Geochemical Characterization of Tailings, Alluvial Solids and Groundwater

Grants Reclamation Project

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Cibola County, New Mexico
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EXECUTIVE SUMMARY

This geochemical characterization report presents chemical and mineralogical testing results for the LTP tailings and surrounding San Mateo Creek alluvial aquifer at the Homestake Grants Reclamation Project located in Cibola County, New Mexico. The objectives are to advance the assessment of potential post-flushing rebound of COC concentrations in the Large Tailings Pile (LTP) and to provide adequate characterization of tailings and the alluvial aquifer to support the current conceptual model and provide information needed for reactive transport modeling of the primary constituents of concern (COCs): Uranium (U), molybdenum (Mo), and selenium (Se). The LTP contains elevated pH, TDS, and is dominated by sodium and sulfate (SO_4) due to the alkaline milling process. The LTP pore water is slightly reducing such that Se is predicted to occur primarily as reduced selenite (SeO_{3}^{-}), while U and Mo mainly exist in their mobile oxidized forms (U-carbonate complexes and MoO_4^{-2}). Tailings solids are composed primarily of quartz and feldspar, with lesser amounts of smectite, kaolinite, calcite, and minor pyrite plus iron oxide. Selenium was the most abundant COC identified in the solids, found in association with pyrite and as reduced native Se. Uranium was commonly observed in association with calcium and vanadium, while no distinct Mo-bearing phases could be identified. The tailings contain pyrite but are net acid neutralizing and thus not expected to become acidic upon future weathering. A 20-week duration humidity cell test did not indicate any significant release of iron, SO_4, U, Mo, or Se from the tailings solids. A multi-faceted approach to evaluating LTP rebound considered trends in existing tailings wells, tailings sumps, controlled static column tests, and new wells with shorter screen lengths. Results from the controlled column study provided no indication of diffusive concentration rebound over a 1-Year test period. Although a few select sumps and former rebound monitoring wells have demonstrated increasing COC concentrations since flushing ceased, the volume-weighted averages of U, Mo, and Se in the LTP have decreased overall.

The native alluvial groundwater is a near-neutral Ca-SO_4 type water which trends toward a more alkaline, Na-SO_4 type water in the vicinity of the LTP. The alluvial aquifer can be classified as oxic with respect to redox conditions, and is comparatively more oxidizing compared to the LTP pore water. Aquifer solids collected from the middle of saturated zone were primarily coarse-grained materials with low clay content and CEC, although it is recognized that dense lenses of clay are sporadic throughout the alluvial aquifer. The samples were dominated by quartz and feldspar, with minor calcite, clays and amorphous Fe oxide. Groundwater transport of the COCs is therefore likely controlled by the presence of Fe oxides due to their overall high adsorption capacity. However, because the dissolved U, Mo, and Se exist in their oxidized forms as neutral or negatively-charged species, they are only weakly adsorbed to the Fe oxide surfaces and thus not strongly attenuated in the alluvial aquifer. In the immediate vicinity of the LTP, Mo precipitation may be occurring where reaction of the LTP pore water with calcite in the alluvium causes oversaturation with respect to calcium molybdate ($CaMoO_4$). Results from this geochemical characterization study have improved our understanding of both COC source characteristics and potential groundwater transport mechanisms at the GRP, and provide a basis for further development of conceptual and geochemical models describing COC transport in the alluvial aquifer.

1.0 INTRODUCTION

Homestake Mining Company (HMC) has managed a groundwater restoration program since 1977 at the Grants Reclamation Project Site (Site) in Cibola County, New Mexico, with the goal of reducing concentrations of constituents of concern (COCs) in underlying aquifers to levels meeting Site standards. Prior flushing, extraction, and reinjection activities have proven effective in reducing both concentrations of the primary COCs uranium (U), molybdenum (Mo), and selenium (Se) in tailings, and the areal extent of their alluvial contaminant plumes. HMC is currently working toward Site closure through the development of hydrologic and geochemical models to evaluate post-closure fate and transport of COCs. In 2017, HMC requested that Worthington Miller Environmental (WME) design and implement a geochemical characterization program to collect the information needed to develop a Site-wide conceptual geochemical model, and to better understand the influence of U mill tailings and aquifer characteristics on groundwater COC transport (WME, 2018a). This report presents the geochemical characterization results for tailings and alluvial aquifer solids which were collected from the Site between March 2018 and February 2020.

1.1 BACKGROUND

The former HMC mill facility operated between 1958 and 1990 and utilized an alkaline leach circuit to recover U from ore containing an average grade of 0.05 to 0.30 percent U_3O_8. Milling operations resulted in the placement of U mill tailings into the large tailings pile (LTP) and the small tailings pile (STP). The STP is an unlined impoundment covering about 40 acres and was used to contain approximately 2 million tons of tailings from ore milled under contracts with the federal government between 1958 and 1962. The STP currently contains no saturation. The LTP is an unlined impoundment covering about 200 acres and contains approximately 21 million tons of tailings from ore processed under both federal and commercial contracts between 1958 and 1990. The LTP pore water contained elevated levels of COCs which included U, Mo, Se, sulfate (SO_4), chloride (Cl), total dissolved solids (TDS), nitrate-nitrogen (NO_3-N), vanadium (V), thorium-230 (Th-230), and radium-226+228 (Ra-226+228). Localized groundwater contamination of the shallow alluvial aquifer downgradient of the LTP was subsequently observed as early as 1961 (Chavez, 1961).

A defined alluvial contaminant plume was later identified in 1976 originating from the LTP and moving off-Site to the south and west. Consequently, a series of injection wells were installed along the southern site boundary in 1977, creating a hydraulic barrier to inhibit contaminant migration across the Site boundary. A complementary series of groundwater extraction wells was also installed in the vicinity of the tailings piles between 1977 and 1982 to collect tailings seepage. Following mill closure in 1990, the hydraulic barrier system was incorporated into the Site groundwater restoration program. Toe drains were also installed at the perimeter of the LTP in 1992 to collect tailings seepage. A reverse osmosis (RO) plant was constructed in 1999 to treat water for injection into the alluvial aquifer, followed by tailings flushing and land application in 2000. Three evaporation ponds were also constructed between 1990 and 2010 to assist with overall water management.

The resulting Corrective Action Program (CAP) for the Site encompassed five operational components: (1) Source control through tailings flushing to expedite LTP seepage drain down to groundwater, (2) plume control by creation of a hydraulic barrier, (3) RO treatment to remove COCs from groundwater and to supply additional clean water for re-injection, (4) evaporation, and (5) land

treatment. Source control began in 1995 when HMC initiated a tailings dewatering program in the LTP to remove tailings pore water. The full-scale implementation of the tailings flushing program then started in 2002 and was terminated in 2015. Source control has effectively reduced the average pore water U concentration to approximately 5 mg/L, and the excess of 200,000 lbs. of U removed represents a mass of U that is no longer available for leaching to groundwater (HMC and HE, 2020). The post-closure source term will ultimately be a function of the geochemical properties of the LTP tailings and the rate of tailings seepage to groundwater.

1.2 RATIONALE AND APPROACH

The source control strategy assumes that the majority of U in the tailings solids in the LTP is present as soluble U in pore water, such that the predicted long-term concentrations will remain stable as the tailings seepage continues to drain. However, in 2010 the U.S. Army Corps of Engineers (ACOE) proposed that a significant mass of U is still present in the tailings, and that diffusive mass transfer of soluble U from fine-grained materials and/or dissolution of solid-phase U could result in additional release of COCs following cessation of flushing (ACOE, 2010). Some concern was also expressed that the long screen intervals (50 to 80 ft) complicate the interpretation of water quality trends in the LTP monitoring wells. Therefore, based on ACOE recommendations, HMC implemented a tailings rebound study to better support the prediction of long-term post-flushing COC behavior in the LTP.

The resulting tailings rebound study (Arcadis, 2012) was conducted in three phases: (1) A gas tracer study to understand local hydraulic and solute transport properties, (2) direct monitoring of COC trends in the LTP porewater, and (3) laboratory evaluation of COC leaching from tailings solids. Although it was concluded that future significant diffusive mass transfer and subsequent rebound of COCs is not expected to occur, HMC requested that additional investigation be conducted to address tailings rebound potential. WME's approach for further assessing tailings rebound at the LTP was to: (1) extend the in situ post-flush monitoring period for existing wells previously used for that purpose (Arcadis, 2012), (2) expand the areal extent and representativeness of in situ post-flush monitoring by installing additional wells with shorter screen lengths in sands and slimes, (3) revise the tailings monitoring analyte list to include major cations/anions plus redox parameters, and (4) conduct a controlled diffusive rebound column study using undisturbed tailings samples from the LTP.

In addition to potential diffusive mass transfer from fine-grained materials, long-term COC release from the tailings will be controlled by geochemical conditions in the LTP. Prior to this study, however, limited data existed regarding LTP tailings mineralogy, redox conditions, or forms of COCs in tailings. In particular it has been noted that dissolved Se concentrations below the LTP have been decreasing, presumably due to the onset of reducing conditions driven by organic matter present in the slimes. The ACOE has suggested that future migration of groundwater into this area could facilitate oxidation and mobilization of reduced Se (and U), and recommended additional testing of redox potential and dissolved oxygen (DO) to evaluate the stability of COCs remaining in the pile (ACOE, 2010). Therefore, WME conducted detailed geochemical characterization of tailings water and solids to understand the forms of COCs present and potential controls on their future release from tailings solids.

Finally, to effectively model future transport scenarios for COCs in groundwater, it is also important to characterize the geochemical properties of the underlying groundwater and the aquifer matrix. In addition to source characterization, regulatory guidance stipulates that for contaminant transport

assessment, geochemical conditions be sufficiently characterized to understand the subsurface geochemical properties and identify contaminant attenuation mechanisms (USNRC, 2003). Therefore, WME also conducted detailed characterization of the water quality, redox conditions, and solid-phase mineralogy of the underlying alluvium to identify the important factors controlling COC transport in the San Mateo Creek (SMC) alluvial aquifer.

In summary, the overall objectives of the geochemical study were to provide adequate characterization of tailings and aquifer properties to develop a Site conceptual geochemical model and to provide numerical input for post-closure contaminant transport modeling. This included detailed characterization of water quality and solids geochemistry for tailings and alluvial aquifer solids to: (1) Advance the assessment of potential post-closure diffusive rebound of COCs in the LTP, (2) understand the geochemical source characteristics of LTP and STP solids, and (3) characterize SMC alluvial aquifer properties and potential COC transport attenuation mechanisms (WME, 2018b).

