dibromo-3-chloropropane in ug/L						1.0 U																	
1,2-Dibromoethane (EDB) in ug/L						0.01 U																	
1,2-Dichlorobenzene in ug/L						1.0 U																	
1,2-Dichloroethane (EDC) in ug/L	0.28	0.25	0.3			1.0 U	1 U	1 U	0.3	1.0 U	1.0 U	1.0 U	1 U	0.2 UJ	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U
1,2-Dichloropropane in ug/L						1.0 U																	
1,3,5-Trimethylbenzene in ug/L						1.0 U																	
1,3-Dichlorobenzene in ug/L						1.0 U																	
1,3-Dichloropropane in ug/L						1.0 U																	
1,4-Dichlorobenzene in ug/L						1.0 U																	
2,2-Dichloropropane in ug/L						1.0 U																	
2-Chlorotoluene in ug/L						1.0 U																	
4-Chlorotoluene in ug/L						1.0 U																	
Benzene in ug/L						1.0 U																	
Bromobenzene in ug/L						1.0 U																	
Bromodichloromethane in ug/L						1.0 U																	
Bromoform in ug/L						1.0 U																	
Bromomethane in ug/L						1.0 U																	
Carbon tetrachloride in ug/L						1.0 U																	
Chlorobenzene in ug/L						1.0 U																	
Chloroethane in ug/L	0.65	0.34	0.82			1.0 U	1 U	1 U	0.2 U	1.0 U	1.0 U	1.0 U	1 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U
Chloroform in ug/L						1.0 U																	
Chloromethane in ug/L						1.0 U																	
cis-1,2-Dichloroethene (DCE) in ug/L	1.5	1.4	1.4			79	90	11	15	9.9	6.2	3.0	3.4	2.1 J	1.3	1.7	0.9	0.6	0.8	5.6	9.8	15	2.7
cis-1,3-Dichloropropene in ug/L						1.0 U																	
Dibromochloromethane in ug/L						1.0 U																	
Dibromomethane in ug/L						1.0 U																	
Dichlorodifluoromethane in ug/L						1.0 U																	
Ethylbenzene in ug/L						1.0 U																	
Hexachlorobutadiene in ug/L						1.0 U																	
Isopropylbenzene in ug/L						1.0 U																	
Methylene chloride in ug/L						1.0 U																	
n-Butylbenzene in ug/L						1.0 U																	
n-Propylbenzene in ug/L						1.0 U																	
p-Isopropyltoluene in ug/L						1.0 U																	
sec-Butylbenzene in ug/L						1.0 U																	
Styrene in ug/L						1.0 U																	
tert-Butylbenzene in ug/L						1.0 U																	
Tetrachloroethene (PCE) in ug/L	0.2 U	0.20 U	0.2 U			1.0 U	1 U	1 U	0.2 U	1.0 U	1.0 U	1.0 U	1 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U
Toluene in ug/L						1.0 U																	
trans-1,2-Dichloroethene in ug/L	0.2 U	0.20 U	0.2 U			1.7	2.5	1 U	0.6	1.0 U	1.0 U	1.0 U	1 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2	0.5	1.0 U	0.2 U
trans-1,3-Dichloropropene in ug/L						1.0 U																	
Trichloroethene (TCE) in ug/L	0.88	0.41	0.28			170	200	26	30	23	13	12	9.4	6.2 J	4.3	4.0	2.4	1.9	3.1	9.4	22	37	6.8
Trichlorofluoromethane in ug/L						1.0 U																	
Vinyl chloride in ug/L	3.0	2.3	3.7 J			0.2 U	1 U	1 U	0.3	1.0 U	1.0 U	1.0 U	1 U	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J	0.5	1.0 U	0.2 U
Xylenes (total) in ug/L						1.0 U																	
Naphthalene in ug/L						1.0 U																	
Total Chlorinated Ethenes in umol/L	0.073	0.057	0.079			2.1	2.5	0.33	0.4	0.3	0.19	0.14	0.13	0.073	0.051	0.052	0.032	0.025	0.036	0.14	0.28	0.46	0.084
Field Parameters																							
Dissolved Oxygen in mg/L	0.24	0.31	0.01	0.23	0.05			1.04	0.56	0.11	1.51	1.04	1.30	4.66	3.72	8.51	8.32	5.35	6.36	4.56	0.53	0.41	5.79
ORP in mVolts	-196.1	-120.9	-46.9	-6.1	-100.2			253 R	184 R	703 R	184.5	347	146.2	348.7	311.6	116	86.9	431.5	409.9	330.8	305.1	273	450
pH in pH Units	6.78	6.86	6.85	6.83	6.74			2.96	3.25	2.77	3.52	3.50	4.58	3.96	2.55	7.70 R	7.40 R	3.53	3.46	4.20	3.75	4.22	4.00
Specific Conductance in us/cm	622	503.9	586.6	548.9	581			1,945	1,831	1,123	1,524	1,535	1,521	1,010	1,541	674	843	1,355	1,526	1,108	1,115	814.0	1,141
Temperature in deg C	16.3	15.0	17.1	16.6	16.9			16.53	14.06	16.62	18.71	15.06	14.58	14.99	16.76	13.46	10.89	16.7	14.9	12.2	14.1	16.4	14.5
Turbidity in NTU	46.6	21.0	25.9	26.4	31.4													13.8	6.51	12	2.45	2.44	4.68

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-5 3/21/13	MW-5 6/18/13	MW-5 9/27/13	MW-5 12/10/13	MW-5 3/20/14	MW-5 6/12/14	MW-5 9/25/14	MW-5 12/18/14	MW-5 3/17/15	MW-5 9/25/15	MW-5 3/22/16	MW-5 9/22/16	MW-7 8/1/08	MW-7 12/17/08	MW-7 3/27/09	MW-7 6/23/09	MW-7 9/14/09	MW-7 12/16/09	MW-7 3/22/10	MW-7 6/17/10	MW-7 9/24/10	MW-7 12/16/10	MW-7 3/17/11
Metals																							
Dissolved Aluminum in ug/L																							
Dissolved Cadmium in ug/L	0.6		0.4		0.2																		
Dissolved Calcium in ug/L																							
Dissolved Chromium (Total) in ug/L																							
Dissolved Copper in ug/L	41.4		39		24.2		22.7								2.0				8.8		2		2.8
Dissolved Iron in ug/L																							
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L																							
Dissolved Magnesium in ug/L																							
Dissolved Manganese in ug/L																							
Dissolved Nickel in ug/L	127		87		60.8		81.3								42.5				102		170		47.7
Dissolved Potassium in ug/L																							
Dissolved Silicon in ug/L																							
Dissolved Sodium in ug/L																							
Dissolved Zinc in ug/L	125		90		48		69								34				33 J		30		12
Iron, Ferrous, Fe+2 in ug/L																							
Total Antimony in ug/L																							
Total Arsenic in ug/L																			0.5		0.8		
Total Barium in ug/L																			22.7		30.2		
Total Beryllium in ug/L																							
Total Cadmium in ug/L	0.6		0.5		0.2																		
Total Calcium in ug/L																							
Total Chromium (Total) in ug/L																							
Total Copper in ug/L	39.4		147		27.2		22.2																
Total Iron in ug/L																			9,400		5,510		
Total Lead in ug/L																							
Total Magnesium in ug/L																							
Total Manganese in ug/L																			2,090		1,740		
Total Mercury in ug/L																							
Total Nickel in ug/L	119		159		64.3		85.9																
Total Potassium in ug/L																							
Total Selenium in ug/L																							
Total Silicon in ug/L																							
Total Silver in ug/L																							
Total Sodium in ug/L																							
Total Thallium in ug/L																							
Total Zinc in ug/L	115		122		49		65																
TCLP Metals																							
Total Mercury in ug/L																							
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3																							
Bicarbonate in mg/L as CaCO3																							
Carbonate in mg/L as CaCO3																							
Chloride in mg/L																							
Cyanide (total) in mg/L																							
Dissolved Calcium in ug/L																							
Dissolved Potassium in ug/L																							
Dissolved Sodium in ug/L																							
Ethane in ug/L																							
Ethene in ug/L																							
Hydroxide in mg/L as CaCO3																							
Methane in ug/L																							
Nitrate + Nitrite in mg-N/L																							
Nitrate as Nitrogen in mg-N/L																							
Nitrite as Nitrogen in mg-N/L																							
ortho-Phosphorus in mg/L																							
pH in pH units																							
Sulfate in mg/L																							
Sulfide in mg/L																							
Total Calcium in ug/L																							
Total Organic Carbon in mg/L																							
Total Potassium in ug/L																							
Total Sodium in ug/L																							
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L																							
1,1,1-Trichloroethane in ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U	1 U	1 U	0.2 U	0.2 U	5.0 U	5.0 U	1 U	1.0 UJ	1.0 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane in ug/L																							
1,1,2-Trichloroethane in ug/L																							
1,1-Dichloroethane in ug/L	1.1	1.0 U	1.7	1.4	1.0 U	2.5	0.89 J	1.6	1.0 U	2.0	1 U	1.50	1.4	1.8	3.5	3.5	5.0 U	5.0 U	3.3	1.9 J	1.0 U	0.2 U	0.2 U
1,1-Dichloroethene in ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U	1.5	1 U	1.0	1.1	5.0 U	5.0 U	1 U	1.0 UJ	1.0 U	0.2 U	0.2 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-5 3/21/13	MW-5 6/18/13	MW-5 9/27/13	MW-5 12/10/13	MW-5 3/20/14	MW-5 6/12/14	MW-5 9/25/14	MW-5 12/18/14	MW-5 3/17/15	MW-5 9/25/15	MW-5 3/22/16	MW-5 9/22/16	MW-7 8/1/08	MW-7 12/17/08	MW-7 3/27/09	MW-7 6/23/09	MW-7 9/14/09	MW-7 12/16/09	MW-7 3/22/10	MW-7 6/17/10	MW-7 9/24/10	MW-7 12/16/10	MW-7 3/17/11
1,1-Dichloropropene in ug/L																							
1,2,3-Trichlorobenzene in ug/L																							
1,2,3-Trichloropropane in ug/L																							
1,2,4-Trichlorobenzene in ug/L																							
1,2,4-Trimethylbenzene in ug/L																							
1,2-Dibromo-3-chloropropane in ug/L																							
1,2-Dibromoethane (EDB) in ug/L																							
1,2-Dichlorobenzene in ug/L																							
1,2-Dichloroethane (EDC) in ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U	1 U	1 U	0.2 U	0.2 U	5.0 U	5.0 U	1 U	1.0 UJ	1.0 U	0.2 U	0.2 U
1,2-Dichloropropane in ug/L																							
1,3,5-Trimethylbenzene in ug/L																							
1,3-Dichlorobenzene in ug/L																							
1,3-Dichloropropane in ug/L																							
1,4-Dichlorobenzene in ug/L																							
2,2-Dichloropropane in ug/L																							
2-Chlorotoluene in ug/L																							
4-Chlorotoluene in ug/L																							
Benzene in ug/L																							
Bromobenzene in ug/L																							
Bromodichloromethane in ug/L																							
Bromoform in ug/L																							
Bromomethane in ug/L																							
Carbon tetrachloride in ug/L																							
Chlorobenzene in ug/L																							
Chloroethane in ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U	1 U	1 U	0.2 U	0.2 U	5.0 U	5.0 U	1 U	1.0 UJ	1.0 U	0.2 U	0.2 U
Chloroform in ug/L																							
Chloromethane in ug/L																							
cis-1,2-Dichloroethene (DCE) in ug/L	1.0 U	1.0 U	5.3	10	8.0	2.5	0.36 J	4.7	3.1	1.5	1.7	19.7	100	46	31	26	25	12	12	7.6 J	3.5	0.5	0.5
cis-1,3-Dichloropropene in ug/L																							
Dibromochloromethane in ug/L																							
Dibromomethane in ug/L																							
Dichlorodifluoromethane in ug/L																							
Ethylbenzene in ug/L																							
Hexachlorobutadiene in ug/L																							
Isopropylbenzene in ug/L																							
Methylene chloride in ug/L																							
n-Butylbenzene in ug/L																							
n-Propylbenzene in ug/L																							
p-Isopropyltoluene in ug/L																							
sec-Butylbenzene in ug/L																							
Styrene in ug/L																							
tert-Butylbenzene in ug/L																							
Tetrachloroethene (PCE) in ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U	1 U	1 U	0.2 U	0.2 U	5.0 U	5.0 U	1 U	1.0 UJ	1.0 U	0.2 U	0.2 U
Toluene in ug/L																							
trans-1,2-Dichloroethene in ug/L	1.0 U	1.0 U	0.14 J	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.72	6.6	2.3	1.5	1.7	5.0 U	5.0 U	1 U	1.0 UJ	1.0 U	0.2 U	0.2 U
trans-1,3-Dichloropropene in ug/L																							
Trichloroethene (TCE) in ug/L	2.9	1.9	6.3	13	13	7.5	2.2	7.5	6.0	4.5	3.6	20.8	1,100	460	260	310	420	230	140	87 J	56	11	8.4
Trichlorofluoromethane in ug/L																							
Vinyl chloride in ug/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	1 U	0.20 U	1 U	1 U	0.5	0.3	5.0 U	5.0 U	1 U	1.0 UJ	1.0 U	0.2 U	0.2 U
Xylenes (total) in ug/L																							
Naphthalene in ug/L																							
Total Chlorinated Ethenes in umol/L	0.049	0.041	0.12	0.22	0.2	0.087	0.042	0.13	0.099	0.071	0.067	0.37	9.5	4.0	2.3	2.7	3.6	2.0	1.2	0.76	0.48	0.093	0.073
Field Parameters																							
Dissolved Oxygen in mg/L	8.16	8.05	1.57	0.44	2.99	6.37	7.27		4.81	6.48	5.57	0.10		0.58	0.27	0.09		0.08	0.13	0.26	0.59	6.04	2.53
ORP in mVolts	287.9	459.4	267.7	133.1	410.9	525.3	471.7		133.8	73.6	143.8	239.5		236 R	254 R	343 R		88	77.3	267.4	-135	65.1	49.1
pH in pH Units	3.85	3.83	3.76	3.76	3.79	3.96	3.92		4.51	4.11	5.06	4.42		5.76	5.38	6.10		5.00	5.14	4.24	4.09	7.48 R	7.75 R
Specific Conductance in us/cm	1,171	1,230	1,004	927	759.0	822	742		508.9	975	364.4	660		710	1,189	1,225		1,448	1,242	1,319	1,057	306	243
Temperature in deg C	12.2	15.2	17.5	15.3	12.6	15.1	17.9		13.9	18.0	13.2	18.8		14.34	12.69	13.8		14.48	13.72	13.74	15.42	13.82	11.45
Turbidity in NTU	2.69	21.5	11.7	7.79	4.21	4.5	2.99		2.02	3.03	27.9	14.2											

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-7 9/15/11	MW-7 12/13/11	MW-7 4/4/12	MW-7 6/12/12	MW-7 9/24/12	MW-7 12/11/12	MW-7 3/19/13	MW-7 3/19/13 FD	MW-7 6/18/13	MW-7 6/18/13 FD	MW-7 9/26/13	MW-7 9/26/13 FD	MW-7 12/11/13	MW-7 3/19/14	MW-7 3/19/14 FD	MW-7 6/12/14	MW-7 6/12/14 FD	MW-7 9/25/14	MW-7 9/25/14 FD	MW-7 12/18/14	MW-7 12/18/14 FD	MW-7 9/21/15	MW-7 9/21/15 FD
Metals																							
Dissolved Aluminum in ug/L																							
Dissolved Cadmium in ug/L			0.4		0.3		0.3	0.3			0.2	0.3		0.1	0.1							0.1	0.2
Dissolved Calcium in ug/L																							
Dissolved Chromium (Total) in ug/L																							
Dissolved Copper in ug/L	32.2		26.5		9.1		24.5	25.0			13.7	15.1		20.5	20.8			42.1	41.5			25.4	27.2
Dissolved Iron in ug/L																							
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L																							
Dissolved Magnesium in ug/L																							
Dissolved Manganese in ug/L																							
Dissolved Nickel in ug/L	321		243		116		84.3	82.2			76.3	76.0		16.6	18.0			69.7	66			47.3	47.3
Dissolved Potassium in ug/L																							
Dissolved Silicon in ug/L																							
Dissolved Sodium in ug/L																							
Dissolved Zinc in ug/L	103		103		75		70	75			58	61		13	18			62	62			38	41
Iron, Ferrous, Fe+2 in ug/L																							
Total Antimony in ug/L																							
Total Arsenic in ug/L																							
Total Barium in ug/L																							
Total Beryllium in ug/L																							
Total Cadmium in ug/L			0.4		0.3		0.3	0.3			0.3	0.3		0.1	0.2								
Total Calcium in ug/L																							
Total Chromium (Total) in ug/L																							
Total Copper in ug/L			27.3		15		26.3	25.1			18.6	18.9		20.3	22.6 J			42.5	41.7				
Total Iron in ug/L																							
Total Lead in ug/L																							
Total Magnesium in ug/L																							
Total Manganese in ug/L																							
Total Mercury in ug/L																							
Total Nickel in ug/L			251		127		85.7	81.7			77.2	74.6		18.2	19.2			69	68.2				
Total Potassium in ug/L																							
Total Selenium in ug/L																							
Total Silicon in ug/L																							
Total Silver in ug/L																							
Total Sodium in ug/L																							
Total Thallium in ug/L																							
Total Zinc in ug/L			105		90		71	69			62	63		14	15			60	56				
TCLP Metals																							
Total Mercury in ug/L																							
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3																							
Bicarbonate in mg/L as CaCO3																							
Carbonate in mg/L as CaCO3																							
Chloride in mg/L																							
Cyanide (total) in mg/L																							
Dissolved Calcium in ug/L																							
Dissolved Potassium in ug/L																							
Dissolved Sodium in ug/L																							
Ethane in ug/L																							
Ethene in ug/L																							
Hydroxide in mg/L as CaCO3																							
Methane in ug/L																							
Nitrate + Nitrite in mg-N/L																							
Nitrate as Nitrogen in mg-N/L																							
Nitrite as Nitrogen in mg-N/L																							
ortho-Phosphorus in mg/L																							
pH in pH units																							
Sulfate in mg/L																							
Sulfide in mg/L																							
Total Calcium in ug/L																							
Total Organic Carbon in mg/L																							
Total Potassium in ug/L																							
Total Sodium in ug/L																							
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L																							
1,1,1-Trichloroethane in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	
1,1,2,2-Tetrachloroethane in ug/L																							
1,1,2-Trichloroethane in ug/L																							
1,1-Dichloroethane in ug/L	0.8	0.8	0.7	1.2	2.7	1.4	2.3	2.6	5.0	5.0	7.9	6.6	5.6	1.0 U	1.0 U	3.2	3.1	3.8	3.5	4.1	4.1	2.8	
1,1-Dichloroethene in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	0.18 J	0.15 J	1.0 U	1.0 U	1.0 U	