1.3 FIELD SAMPLING PROGRAM

The geochemical field sampling program consisted of detailed water quality and solid-phase testing of tailings and alluvium, utilizing both existing monitoring wells and through the installation of additional monitoring wells and/or borings. Between June 13th and June 25th 2018, six monitoring wells were installed in the LTP, two monitoring wells were installed in the STP, and seven borings were drilled into the alluvial aquifer for solids and/or water quality sample collection. Details regarding all monitoring well drilling and sampling are provided in Attachment 1. Tailings water and alluvial groundwater samples were collected for analysis of major cations, major anions, metals, nutrients, COCs, and redox indicators according to a Standard Operating Procedure (WME, 2018c).

1.3.1 Tailings and Alluvial Solids

The LTP monitoring well borings included three sand (WME-1 through WME-3) and three slime locations (WME-4 through WME-6) where wells were installed and solids were collected for geochemical testing (Figure 1). Two additional borings (WME-7 below LTP sands and WME-8 below LTP slimes) obtained samples of underlying alluvium from an upper perched zone and a lower vadose zone (Figure 1). Samples of the STP solids were collected during the installation of monitoring wells in the underlying alluvium (WME-9 and WME-10) (Figure 2). The seven remaining borings originally proposed for saturated-zone alluvial solids collection (WME, 2018a) are shown on Figure 3 (it should be noted that saturated alluvium could not be collected from locations WME-12 and WME-13 because the drill stem hit refusal on igneous bedrock before groundwater was encountered). Samples are referred to as North Alluvium (background, WME-11), South Alluvium (prior tailings influences, WME-14 and WME-15), and Adjacent Alluvium (strong tailings influence, WME-16 and WME-17). Table 1 summarizes all tailings and alluvial solids sample collection and associated geochemical testing. A more detailed description of the testing objectives and procedures is provided in subsequent sections of this report.

1.3.2 Tailings Water and Alluvial Groundwater

The locations for detailed tailings water quality evaluation includes: (1) New LTP wells WME-1 through WME-6 with short screen lengths (5'), (2) a series of existing Arcadis LTP wells (WE9, WF2, WF9, WF11) located in the extended shutdown area, used in a previous tailings rebound evaluation (Arcadis, 2012), and (3) six LTP toe drain (sump) locations (North Sump 1, North Sump 3, East Sump

1, East Sump 2, West Sump 1, South Sump 1) (Figure 1). Saturated conditions do not exist within the STP and therefore no monitoring wells were screened directly within the STP.

The locations for detailed alluvial groundwater sampling includes the two new wells WME-9 and WME-10 completed in alluvium underlying the STP (Figure 2), in addition to the following 13 existing Site monitoring wells categorized with respect to their location relative to the LTP (Figure 3): (1) North alluvial (background) wells (DD, R, Q), (2) west alluvial wells (S4, M19, MR), (3) south alluvial wells (D1, X, F, I), and (4) LTP underlying alluvial wells (T2, T20, T22).

A summary of all tailings and alluvial monitoring well completion information, sampling frequencies, and water quality analyses is provided in Table 2. The LTP Arcadis wells were sampled monthly from April through December 2018, and the LTP sumps were sampled every 2 months from March through September 2018, for a full suite of geochemical parameters. For the remainder of the study, the LTP Arcadis wells and the LTP sumps were sampled at the same frequency, but only analyzed for U, Mo, Se, Cl and SO_4 as part of the LTP rebound evaluation.

2.0 TAILINGS SOURCE TERM CHARACTERIZATION

The chemistry and mineralogy of LTP and STP tailings solids has not been previously evaluated, nor have the detailed chemistry and associated redox conditions within the tailings water been adequately characterized. Geochemical testing is used to identify the specific solid-phase and dissolved forms of COCs and major mineralogical characteristics of the tailings, which ultimately controls the long-term chemical behavior and potential future release of COCs from the LTP and STP. The predominant factors controlling the forms of dissolved COCs in the LTP are the major ion chemistry, pH, and redox conditions.

2.1 TAILINGS WATER QUALITY AND REDOX CONDITIONS

Information regarding detailed water quality and redox conditions in the LTP were collected in conjunction with the LTP concentration rebound assessment (Section 4.0). All water quality and field parameter results are contained in Attachment 2. The LTP wells and sumps have been analyzed for field parameters (pH, specific conductivity or SC, temperature, ORP, and DO) and a full suite of major ions and trace metals according to the schedule in Table 2. Because adequate information for geochemical characterization had been collected from the Arcadis wells and the LTP sumps by the end of 2018, their analyte list was reduced to only Cl, Mo, U, and Se for the ongoing concentration rebound evaluation (Section 4.0). This section presents the major water quality characteristics of the tailings pore water and geochemical modeling results from selected tailings wells. Trends in the major COCs U, Mo, and Se in the new short-screened LTP wells and selected Arcadis wells are presented and discussed in Section 4.0.

The major ion water quality for the LTP wells and sumps are plotted using a trilinear diagram on Figure 4 (only 2018 data are shown for clarity). The tailings water is classified as a Na-SO_4 type water (except for Well WME-5 which is a Na-CO_3 type water) due to the use of sodium carbonate, sodium bicarbonate, sodium hydroxide, and sulfuric acid in the milling process (Skiff and Turner, 1981). Uranium was recovered from the ore using an alkaline leach and thus the tailings wells and sumps generally contain elevated pH values which generally increased over time (Figure 5). Chemical addition and evapoconcentration of tailings water in the former ponds also resulted in elevated TDS concentrations. A comparison of calculated TDS values shows that with a few exceptions, TDS tends

to be more elevated in the sumps and new LTP wells (WME-1 through WME-6) compared to the Arcadis wells which are partially screened in the underlying alluvium (Figure 5).

Redox conditions in the LTP were evaluated by assessing DO content, measured redox potential (Eh), and the concentrations of various redox indicators. Redox potential expressed as Eh is required for geochemical calculations and is calculated based on field ORP measurement of the sample in conjunction with a redox standard (Zobell's Solution) (USGS, 2005). However, Eh measurements are sometimes unstable and only of qualitative value unless the system is completely anoxic (devoid of DO) and dominated by iron (Fe), sulfur (S), and manganese (Mn) (Langmuir, 1997). Therefore, analysis for additional redox "couples" was conducted to assess the redox status of the groundwater, including the dissolved species of Fe (Fe^{2+}/Fe^{3+}), nitrogen (N, as NH_4^+/NO_3^-), and S (H_2S/SO_4^{2-}).

The relationship between the various forms of redox indicators and the Eh is shown using the concept of a "redox ladder" (Figure 6). In natural waters, atmospheric oxygen is the major oxidant and organic matter is the major reductant. During the decay of dissolved organic carbon (DOC) in groundwater isolated from the atmosphere (aerobic decay), DO becomes depleted and the Eh drops. If the rate of oxygen depletion is greater than its rate of replenishment, anaerobic conditions are established. The redox ladder on Figure 6 shows that once the DO is depleted, the progressive reduction of NO_3, Se, Mn, Fe, U, and SO_4 occurs with decreasing Eh. The tailings water (new LTP wells and sumps) contains an average DOC concentration of 13 mg/L which is more than adequate to produce anoxic conditions (Langmuir, 1997). The DO concentrations in the WME tailings ranged from 0.14 to 11.4 mg/L (Figure 7) and are generally higher compared to the Arcadis wells which are partially screened in the underlying alluvium. Consequently, Eh values also indicate more oxidizing conditions in the sumps and LTP wells compared to the Arcadis wells (Figure 7).

The low DO concentrations in some wells (Figure 7) indicate that DO is being consumed by organic decay, causing the reduction of NO_3^- to ammonium (NH_4^+) (Figure 8). Measurable hydrogen sulfide (H_2S) is also present in some wells (Figure 8). The presence of both reduced N and S species in conjunction with low DO concentrations indicates the heterogeneous nature of the tailings which apparently contain zones that are both oxidizing and reducing. These zones become mixed during well purging and produce waters containing both measurable DO and more reduced N and S species. Although some ferrous Fe (Fe^{+2}) would also be expected in these waters (Figure 6), most values were below detection (<0.02 mg/L), but Mn was detected at low concentrations (0.002 to 0.392 mg/L) (Attachment 2). The redox classification scheme developed for groundwaters (Langmuir, 1997) in Table 3 shows that measurable DO generally indicates an "oxic" or "suboxic" environment, whereas its absence indicates an "anoxic" environment. Anoxic systems are further divided into those with or without measurable H_2S ("sulfidic" and "nonsulfidic"). The overall redox status of the LTP can be categorized as oxic to suboxic, although the presence of low H_2S concentrations suggests the existence of some anoxic sulfidic zones.

Field measured Eh values from the LTP wells were compared to the Eh values computed from each of the individual redox couples (H_2O/O_2, Fe^{2+}/Fe^{3+}, NH_4^+/NO_3^-, and H_2S/SO_4^{2-}) (Figure 9). The general poor agreement between measured and computed Eh in groundwater is common and indicates there is no overall system Eh controlling the distribution of all redox-sensitive species. The lack of redox equilibrium has been attributed to a number of factors, such as: (1) non-electroactive behavior at the platinum electrode of some redox couple species, (2) irreversibility or slow kinetics of redox couple

reactions, (3) presence of mixed potentials, or (4) Eh measurement errors (Langmuir, 1997). Therefore, Eh should generally be thought of as a qualitative expression of the state of oxidation or reduction in a natural system (Langmuir, 1997). However for LTP tailings, the Eh computed from the NH_4^+/NO_3^- redox couple provides the closest match to field-measured Eh values (Figure 9).

2.1.1 Geochemical Modeling of Tailings

The specific form of each dissolved COC in solution is an important factor controlling its ultimate mobility from tailings into the alluvial aquifer. The geochemical speciation model PHREEQC (Parkhurst and Appelo, 2013) was used to predict the dissolved forms of U, Se, and Mo in the tailings water. The concentrations of major cations/anions, metals, and COCs (Attachment 2) were input into the model and the redox was controlled using the NH_4^+/NO_3^- redox couple. The MINTEQv4.dat database developed by the USEPA was used for all model calculations. The speciation results for the WME tailings wells and most sumps (Table 4) indicate that U occurs primarily as U(VI) in the form of the negatively-charged $UO_2(CO_3)_3^{4-}$ species. The Arcadis wells are partially screened in the alluvium and contain a higher proportion of the calcium (Ca)-magnesium (Mg) U-carbonate complexes.