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-7 9/15/11	MW-7 12/13/11	MW-7 4/4/12	MW-7 6/12/12	MW-7 9/24/12	MW-7 12/11/12	MW-7 3/19/13	MW-7 3/19/13 FD	MW-7 6/18/13	MW-7 6/18/13 FD	MW-7 9/26/13	MW-7 9/26/13 FD	MW-7 12/11/13	MW-7 3/19/14	MW-7 3/19/14 FD	MW-7 6/12/14	MW-7 6/12/14 FD	MW-7 9/25/14	MW-7 9/25/14 FD	MW-7 12/18/14	MW-7 12/18/14 FD	MW-7 9/21/15	MW-7 9/21/15 FD
1,1-Dichloropropene in ug/L																							
1,2,3-Trichlorobenzene in ug/L																							
1,2,3-Trichloropropane in ug/L																							
1,2,4-Trichlorobenzene in ug/L																							
1,2,4-Trimethylbenzene in ug/L																							
1,2-Dibromo-3-chloropropane in ug/L																							
1,2-Dibromoethane (EDB) in ug/L																							
1,2-Dichlorobenzene in ug/L																							
1,2-Dichloroethane (EDC) in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.11 J	1.0 U	1.0 U	1.0 U	1 U	1 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	
1,2-Dichloropropane in ug/L																							
1,3,5-Trimethylbenzene in ug/L																							
1,3-Dichlorobenzene in ug/L																							
1,3-Dichloropropane in ug/L																							
1,4-Dichlorobenzene in ug/L																							
2,2-Dichloropropane in ug/L																							
2-Chlorotoluene in ug/L																							
4-Chlorotoluene in ug/L																							
Benzene in ug/L																							
Bromobenzene in ug/L																							
Bromodichloromethane in ug/L																							
Bromoform in ug/L																							
Bromomethane in ug/L																							
Carbon tetrachloride in ug/L																							
Chlorobenzene in ug/L																							
Chloroethane in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	
Chloroform in ug/L																							
Chloromethane in ug/L																							
cis-1,2-Dichloroethene (DCE) in ug/L	1.6	1.5	1.5	2.3	2.2	2.1	5.2	5.0	3.8	4.0	3.8	3.2	2.8	1.0 U	1.0 U	4.4	4.5	5.4	5.1	3.3	3.5	2.6	
cis-1,3-Dichloropropene in ug/L																							
Dibromochloromethane in ug/L																							
Dibromomethane in ug/L																							
Dichlorodifluoromethane in ug/L																							
Ethylbenzene in ug/L																							
Hexachlorobutadiene in ug/L																							
Isopropylbenzene in ug/L																							
Methylene chloride in ug/L																							
n-Butylbenzene in ug/L																							
n-Propylbenzene in ug/L																							
p-Isopropyltoluene in ug/L																							
sec-Butylbenzene in ug/L																							
Styrene in ug/L																							
tert-Butylbenzene in ug/L																							
Tetrachloroethene (PCE) in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	
Toluene in ug/L																							
trans-1,2-Dichloroethene in ug/L	0.2 U	0.2 U	0.2 U	0.2 J	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	0.26 J	0.24 J	1.0 U	1.0 U	1.0 U	1 U	1 U	0.28	0.28 J	1.0 U	1.0 U	1.0 U	
trans-1,3-Dichloropropene in ug/L																							
Trichloroethene (TCE) in ug/L	32	34	26	36	41	23	40	38	33	35	38	39	30	5.6	6.9	27	26	35	32	22	22	22	
Trichlorofluoromethane in ug/L																							
Vinyl chloride in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1 U	1 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	
Xylenes (total) in ug/L																							
Naphthalene in ug/L																							
Total Chlorinated Ethenes in umol/L	0.26	0.28	0.22	0.3	0.36	0.2	0.38	0.36	0.31	0.33	0.35	0.35	0.28	0.069	0.079	0.27	0.27	0.33	0.31	0.22	0.23	0.22	
Field Parameters																							
Dissolved Oxygen in mg/L	0.86	1.49	0.90	0.52	0.66	0.63	1.71		0.39		0.29		0.47	6.29		0.45		0.38				0.79	
ORP in mVolts	336.7	332.4	347	95.3	217.7	287.3	280.1		356.4		85.7		183.7	207.8		436.4		332.2				89.7	
pH in pH Units	3.80	3.80	3.83	4.12	4.84	4.62	4.65		4.30		4.27		4.22	5.97		5.22		4.29				4.35	
Specific Conductance in us/cm	1,144	893	1,180	1,206	665.0	1,341	714		546.1		763		515	745.0		805		6.17				688	
Temperature in deg C	14.6	14.6	12.1	12.4	14.8	13.3	12.4		13.2		16.0		15.0	12.5		14		17.3				18.6	
Turbidity in NTU	8.28	3.99	3.27		10.2	6.53	6.79		8.99		2.38		2.45	2.45		1.54		2.90				4.11	

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-7 9/21/16	MW-7 9/21/16 FD	MW-8 5/11/07	MW-8 7/30/08	MW-8 12/16/08	MW-8 3/26/09	MW-8 6/26/09	MW-8 9/17/09	MW-8 12/15/09	MW-8 3/23/10	MW-8 6/16/10	MW-8 9/23/10	MW-8 12/16/10	MW-8 3/17/11	MW-8 9/15/11	MW-8 12/13/11	MW-8 4/2/12	MW-8 6/12/12	MW-8 9/24/12	MW-8 12/12/12	MW-8 12/12/12 FD	MW-8 3/19/13	MW-8 6/18/13
Metals																							
Dissolved Aluminum in ug/L																							
Dissolved Cadmium in ug/L	0.100 U	0.113															0.1 U		0.1 U			0.1 U	
Dissolved Calcium in ug/L																							
Dissolved Chromium (Total) in ug/L																							
Dissolved Copper in ug/L	5.80	5.95				0.5				0.6		0.5			0.8		0.8		0.7			0.6	
Dissolved Iron in ug/L																							
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L																							
Dissolved Magnesium in ug/L																							
Dissolved Manganese in ug/L																							
Dissolved Nickel in ug/L	50.0	51.3				3.4				7.4		5.1			1,850		4,750		4,710			2,380	
Dissolved Potassium in ug/L																							
Dissolved Silicon in ug/L																							
Dissolved Sodium in ug/L																							
Dissolved Zinc in ug/L	32.9	33.3				4 U				11 J		5			9		5		6			6	
Iron, Ferrous, Fe+2 in ug/L				13,000		10,800		70,500															
Total Antimony in ug/L																							
Total Arsenic in ug/L										0.5		1.1										0.6	
Total Barium in ug/L										54.2		51.8										17.2	
Total Beryllium in ug/L																							
Total Cadmium in ug/L																	0.1 U		0.1 U			0.1 U	
Total Calcium in ug/L																	147,000						
Total Chromium (Total) in ug/L																							
Total Copper in ug/L																	0.9		1.2			1.6	
Total Iron in ug/L				12,600		11,200		72,700		59,600		40,000					13,200						
Total Lead in ug/L																							
Total Magnesium in ug/L																	51,600						
Total Manganese in ug/L				829		671		2,100		2,640		2,930					3,160						
Total Mercury in ug/L																							
Total Nickel in ug/L																	4,550		5,180			2,550	
Total Potassium in ug/L																	25,200						
Total Selenium in ug/L																							
Total Silicon in ug/L																	39,100 J						
Total Silver in ug/L																							
Total Sodium in ug/L																	49,600						
Total Thallium in ug/L																							
Total Zinc in ug/L																	5		7			7	
TCLP Metals																							
Total Mercury in ug/L																							
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3				126		68.5		7.7									16.6						
Bicarbonate in mg/L as CaCO3						68.5		7.7									16.6						
Carbonate in mg/L as CaCO3						1.0 U		1.0 U									1.0 U						
Chloride in mg/L						15.0		20.6									35.5						
Cyanide (total) in mg/L																							
Dissolved Calcium in ug/L																							
Dissolved Potassium in ug/L																							
Dissolved Sodium in ug/L																							
Ethane in ug/L				50.5 U		48.8		2.2															
Ethene in ug/L				1.1 U		1.1 U		1.1 U															
Hydroxide in mg/L as CaCO3						1.0 U		1.0 U									1.0 U						
Methane in ug/L				665		267		23.2															
Nitrate + Nitrite in mg-N/L				0.02 U																			
Nitrate as Nitrogen in mg-N/L				0.02 U		0.1		0.1 U															
Nitrite as Nitrogen in mg-N/L				0.02 U		0.1 U		0.1 U															
ortho-Phosphorus in mg/L																	0.1 UJ						
pH in pH units						6.40		6.16															
Sulfate in mg/L				99.2		191		913									657						
Sulfide in mg/L																	0.050 U						
Total Calcium in ug/L																	147,000						
Total Organic Carbon in mg/L						2.92		1.64									1.73						
Total Potassium in ug/L																	25,200						
Total Sodium in ug/L																	49,600						
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L					2 U																		
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L			1.0 U																				
1,1,1-Trichloroethane in ug/L	0.20 U		1.0 U	1 U	1 U	0.2 U	1.0 U	20 U	3.0 U	1 U	1.0 UJ	2.0 U	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	0.2 U	1.0 U	1.0 U
1,1,2,2-Tetrachloroethane in ug/L			1.0 U																				
1,1,2-Trichloroethane in ug/L			1.0 U																				
1,1-Dichloroethane in ug/L	1.49		17	4.6	4.2	7.6	3.9	20 U	3.0 U	4.2	1.4 J	2.0 U	0.6 U	0.4	0.2 U	0.2 U	0.2 J	0.2	1.0 U	0.49	0.42	2.9	3.4
1,1-Dichloroethene in ug/L	0.20 U		1.0 U	1.8	1.5	0.4	1.0 U	20 U	3.0 U	1 U	1.0 UJ	2.0 U	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	0.2 U	1.0 U	1.0 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-7 9/21/16	MW-7 9/21/16 FD	MW-8 5/11/07	MW-8 7/30/08	MW-8 12/16/08	MW-8 3/26/09	MW-8 6/26/09	MW-8 9/17/09	MW-8 12/15/09	MW-8 3/23/10	MW-8 6/16/10	MW-8 9/23/10	MW-8 12/16/10	MW-8 3/17/11	MW-8 9/15/11	MW-8 12/13/11	MW-8 4/2/12	MW-8 6/12/12	MW-8 9/24/12	MW-8 12/12/12	MW-8 12/12/12 FD	MW-8 3/19/13	MW-8 6/18/13
1,1-Dichloropropene in ug/L			1.0 U																				
1,2,3-Trichlorobenzene in ug/L			1.0 U																				
1,2,3-Trichloropropane in ug/L			1.0 U																				
1,2,4-Trichlorobenzene in ug/L			1.0 U																				
1,2,4-Trimethylbenzene in ug/L			1.0 U																				
1,2-Dibromo-3-chloropropane in ug/L			1.0 U																				
1,2-Dibromoethane (EDB) in ug/L			0.01 U																				
1,2-Dichlorobenzene in ug/L			1.0 U																				
1,2-Dichloroethane (EDC) in ug/L	0.20 U		1.0 U	1 U	1 U	0.2 U	1.0 U	20 U	3.0 U	1 U	1.0 UJ	2.0 U	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	0.2 U	1.0 U	1.0 U
1,2-Dichloropropane in ug/L			1.0 U																				
1,3,5-Trimethylbenzene in ug/L			1.0 U																				
1,3-Dichlorobenzene in ug/L			1.0 U																				
1,3-Dichloropropane in ug/L			1.0 U																				
1,4-Dichlorobenzene in ug/L			1.0 U																				
2,2-Dichloropropane in ug/L			1.0 U																				
2-Chlorotoluene in ug/L			1.0 U																				
4-Chlorotoluene in ug/L			1.0 U																				
Benzene in ug/L			1.0 U																				
Bromobenzene in ug/L			1.0 U																				
Bromodichloromethane in ug/L			1.0 U																				
Bromoform in ug/L			1.0 U																				
Bromomethane in ug/L			1.0 U																				
Carbon tetrachloride in ug/L			1.0 U																				
Chlorobenzene in ug/L			1.0 U																				
Chloroethane in ug/L	0.20 U		1.0 U	1 U	1 U	0.2 U	1.0 U	20 U	3.0 U	1 U	1.0 UJ	2.0 U	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	0.2 U	1.0 U	1.0 U
Chloroform in ug/L			1.0 U																				
Chloromethane in ug/L			1.0 U																				
cis-1,2-Dichloroethene (DCE) in ug/L	6.08		1.6	350	350	89	190	95	42	42	16 J	11	8.4	4.3	5.3	6.2	3.4	3.8	3.9	4.1	4.2	5.0	6.5
cis-1,3-Dichloropropene in ug/L			1.0 U																				
Dibromochloromethane in ug/L			1.0 U																				
Dibromomethane in ug/L			1.0 U																				
Dichlorodifluoromethane in ug/L			1.0 U																				
Ethylbenzene in ug/L			1.0 U																				
Hexachlorobutadiene in ug/L			1.0 U																				
Isopropylbenzene in ug/L			1.0 U																				
Methylene chloride in ug/L			1.0 U																				
n-Butylbenzene in ug/L			1.0 U																				
n-Propylbenzene in ug/L			1.0 U																				
p-Isopropyltoluene in ug/L			1.0 U																				
sec-Butylbenzene in ug/L			1.0 U																				
Styrene in ug/L			1.0 U																				
tert-Butylbenzene in ug/L			1.0 U																				
Tetrachloroethene (PCE) in ug/L	0.20 U		1.0 U	1 U	1 U	0.2 U	1.0 U	20 U	3.0 U	1 U	1.0 UJ	2.0 U	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	0.2 U	1.0 U	1.0 U
Toluene in ug/L			1.0 U																				
trans-1,2-Dichloroethene in ug/L	0.39		1.0 U	5.8	5.3	0.4	3.8	20 U	3.0 U	1.2	1.0 UJ	2.0 U	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 J	1.0 U	0.2 U	0.2 U	1.0 U	1.0 U
trans-1,3-Dichloropropene in ug/L			1.0 U																				
Trichloroethene (TCE) in ug/L	42.0		76	2,900	2,500	770	580	630	300	190	170 J	150	94	53	62	51	36	39	43	38	33	33	33
Trichlorofluoromethane in ug/L			1.0 U																				
Vinyl chloride in ug/L	0.20 U		12	1.8	2.7	6.3	4.9	20 U	3.0 U	1 U	1.0 UJ	2.0 U	0.6 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	1.0 U	0.2 U	0.2 U	1.9	1.0 U
Xylenes (total) in ug/L			1.0 U																				
Naphthalene in ug/L			1.0 U																				
Total Chlorinated Ethenes in umol/L	0.39		18	26	23	6.9	6.5	6.2	2.8	1.9	1.5	1.3	0.82	0.45	0.53	0.46	0.31	0.34	0.39	0.34	0.3	0.35	0.34
Field Parameters																							
Dissolved Oxygen in mg/L	0.22				0.04	0.24	0.28	0.26	0.22	0.10	0.02	0.30	0.18	0.27	0.17	0.65	0.47	0.09	0.31	0.09		2.99	0.10
ORP in mVolts	73.9				25.8 R	264 R	372 R	-47	-15	21	-61.2	-97.3	38.5	41.8	-87.1	-43.2	-298.6	-444.6	-37.1	16.4		35	27.3
pH in pH Units	5.20				6.21	5.77	6.09	6.41	6.21	5.96	6.61	5.75	8.18 R	7.82 R	6.31	6.14	6.17	6.07	6.50	6.16		5.88	6.31
Specific Conductance in us/cm	636				602	537	1,078	1,741	1,348	1,517	1,412	1,551	1,388	1,337	1,612	1,575	1,324	1,365	1,022	1,223		774	667
Temperature in deg C	17.2				14.97	12.73	14.43	17.63	15.15	13.65	14.98	17.39	15.64	12.69	16.6	15.8	13.1	12.6	16.5	15.7		12.5	14.8
Turbidity in NTU	27.7														13.8	10.4	1	1.62	4.45	1.5		3.34	3.86

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-8 9/27/13	MW-8 12/10/13	MW-8 3/20/14	MW-8 6/12/14	MW-8 9/22/14	MW-8 12/18/14	MW-8 3/17/15	MW-8 9/22/15	MW-8 9/21/16	MW-9 7/30/08	MW-9 12/17/08	MW-9 3/30/09	MW-9 6/23/09	MW-9 9/14/09	MW-9 12/16/09	MW-9 3/23/10	MW-9 6/16/10	MW-9 9/23/10	MW-9 12/16/10	MW-9 3/16/11	MW-9 9/14/11	MW-9 12/13/11	MW-9 4/4/12
Metals																							
Dissolved Aluminum in ug/L					50 U																		
Dissolved Cadmium in ug/L	0.1 U		0.1 U		0.1 U			0.1 U	0.100 U														0.1 U
Dissolved Calcium in ug/L					62,800																		
Dissolved Chromium (Total) in ug/L																							
Dissolved Copper in ug/L	0.9		1.5		0.5 U			0.5 U	0.726			0.6				0.6		0.7					0.8
Dissolved Iron in ug/L					18,900																		
Dissolved Iron, Ferrous, Fe+2 in ug/L							14,900																
Dissolved Lead in ug/L																							
Dissolved Magnesium in ug/L					21,100																		
Dissolved Manganese in ug/L					1,470																		
Dissolved Nickel in ug/L	3,920		2,960		5,930			12,000	8,710			7.8				3.8		5					2.1
Dissolved Potassium in ug/L					18,000																		
Dissolved Silicon in ug/L					49,300																		
Dissolved Sodium in ug/L					48,800																		
Dissolved Zinc in ug/L	8		5		4			5	9.60			4 U				11		7					7
Iron, Ferrous, Fe+2 in ug/L																							
Total Antimony in ug/L																							
Total Arsenic in ug/L	1.0		0.8		1.1											56.3		52.4					
Total Barium in ug/L	30		23.3		19.8											24.5		27.6					
Total Beryllium in ug/L																							
Total Cadmium in ug/L	0.2 U		0.1 U		0.1 U																		0.1 U
Total Calcium in ug/L																							
Total Chromium (Total) in ug/L																							
Total Copper in ug/L	2		1.4		0.8																		9.3
Total Iron in ug/L							16,500									26,000		35,700					
Total Lead in ug/L																							
Total Magnesium in ug/L																							
Total Manganese in ug/L							1,210									1,480		944					
Total Mercury in ug/L																							
Total Nickel in ug/L	3,960		3,140		5,860																		4.4
Total Potassium in ug/L																							
Total Selenium in ug/L																							
Total Silicon in ug/L																							
Total Silver in ug/L																							
Total Sodium in ug/L																							
Total Thallium in ug/L																							
Total Zinc in ug/L	10 U		5		5 J																		23
TCLP Metals																							
Total Mercury in ug/L																							
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3					15		15.6																
Bicarbonate in mg/L as CaCO3					15		15.6																
Carbonate in mg/L as CaCO3					1 U		1.0 U																
Chloride in mg/L					34.3																		
Cyanide (total) in mg/L																							
Dissolved Calcium in ug/L					62,800																		
Dissolved Potassium in ug/L					18,000																		
Dissolved Sodium in ug/L					48,800																		
Ethane in ug/L							1.2 U																
Ethene in ug/L							1.1 U																
Hydroxide in mg/L as CaCO3					1 U		1.0 U																
Methane in ug/L							0.7 U																
Nitrate + Nitrite in mg-N/L																							
Nitrate as Nitrogen in mg-N/L					0.1 U		0.1																
Nitrite as Nitrogen in mg-N/L							0.1 U																
ortho-Phosphorus in mg/L					0.1 U																		
pH in pH units																							
Sulfate in mg/L					341		302 J																
Sulfide in mg/L					0.05 U																		
Total Calcium in ug/L																							
Total Organic Carbon in mg/L					1.5 U																		
Total Potassium in ug/L																							
Total Sodium in ug/L																							
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L																							
1,1,1-Trichloroethane in ug/L	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	0.20 U	1 U	1 U	0.2 U	1.0 U	5.0 U	5.0 U	4.0 U	2.0 UJ	2.0 U	2.0 U	0.6 U	1.0 U	0.6 U	0.6 U
1,1,2,2-Tetrachloroethane in ug/L																							
1,1,2-Trichloroethane in ug/L																							
1,1-Dichloroethane in ug/L	2.1	1.1	1.0 U	0.48	0.9 J	1.0	1.0 U	1.0 U	0.20 U	4.6	2.7	2.2	2.4	5.0 U	5.0 U	4.4	3.0 J	2.5	2.2	1.2	1.4	1.6	1.1
1,1-Dichloroethene in ug/L	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	0.20 U	1.3	1.5	1.3	1.0	5.0 U	5.0 U	4.0 U	2.0 UJ	2.0 U	2.0 U	0.6 U	1.0 U	0.6 U	0.6 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-8 9/27/13	MW-8 12/10/13	MW-8 3/20/14	MW-8 6/12/14	MW-8 9/22/14	MW-8 12/18/14	MW-8 3/17/15	MW-8 9/22/15	MW-8 9/21/16	MW-9 7/30/08	MW-9 12/17/08	MW-9 3/30/09	MW-9 6/23/09	MW-9 9/14/09	MW-9 12/16/09	MW-9 3/23/10	MW-9 6/16/10	MW-9 9/23/10	MW-9 12/16/10	MW-9 3/16/11	MW-9 9/14/11	MW-9 12/13/11	MW-9 4/4/12
1,1-Dichloropropene in ug/L																							
1,2,3-Trichlorobenzene in ug/L																							
1,2,3-Trichloropropane in ug/L																							
1,2,4-Trichlorobenzene in ug/L																							
1,2,4-Trimethylbenzene in ug/L																							
1,2-Dibromo-3-chloropropane in ug/L																							
1,2-Dibromoethane (EDB) in ug/L																							
1,2-Dichlorobenzene in ug/L																							
1,2-Dichloroethane (EDC) in ug/L	0.14 J	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	0.20 U	1 U	1 U	0.2 U	1.0 U	5.0 U	5.0 U	4.0 U	2.0 UJ	2.0 U	2.0 U	0.6 U	1.0 U	0.6 U	0.6 U
1,2-Dichloropropane in ug/L																							
1,3,5-Trimethylbenzene in ug/L																							
1,3-Dichlorobenzene in ug/L																							
1,3-Dichloropropane in ug/L																							
1,4-Dichlorobenzene in ug/L																							
2,2-Dichloropropane in ug/L																							
2-Chlorotoluene in ug/L																							
4-Chlorotoluene in ug/L																							
Benzene in ug/L																							
Bromobenzene in ug/L																							
Bromodichloromethane in ug/L																							
Bromoform in ug/L																							
Bromomethane in ug/L																							
Carbon tetrachloride in ug/L																							
Chlorobenzene in ug/L																							
Chloroethane in ug/L	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	0.20 U	1 U	1 U	0.2 U	1.0 U	5.0 U	5.0 U	4.0 U	2.0 UJ	2.0 U	2.0 U	0.6 U	1.0 U	0.6 U	0.6 U
Chloroform in ug/L																							
Chloromethane in ug/L																							
cis-1,2-Dichloroethene (DCE) in ug/L	29	21	13	11	8.7	6.6	5.7	4.6	0.20 U	52	80	90	67	68	35	22	16 J	14	10	8.8	9.4	7.7	7.6
cis-1,3-Dichloropropene in ug/L																							
Dibromochloromethane in ug/L																							
Dibromomethane in ug/L																							
Dichlorodifluoromethane in ug/L																							
Ethylbenzene in ug/L																							
Hexachlorobutadiene in ug/L																							
Isopropylbenzene in ug/L																							
Methylene chloride in ug/L																							
n-Butylbenzene in ug/L																							
n-Propylbenzene in ug/L																							
p-Isopropyltoluene in ug/L																							
sec-Butylbenzene in ug/L																							
Styrene in ug/L																							
tert-Butylbenzene in ug/L																							
Tetrachloroethene (PCE) in ug/L	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	0.20 U	1 U	1 U	0.2 U	1.0 U	5.0 U	5.0 U	4.0 U	2.0 UJ	2.0 U	2.0 U	0.6 U	1.0 U	0.6 U	0.6 U
Toluene in ug/L																							
trans-1,2-Dichloroethene in ug/L	0.66 J	1.0 U	1.0 U	0.56	1 U	1.0 U	1.0 U	1.0 U	0.20 U	3.2	3.4	1.3	4.1	5.0 U	5.0 U	4.0 U	2.0 UJ	2.0 U	2.0 U	0.7	1.0 U	0.6	0.6 U
trans-1,3-Dichloropropene in ug/L																							
Trichloroethene (TCE) in ug/L	54	49	34	41	51	44	40	45	0.20 U	550	350		410	450	350	280	260 J	250	190	110	120	120	95
Trichlorofluoromethane in ug/L																							
Vinyl chloride in ug/L	1.0 U	1.0 U	1.0 U	0.2 U	1 U	1.0 U	1.0 U	1.0 U	0.20 U	1 U	1 U	0.5	1.0 U	5.0 U	5.0 U	4.0 U	2.0 UJ	2.0 U	2.0 U	0.6 U	1.0 U	0.6 U	0.6 U
Xylenes (total) in ug/L																							
Naphthalene in ug/L																							
Total Chlorinated Ethenes in umol/L	0.74	0.61	0.42	0.44	0.5	0.43	0.39	0.41	ND	4.8	3.6		3.9	4.2	3.1	2.4	2.2	2.1	1.6	0.95	1.0	1.0	0.82
Field Parameters																							
Dissolved Oxygen in mg/L	0.26	0.43	0.39	0.36	0.01		0.33	0.28	0.20		0.12	0.34	0.13		0.11	0.64	0.29	0.15	0.11	0.24	0.62	0.50	0.72
ORP in mVolts	-106.9	48.2	6.5	245.8	23.3		77.4	27.4	23.7		248.5 R	278 R	339 R		-060	-64.8	-92.5	-233.4	-31.4	3.7	-224.8	-131.2	-96.9
pH in pH Units	6.14	6.14	6.25	6.14	6.18		6.18	6.28	7.27		6.31	6.34	6.93		6.51	6.35	6.85	5.81	8.24 R	9.02 R	6.71	6.57	6.75
Specific Conductance in us/cm	1,274	1,086	860.0	866	866		755	830	611.8		560	655	736		779	846	8.42	1,092	885	780	823	919	1,125
Temperature in deg C	16.7	15.6	12.8	14	17.4		13.5	18.0	14.8		14.84	13.66	15.77		14.99	13.98	15.45	16.44	14.97	13.62	16.5	14.4	13.1
Turbidity in NTU	2.27	4.69	7.51	3.1	3.02		3.21	4.68	13.2												5.07	4.33	9.57

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-9 6/12/12	MW-9 9/24/12	MW-9 3/21/13	MW-9 9/26/13	MW-9 3/20/14	MW-9 9/26/14	MW-9 9/22/15	MW-9 9/22/16	MW-16 3/27/09	MW-16 6/24/09	MW-16 9/16/09	MW-16 3/24/10	MW-16 9/21/10	MW-16 3/16/11	MW-16 9/14/11	MW-16 12/12/11	MW-16 4/2/12	MW-16 9/20/12	MW-16 3/20/13	MW-16 9/25/13	MW-16 3/17/14	MW-16 9/26/14	MW-16 9/22/15
Metals																							
Dissolved Aluminum in ug/L																							
Dissolved Cadmium in ug/L		0.1 U	0.1 U	0.1 U	0.1 U												0.1 U	0.1 U					0.2
Dissolved Calcium in ug/L																							
Dissolved Chromium (Total) in ug/L																							
Dissolved Copper in ug/L		0.5 U	0.5 U	0.5 U	0.8	0.5 U			7						4.7	3.6	8.7	1.0	3.9	5.3	9.8	4.3	6.4
Dissolved Iron in ug/L																							
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L																							
Dissolved Magnesium in ug/L																							
Dissolved Manganese in ug/L																							
Dissolved Nickel in ug/L		2.3	2.5	2.0	2.4	3.5			32						5.7	5.5	1.7	2.3	1.4	3.5	4.0	7.7	9.1
Dissolved Potassium in ug/L																							
Dissolved Silicon in ug/L																							
Dissolved Sodium in ug/L																							
Dissolved Zinc in ug/L		5	11	4 U	7	6			90						18	24	22	4 U	10	19	36	27	27
Iron, Ferrous, Fe+2 in ug/L									4,580		5,880												
Total Antimony in ug/L																							
Total Arsenic in ug/L			30.7	27.1	29.6	28.1																	
Total Barium in ug/L			10.8	10.9	9.7	14																	
Total Beryllium in ug/L																							
Total Cadmium in ug/L		0.1 U	0.1 U	0.1 U	0.1 U												0.1 U	0.1					
Total Calcium in ug/L																	7,810						
Total Chromium (Total) in ug/L																							
Total Copper in ug/L		1.0	0.5 U	2.3	2.2	0.8											8.6	20.6	12.7	29.8	11.3 J	12.5	
Total Iron in ug/L				16,300		19,000			6,340		5,250		46,900				550			18,600		4,360	
Total Lead in ug/L																							
Total Magnesium in ug/L																	1,710						
Total Manganese in ug/L				828		1,040			359		409		195				29.2			144		151	
Total Mercury in ug/L																							
Total Nickel in ug/L		2.5	2.8	2.4	4.1	3.9											1.7	2.5	1.6	4.9	4.0	7.6	
Total Potassium in ug/L																	6,840						
Total Selenium in ug/L																							
Total Silicon in ug/L																	20,700 J						
Total Silver in ug/L																							
Total Sodium in ug/L																	13,900						
Total Thallium in ug/L																							
Total Zinc in ug/L		5	10	6	9	5											22	12	13	37	36	28	
TCLP Metals																							
Total Mercury in ug/L																							
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3			65.0		82.2				1.7		9.7						1.0 U						
Bicarbonate in mg/L as CaCO3			65.0		82.2						9.7						1.0 U						
Carbonate in mg/L as CaCO3			1.0 U		1.0 U						1.0 U						1.0 U						
Chloride in mg/L									83.0		36.1						13.9						
Cyanide (total) in mg/L																							
Dissolved Calcium in ug/L																							
Dissolved Potassium in ug/L																							
Dissolved Sodium in ug/L																							
Ethane in ug/L									1.2 U		1.2 U												
Ethene in ug/L									1.1 U		1.1 U												
Hydroxide in mg/L as CaCO3			1.0 U		1.0 U						1.0 U						1.0						
Methane in ug/L									0.7 U		0.7 U												
Nitrate + Nitrite in mg-N/L									36.4														
Nitrate as Nitrogen in mg-N/L									36.3		0.1 U												
Nitrite as Nitrogen in mg-N/L									0.054		0.1 U												
ortho-Phosphorus in mg/L																	0.1 UJ						
pH in pH units									4.81		5.31												
Sulfate in mg/L			247		249				51.5		224						12.8						
Sulfide in mg/L			0.050 U		0.050 UJ												0.050 U						
Total Calcium in ug/L																	7,810						
Total Organic Carbon in mg/L			8.40		9.33				4.48		1.72						8.33						
Total Potassium in ug/L																	6,840						
Total Sodium in ug/L																	13,900						
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L																							
1,1,1-Trichloroethane in ug/L	0.4 U	1.0 U	2.0 U	2.0 U	2.0 U	1 U	1.0 U	0.20 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
1,1,2,2-Tetrachloroethane in ug/L																							
1,1,2-Trichloroethane in ug/L																							
1,1-Dichloroethane in ug/L	1.4	1.8	2.0 U	2.1	2.1	3.6	3.5	2.77	1.0 U	0.3	0.4	0.2 U	0.2	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
1,1-Dichloroethene in ug/L	0.3 J	1.0 U	2.0 U	0.46 J	2.0 U	0.28 J	1.0 U	0.30	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-9 6/12/12	MW-9 9/24/12	MW-9 3/21/13	MW-9 9/26/13	MW-9 3/20/14	MW-9 9/26/14	MW-9 9/22/15	MW-9 9/22/16	MW-16 3/27/09	MW-16 6/24/09	MW-16 9/16/09	MW-16 3/24/10	MW-16 9/21/10	MW-16 3/16/11	MW-16 9/14/11	MW-16 12/12/11	MW-16 4/2/12	MW-16 9/20/12	MW-16 3/20/13	MW-16 9/25/13	MW-16 3/17/14	MW-16 9/26/14	MW-16 9/22/15
1,1-Dichloropropene in ug/L																							
1,2,3-Trichlorobenzene in ug/L																							
1,2,3-Trichloropropane in ug/L																							
1,2,4-Trichlorobenzene in ug/L																							
1,2,4-Trimethylbenzene in ug/L																							
1,2-Dibromo-3-chloropropane in ug/L																							
1,2-Dibromoethane (EDB) in ug/L																							
1,2-Dichlorobenzene in ug/L																							
1,2-Dichloroethane (EDC) in ug/L	0.4 U	1.0 U	2.0 U	2.0 U	2.0 U	1 U	1.0 U	0.20 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
1,2-Dichloropropane in ug/L																							
1,3,5-Trimethylbenzene in ug/L																							
1,3-Dichlorobenzene in ug/L																							
1,3-Dichloropropane in ug/L																							
1,4-Dichlorobenzene in ug/L																							
2,2-Dichloropropane in ug/L																							
2-Chlorotoluene in ug/L																							
4-Chlorotoluene in ug/L																							
Benzene in ug/L																							
Bromobenzene in ug/L																							
Bromodichloromethane in ug/L																							
Bromoform in ug/L																							
Bromomethane in ug/L																							
Carbon tetrachloride in ug/L																							
Chlorobenzene in ug/L																							
Chloroethane in ug/L	0.4 U	1.0 U	2.0 U	2.0 U	2.0 U	1 U	1.0 U	0.20 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
Chloroform in ug/L																							
Chloromethane in ug/L																							
cis-1,2-Dichloroethene (DCE) in ug/L	9.3	8.7	7.4	11	12	16	24	26.3	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
cis-1,3-Dichloropropene in ug/L																							
Dibromochloromethane in ug/L																							
Dibromomethane in ug/L																							
Dichlorodifluoromethane in ug/L																							
Ethylbenzene in ug/L																							
Hexachlorobutadiene in ug/L																							
Isopropylbenzene in ug/L																							
Methylene chloride in ug/L																							
n-Butylbenzene in ug/L																							
n-Propylbenzene in ug/L																							
p-Isopropyltoluene in ug/L																							
sec-Butylbenzene in ug/L																							
Styrene in ug/L																							
tert-Butylbenzene in ug/L																							
Tetrachloroethene (PCE) in ug/L	0.4 U	1.0 U	2.0 U	2.0 U	2.0 U	1 U	1.0 U	0.20 U	1.0 U	0.2 U	0.2 U	0.2	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
Toluene in ug/L																							
trans-1,2-Dichloroethene in ug/L	0.9	1.0 U	2.0 U	1.2 J	2.0 U	0.89 J	1.2	1.05	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
trans-1,3-Dichloropropene in ug/L																							
Trichloroethene (TCE) in ug/L	120	110	74	110	69	100	65	62.1	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.3	0.2 U		0.2 U	0.20	0.2 U	0.2 U	0.20 U	0.2 U	
Trichlorofluoromethane in ug/L																							
Vinyl chloride in ug/L	0.2 J	1.0 U	2.0 U	2.0 U	2.0 U	0.1 J	1.0 U	0.20 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U	0.2 U	0.2 U	0.20 U	0.2 U	
Xylenes (total) in ug/L																							
Naphthalene in ug/L																							
Total Chlorinated Ethenes in umol/L	1.0	0.95	0.68	0.99	0.69	0.94	0.77	0.76	ND	ND	ND	0.0067	ND	0.0076	ND		ND	0.0069	ND	ND	ND	ND	
Field Parameters																							
Dissolved Oxygen in mg/L	0.17	0.36	1.54	0.29	0.37	0.01	0.35	0.11	0.50	0.23	0.27	0.11	0.14	2.00	0.91	0.55	3.00	0.31	2.79	0.33	3.87	0.01	0.20
ORP in mVolts	-458.4	-31.3	-44.4	-155.4	-51.6	13.1	17.7	-32.9	170 R	393 R	78.9	24.3	-311.1	64.6	5.6	1.1	150.6	-87.4	12.4	-107.8	107.1	33.0	72.1
pH in pH Units	6.43	6.88	6.49	6.45	6.69	6.51	6.35	6.07	4.37	4.38	5.23	5.92	5.45	7.41 R	5.38	5.65	4.90	6.58	5.30	5.36	4.87	6.23	5.27
Specific Conductance in us/cm	1,220	682.0	6.99	717	591.1	749	506.0	637	709	627	643	495	700	290	296.5	426.7	218.7	460.7	193.2	290.2	410.2	4,850	373.6
Temperature in deg C	14.7	16.2	13.1	16.2	13.4	16.8	17.1	17.5	12.81	14.77	15.61	13.39	15.89	10.75	16.5	14.2	10.7	17.4	11.9	16.6	10.7	15.6	16.7
Turbidity in NTU	2.97	5.35	23.2	2.74	7.39	1.29	2.76	10.7							13.9	3.88	10.2	51.1	21.5	17.6	9.54	1.11	54.4