Selenium is more easily reduced than U (Figure 6), and therefore was predicted to occur mainly as reduced selenite [Se(IV)] (e.g., SeO_3^-), and to a lesser extent oxidized selenate [Se(VI)] (e.g., SeO_4^{2-}) in most tailings wells and sumps (Table 4). Virtually 100% of the dissolved Mo is predicted to occur as the oxidized Mo(VI) molybdate ion (MoO_4^{2-}) in all samples (Table 4).

The concentrations of COCs in the tailings water are potentially controlled by their occurrence as discrete mineral phases. The potential for a given mineral to exist in contact with the solution can be evaluated using the Saturation Index (SI), which is defined as $SI = \log(IAP/K_{sp})$, where IAP is the ion activity product in solution, and K_{sp} is the solubility product at the field temperature. Thus, when SI >0, the IAP exceeds the K_{sp} and the mineral can potentially precipitate (oversaturated). When SI <0, the IAP is less than the K_{sp} and the mineral can dissolve (undersaturated). When IAP = K_{sp}, the resulting SI = 0 indicates that the mineral and the solution are in equilibrium. Due to inherent uncertainties in the analytical and thermodynamic data, equilibrium conditions are generally assumed to exist when $-0.50 < SI < +0.50$.

The SI values for some of the common U, Mo, and Se minerals which control their concentrations in the environment are shown in Table 5. The SI values for the reduced U(IV) minerals (amorphous UO_2 and crystalline UO_2, uraninite) are highly undersaturated, in part due to the very low calculated proportion of reduced U(IV). In addition, the concentrations of oxidized U(VI) and accessory components are not elevated enough to reach saturation with respect to the common oxidized U minerals, such as carnotite or tyuyamunite, as indicated by the highly negative SI values in Table 5. Negative SI values for amorphous elemental Se [Se(am)] and ferroselite ($FeSe_2$, values not shown) indicate that conditions are not adequately reducing to precipitate reduced Se phases. Saturation index values for calcium molybdate ($CaMoO_4$) indicated undersaturated conditions at most locations. Considering some of the potential major mineral phases, the tailings are generally oversaturated or in equilibrium with respect to calcite, ferrihydrite, quartz, and rhodochrosite (Table 5). The tailings are undersaturated with respect to amorphous aluminum (Al) hydroxide [$Al(OH)_3$(am)], and undersaturation was also predicted for the Fe sulfides when Fe^{2+} data were available (not tabulated).

2.2 TAILINGS SOLIDS

Physical descriptions and photographs of tailings solids obtained during sample collection are provided in Attachment 1. The LTP sands were comprised of loose, well-sorted fine sands containing some clay (10 to 20%) and clay stringers. The LTP sands were medium-to dark gray in color, displayed a weak reaction to hydrochloric acid (HCl) indicating the presence of minor carbonate (CO_3), and moisture content that increased with depth. The LTP slimes consisted of medium-dark gray stiff clays with little sand (<10%). The STP sands consisted of light brown, loose silty sand with traces of clay and strong reaction to HCl. The STP slimes were generally light brown, stiff sandy clays with thin bedding of black and grays. The STP slimes exhibited strong reaction to HCl and often exhibited an odor of sulfur. Samples of tailings solids from the LTP and STP were subjected to detailed mineralogical and geochemical characterization (Table 1) to understand their bulk mineral composition and reactivity, the forms of COCs present, and their potential future mobility.

2.2.1 Tailings Mineralogy

Mineralogical analyses of the LTP and STP tailings solids (Table 1) were conducted by DCM Science Laboratory Inc. (Wheat Ridge, CO). All samples from the LTP and STP were analyzed using X-ray diffraction (XRD) analyses to identify their bulk and clay mineral compositions and the original report is provided in Attachment 3. The XRD results in Table 6 show the LTP and STP tailings are composed primarily of quartz, potassium feldspar, and plagioclase feldspar, which generally have low reactivity and are highly resistant to weathering. Lesser amounts of calcite ($CaCO_3$) are present which will remain stable in the high pH environment. Relatively low quantities of pyrite (Fe sulfide, FeS_2) up to 1% were also identified. Upon exposure to water and atmospheric oxygen, pyrite has the potential to release SO_4 and acidity as it weathers. As expected, the clay content of tailings samples was higher in the slimes compared to the sands, although the maximum measured clay content was only 29%. The tailings clay fractions were dominated by approximate equal amounts of smectite and kaolinite, with lesser amounts of illite and chlorite (Table 6).

Samples from the LTP (WME-2, -3, and-5) and STP (WME-10) were also examined by scanning electron microscopy (SEM) to characterize grain morphology in conjunction with energy dispersive spectroscopy (EDS) to obtain elemental composition. The detailed SEM mineralogical report is provided in Attachment 3 and the key attributes from SEM and EDS examination are summarized in Table 7. Examination of the tailings sands were consistent with XRD results showing that the dominant minerals are quartz, plagioclase feldspar, and potassium (K)-feldspar. The tailings sands were described as brown in color, containing very fine to medium-grained silty sand with lesser amounts of clay. The feldspar grains commonly display corroded edges and surface pitting, presumably due to the caustic nature of the original milling process solutions. The grey tailings slimes also contained quartz and feldspars as dominant components, with edge corrosion and surface pitting of the feldspars also evident in the slimes.

Some example mineral occurrences observed during SEM examination are shown on Figure 10. Pyrite commonly occurs as mineral inclusions as shown in the grain containing mixed quartz and feldspar (Figure 10a). Rare earth (Ce, La, Nd) phosphate minerals were commonly observed as inclusions within feldspar grains (Figure 10b). Iron exists in both reduced (e.g., pyrite) and oxidized (e.g., goethite) forms, with an example of goethite replacing pyrite on Figure 10c. Calcite is common

in both tailings sands and slimes, sometimes with inclusions of Se or gold (Au) (Figure 10d). Selenium was the most abundant COC in the tailings and was recognized in association with Fe on the surface of pyrite (Figure 11a), as native (elemental) Se mineral inclusions (Figure 11b) or liberated grains (Figure 11c), and in close association with lead (Pb) or copper (Cu) (Figure 11d). Uranium tended to be less abundant during SEM examination but was most commonly observed in association with Ca and V (e.g., tyuyamunite) (Figures 12a, 12b, 12c) or titanium (Ti) (Figure 12d). No distinct Mo-bearing solids phases could be detected in the tailings using SEM.

2.2.2 Acid-Base Accounting, pH, and Sulfur Forms

Homestake utilized an alkaline leaching process (pH >10) to recover U from the ore, and the tailings contain acid-consuming silicate minerals and calcite (Section 2.2.1). Therefore the tailings possess some degree of acid neutralization potential (ANP). The original ore and existing tailings also contain minor amounts of Fe sulfide minerals (e.g., pyrite) (Section 2.2.1) which can produce acid upon weathering, and thus the tailings also possess some degree of acid generation potential (AGP). Acid generation by tailings is undesirable because acid generation can affect the physical stability of tailings and also accelerate the release of low pH, SO_4, and COCs from tailings upon weathering. The balance between the ANP and the AGP (expressed as kg $CaCO_3$/T) is measured using acid-base accounting (ABA), which provides information on forms of S in a sample, particularly acid generating sulfide minerals (e.g., pyrite). The Net Neutralizing Potential (NNP) is calculated as the difference between the ANP and the AGP (NNP = ANP-AGP). Theoretically, a given material has an overall capacity to neutralize acidity when NNP > 1, and an overall capacity to generate acidity when NNP < 1. In practice, it is generally considered that samples containing an NNP > +20 kg $CaCO_3$/T present the least risk for acid generation (USEPA, 1994).

The ABA results with sulfur forms and calculated NNP values for the tailings are provided in Table 8. The two primary forms of S in the tailings are sulfide-S (reduced) and sulfate-S (oxidized) (Figure 13). The tailings contained up to 0.35% sulfide-S with no distinct differences between sands and slimes. The tailings contain elevated pH (Table 8) and the overall balance between the AGP and ANP is such that the ANP outweighs the AGP (Figure 14) and all NNP values are > +20 kg $CaCO_3$/T (Table 8). The ABA results indicate that the tailings are theoretically net acid-neutralizing and would not be expected to generate acidity upon weathering, but the tailing have the capacity to release additional SO_4 (and potentially COCs) if exposed to atmospheric (oxidizing) conditions.

2.2.3 Cation Exchange Capacity/Total Organic Carbon

The results for cation exchange capacity (CEC) and total organic carbon (TOC) of the tailings are provided in Table 8. The CEC values for the tailings samples are low (3.4 to 14.4 $cmol_c$/kg) due to the overall low clay content containing approximately 50% kaolinite with low exchange capacity. The TOC content of the tailings ranged from <0.10% in some sands to 0.3% in slimes. The source of TOC in the tailings largely originates from organic material that was present in the original ore. Clays and organic matter may provide a reservoir for solid-phase partitioning of COCs (particularly U and Se) and a source of DOC when present. Although the TOC content is generally low relative to natural soils, its presence has the capability of creating reducing conditions (decreasing Eh) in the tailings water.

2.2.4 Selective Chemical Extraction

A selective chemical extraction technique was used to provide supplemental information regarding the partitioning of COCs within the solid tailings matrix. During selective chemical extraction, a sample of tailings is sequentially leached with a series of increasingly aggressive solutions to extract the COCs from various solid phase components. The selective extraction technique designed by Tessier et al. (1979) targets those mineral phases which have been documented to occur in sandstone and limestone ore (and presumably tailings) from the Grants District: (1) Exchangeable (bound to clay surfaces), (2) carbonate bound (occurring as or coprecipitated with carbonate minerals), (3) oxide bound (adsorbed to or coprecipitated with Fe/Mn oxides), (4) organic bound (complexed with organic matter), and (5) residual (occurring as or incorporated within highly-resistant silicate minerals and only dissolved using strong acid). While the original Tessier et al. (2009) procedure did not include a specific step for dissolving reduced sulfide minerals, sulfide minerals would be oxidized and dissolved upon contact with nitric acid. Therefore, Step 4 of the original procedure is referred to as "organic/sulfide bound". The original Tessier et al. (1979) procedure was modified to also extract the water-soluble fraction of COCs prior to the exchangeable phase (Ma and Rao, 1997). The modified selective extraction procedure is shown in Table 9.