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-16 9/23/16	PMW-1 6/29/06	PMW-1 7/30/08	PMW-1 12/18/08	PMW-1 3/23/09	PMW-1 6/22/09	PMW-1 9/15/09	PMW-1 3/23/10	PMW-1 9/21/10	PMW-1 3/14/11	PMW-1 11/1/11	PMW-1 12/14/11	PMW-1 4/4/12	PMW-1 6/13/12	PMW-1 9/21/12	PMW-1 12/12/12	PMW-1 3/19/13	PMW-1 6/18/13	PMW-1 9/27/13	PMW-1 12/10/13	PMW-1 3/21/14	PMW-1 6/12/14	PMW-1 9/23/14
Metals																							
Dissolved Aluminum in ug/L																							
Dissolved Cadmium in ug/L	0.100 U																						
Dissolved Calcium in ug/L																							
Dissolved Chromium (Total) in ug/L																							
Dissolved Copper in ug/L	5.06				15.0																		
Dissolved Iron in ug/L																							
Dissolved Iron, Ferrous, Fe+2 in ug/L																							
Dissolved Lead in ug/L					1 U																		
Dissolved Magnesium in ug/L																							
Dissolved Manganese in ug/L																							
Dissolved Nickel in ug/L	6.38				391																		
Dissolved Potassium in ug/L																							
Dissolved Silicon in ug/L																							
Dissolved Sodium in ug/L																							
Dissolved Zinc in ug/L	23.9				76																		
Iron, Ferrous, Fe+2 in ug/L																							
Total Antimony in ug/L																							
Total Arsenic in ug/L																							
Total Barium in ug/L																							
Total Beryllium in ug/L																							
Total Cadmium in ug/L																							
Total Calcium in ug/L																							
Total Chromium (Total) in ug/L																							
Total Copper in ug/L																							
Total Iron in ug/L																							
Total Lead in ug/L																							
Total Magnesium in ug/L																							
Total Manganese in ug/L																							
Total Mercury in ug/L																							
Total Nickel in ug/L																							
Total Potassium in ug/L																							
Total Selenium in ug/L																							
Total Silicon in ug/L																							
Total Silver in ug/L																							
Total Sodium in ug/L																							
Total Thallium in ug/L																							
Total Zinc in ug/L																							
TCLP Metals																							
Total Mercury in ug/L																							
Conventional Chemistry Parameters																							
Alkalinity (Total) in mg/L as CaCO3																							
Bicarbonate in mg/L as CaCO3																							
Carbonate in mg/L as CaCO3																							
Chloride in mg/L																							
Cyanide (total) in mg/L																							
Dissolved Calcium in ug/L																							
Dissolved Potassium in ug/L																							
Dissolved Sodium in ug/L																							
Ethane in ug/L																							
Ethene in ug/L																							
Hydroxide in mg/L as CaCO3																							
Methane in ug/L																							
Nitrate + Nitrite in mg-N/L																							
Nitrate as Nitrogen in mg-N/L																							
Nitrite as Nitrogen in mg-N/L																							
ortho-Phosphorus in mg/L																							
pH in pH units																							
Sulfate in mg/L																							
Sulfide in mg/L																							
Total Calcium in ug/L																							
Total Organic Carbon in mg/L																							
Total Potassium in ug/L																							
Total Sodium in ug/L																							
Other (Non-PAH) Semivolatiles																							
1,4-Dioxane in ug/L																							
Volatile Organic Compounds (VOC)																							
1,1,1,2-Tetrachloroethane in ug/L		1.0 U																					
1,1,1-Trichloroethane in ug/L		1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	4.0 U	6.0 U	0.4 U	1.0 U	1.0 U	20 U	10 U	10 U	10 U	2 U
1,1,2,2-Tetrachloroethane in ug/L		1.0 U																					
1,1,2-Trichloroethane in ug/L		1.0 U																					
1,1-Dichloroethane in ug/L		1.0 U	1 U	1.6	1.8	1.4	2.1	2.5	1.2	1.8	1.3	1.2	0.8	4.0 U	6.0 U	2.2	3.0	2.4	20 U	10 U	10 U	10 U	2 U
1,1-Dichloroethene in ug/L		1.0 U	1.9	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	0.2 U	0.2 U	0.8	4.0 U	6.0 U	0.4 U	1.0 U	1.0 U	20 U	10 U	10 U	10 U	2 U

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	MW-16 9/23/16	PMW-1 6/29/06	PMW-1 7/30/08	PMW-1 12/18/08	PMW-1 3/23/09	PMW-1 6/22/09	PMW-1 9/15/09	PMW-1 3/23/10	PMW-1 9/21/10	PMW-1 3/14/11	PMW-1 11/1/11	PMW-1 12/14/11	PMW-1 4/4/12	PMW-1 6/13/12	PMW-1 9/21/12	PMW-1 12/12/12	PMW-1 3/19/13	PMW-1 6/18/13	PMW-1 9/27/13	PMW-1 12/10/13	PMW-1 3/21/14	PMW-1 6/12/14	PMW-1 9/23/14
1,1-Dichloropropene in ug/L		1.0 U																					
1,2,3-Trichlorobenzene in ug/L		1.0 U																					
1,2,3-Trichloropropane in ug/L		1.0 U																					
1,2,4-Trichlorobenzene in ug/L		1.0 U																					
1,2,4-Trimethylbenzene in ug/L		1.0 U																					
1,2-Dibromo-3-chloropropane in ug/L		1.0 U																					
1,2-Dibromoethane (EDB) in ug/L		0.01 U																					
1,2-Dichlorobenzene in ug/L		1.0 U																					
1,2-Dichloroethane (EDC) in ug/L		1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	4.0 U	6.0 U	0.4 U	1.0 U	1.0 U	20 U	10 U	10 U	10 U	2 U
1,2-Dichloropropane in ug/L		1.0 U																					
1,3,5-Trimethylbenzene in ug/L		1.0 U																					
1,3-Dichlorobenzene in ug/L		1.0 U																					
1,3-Dichloropropane in ug/L		1.0 U																					
1,4-Dichlorobenzene in ug/L		1.0 U																					
2,2-Dichloropropane in ug/L		1.0 U																					
2-Chlorotoluene in ug/L		1.0 U																					
4-Chlorotoluene in ug/L		1.0 U																					
Benzene in ug/L		1.0 U																					
Bromobenzene in ug/L		1.0 U																					
Bromodichloromethane in ug/L		1.0 U																					
Bromoform in ug/L		1.0 U																					
Bromomethane in ug/L		1.0 U																					
Carbon tetrachloride in ug/L		1.0 U																					
Chlorobenzene in ug/L		1.0 U																					
Chloroethane in ug/L		1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	4.0 U	6.0 U	0.4 U	1.0 U	1.0 U	20 U	10 U	10 U	10 U	2 U
Chloroform in ug/L		1.0 U																					
Chloromethane in ug/L		1.0 U																					
cis-1,2-Dichloroethene (DCE) in ug/L		900	1,100	100	18	91	100	110	45	68	48	50	820	880	800	110	80	42	590	800	580	270	45
cis-1,3-Dichloropropene in ug/L		1.0 U																					
Dibromochloromethane in ug/L		1.0 U																					
Dibromomethane in ug/L		1.0 U																					
Dichlorodifluoromethane in ug/L		1.0 U																					
Ethylbenzene in ug/L		1.0 U																					
Hexachlorobutadiene in ug/L		1.0 U																					
Isopropylbenzene in ug/L		1.0 U																					
Methylene chloride in ug/L		1.0 U																					
n-Butylbenzene in ug/L		1.0 U																					
n-Propylbenzene in ug/L		1.0 U																					
p-Isopropyltoluene in ug/L		1.0 U																					
sec-Butylbenzene in ug/L		1.0 U																					
Styrene in ug/L		1.0 U																					
tert-Butylbenzene in ug/L		1.0 U																					
Tetrachloroethene (PCE) in ug/L		1.0 U	1 U	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	4.0 U	6.0 U	0.4 U	1.0 U	1.0 U	20 U	10 U	10 U	10 U	2 U
Toluene in ug/L		1.0 U																					
trans-1,2-Dichloroethene in ug/L		1.0 U	23	1.7	1.0 U	2.2	1.3	1.8	1.0 U	0.6	0.4	0.6	17	25	18	1.6	1.0 U	1.0 U	10 J	18	14	10 U	2 U
trans-1,3-Dichloropropene in ug/L		1.0 U																					
Trichloroethene (TCE) in ug/L		260	660	66	21	58	83	80	47	51	31	38	430	760	570	81	57	57	330	450	430	230	69
Trichlorofluoromethane in ug/L		1.0 U																					
Vinyl chloride in ug/L		0.2 U	2.5	1 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.2 U	0.2 U	0.2 U	0.2 U	4.0 U	6.0 U	0.4 U	1.0 U	1.0 U	20 U	10 U	10 U	10 U	2 U
Xylenes (total) in ug/L		1.0 U																					
Naphthalene in ug/L		1.0 U																					
Total Chlorinated Ethenes in umol/L		11	17	1.6	0.37	1.4	1.7	1.8	0.85	1.1	0.74	0.82	12	15	13	1.8	1.3	0.89	9.1	12	9.6	4.8	1.0
Field Parameters																							
Dissolved Oxygen in mg/L	0.24			0.17	0.66	0.37	6.07	5.73	7.68	15.67	9.46	7.28	1.14	0.78	0.76	7.85	8.96	7.89	3.34	0.37	0.40	6.93	7.35
ORP in mVolts	65.6			244.6 R	223 R	618 R	255.8	220	122	4.36	493.2	447.5	375.5	79.9	317	435.2	382.1	422.3	243.5	332	311.7	586.1	470.0
pH in pH Units	5.50			5.50	5.23	3.99	3.77	3.76	3.56	7.55 R	3.84	3.69	3.60	3.85	4.03	3.96	3.74	3.97	3.96	3.91	4.21	3.89	3.91
Specific Conductance in us/cm	360.9			1,572	1,682	1,396	1,620	1,498	1,872	15.35	1,350	1,296	1,499	1,252	755.0	1,068	1,232	1,053	1,132	951	682.0	984	837
Temperature in deg C	16.5			17.09	15.9	16.09	17.84	15.92	17.9	8.75	17.4	16.9	15.0	15.5	17.4	16.6	15.3	16.1	17.5	16.4	15.2	16.1	18.1
Turbidity in NTU	13.0										1.18	2.35	4.98	2.29	5.83	0.77	3.93	4.07	2.5	3.31	4.42	7.19	0.48

Notes

J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

Chemical Name	PMW-1 12/18/14	PMW-1 3/20/15	PMW-1 9/25/15	PMW-1 3/22/16	PMW-1 9/22/16
Metals					
Dissolved Aluminum in ug/L					
Dissolved Cadmium in ug/L			0.3		0.558
Dissolved Calcium in ug/L					
Dissolved Chromium (Total) in ug/L					
Dissolved Copper in ug/L			21.6		36.7
Dissolved Iron in ug/L					
Dissolved Iron, Ferrous, Fe+2 in ug/L					
Dissolved Lead in ug/L					
Dissolved Magnesium in ug/L					
Dissolved Manganese in ug/L					
Dissolved Nickel in ug/L			101		160
Dissolved Potassium in ug/L					
Dissolved Silicon in ug/L					
Dissolved Sodium in ug/L					
Dissolved Zinc in ug/L			54		102
Iron, Ferrous, Fe+2 in ug/L					
Total Antimony in ug/L					
Total Arsenic in ug/L					
Total Barium in ug/L					
Total Beryllium in ug/L					
Total Cadmium in ug/L					
Total Calcium in ug/L					
Total Chromium (Total) in ug/L					
Total Copper in ug/L					
Total Iron in ug/L					
Total Lead in ug/L					
Total Magnesium in ug/L					
Total Manganese in ug/L					
Total Mercury in ug/L					
Total Nickel in ug/L					
Total Potassium in ug/L					
Total Selenium in ug/L					
Total Silicon in ug/L					
Total Silver in ug/L					
Total Sodium in ug/L					
Total Thallium in ug/L					
Total Zinc in ug/L					
TCLP Metals					
Total Mercury in ug/L					
Conventional Chemistry Parameters					
Alkalinity (Total) in mg/L as CaCO3					
Bicarbonate in mg/L as CaCO3					
Carbonate in mg/L as CaCO3					
Chloride in mg/L					
Cyanide (total) in mg/L					
Dissolved Calcium in ug/L					
Dissolved Potassium in ug/L					
Dissolved Sodium in ug/L					
Ethane in ug/L					
Ethene in ug/L					
Hydroxide in mg/L as CaCO3					
Methane in ug/L					
Nitrate + Nitrite in mg-N/L					
Nitrate as Nitrogen in mg-N/L					
Nitrite as Nitrogen in mg-N/L					
ortho-Phosphorus in mg/L					
pH in pH units					
Sulfate in mg/L					
Sulfide in mg/L					
Total Calcium in ug/L					
Total Organic Carbon in mg/L					
Total Potassium in ug/L					
Total Sodium in ug/L					
Other (Non-PAH) Semivolatiles					
1,4-Dioxane in ug/L					
Volatile Organic Compounds (VOC)					
1,1,1,2-Tetrachloroethane in ug/L					
1,1,1-Trichloroethane in ug/L	10 U	2.0 U	1.0 U	1 U	1.00 U
1,1,2,2-Tetrachloroethane in ug/L					
1,1,2-Trichloroethane in ug/L					
1,1-Dichloroethane in ug/L	10 U	2.0 U	2.2	1	1.00 U
1,1-Dichloroethene in ug/L	10 U	2.0 U	1.0 U	1 U	1.16