It is recognized that no chemical extraction can be 100% selective, however these methods provide a general indication of solid-phase associations and allow for relative comparisons between samples. A few key elements were analyzed in the extracts to qualitatively evaluate the selectiveness of the extraction sequence. Basic plots were then prepared showing the fraction of various extractable forms for tailings and alluvium. For example, Ca is strongly retained by clays and mineralogical testing has indicated the presence of calcite (Table 6). The Ca fractionation results for tailings (Figure 15) are consistent, indicating that most Ca exists in the exchangeable and carbonate bound form. The low percentage of Ca in the residual fraction (quartz and feldspars) suggests that the form of plagioclase feldspar is low in Ca.

The tailings solutions are elevated in sodium (Na), which is also retained by clays, and consequently fractionation results indicate a large proportion of Na is soluble and exchangeable. The remaining Na is associated with the residual fraction, consistent with the presence of a Na-dominated feldspar rather than a Ca-dominated feldspar (Figure 16). Iron is relatively insoluble and thus the soluble and exchangeable forms should be minor components compared to Fe oxides, Fe sulfides, or Fe carbonate (siderite, which was not identified by XRD or SEM). Fractionation results show little to no occurrence of Fe in the soluble, exchangeable, or carbonate bound forms, although Fe was extracted from the Fe oxide bound, sulfide bound, and residual fractions (Figure 17). The Fe fractionation results are consistent with mineralogical identification of Fe sulfides (pyrite), Fe oxides (goethite, ferrihydrite), resistant Fe oxide minerals (hematite), and aluminosilicate clay minerals containing Fe. The silica (SiO_2) fractionation results (Figure 18) show residual SiO_2 is the main component, consistent with a quartz, feldspar, and aluminosilicate clay-dominated mineralogy (Tables 6 and 7). The results for Ca, Na, Fe, and SiO_2 (Figures 15 through 18) demonstrate fair selectivity of the chemical extractions, and support the use of selective extractions in evaluating the solid-phase forms of COCs in the tailings.

Uranium was extracted from all fractions but was mainly associated with the soluble, Fe/Mn oxide, organic/sulfide, and residual fractions (Figure 19). The soluble fraction mainly represents U present in the tailings pore water, and was higher in slimes compared to sands, presumably due to the

relatively higher water and clay content of the slimes. Uranium in the residual form could indicate the presence of coffinite [$U(SiO_4)_{1-x}(OH)_{4x}$], a U-silicate mineral. Uranium can coprecipitate with calcite and therefore may exist as carbonate bound U. Uranium released from the organic/sulfide bound fraction may also indicate the presence of reduced U as uraninite (UO_2). Carnotite, coffinite, and uraninite were known to be present in the sandstone-hosted ore from the Grant District. Mineralogical results were not completely conclusive with respect to the U minerals present and did not identify U in association with silicon (Si). However, U was observed in association with Ca and V, consistent with the presence of carnotite and tyuyamunite, and the observed association of U with Ti and rare earth phosphates may also represent a more resistant (residual) form.

Molybdenum in the tailings tended to be mainly associated with either the soluble or the residual fractions (Figure 20). In the sands, Mo was primarily in the residual phase, whereas a larger proportion of the Mo in the slimes was soluble. The higher fraction of soluble Mo in the slimes is presumably due to their higher porosity and water holding capacity compared to the sands. The organic/sulfide bound fraction was insignificant, suggesting that any Mo sulfide that may have been present in the original ore has been oxidized. No discrete Mo-bearing phases were identified during mineralogical analysis, and the form of residual Mo has thus not yet been identified. Selenium in the tailings was predominantly associated with the organic/sulfide bound and soluble fractions (Figure 21). The soluble fraction represents the entrained pore water tailings solution containing elevated Se, while the organic/sulfide bound fraction represents oxidation of reduced Fe selenide and native Se that was identified using SEM (Section 2.2.1).

2.2.5 Humidity Cell Testing

Humidity cell tests (HCTs) are designed to accelerate the weathering and release of constituents from solids by exposing them to alternating wetting/drying cycles under oxidizing conditions. The sample is rinsed with clean water on a weekly basis (solution:solid ratio of 1:1) and the leachate is analyzed for the constituents of interest. Results from HCTs can be used to: (1) determine whether a solid material will produce an acidic or alkaline effluent with extensive weathering over time, (2) identify solutes in the effluent that represent dissolved weathering products, such as Se, U, Mo, and SO_4 that could be released upon oxidation, (3) determine the mass of solute release, and (4) determine the rate at which solutes could be release upon prolonged weathering (ASTM, 2013). The HCTs were conducted on run-of mine tailings samples, rather than on crushed samples, to avoid any artificial increase in liberation that could result from increased surface area induced by particle size reduction.

Four HCTs were conducted: Two LTP sands (WME-2 and -3), STP sand (WME-9), and STP slime (WME-10) (Table 1). The LTP slime samples contained excessive clay which rendered them unsuitable for testing because water could not easily be passed through and extracted from the material. The HCTs were run for 20 weeks with leachate collected weekly and analyzed for a "short-list" of constituents which includes SO_4, Fe, pH, alkalinity, and specific conductivity (SC). A "long-list" of constituents including selected metals (Ca, Mg, Na, Fe, Al, Mn, Si) and COCs (U, V, Mo, Se) was first analyzed weekly (Weeks 0, 1, and 2) and then less frequently (Weeks 4, 6, 8, 10, 12, 16, and 20).

The HCT results for the four samples are summarized on Figures 22 through 25, with detailed results being presented in Attachment 4. Specific conductance was initially highest for the slime sample, but there was an overall decrease in SC for all samples with time indicating no significant dissolution of

soluble or oxidizable minerals (Figure 22). Elevated pH values (> 9) in the HCT leachate are consistent with tailings as observed in the initial leachates, but decreased with time as the tailings pore water was rinsed from the solids. The tailings sand pH decreased relatively rapidly compared to the slimes, which are more buffered (Figure 22). However the pH of all HCT effluents remained >7 with no significant effects due to sulfide oxidation. Iron concentrations were low (<1 mg/L) and generally decreased over time, except for a few small concentration spikes which were most pronounced in the slime sample. The Fe concentrations in all HCT leachates had decreased to <0.05 mg/L in all samples during the last few weeks of testing, indicating the source of Fe (Fe sulfides) was exhausted when testing was terminated. The SO_4 trends indicate an overall lack of SO_4 production from mineral sulfide oxidation (Figure 22).

Uranium, Mo, Se, and V (Figure 23) displayed early concentration spikes in a few samples, but the overall decreasing trends do not indicate significant residual sources of COCs that would be released from the tailings upon future long-term weathering. A U spike was only observed for the slime sample and is likely due to delayed flushing-diffusion from the finer-grained material (as opposed to oxidation) due to the presence of U in the oxidized form. Spikes in Mo, Se, and V were noted in the slime and some sands, and may be the result of either physical (delayed flushing-diffusion) or chemical (oxidation of Mo sulfides and elemental Se). Plots of cumulative mass released for U, Mo, Se, and V (Figure 24) show little to no increase after 20 weeks, indicating that the capacity of the tailings to release additional COCs had become exhausted by the end of the test.

Sodium and carbonate alkalinity are the primary dissolved constituents in the shallow tailings wells (Figure 4); and, while little additional Na was being released by the end of the test, cumulative alkalinity was still increasing along with Ca (Figure 25). Cumulative SO_4 was also increasing toward the end of the 20-week test, although at much lower rates compared to weeks 0 through 5 (Figure 25). Overall these results indicate that rinsing of soluble constituents, dissolution of calcite, and oxidation of sulfide minerals (primarily pyrite, FeS_2) are the primary mechanisms controlling the long-term chemistry of weathered tailings solids leachate.

2.3 TAILINGS CHARACTERIZATION SUMMARY

The LTP pore water contains elevated pH, TDS, and is dominated by Na, SO_4, and CO_3 due to the alkaline milling process. Evaluation of redox conditions indicates the tailings water ranges from oxic to suboxic, with measured Eh values corresponding most closely to those calculated from the NH_4^+/NO_3^- redox couple. Water in the tailings sumps tends to be more oxidizing in comparison. Geochemical speciation calculations conducted using the field-derived redox information along with complete water quality analysis indicate that dissolved U and Mo exist primarily in their oxidized forms. The dissolved U primarily occurs as neutral or negatively-charged carbonate species and Mo occurs primarily as the molybdate ion (MoO_4^{-2}). Selenium is more easily reduced and is predicted to exist primarily as reduced [Se(IV)] selenite (SeO_3^-). These forms of COCs are referred to as oxyanions and are relatively mobile in the environment.

The tailings solids are composed primarily of quartz and feldspar, with lesser amounts of clay (smectite, kaolinite), calcite, and minor pyrite (Fe sulfide) based on XRD analysis. The SEM results were consistent with XRD and revealed feldspars with a high degree of edge corrosion and surface pitting due to the caustic environment. Iron occurs as both reduced (pyrite) and oxidized (goethite)

minerals. Selenium was the most abundant COC identified using SEM, and was found in a reduced state associated with pyrite and occurring as native Se. Uranium appeared less abundant but was commonly observed in association with Ca and V, suggesting an oxidized form (e.g., tyuyamunite), while no distinct Mo-bearing phases were identified.

Additional geochemical characterization of the tailings solids was conducted using ABA, selective extractions, and HCTs. The pyrite content of the tailings (up to 0.35%) contributes to its acid generation capacity, but due a greater potential for acid neutralization, the tailings are net acid neutralizing and not expected to become acidic upon future weathering. Selective chemical extraction results showed both U and Mo were predominantly recovered from the soluble (mobile) fraction and an unidentified (immobile) residual fraction. Selenium in the tailings solids was mostly associated with the soluble and organic/sulfide bound fraction, the latter which is consistent with SEM identification of Se occurring with pyrite and as elemental Se. Although there does not appear to be a significant secondary source of U, Mo, or Se which could be released during long-term weathering, pyrite oxidation could represent a potential future secondary source of SO_4 if conditions were to become oxidizing.

3.0 ALLUVIAL AQUIFER AND TRANSPORT CHARACTERISTICS

Apart from hydrodynamic factors such as diffusion and dispersion, the mobility of COCs and other mill-derived constituents in the alluvial aquifer will be controlled by the groundwater composition and mineral interactions. Therefore, detailed characterization of water chemistry and aquifer mineralogy was conducted in four general zones to assess the alluvial aquifer with respect to COC transport. The locations for alluvial groundwater sampling includes the two new wells WME-9 and WME-10 completed in alluvium underlying the STP (Figure 2), in addition to the following 13 existing Site monitoring wells categorized with respect to their location relative to the LTP (Table 2 and Figure 3): (1) North alluvial (background) wells (DD, R, Q), (2) western alluvial wells (S4, M19, MR), (3) southern alluvial wells (D1, X, F, I), and (4) LTP underlying alluvial wells (T2, T20, T22).