Appendix C - Historical Groundwater Analytical Results

Art Brass Plating 050067

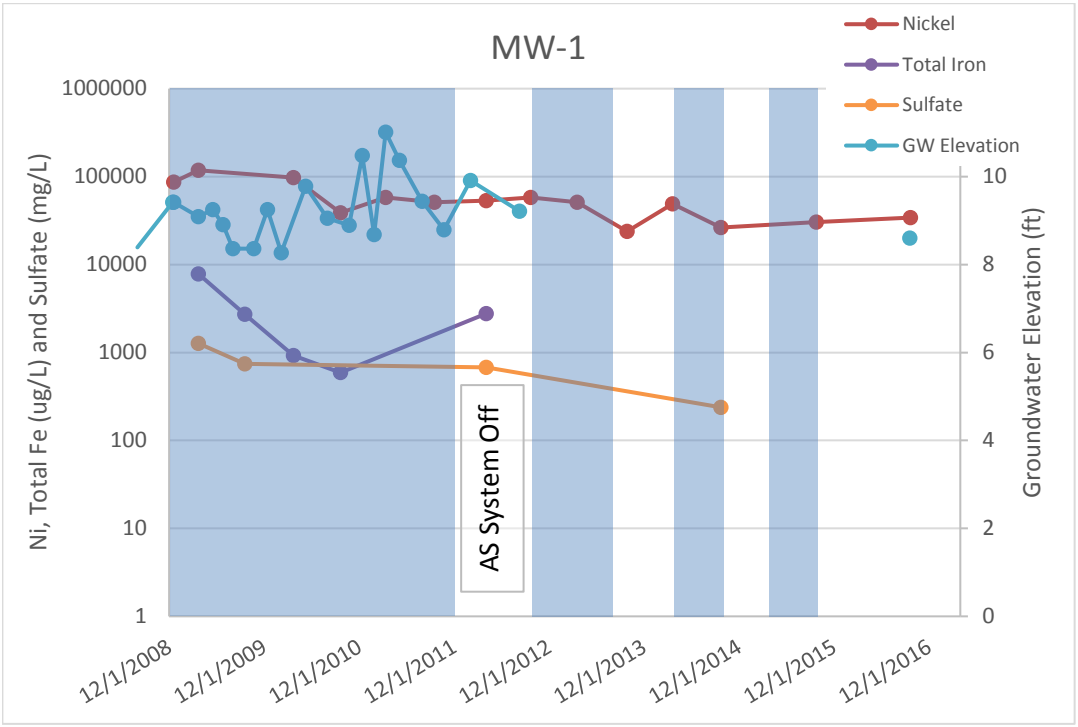
Chemical Name	PMW-1 12/18/14	PMW-1 3/20/15	PMW-1 9/25/15	PMW-1 3/22/16	PMW-1 9/22/16
1,1-Dichloropropene in ug/L					
1,2,3-Trichlorobenzene in ug/L					
1,2,3-Trichloropropane in ug/L					
1,2,4-Trichlorobenzene in ug/L					
1,2,4-Trimethylbenzene in ug/L					
1,2-Dibromo-3-chloropropane in ug/L					
1,2-Dibromoethane (EDB) in ug/L					
1,2-Dichlorobenzene in ug/L					
1,2-Dichloroethane (EDC) in ug/L	10 U	2.0 U	1.0 U	1 UJ	1.00 U
1,2-Dichloropropane in ug/L					
1,3,5-Trimethylbenzene in ug/L					
1,3-Dichlorobenzene in ug/L					
1,3-Dichloropropane in ug/L					
1,4-Dichlorobenzene in ug/L					
2,2-Dichloropropane in ug/L					
2-Chlorotoluene in ug/L					
4-Chlorotoluene in ug/L					
Benzene in ug/L					
Bromobenzene in ug/L					
Bromodichloromethane in ug/L					
Bromoform in ug/L					
Bromomethane in ug/L					
Carbon tetrachloride in ug/L					
Chlorobenzene in ug/L					
Chloroethane in ug/L	10 U	2.0 U	1.0 U	1 U	1.00 U
Chloroform in ug/L					
Chloromethane in ug/L					
cis-1,2-Dichloroethene (DCE) in ug/L	540	410	52	460	488
cis-1,3-Dichloropropene in ug/L					
Dibromochloromethane in ug/L					
Dibromomethane in ug/L					
Dichlorodifluoromethane in ug/L					
Ethylbenzene in ug/L					
Hexachlorobutadiene in ug/L					
Isopropylbenzene in ug/L					
Methylene chloride in ug/L					
n-Butylbenzene in ug/L					
n-Propylbenzene in ug/L					
p-Isopropyltoluene in ug/L					
sec-Butylbenzene in ug/L					
Styrene in ug/L					
tert-Butylbenzene in ug/L					
Tetrachloroethene (PCE) in ug/L	10 U	2.0 U	1.0 U	1 U	1.00 U
Toluene in ug/L					
trans-1,2-Dichloroethene in ug/L	12	9.8	1.0	18	18.9
trans-1,3-Dichloropropene in ug/L					
Trichloroethene (TCE) in ug/L	320	260	53	380	937
Trichlorofluoromethane in ug/L					
Vinyl chloride in ug/L	10 U	2.0 U	1.0 U	1 U	1.00 U
Xylenes (total) in ug/L					
Naphthalene in ug/L					
Total Chlorinated Ethenes in umol/L	8.4	6.4	0.97	7.9	12
Field Parameters					
Dissolved Oxygen in mg/L		0.23	7.68	0.17	0.12
ORP in mVolts		187.6	99.0	37.2	154.5
pH in pH Units		3.93	3.81	4.19	4.22
Specific Conductance in us/cm		868	844	927	999
Temperature in deg C		16.4	18.6	16.4	18.6
Turbidity in NTU		1.42	2.05	6.94	17.3

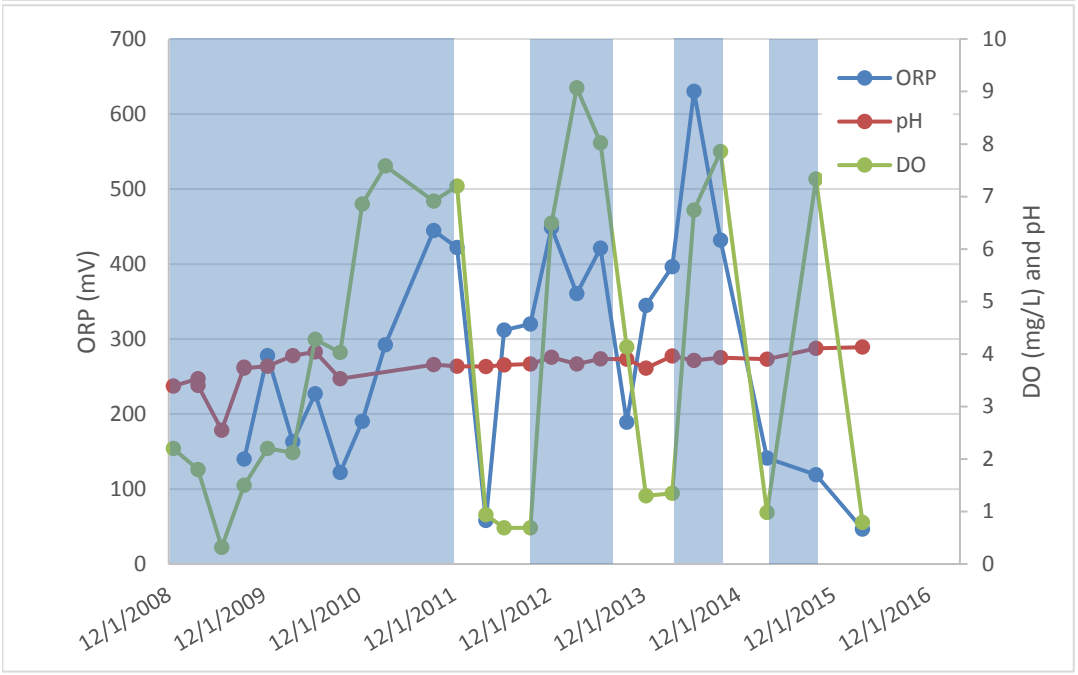
Notes

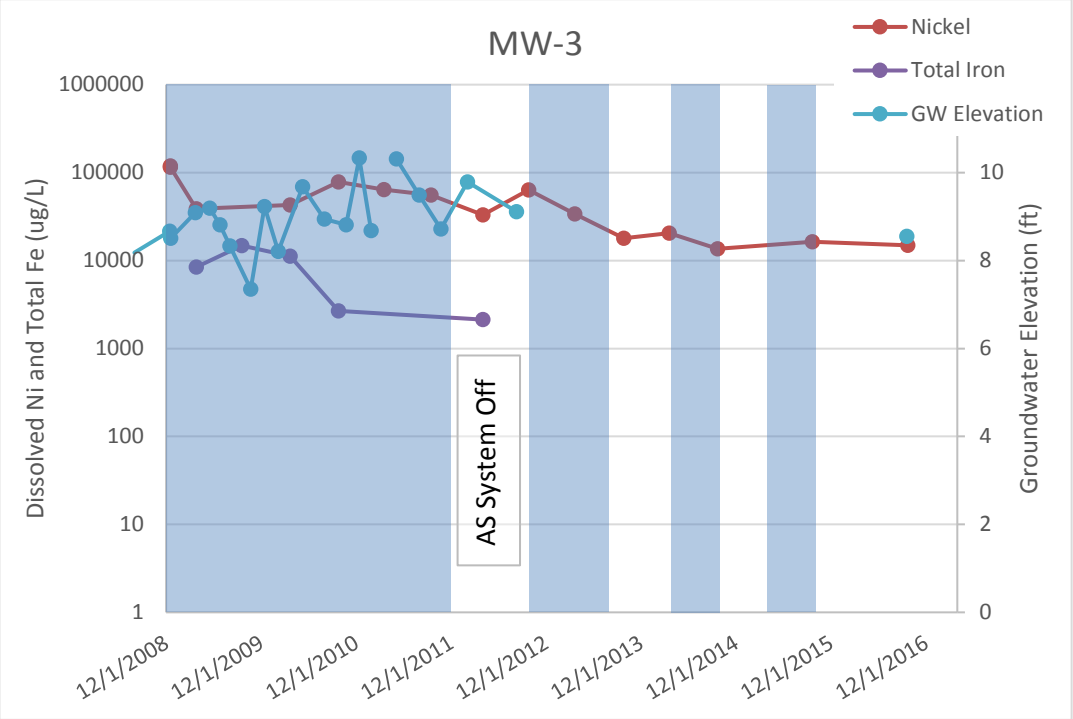
J - Analyte was positively identified. The reported result is an estimate.
R - Rejected.
U - Analyte was not detected at or above the reported result.
UJ - Analyte was not detected at or above the reported estimate