3.1 ALLUVIAL WATER QUALITY AND REDOX CONDITIONS

Information regarding detailed water quality and redox conditions in the alluvial groundwater were collected to understand major solution controls on COC transport. All water quality and field parameter results are contained in Attachment 2. The major ion water quality signature for the alluvial wells (Figure 26) shows background wells to the north (Wells DD, R, Q) consist of a Ca-SO_4-type water. Wells to the west tend to be dominated by Na-SO_4-type closest to the LTP due to tailings influence (Well S4), and become more Ca-SO_4 dominated with distance (Wells M19 and MR). Wells to the south (D1, X, F, I) also tend to be more dominated by Na as the major cation. The alluvial wells underlying the LTP (T2, T20, T22) and the STP (WME-9, WME-10) are consistent with a tailings signature (Figure 4) due to vertical migration of tailings solution into the alluvium, although Well WME-10 appears to be less influenced by tailings.

The pH and TDS for the alluvial wells are shown on Figure 27. The pH values for the alluvial wells are very consistent (within < 1 unit), ranging only from about 6.7 to 7.5 for the wells along flow paths to the west and south. Slightly higher pH values were observed for the background wells to the north and most alluvial wells underlying the LTP and STP. These data indicate that influences of elevated

pH in the tailings wells (> 9) (Figure 5) are rapidly attenuated in the alluvial aquifer. Elevated TDS concentrations exist in the alluvial wells underlying the LTP (but not STP) due to ongoing seepage.

The results of field DO measurements using a flow-through cell (Figure 28) indicate most of the alluvial wells studied can be classified as oxic with respect to redox conditions (Table 3), where measurable DO is as high as 6 mg/L in some wells. The alluvial wells underlying the LTP (T2, T20, T22) generally had lower levels of DO while alluvial wells to the south (D1, X, F, I) contained the highest DO concentrations, perhaps due to the injection of fresh water as part of the corrective actions. While the Eh values were highly-variable, higher Eh values (more oxidizing conditions) are also reflected in the wells to the south (Figure 28). The concentrations of Fe^{+2} were mostly below detection (<0.02 mg/L) with the exception of Well T20 below the LTP where locally-reducing conditions exist and Fe^{2+} ranged from 2.0 to 5.7 mg/L. The concentrations of H_2S and NH_3-N were below detection or very low in most alluvial wells (Attachment 2).

3.1.1 Geochemical Modeling of Alluvial Aquifer

The specific form of each dissolved COC in solution is an important factor controlling its degree of attenuation in the alluvial aquifer. The geochemical speciation model PHREEQC (Parkhurst and Appelo, 2013) was used to predict the dissolved forms of U, Se, and Mo in the alluvial wells to the north and along potential transport pathways to the west and south. The concentrations of major cations, major anions, metals, and COCs (Attachment 2) were input into the model and the redox was controlled using the O(-2)/O(0) redox couple based on the oxic conditions in the alluvial aquifer where reduced species of N, Fe, and S are very low or non-detectable. The MINTEQv4.dat database which was developed by the USEPA was used for all model calculations. The model results for the alluvial wells (Table 10) indicates that the oxidized form of U(VI) predominates and exists primarily as the neutral uncharged $Ca_2UO_2(CO_3)_3$ species and the negatively charged $CaUO_2(CO_3)_3^{2-}$ species. Under oxic conditions, virtually 100% of the Se is predicted to occur mainly as selenate [Se(VI)] (e.g., SeO_4^{2-}) and 100% of the dissolved Mo is predicted to occur as the oxidized molybdate ([Mo(VI)] ion (MoO_4^{2-}). The negatively charged species of U, Se, and Mo are collectively referred to as "oxyanions" and generally tend to be relatively mobile in the environment.

The COC concentrations in the alluvial aquifer are potentially controlled by their occurrence as discrete mineral phases and by their interaction with other major minerals along the flow path. The saturation index (SI) values (Section 2.1.1) for some of the common U, Se, and Mo minerals in the natural environment are shown in Table 11. The SI values for the reduced U(IV) minerals (amorphous UO_2 and crystalline UO_2, uraninite) are highly undersaturated, in part due to the very low calculated proportion of reduced U(IV). In addition, the concentrations of oxidized U(VI) and accessory components are not elevated enough to reach saturation with respect to the oxidized U minerals, such as carnotite or tyuyamunite, as indicated by the highly negative SI values. Negative SI values for amorphous elemental Se and ferroselite ($FeSe_2$, values not shown) indicate conditions are not adequately reducing to precipitate reduced Se phases. Saturation index values for calcium molybdate ($CaMoO_4$) generally indicate undersaturated conditions, except below the LTP (Wells T2, T20, T22) where the groundwater was either oversaturated or in equilibrium with respect to $CaMoO_4$. The alluvial aquifer is in equilibrium with calcite, oversaturated with respect to ferrihydrite and quartz, and undersaturated with respect to Al hydroxide. Undersaturation was also predicted for Fe sulfide (pyrite), siderite (Fe carbonate), and rhodochrosite (Mn carbonate) (data not shown).

3.2 ALLUVIAL AQUIFER SOLIDS

Alluvial aquifer solids were collected for geochemical testing from areas located north (background), south, and adjacent to the LTP, in addition to samples of alluvium that were collected from the perched and underlying vadose zones below the LTP. Table 1 summarizes the original alluvial solids collection and geochemical testing program, and the alluvial boring locations are shown on Figure 3 (it should be noted that saturated alluvium could not be collected from locations WME-12 and WME-13 because the drill stem hit refusal on igneous bedrock before groundwater was encountered). Solid-phase characterization of the aquifer solids is used to develop conceptual potential COC attenuation mechanisms and also provides site-specific input for reactive transport modeling.

3.2.1 Alluvial Aquifer Mineralogy

Mineralogical analyses of the alluvium samples (Table 1) was conducted by DCM Science Laboratory, Inc. (Wheat Ridge, CO). The original XRD mineralogical report is provided in Attachment 3 and key findings are summarized in Table 7. Seven samples of alluvium were analyzed using XRD analysis to identify their bulk and clay mineral compositions. The XRD results in Table 6 show the alluvium is primarily composed of quartz, potassium feldspar, plagioclase, and calcite which are very stable but provide little attenuation capacity. Pyrite was detected in the north alluvium sample at the detection limit. The clay content of the alluvium samples ranges from 2 to 15% and is composed of smectite, illite, and kaolinite.

One alluvium sample located directly adjacent to the LTP (WME-16, currently impacted) and a sample from the south (WME-14, formerly impacted) were also examined using SEM to identify potential COC associations and attenuation mechanisms (Table 1, Figure 3). The SEM results were consistent with XRD results indicating that the dominant minerals are quartz, plagioclase feldspar, and K-feldspar, with lesser amounts of clay. Feldspars were shown to contain small inclusions of pyrite, chalcopyrite, barite, rutile, zircon, and rare earth phosphates. Calcite was the sole carbonate identified with a content ranging from 6 to 20%. The amorphous material in alluvium sample WME-14 which could not be identified using XRD (Table 6) was recognized as volcanic glass using SEM. No Se-, U-, or Mo-bearing phases could be identified.

3.2.2 Acid-Base Accounting, pH, and Sulfur Forms

The ABA results with sulfur forms and calculated NNP values for the alluvium are provided in Table 8. The sulfide-S content in all alluvium samples determined by Leco furnace was below detection (<0.01 %) although traces of pyrite were detected in a few samples during mineralogical testing (Tables 6 and 7). The total-S content of the alluvium is low (<0.01 to 0.04%) and the primary form of sulfur is sulfate-S (likely present as trace gypsum) due to predominantly arid and oxidizing conditions in the alluvium (Figure 13).

3.2.3 Cation Exchange Capacity/Total Organic Carbon

The results for CEC and TOC of the alluvium samples are provided in Table 8. Both CEC values and TOC contents of the alluvium are notably lower compared to the tailings. The CEC of the alluvium (2.9 to 7.7 $cmol_c/kg$) is low due to the low clay content (Table 6). The TOC content of the alluvium is generally below detection (<0.10%) due to the arid environment and oxidizing conditions.

3.2.4 Selective Chemical Extraction

Chemical selective extraction was also conducted on samples of the alluvium using the procedures outlined in Table 9. The selective extraction results for the alluvium indicate a higher proportion of potentially mobile U phases where the alluvium has been influenced by tailings. Alluvium adjacent to the LTP (WME-16) and from perched and vadose zones underlying the LTP contain higher proportions of soluble, exchangeable, carbonate bound, Fe/Mn oxide bound, and organic/sulfide bound compared to more distant samples (WME-11, -14, and -15) (Figure 29). Similar results were obtained for Mo where the adjacent and underlying alluvium contains an appreciable fraction of soluble Mo compared to the more distant upgradient and downgradient locations (Figure 30). The adjacent and underlying alluvium samples also contained a higher proportion of soluble Se compared to the remaining samples (Figure 31). The perched alluvium sample collected from below the slimes area (WME-8@110) contained a higher proportion of organic/sulfide bound Se compared to the other LTP-influenced samples, indicating the presence of Fe selenide and/or native Se under more localized reducing conditions below the LTP.

3.2.5 Meteoric Water Mobility Testing

The Meteoric Water Mobility Procedure (MWMP) is a column percolation test that was originally designed to determine the potential for dissolution and mobility of constituents from mine rock by meteoric water (ASTM, 2002). Although the Synthetic Precipitation Leaching Procedure (SPLP, USEPA Method 1312) outlines similar objectives for fine-grained materials, the MWMP is generally preferred over the SPLP due to the low water:rock ratio used. The MWMP utilizes the lowest water:rock ratio practical for leaching studies (1:1), whereas the SPLP uses a 20:1 water:rock ratio which produces a highly diluted leachate. A consecutive MWMP test consisting of three successive leaches was conducted on the four alluvium samples collected from perched and vadose zones underlying the LTP (Table 1). The objective of the MWMP testing is to characterize the potential future release of COCs from impacted alluvium underlying the LTP.

The tabulated MWMP results and pore volume (PV) calculations for the alluvium are shown in Table 12. The procedure uses 5 kg of alluvium and a leachate volume of 5 L (1:1) therefore the results can be expressed as either mg/L or mg/kg. The volume of each sample was calculated using a bulk density of 1.86 g/cm^3 which was computed assuming a total porosity of 0.30 and a particle density of 2.65 g/cm^3. The effective porosity of 0.2 was then used to calculate a PV which is equal to 0.54 L. Therefore, each of the three consecutive 5-L MWMP leaches represents approximately 9 PV (5 L/0.54).

The MWMP-extractable concentrations of U, Mo, and Se are shown relative to their total concentrations on Figures 32 through 34. The insoluble fractions were calculated from the difference between the total concentrations obtained from the sum of the selective extraction steps (Section 3.2.4) on a sample split, and the concentrations released from the MWMP leach. Except for Mo in the perched zone at location WME-7, the leachable concentrations of COCs are generally higher from samples below the LTP sands (WME-7) compared to samples below the LTP slimes (WME-8). This is consistent with lower clay contents and soluble COC concentrations observed in the LTP sands indicating a potentially higher degree of COC migration into the alluvium below the sands. The percentages of total U, Mo, and Se leached from the underlying LTP alluvium samples by the MWMP

(for Leaches 1 through 3) are indicated on Figures 32 through 34. Only a small fraction of the total was released by the MWMP: 4.9 to 16.3% for U, 11.1 to 16.1% for Mo, and 1.4 to 15.9% for Se.

3.3 ALLUVIAL AQUIFER CHARACTERIZATION SUMMARY

The alluvial aquifer quality displayed variable major ion composition depending on proximity to the LTP in the alluvial wells studied. The native alluvial groundwater is a Ca-SO_4 type water, whereas influences from the LTP underlying and adjacent to the LTP is evident by a Na-SO_4 type signature and elevated pH. The alluvial groundwater can be classified as oxic with respect to redox conditions, and is comparatively more oxidizing compared to the LTP pore water. The alluvial solids are predominantly composed of quartz, feldspar, and calcite. Pyrite is generally absent and the alluvium contains low contents of amorphous Fe hydroxide and a low clay content. The dissolved U, Mo, and Se exist in their oxidized form as neutral or negatively charged species and therefore are not expected to be strongly attenuated in the alluvial aquifer.

4.0 LARGE TAILINGS PILE CONCENTRATION REBOUND ASSESSMENT

Active flushing of the LTP ceased entirely in July 2015. The current source control strategy assumes that the predicted long-term concentrations will remain stable as the tailings seepage continues to drain. However, in 2010 the U.S. Army Corps of Engineers (ACOE) recognized that a significant mass of U is still present in the tailings, and that diffusive mass transfer of soluble U from fine-grained materials and/or dissolution of solid-phase U could result in additional release of COCs following cessation of flushing. Therefore, based on ACOE recommendations, HMC implemented a tailings rebound study to better support the prediction of long-term post-flushing behavior in the LTP. The information presented in this section builds upon the initial tailings rebound study that was conducted (Arcadis, 2012).

The objective of the current rebound study was to conduct additional *in situ* tailings pore water monitoring from both new (short-screen) and existing (long-screen) wells, evaluate solid-phase forms of COCs, and conduct a controlled column study to improve the assessment of COC rebound in the LTP. The approach for the supplemental tailings rebound assessment is to: (1) Evaluate in detail the long-term pre-and post-flushing trends in COC concentrations in all tailings wells and sumps, (2) extend the in situ post-flush monitoring period for existing wells previously used for that purpose (Arcadis, 2012), (3) expand the areal extent and representativeness of in situ post-flush monitoring by installing additional wells with shorter screen lengths in sands and slimes, and (4) conduct a controlled column study using isolated tailings samples. The evaluation considers the solid-phase chemical and mineralogical information from source characterization and geochemical speciation modeling (Sections 2.0 and 3.0) to understand potential controls on pore water COC concentrations.

4.1 EXISTING AND HISTORICAL MONITORING WELLS (LONG SCREEN)

HMC has routinely used a group of sand and slimes wells installed in the LTP to monitor COC concentrations and to calculate the distribution of soluble U in the LTP (HMC and HE, 2020). Hydro-Engineering (Casper, WY) has provided historical tailings water quality data from individual LTP wells, in addition to the volume-weighted average U concentrations which have been calculated for U (since 2006), Mo (since 2010), and Se (since 2018). Because the number and locations of individual monitoring points varied from year-to-year, the volume-weighted average are used when available to better represent the average concentrations in the LTP.

The long-term average concentrations of U, Mo, and Se in these wells are shown on Figures 35 through 37 compared to times when flushing began in 2000 and when flushing ceased in 2015. Uranium and Mo (Figure 35-36) show similar trends, with average concentrations decreasing sharply upon flushing and an overall downward trend through 2019. The average Se concentrations were more variable but also show an overall decreasing trend since flushing began (Figure 37). Geochemical evaluation of tailings water and solids (Section 2.0) indicates that U and Mo occur primarily in their dissolved form as mobile oxidized species, whereas Se may occur in solution as both the Se(IV) and Se(VI) oxidation states, and as reduced Se in association with Fe sulfides (pyrite). The higher variability and degree of fluctuation in dissolved Se concentrations compared to U and Mo could be a result of alternating redox conditions induced during flushing. The trends in average COC concentrations since flushing ceased provide no indication of concentration rebound.

4.2 TAILINGS SUMPS

The concentrations of U, Mo, and Se in tailings sumps were also evaluated as potential indicators of the bulk LTP post-flushing behavior. Other than a few concentration spikes in 2018, the U concentrations in the sumps have decreased steadily since flushing was initiated and have not demonstrated any significant increasing trends since flushing ceased (Figure 38). Molybdenum concentrations in the sumps also continued to decrease during flushing, and have continued to decrease post-flushing, with the exception of the West 1 and North 3 Sumps, where Mo began to increase after 2017, but has since declined (Figure 39). The behavior of Se in most sumps differed from U and Mo, with notable increases in the early years of flushing, followed by rinsing out to levels below pre-flushing concentrations (Figure 40). The increases in Se may have resulted from flushing-enhanced dissolution and/or oxidation of reduced forms of Se which have been identified in the LTP solids (Section 2). All sumps displayed a spike in Se concentration during 2018, but have again been trending downward in 2019 (Figure 40). Chloride is a conservative constituent which can be used as a baseline to evaluate the potential for diffusive rebound. Chloride concentration trends in sumps (Figure 41) were similar to those of U, Mo, and Se, where a few small concentration spikes occurred in 2018, but the predominantly decreasing trends provide no indication of diffusive rebound.

4.3 EXISTING REBOUND EVALUATION WELLS

Arcadis (2012) used four primary monitoring wells (WF2, WF9, WF11, WE9) for *in situ* post-flush monitoring of COCs in the LTP. These wells are located in a sub-area of the LTP referred to as the "extended shutdown area" (Figure 1) where flushing ceased on May 19, 2011. Although this group of wells has extended screen lengths (50 to 80 ft.) as criticized by ACOE (2010), a significant amount of post-flushing data (1-Yr. period) had been collected from these wells. Those post-flushing COC concentrations trends were inconclusive due to the variability in observed post-flushing levels (Arcadis, 2012). Rather than abandon these wells, it was proposed to take advantage of the existing data by re-initiating monitoring on a monthly basis for an additional 1-Yr. period (WME, 2018a).

Uranium concentrations in the wells decreased during active flushing and remained below 1 mg/L during the subsequent 1-Yr. monitoring period (Figure 42). Since that time, U concentrations increased to between 1 and 3 mg/L at WE, WF2, and WF9 through 2018, but have since declined. Uranium concentrations have continued to decrease in WF11. Molybdenum concentrations began to increase more rapidly after flushing was ceased compared to U, and have trended upward at these

locations except for Well WF11 where Mo has been decreasing (Figure 43). Since flushing ceased, Se concentrations have trended downward in all wells except WF2 where Se has slightly increased (Figure 44). In recent years, Se concentrations have steadily declined at WF11, whereas concentrations have been fluctuating in the remaining wells. Since flushing ceased, Cl concentrations have slightly increased at WE9, WF2, and WF9, and slightly decreased at WF11 (Figure 45).

In Well WF11, the concentrations of U, Mo, Se, and Cl have all shown decreasing trends since flushing was ceased. At WE9, WF2, and WF9, the increases in U and Mo were also accompanied by an increase in Cl. However there are two locations where Se has decreased (WE9, WF9) while chloride (and U, Mo) have increased. Concentrations which increase in association with Cl may be attributed to diffusive rebound, whereas decreasing Se concentrations may be a result of Se reduction and precipitation due to re-establishment of more reducing conditions following flushing.

4.4 NEW TAILINGS WELLS (SHORT SCREEN)

Three new sand wells (WME-1, -2, -3) and three new slime wells (WME-4, -5, -6) were installed in the LTP with short screen lengths (5 ft.) for monitoring dissolved COCs and major constituents as part of the tailings rebound study (Figure 1, Table 2). These borings were also utilized to collect tailings solids for geochemical analyses and a controlled static column study (Section 4.5). The wells were sampled approximately every 2 months from August 2018 through February 2020, with the exception of WME-1 which went dry after June 2019, and WME-2 which was not sampled in 2020. The trends for U and Mo (Figure 46) have either decreased (WME-1) or remained fairly constant, other than an initial increase that was observed at WME-5. Similar to observations from the LTP sumps (Section 4.2) and Arcadis wells (Section 4.3), Se concentrations tend to fluctuate slightly with no consistent trends. Although a spike in V occurred in late 2018, the V concentrations have overall decreased (Figure 46). By and large, the concentrations of major constituents Na, Cl, SO_4, and TDS have also either decreased (WME-1) or remained fairly constant since 2018 (Figure 47). Taken as a whole, the concentration trends for COCs and major dissolved constituents in the short-screen wells provide no indication of significant diffusive rebound into the LTP pore water.

4.5 CONTROLLED STATIC COLUMN STUDY

On-site static column testing was conducted using tailings collected from the new LTP wells (WME-1 through WME-6) to evaluate potential diffusive rebound of COCs from isolated tailings samples under controlled conditions (WME, 2018d). Minimally-disturbed cores of sand (WME-1 through-3) and slime (WME-4 through 6) were collected during installation of the new wells and placed into six PVC columns (8 in. x 60 in.). Immediately upon filling with tailings, each column was thoroughly flushed with nitrogen gas to minimize contact of the tailings with air and prevent oxidation. Following well development, tailings water from each respective well was placed into a large plastic container and sparged with nitrogen gas. Each column was then filled with their respective tailings water in an up-flow configuration to minimize entrapment of gas within the tailings solids. A sample of the initial column fluid was collected after 24 hours, and then subsequently after 1, 3, 6, 9, and 12 months. Column effluent samples were analyzed for dissolved COCs, major cations/anions, metals, and pH. Detailed column test results are provided in Attachment 5.