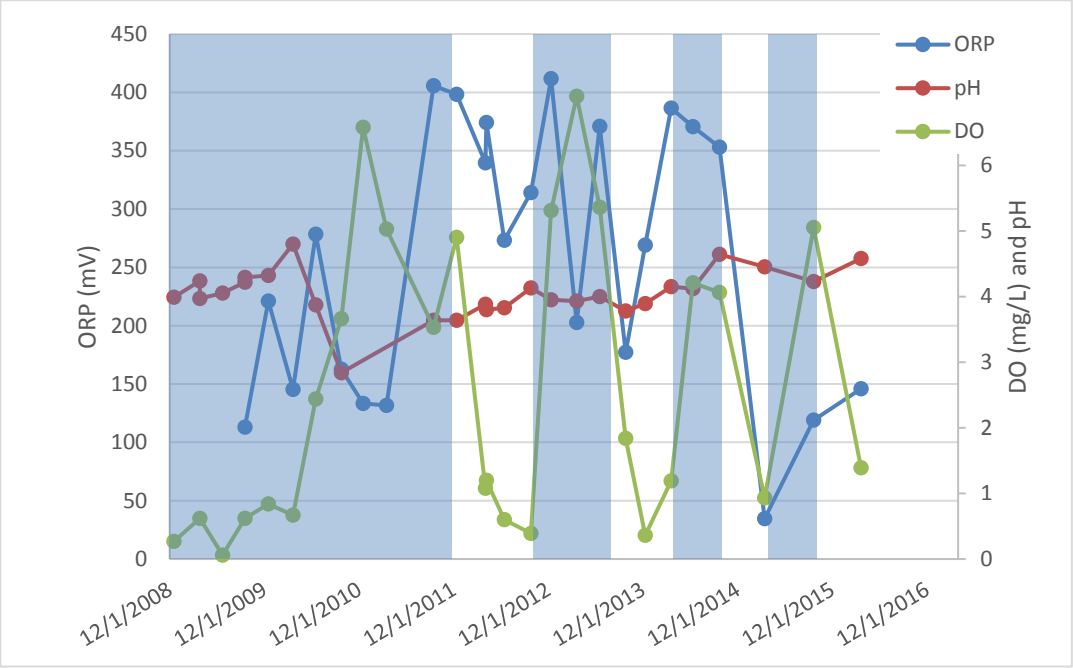
APPENDIX D

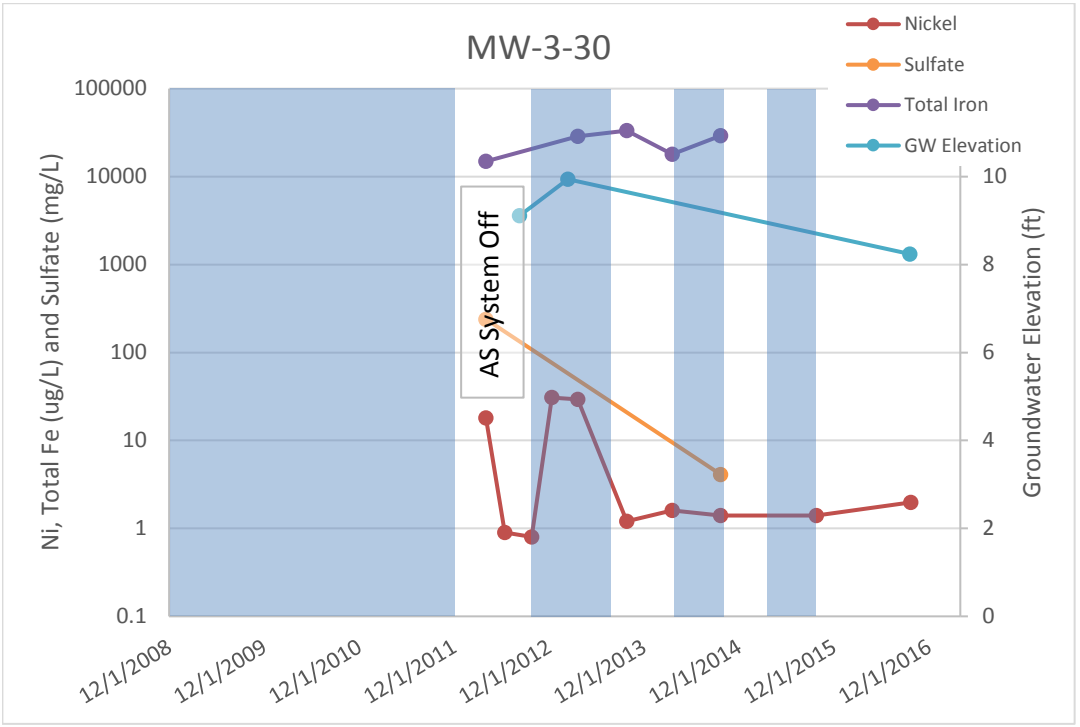
Trend Charts

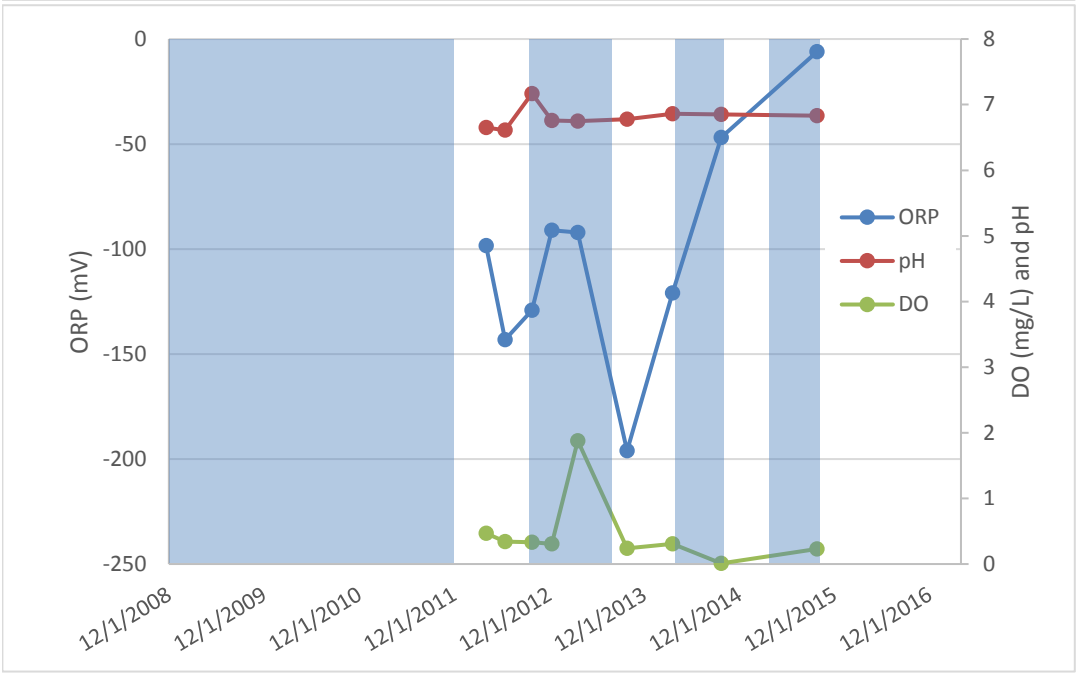

MW-1
Nickel
Total Iron
Sulfate
GW Elevation
Ni, Total Fe (ug/L) and Sulfate (mg/L)
Groundwater Elevation (ft)
1000000
100000
10000
1000
100
10
1
10
8
6
4
2
0
AS System Off
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

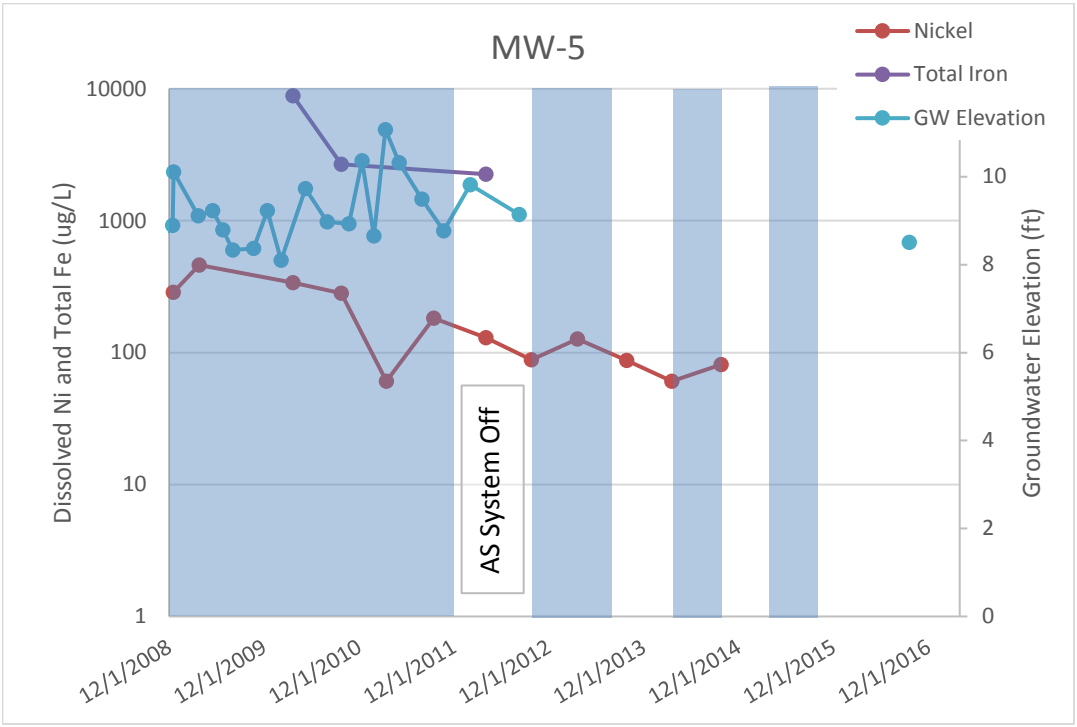

ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
700
600
500
400
300
200
100
0
10
9
8
7
6
5
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

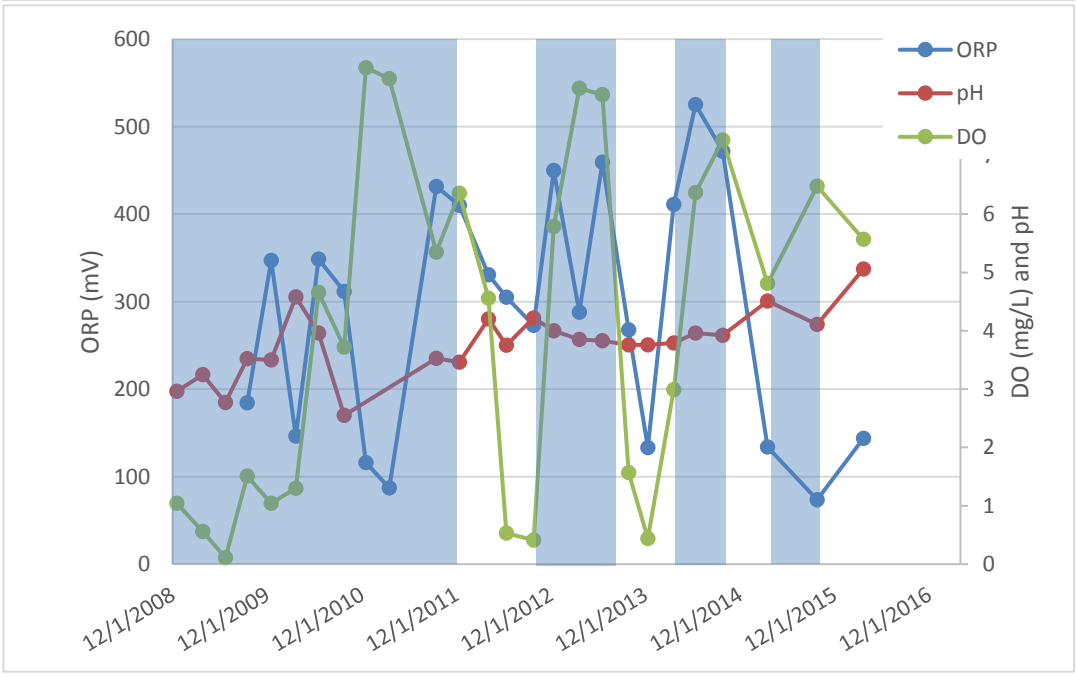

MW-3
Nickel
Total Iron
GW Elevation
Dissolved Ni and Total Fe (ug/L)
Groundwater Elevation (ft)
1000000
100000
10000
1000
100
10
1
10
8
6
4
2
0
AS System Off
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

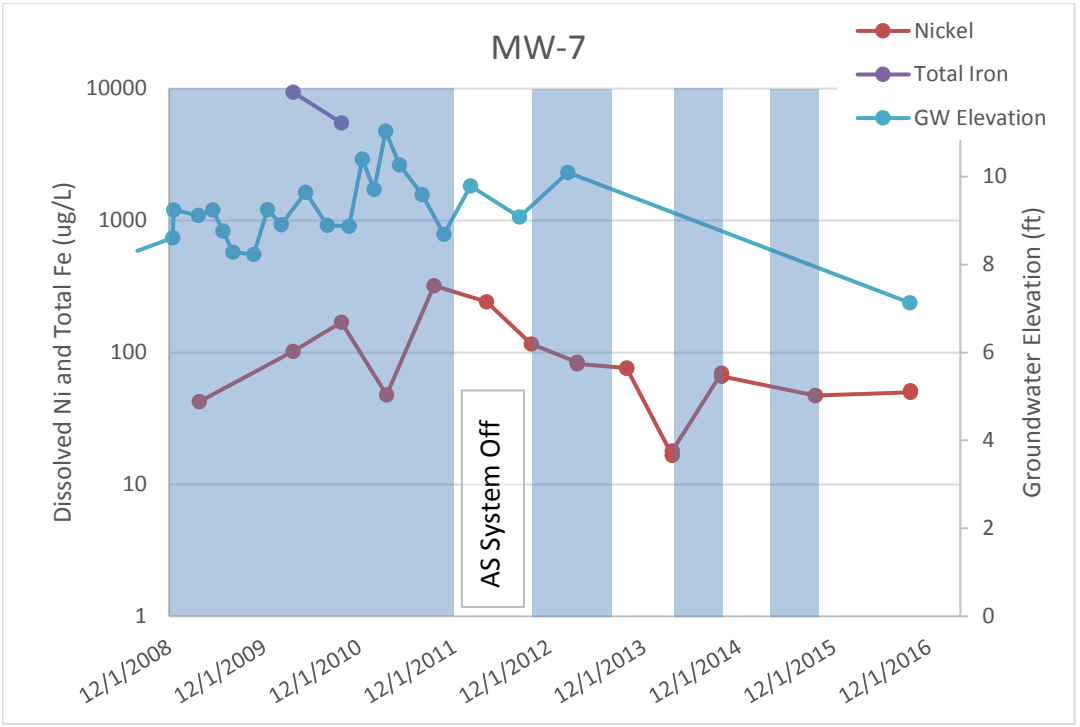

ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
450
400
350
300
250
200
150
100
50
0
6
5
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

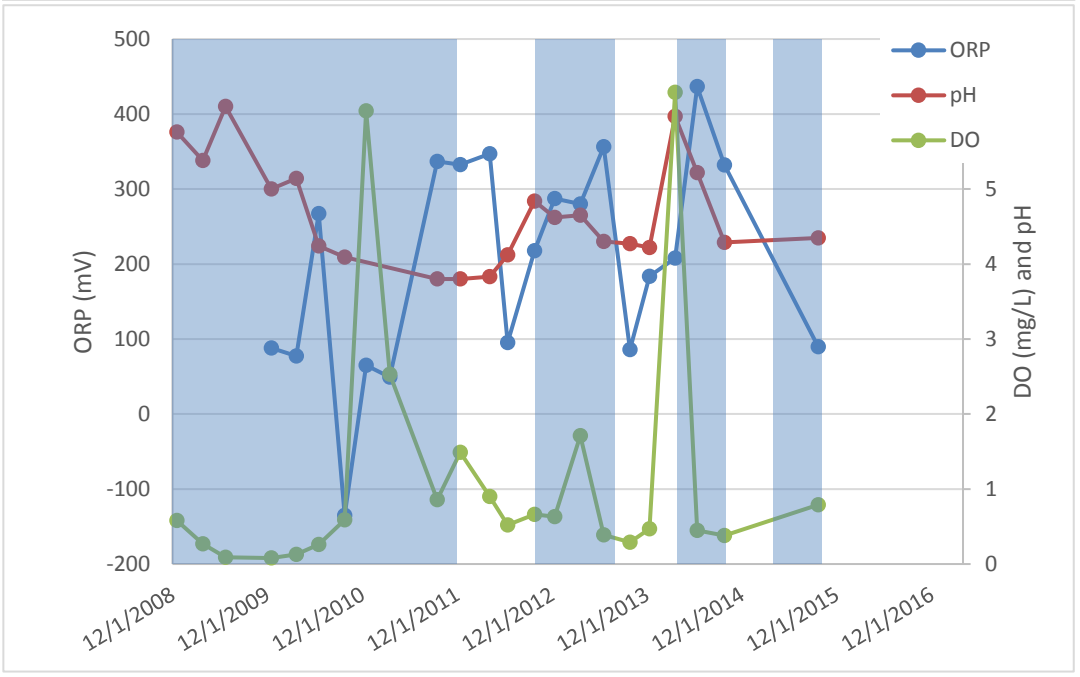

MW-3-30
Nickel
Sulfate
Total Iron
GW Elevation
AS System Off
Ni, Total Fe (ug/L) and Sulfate (mg/L)
Groundwater Elevation (ft)
100000
10000
1000
100
10
1
0.1
10
8
6
4
2
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

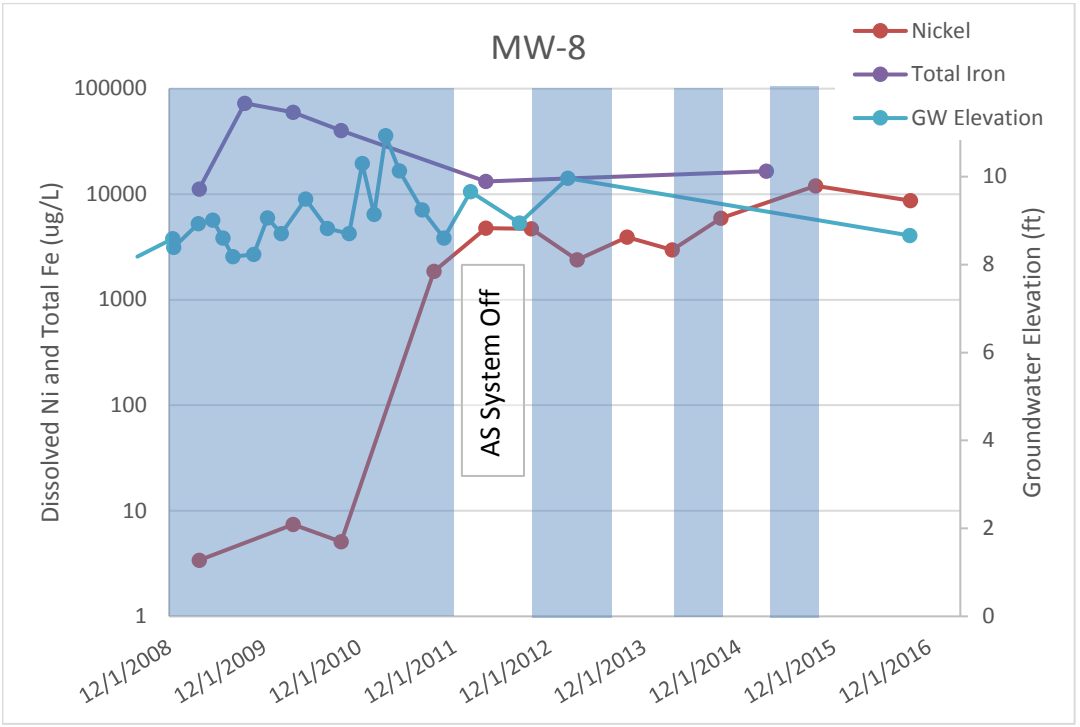

ORP (mV)
DO (mg/L) and pH
ORP
pH
DO
0
-50
-100
-150
-200
-250
8
7
6
5
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

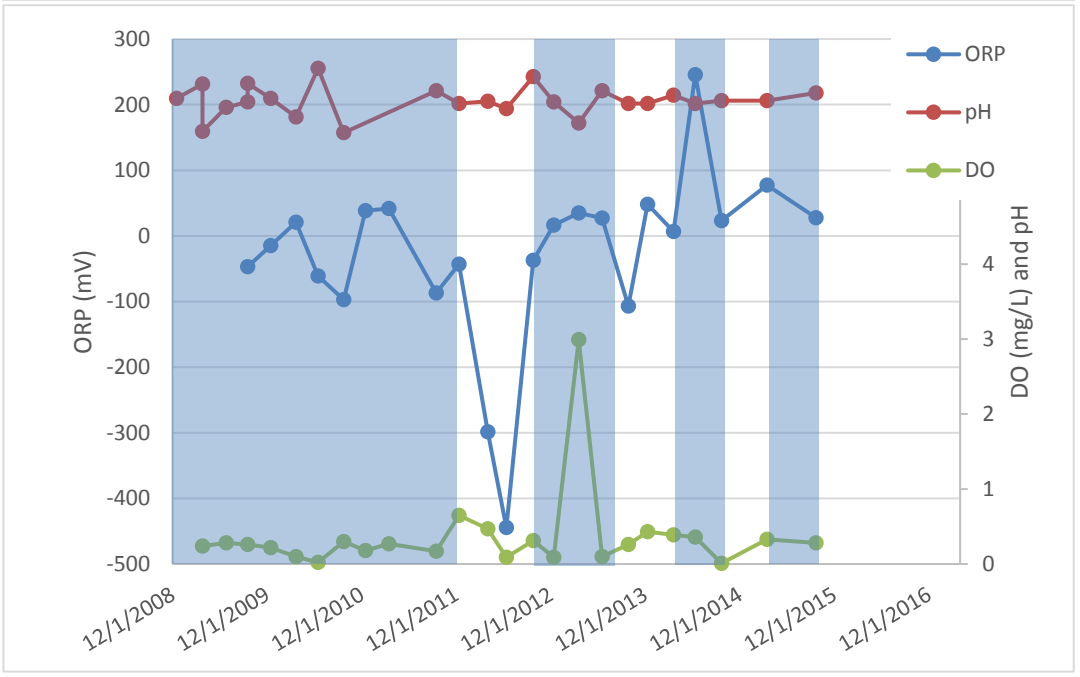

MW-5
Nickel
Total Iron
GW Elevation
Dissolved Ni and Total Fe (ug/L)
Groundwater Elevation (ft)
AS System Off
10000
1000
100
10
1
10
8
6
4
2
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