The column test results for U (Figure 48) and Mo (Figure 49) show initial concentration increases in the slimes, but concentrations in all columns either remained constant or decreased slightly during

the 1-Year test. Selenium concentrations were most elevated in the initial samples (Day 0), but then rapidly decreased and remained stable during the 1-Year test (Figure 50). The initial Se concentrations in Columns 1 through 6 were much higher compared to their respective well locations (WME-1 through -6) where water and tailings solids were collected (Attachment 2). Although precautions were taken to exclude atmospheric oxygen from the columns, some oxidation of solid-phase Se probably occurred during the initial stages of column setup and sampling. Entry of oxygen into the sealed columns was limited however, and reducing conditions were quickly re-established, with associated decreases in Se. Chloride concentrations (Figure 51) remained constant in all columns and thus provide no indication for diffusive rebound.

4.6 LTP REBOUND EVALUATION SUMMARY

A multi-faceted approach to evaluating post-flushing rebound of COC concentrations in the LTP pore water considers trends in existing tailings wells and sumps, in addition to those from new wells with shorter screens and from a controlled static column study. Although a few select sumps and former rebound monitoring wells have demonstrated increasing COC concentrations since flushing ceased, monitoring of short-screen wells indicates either decreasing or overall stable concentrations of COCs and major dissolved constituents in LTP pore water. In addition, results from the controlled static column study provided no indication of diffusive rebound over a 1-Year test period. The volume-weighted concentrations of U, Mo, and Se in the LTP have also been decreasing since flushing ceased, providing no indication of diffusive concentration rebound in the LTP as a whole.

5.0 CONCLUSIONS

Geochemical characterization of HMC's LTP facility and the surrounding alluvial aquifer was conducted to refine and support the current conceptual geochemical model, to understand LTP source characteristics, and to predict future COC transport behavior in the alluvial aquifer. Redox conditions in the LTP range from oxic to suboxic such that dissolved Se is predicted to exist mainly as selenite (SeO_3^-). Molybdenum occurs as the oxidized molybdate ion (MoO_4^{2-}) and U as neutral or negatively-charged carbonate complexes. Geochemical testing of the tailings solids indicate they are net acid neutralizing, and the presence of significant residual secondary sources of U or Mo were not identified. Yet, some reduced forms of Se were identified in association with pyrite and occurring as elemental Se, which could present possible long-term secondary sources of Se and SO_4. However, the HCT results collected through 20 weeks of testing did not indicate any significant release of Fe, SO_4, U, Mo, or Se from the tailings solids upon accelerated weathering. Although evaluation of post-flushing rebound in the LTP shows that some wells and sumps have demonstrated COC increases since flushing ceased, their post-flushing volume-weighted averages have continued to decrease, and results from the controlled column study provide no indication of diffusive rebound.

The native alluvial groundwater is a near-neutral Ca-SO_4 type water which trends toward a more alkaline, Na-SO_4 type water in the vicinity of the LTP. The alluvial aquifer can be classified as oxic with respect to redox conditions, and is comparatively more oxidizing compared to the LTP pore water. Aquifer solids collected from the middle of saturated zone were primarily coarse-grained materials with low clay content and CEC, although it is recognized that dense lenses of clay are sporadic throughout the alluvial aquifer. The samples were dominated by quartz and feldspar, with

minor calcite, clays and amorphous Fe oxide. Groundwater transport of the COCs is therefore likely controlled by the presence of Fe oxides due to their overall high adsorption capacity. However, because the dissolved U, Mo, and Se exist in their oxidized forms as neutral or negatively-charged species, they are only weakly adsorbed to the Fe oxide surfaces and thus not strongly attenuated in the alluvial aquifer. In the immediate vicinity of the LTP, Mo precipitation may be occurring where reaction of the LTP pore water with calcite in the alluvium causes oversaturation with respect to calcium molybdate ($CaMoO_4$). Results from this geochemical characterization study have improved our understanding of both COC source characteristics and potential groundwater transport mechanisms at the GRP, and provide a basis for further development of conceptual and geochemical models describing COC transport in the alluvial aquifer.

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Tables

Table 1. Summary of Homestake Tailings and Alluvial Solids Sample Collection and Geochemical Testing.[1]

Location ID	Material Description	Depth (ft. bgs)	ABA-pH-CEC-TOC	XRD	HCT	Selective Extraction	SEM	MWMP
WME-1	LTP Sands	55'	X	X	------	------	------	
WME-2	LTP Sands	61'	X	X	X	X	X	------
WME-3	LTP Sands	65'	X	X	X	X	X	------
WME-4	LTP Slimes	65'	X	X	------	------	------	------
WME-5	LTP Slimes	75'	X	X	------	X	X	------
WME-6	LTP Slimes	65'	X	X	------	X	------	------
WME-7@108	LTP Perched Alluvium	108'	X	X	------	X	------	X
WME-7@113	LTP Vadose Alluvium	113'	X	X	------	X	------	X
WME-8@110	LTP Perched Alluvium	110'	X	X	------	------	------	X
WME-8@121	LTP Vadose Alluvium	121'	X	X	------	------	------	X
WME-9	STP Sands	30'	X	X	X	X	------	------
WME-10	STP Slimes	35'	X	X	X	X	X	------
WME-11	North Alluvium	65'	X	X	------	X	------	------
WME-12	West Alluvium	No Sample	------	------	------	------	------	------
WME-13	West Alluvium	No Sample	------	------	------	------	------	------
WME-14	South Alluvium	45'	X	X	------	X	X	------
WME-15	South Alluvium	55'	X	X	------	------	------	------
WME-16	Adjacent Alluvium	65'	X	X	------	X	X	------
WME-17	Adjacent Alluvium	55'	X	X	------	------	------	------

[1] ABA-pH-CEC-TOC = Acid-base accounting, pH, cation exchange capacity, and total organic carbon. XRD = X-ray Diffraction analysis. HCT = humidity cell testing. SEM = scanning electron microscopy. MWMP = Meteoric Water Mobility Procedure.

Table 2. Well Completion Information and Sampling Protocols for New and Existing Tailings and Alluvial Wells.[1]

Well ID	Lithology	Total Depth (ft. TOC)	Top Screen (ft. TOC)	Depth to Water (ft. TOC)	Saturated Thickness (ft.)	Well Volume (gal.)	Sampling Frequency & Duration[2]
WME-1	LTP Sands	57.30	51.80	53.45	3.85	2.5	2 months / 19 months[3]
WME-2	LTP Sands	64.60	59.10	57.25	7.35	4.8	
WME-3	LTP Sands	72.65	67.15	61.3	11.35	7.4	
WME-4	LTP Slimes	67.60	62.10	57.49	10.11	6.6	
WME-5	LTP Slimes	77.32	71.82	66.98	10.34	6.8	
WME-6	LTP Slimes	67.25	61.75	54.95	12.30	8.0	
WF2[4]	LTP Slimes	110	28	62.33	47.67	48.6	1 month / 1 year
WF9	LTP Slimes	116	36	63.65	52.35	53.4	
WF11	LTP Slimes	116	36	56.52	60.42	61.6	
WE9[4]	LTP Slimes	116	36	55.58	60.20	61.4	
WME-9	STP Alluvium	73.20	67.70	58.5	14.70	9.6	Quarterly / 17 months[5]
WME-10	STP Alluvium	76.70	71.20	58.9	17.80	11.6	
DD	North Alluvial	79.8	40.0	47.9	32.0	21.0	Quarterly / 1 year
R		85.0	60.0	39.84	45.16	29.3	
Q		102.17	72.0	42.08	60.1	39.1	
S4	Western Alluvial	112.05	50.0	39.7	72.4	47.0	
M19[6]		104.1	60.0	65.5	38.6	25.3	
MR		75.85	54.0	66.46	9.39	9.5	
D1	Southern Alluvial	87.0	58.0	40.5	46.5	47.4	
X		48.6	--------	31.50	17.1	11.1	
F		62.0	50.0	34.1	27.9	18.2	
I		69.4	52.0	36.2	33.2	21.5	
T2	LTP Underlying Alluvial	186.0	100.0	119.8	66.2	67.5	
T20		157.3	140.0	129.5	27.8	28.4	
T22		159.0	120.0	122.9	36.1	36.8	

[1] Water levels and volumes based on measurements from June 2018. WME-1 became dry after June 2019. [2]Analyses include major cations (Ca, Mg, Na, K), Major anions (Cl, SO_4, NO_3+NO_2-N, NH_3-N, PO_4, F, HCO_3+CO_3), metals (Al, Fe, Mn, Si), COCs (U, V, Mo, Se), field redox parameters (DO, pH, ORP/Eh, specific conductivity temperature, ferrous iron, sulfide-S using a flow cell. [3] No samples collected in August or October 2018. [4] No samples collected in July 2018. [5] No samples collected August or November of 2019 with last sample being collected December 2019. [6] No sample collected 4th quarter 2018.

Table 3. Redox Classification for Groundwater Showing Concentrations of Dissolved Oxygen, Total, Sulfide, and Characteristic Mineral Phases.