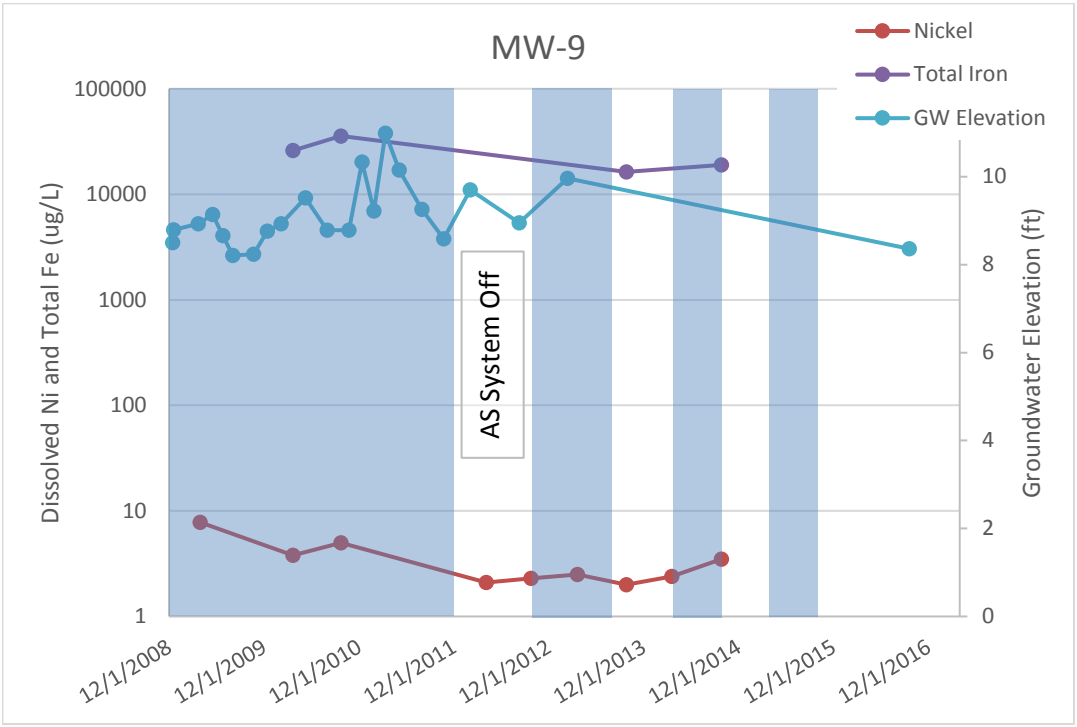

ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
600
500
400
300
200
100
0
6
5
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

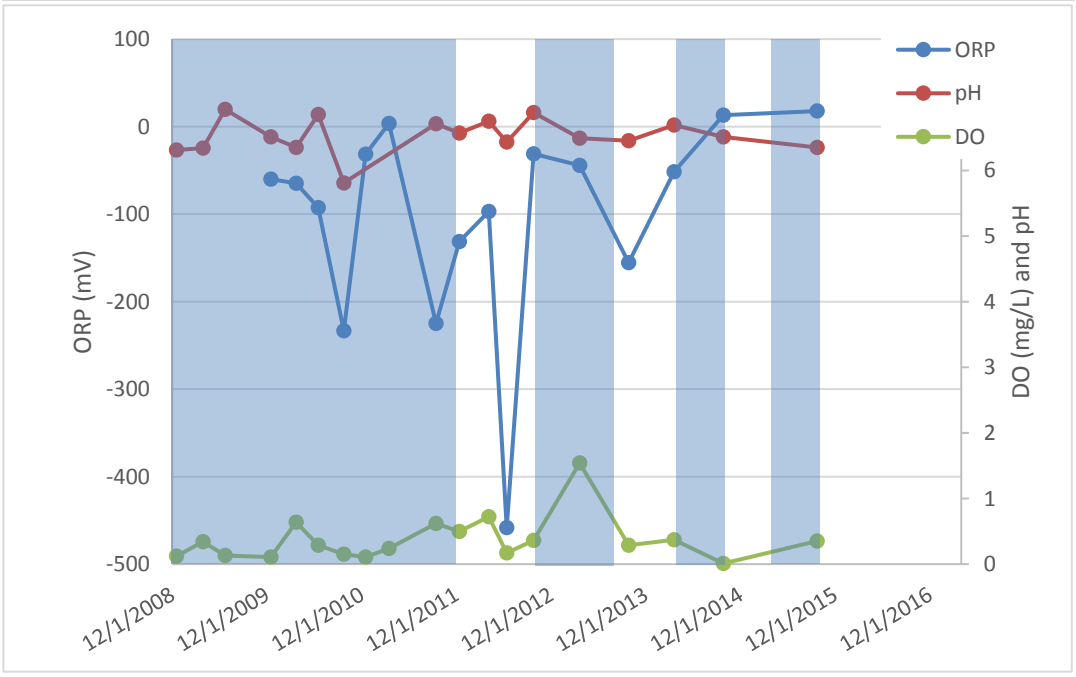

MW-7
Nickel
Total Iron
GW Elevation
Dissolved Ni and Total Fe (ug/L)
Groundwater Elevation (ft)
AS System Off
10000
1000
100
10
1
10
8
6
4
2
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

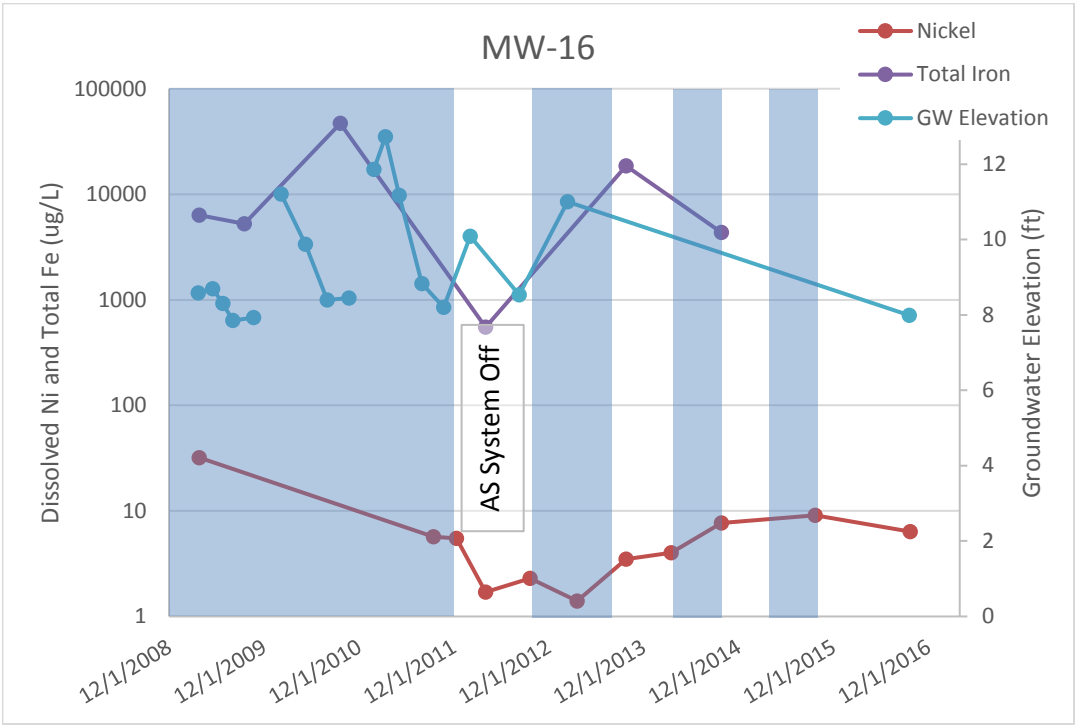

ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
500
400
300
200
100
0
-100
-200
5
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

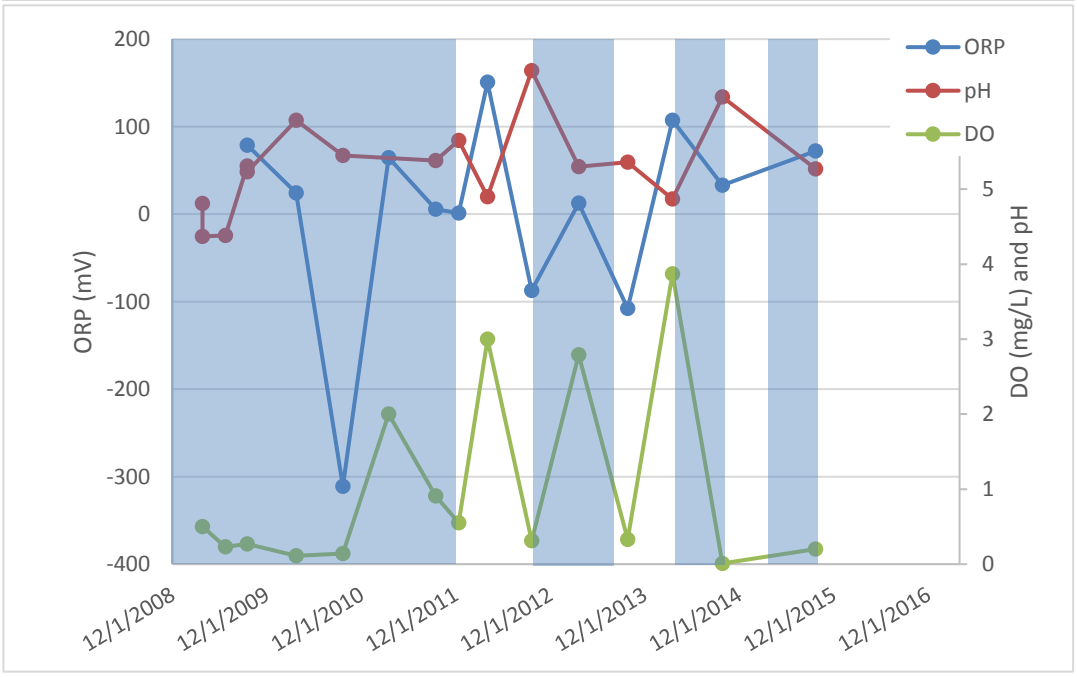

MW-8
Nickel
Total Iron
GW Elevation
Dissolved Ni and Total Fe (ug/L)
Groundwater Elevation (ft)
AS System Off
100000
10000
1000
100
10
1
10
8
6
4
2
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

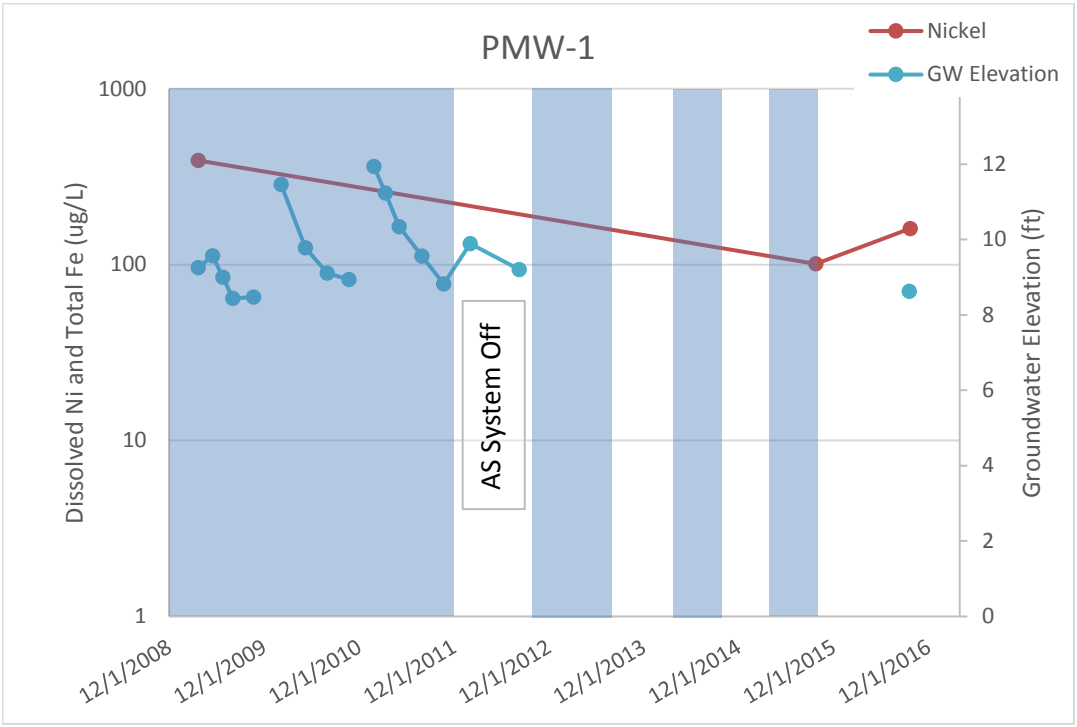

ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
300
200
100
0
-100
-200
-300
-400
-500
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

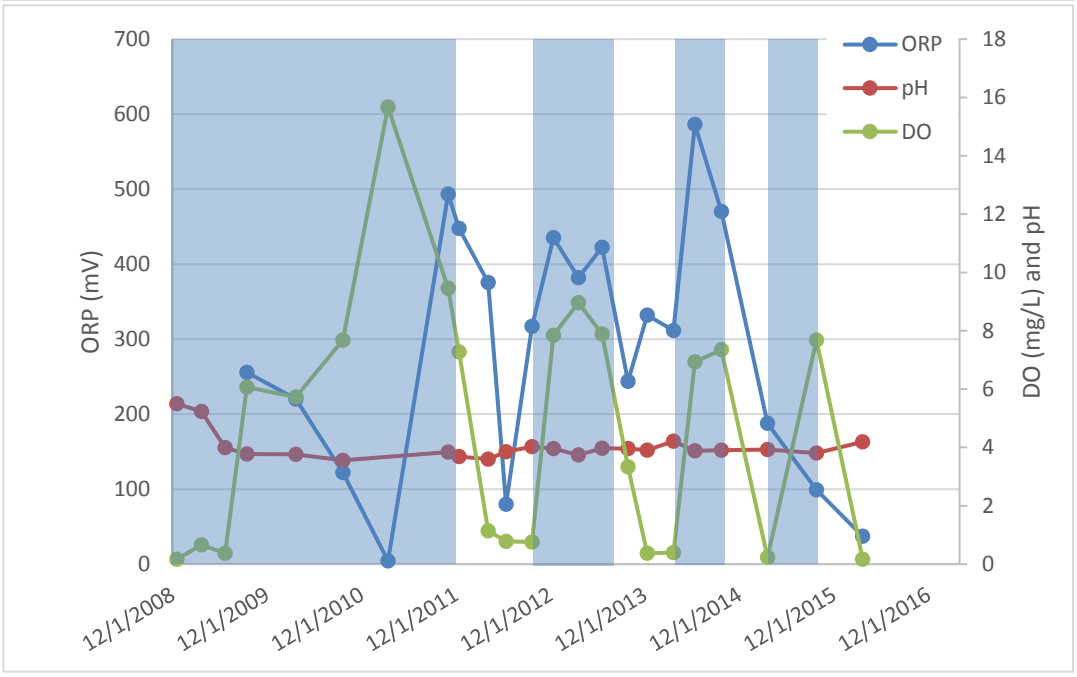

MW-9
Nickel
Total Iron
GW Elevation
Dissolved Ni and Total Fe (ug/L)
Groundwater Elevation (ft)
AS System Off
100000
10000
1000
100
10
1
10
8
6
4
2
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016


ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
100
0
-100
-200
-300
-400
-500
6
5
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016


MW-16
Nickel
Total Iron
GW Elevation
Dissolved Ni and Total Fe (ug/L)
Groundwater Elevation (ft)
AS System Off
100000
10000
1000
100
10
1
12
10
8
6
4
2
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

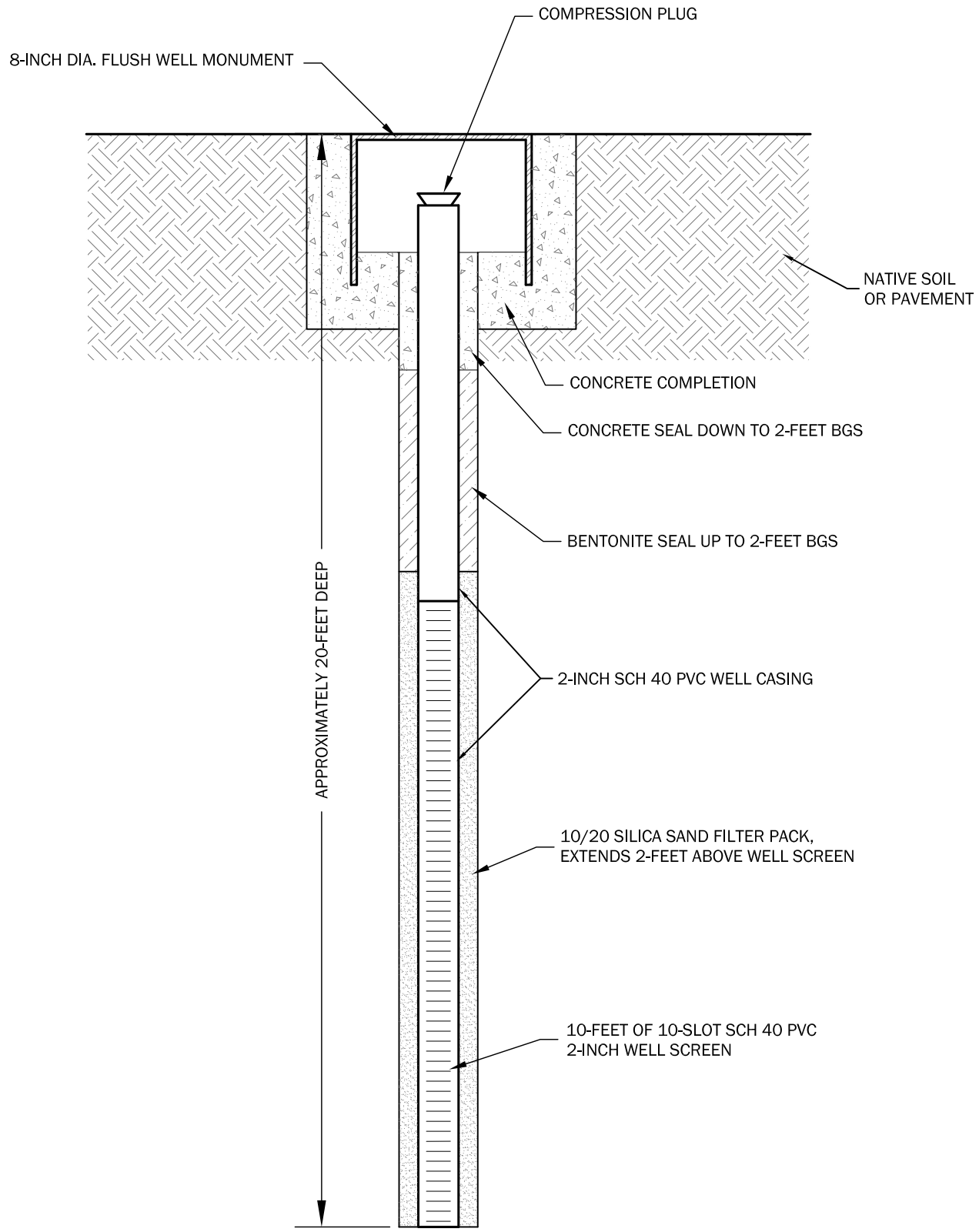

ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
200
100
0
-100
-200
-300
-400
5
4
3
2
1
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016


PMW-1
Nickel
GW Elevation
Dissolved Ni and Total Fe (ug/L)
Groundwater Elevation (ft)
1000
100
10
1
12
10
8
6
4
2
0
AS System Off
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016


ORP
pH
DO
ORP (mV)
DO (mg/L) and pH
700
600
500
400
300
200
100
0
18
16
14
12
10
8
6
4
2
0
12/1/2008
12/1/2009
12/1/2010
12/1/2011
12/1/2012
12/1/2013
12/1/2014
12/1/2015
12/1/2016

APPENDIX E

Well Construction Diagrams

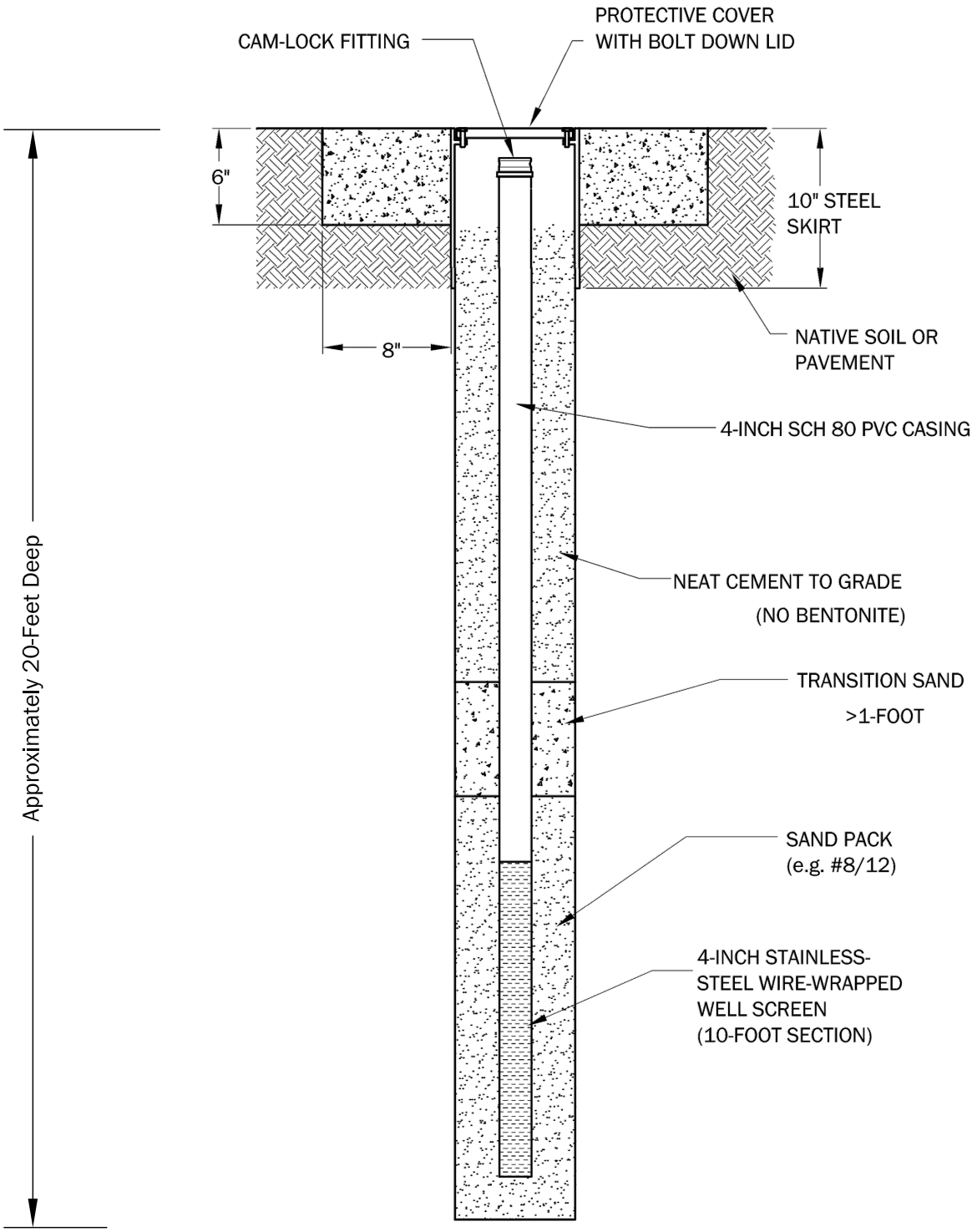


NOTE: NOT TO SCALE

Proposed Monitoring Well Construction Details

In-Situ Metals Immobilization-Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	Apr-2017	BY: ELG/SCC	Appendix E-1
	PROJECT NO. 050067	REVISED BY: DIM/SCC	



NOTE: NOT TO SCALE

Proposed Injection Well Construction Details

In-Situ Metals Immobilization-Pilot Testing Work Plan
Art Brass Plating
Seattle, Washington

Aspect CONSULTING	Apr-2017	BY: ELG/SCC	Appendix E-2
	PROJECT NO. 050067	REVISED BY: DIM/SCC	

APPENDIX F

Basis for Alkaline Reagent Selection

F.Basis of Alkaline Reagent Selection

The Site Unit 1 Feasibility Study presents pH neutralization as the preferred remedial technology for treatment of dissolved metals in ABP source area groundwater (Aspect, 2016). As detailed in the main body of this work plan, pilot testing will be conducted to assess the effectiveness and cost of an *in situ* pH adjustment to immobilize plating metals from groundwater and the appropriateness for full-scale CAP implementation. One pilot test objective is determining an appropriate alkaline reagent and dosing for field-scale pilot testing. This determination will consist of bench-scale laboratory testing of different alkaline reagents and dosages in the presence of ABP source area soils and groundwater. This appendix presents the basis of the reagents selected for bench-scale tests.

Background

Previous work has established an association between the presence of plating metals dissolved in groundwater and the acidic pH of groundwater (Aspect, 2016). At low pH, mineral surfaces have a net positive charge and cation sorption is weak resulting in increased solubility of plating metals. As the pH increases, proton concentrations on mineral surfaces decline and these surfaces create a net negative charge and thus retain cations (metals) from groundwater. As a result, increasing pH can greatly reduce metals mobility in the subsurface through numerous mineral precipitation and surface adsorption processes (Turex et al., 2011). Of the plating metals, nickel exhibits the greatest extent in groundwater; therefore, it's the focus of pilot testing. However, the technology is expected to be effective for other plating metals, which will be monitored during pilot testing.

Significant attenuation of pH is occurring at the Site downgradient of the ABP source area due to the buffering capacity of aquifer solids. The metals fate and transport evaluation identified three primary geochemical mechanisms contributing to this observed attenuation: 1) acidity neutralization; 2) adsorption, precipitation, and coprecipitation with oxide/hydroxides; and 3) precipitation with sulfide minerals (Aspect, 2016). The reagents for pilot testing were selected based on chemistry that would enhance these attenuation mechanisms and screened based on their chemical properties, and handling requirements.

Summary of Reagent Selection

A body of applied work provides useful insights into the effectiveness of *in situ* pH adjustments for inorganic treatment and this pilot test. Significant pH adjustment work has been conducted for *in situ* enhanced reductive dechlorination (ERD) systems, where pH adjustments are necessary to maintain nontoxic pH conditions for biological processes (Arcadis, 2002; Lutes, 2004). Others, more recently, have evaluated *in situ* pH adjustments with a focus on nickel and formation of insoluble nickel complexes (McDonough et al., 2014 and 2016). This work focuses on the use of carbonate/bicarbonate, hydroxide, and sulfide alkaline reagents for *in situ* pH

adjustments. There are many commercial-grade, and remediation-vendor chemical products available for use.

In recent literature, EOS Remediation introduced a low solubility product CoBupH-Mg™ ($Mg(OH_2)$), which has been demonstrated as a "slow-release" pH buffer for microbial-mediated remediation technologies (Borden, 2016). The planned chemical pH adjustment for pilot testing does not require a moderated pH adjustment that biologically mediated remediation technologies require. Further, this product formulation comes at a higher cost than commercially available chemical products; therefore, CoBupH-Mg™ was not considered for pilot testing.

As discussed in Section 4.3 of this pilot test work plan, the selected alkaline reagent will be delivered in large volumes at nonfracturing injection pressures, promoting porous distribution in the subsurface, all of which requires a soluble reagent. Therefore, calcium and magnesium alkaline chemical products are not considered as they are low solubility and would require fractured emplacement as a slurry using direct-push equipment. Conversely, sodium alkaline products are soluble in water and were preferred for pilot testing. The alkaline reagents for pilot testing and basis of selection are as follows:

- **Sodium bicarbonate** is a weak base and well-demonstrated alkaline reagent for *in situ* remediation. It is the least alkaline of the selected reagents and would primarily enhance nickel attenuation through acidity neutralization. Sodium bicarbonate is a commonly used reagent for pH adjustments because of its solubility, and proven effectiveness (Lutes, 2004). Sodium carbonate, a stronger base, is also demonstrated to be effective, but sodium bicarbonate was selected to evaluate effectiveness of a nontoxic weak base with no special handling requirements. Potassium carbonate/bicarbonate is also commercially available and soluble; however, not as well-demonstrated for *in situ* remediation applications.
- **Sodium hydroxide** is a strong base capable of increasing groundwater pH to form insoluble nickel hydroxides ($Ni(OH)_2$), which are predicted to be stable at most pH conditions (Suthersan and Payne, 2005). Miller et al. (2006), demonstrated that addition of sodium hydroxide could be used to increase the pH of groundwater (pH 3 to 4 s.u.), reducing levels of dissolved cadmium, copper, lead, manganese, nickel, and zinc. Sodium hydroxide provides a large number of OH equivalents; and, therefore, will require a lower volume for comparable pH adjustments relative to other reagents. Further, this emphasizes the importance of bench-scale testing to avoid exceeding the target pH.

  Potassium hydroxide has very similar chemical properties to sodium hydroxide; however, it is used less commonly and costs significantly more than the selected reagent, sodium hydroxide.
- **Sodium polysulfide** is a strong base that will increase groundwater pH and promote direct precipitation of nickel with highly reactive sulfide to form insoluble, stable sulfide minerals, NiS (McDonough, 2014). Sulfide minerals are more stable than hydroxide or carbonate phases. This reagent does have the potential to generate hydrogen sulfide, which will be evaluated carefully in the laboratory.

The following table compares key characteristics of the selected reagents:

Base	Chemical Formula	Molecular Weight (g/mol)	Estimated Solubility (g/L)	Estimated pH at Alkalinity of 100 mg/L $CaCO_3$	pH of Saturated Solution
Sodium Bicarbonate	$NaHCO_3$	84.0	100	8.3	~8.3
Sodium Hydroxide	NaOH	40.0	1,100	11	~13
Sodium Polysulfide	Na_2S_4	57.1	125	~11	~12

Laboratory Testing

The laboratory will follow necessary handling requirements for each of the reagents. The FIWP will include the handling requirements of the selected reagent and an updated HASP to prevent any hazards associated with the chemical reagent handling.

Some work has concluded that combination of sodium hydroxide and sodium polysulfide was most effective (McDonough, 2016). The planned batch testing will evaluate reagents alone to determine performance in the presence of the Site-specific chemistry; however, the work plan includes the option to conduct an additional round of batch testing looking at the cumulative effectiveness of multiple reagents, if deemed necessary.

References

Aspect Consulting, LLC (Aspect), 2016, Final Feasibility Study for Site Unit 1, August 11, 2016.

Arcadis, 2002, Technical Protocol for Using Carbohydrates to Enhance Reductive Dechlorination of Chlorinated Aliphatic Hydrocarbons, Report prepared for ESTCP (Contract #F41624-99-C-8032), 2002.

Borden, R., Y. Lai, J. Overmeyer B. Yuncu J. Allen, 2016, In Situ pH Adjustment with Collodial Mg (OH)2, Applied Research & Practice, Volume 17, Fall 2016.

Lutes, C., A. Frizzel, S. Suthersan, 2004, "Enhanced Reductive Dechlorination of CAHs using Soluble Carbohydrates – A Summary of Detailed Data from 50 Sites," Principles and Practices of Enhanced Anaerobic Bioremediation of Chlorinated Solvents, Appendix E, AFCEE/NFESC/ESTCP, Brooks City-Base, TX, August 2004.

Miller, G., M. Hayter, and P. Storch, 2006, Abstract: In Situ Treatment of Acidic, Metals-Impacted Groundwater using Calcium Polysulfide and Sodium Hydroxide, The

Fifth International Conference of Remediation of Chlorinated and Recalcitrant Compounds – 9th International Conference, Monterey, CA, 2006.

McDonough, J. et al., 2014, Geochemical Stabilization of Nickel in Groundwater: Case Study Comparison, Presented at Remediation of Chlorinated and Recalcitrant Compounds – 9th International Conference, Monterey, CA, May 2014.

McDonough, J. et al., 2016, The Complexities of Nickel Complexation, Presented at Remediation of Chlorinated and Recalcitrant Compounds – 10th International Conference, Monterey, CA, May 2016.

Suthersan, S., and F. Payne, 2005, In Situ Remediation Engineering, Boca Raton CRC Press.

Truex, M., P. Brady, C. Newell, M. Rysz, M. Denham, K. Vangelas,2011, The Scenarios Approach to Attenuation-Based Remedies for Inorganic and Radionuclide Contaminants, Savannah River National Laboratory, SNRL-STI-2011-00459.

V:\050067 Art Brass Plating\Pilot Study\Metals\Pilot Test Work Plan\Final\Appendices\Appendix F\AppendixF.docx