Environment	Characteristic Mineral Phases
Oxic - O_2 > 1 mg/L	Iron oxides (hematite, ferrihydrite), manganese oxides, organic matter absent
Suboxic - $O_2 \geq 0.03$ mg/L and < 1 mg/L; detectable Mn	Iron oxides (hematite, ferrihydrite), manganese oxides, minor organic matter
Anoxic (O_2 < 0.03 mg/L)	Pyrite/marcasite, rhodochrosite, organic matter
Sulfidic ($H_2S \geq 0.03$ mg/L)	
Nonsulfidic ((H_2S < 0.03 mg/L)	

Table 4. Percent Distribution of U, Se, and Mo Species for LTP Wells and Sumps.[1]

Location	Date	Uranium					Selenium			Molybdenum
		$UO_2(CO_3)_3^{4-}$	$CaUO_2(CO_3)_3^{2-}$	$Ca_2UO_2(CO_3)_3$	$MgUO_2(CO_3)_3^{2}$	$UO_2(CO_3)_2^{2-}$	SeO_3^{2-}	$HSeO_3^{-}$	SeO_4^{2-}	MoO_4^{2-}
WME-1	8/21/2018	99.98	0.02	0.00	0.00	0.00	99.68	0.28	0.04	100
WME-1	10/25/2018	99.99	0.01	0.00	0.00	0.00	99.58	0.37	0.04	100
WME-1	12/14/2018	99.94	0.06	0.00	0.00	0.00	99.50	0.45	0.05	100
WME-1	2/26/2019	99.98	0.02	0.00	0.00	0.00	99.77	0.19	0.05	100
WME-1	4/9/2019	99.98	0.02	0.00	0.00	0.00	99.73	0.22	0.05	100
WME-1	6/21/2019	99.92	0.08	0.00	0.00	0.00	86.06	0.18	13.76	100
WME-2	8/21/2018	90.38	9.22	0.32	0.05	0.03	95.23	4.18	0.59	100
WME-2	10/25/2018	92.67	7.05	0.22	0.04	0.01	96.75	1.66	1.60	100
WME-2	12/14/2018	89.77	9.81	0.38	0.02	0.01	96.50	1.44	2.06	100
WME-2	2/26/2019	88.59	10.90	0.47	0.02	0.01	99.21	0.77	0.02	100
WME-2	4/9/2019	95.21	4.67	0.08	0.02	0.01	99.21	0.77	0.02	100
WME-2	6/21/2019	85.78	13.54	0.64	0.02	0.02	98.86	1.09	0.05	100
WME-2	12/12/2019	95.36	4.52	0.08	0.02	0.01	99.41	0.55	0.04	100
WME-3	8/21/2018	97.86	2.11	0.02	0.01	0.01	93.83	1.35	4.82	100
WME-3	10/25/2018	98.80	1.18	0.01	0.01	0.01	80.94	0.58	18.49	100
WME-3	12/14/2018	96.23	3.70	0.05	0.01	0.01	83.27	0.44	16.29	100
WME-3	2/26/2019	92.92	6.91	0.15	0.00	0.01	99.62	0.35	0.02	100
WME-3	4/9/2019	98.57	1.38	0.01	0.02	0.01	99.60	0.38	0.02	100
WME-3	6/21/2019	93.10	6.71	0.16	0.01	0.01	99.68	0.29	0.03	100
WME-3	12/11/2019	96.75	3.12	0.04	0.01	0.01	99.84	0.14	0.02	100
WME-3	2/20/2020	98.88	1.08	0.00	0.00	0.01	99.72	0.25	0.03	100
WME-4	8/21/2018	99.99	0.01	0.00	0.00	0.00	99.83	0.16	0.01	100
WME-4	10/25/2018	100	0.00	0.00	0.00	0.00	93.87	0.09	6.03	100
WME-4	12/14/2018	99.99	0.01	0.00	0.00	0.00	99.78	0.21	0.00	100
WME-4	2/26/2019	100	0.00	0.00	0.00	0.00	99.89	0.10	0.00	100
WME-4	4/9/2019	100	0.00	0.00	0.00	0.00	99.93	0.06	0.00	100
WME-4	6/21/2019	99.99	0.01	0.00	0.00	0.00	99.92	0.07	0.00	100
WME-4	12/11/2019	99.99	0.00	0.00	0.00	0.00	99.97	0.02	0.01	100

Table 4. Percent Distribution of U, Se, and Mo Species for LTP Wells and Sumps (Continued).

Location	Date	Uranium					Selenium			Molybdenum
		$UO_2(CO_3)_3^{4-}$	$CaUO_2(CO_3)_3^{2-}$	$Ca_2UO_2(CO_3)_3$	$MgUO_2(CO_3)_3^{2}$	$UO_2(CO_3)_2^{2}$	SeO_3^{2-}	$HSeO_3^{-}$	SeO_4^{2-}	MoO_4^{2-}
WME-4	2/20/2020	100	0.00	0.00	0.00	0.00	99.96	0.04	0.00	100
WME-5	8/22/2018	99.69	0.22	0.00	0.00	0.00	99.96	0.03	0.01	100
WME-5	10/25/2018	99.87	0.11	0.00	0.00	0.00	99.96	0.04	0.00	100
WME-5	12/14/2018	99.71	0.28	0.00	0.00	0.00	99.93	0.06	0.01	100
WME-5	2/26/2019	99.95	0.05	0.00	0.00	0.00	99.72	0.27	0.02	100
WME-5	4/9/2019	99.88	0.12	0.00	0.00	0.00	99.62	0.34	0.03	100
WME-5	6/21/2019	99.47	0.52	0.01	0.00	0.00	99.92	0.07	0.01	100
WME-5	12/12/2019	99.81	0.18	0.00	0.00	0.00	99.95	0.04	0.01	100
WME-5	2/20/2020	99.90	0.09	0.00	0.00	0.00	99.94	0.04	0.01	100
WME-6	8/22/2018	99.89	0.11	0.00	0.00	0.00	99.57	0.41	0.01	100
WME-6	10/25/2018	99.91	0.09	0.00	0.00	0.00	99.76	0.22	0.02	100
WME-6	12/14/2018	99.42	0.57	0.01	0.00	0.00	99.76	0.23	0.02	100
WME-6	2/26/2019	99.83	0.17	0.00	0.00	0.00	99.82	0.16	0.01	100
WME-6	4/9/2019	99.83	0.16	0.00	0.00	0.00	99.79	0.18	0.02	100
WME-6	6/21/2019	98.92	1.06	0.02	0.00	0.00	99.83	0.13	0.04	100
WME-6	12/12/2019	99.63	0.36	0.00	0.00	0.00	99.92	0.07	0.01	100
WME-6	2/20/2020	99.83	0.16	0.00	0.00	0.00	99.89	0.10	0.01	100
WE9	4/16/2018	84.37	14.70	0.72	0.19	0.02	99.34	0.61	0.06	100
WE9	5/23/2018	79.43	19.11	1.20	0.22	0.04	95.14	4.72	0.14	100
WE9	6/6/2018	82.01	16.80	0.99	0.17	0.03	96.72	3.19	0.09	100
WE9	8/13/2018	91.34	8.25	0.21	0.18	0.02	98.16	1.77	0.07	100
WE9	10/2/2018	88.12	11.26	0.44	0.16	0.02	98.18	1.70	0.13	100
WE9	10/30/2018	88.47	10.86	0.49	0.16	0.02	98.01	1.89	0.10	100
WE9	11/27/2018	86.80	12.50	0.56	0.13	0.02	98.55	1.34	0.10	100
WE9	12/18/2018	89.76	9.78	0.36	0.09	0.01	98.91	1.02	0.07	100
WF2	4/11/2018	93.73	5.99	0.16	0.10	0.01	96.39	1.63	1.98	100
WF2	5/23/2018	95.84	3.99	0.13	0.05	0.01	98.66	1.31	0.02	100
WF2	6/6/2018	93.92	5.82	0.16	0.09	0.01	89.78	1.12	9.10	100

Table 4. Percent Distribution of U, Se, and Mo Species for LTP Wells and Sumps (Continued).

Location	Date	Uranium					Selenium			Molybdenum
		$UO_2(CO_3)_3^{4-}$	$CaUO_2(CO_3)_3^{2-}$	$Ca_2UO_2(CO_3)_3$	$MgUO_2(CO_3)_3^{2}$	$UO_2(CO_3)_2^{2}$	SeO_3^{2-}	$HSeO_3^{-}$	SeO_4^{2-}	MoO_4^{2-}
WF2	8/13/2018	94.36	5.39	0.11	0.12	0.01	92.15	1.01	6.84	100
WF2	10/2/2018	95.88	3.94	0.08	0.09	0.01	87.06	0.54	12.41	100
WF2	10/30/2018	94.71	5.03	0.14	0.10	0.01	99.11	0.86	0.04	100
WF2	11/26/2018	93.09	6.59	0.20	0.10	0.01	99.34	0.63	0.03	100
WF2	12/18/2018	94.29	5.46	0.16	0.08	0.01	88.01	0.51	11.48	100
WF9	4/10/2018	89.70	9.74	0.38	0.16	0.02	97.61	2.33	0.05	100
WF9	5/7/2018	84.28	14.68	0.83	0.18	0.02	97.82	2.10	0.08	100
WF9	6/6/2018	80.49	17.94	1.37	0.19	0.02	97.83	2.10	0.06	100
WF9	7/18/2018	80.50	18.17	1.09	0.21	0.02	98.02	1.93	0.06	100
WF9	8/16/2018	84.43	14.55	0.84	0.16	0.02	98.18	1.78	0.03	100
WF9	10/2/2018	87.93	11.38	0.55	0.12	0.01	98.91	1.06	0.03	100
WF9	10/30/2018	86.87	12.24	0.72	0.15	0.01	98.97	0.99	0.04	100
WF9	11/26/2018	81.54	17.01	1.30	0.13	0.01	99.05	0.90	0.04	100
WF9	12/17/2018	86.93	12.29	0.64	0.12	0.01	99.19	0.78	0.03	100
WF11	4/5/2018	66.65	30.11	2.91	0.29	0.05	94.78	5.17	0.05	100
WF11	5/23/2018	60.76	34.76	4.15	0.28	0.04	95.06	4.89	0.06	100
WF11	6/5/2018	45.82	45.79	8.10	0.23	0.06	92.51	7.36	0.12	100
WF11	7/18/2018	53.76	40.25	5.66	0.26	0.07	90.84	9.04	0.12	100
WF11	8/16/2018	69.13	28.14	2.42	0.26	0.04	96.04	3.89	0.07	100
WF11	10/1/2018	49.06	43.89	6.74	0.25	0.06	93.66	6.23	0.11	100
WF11	10/30/2018	49.33	42.25	8.13	0.25	0.05	92.74	7.15	0.11	100
WF11	11/26/2018	36.98	50.01	12.75	0.24	0.02	97.11	2.82	0.07	100
WF11	12/17/2018	39.69	47.81	12.27	0.21	0.02	96.32	3.60	0.07	100
East 1 Sump	3/20/2018	99.98	0.02	0.00	0.00	0.00	99.67	0.33	0.01	100
East 1 Sump	5/7/2018	99.98	0.02	0.00	0.00	0.00	97.91	0.44	1.65	100
East 1 Sump	7/17/2018	99.97	0.02	0.00	0.00	0.00	99.42	0.54	0.03	100
East 1 Sump	9/11/2018	99.98	0.02	0.00	0.00	0.00	99.30	0.66	0.04	100
East 2 Sump	3/20/2018	99.94	0.06	0.00	0.00	0.00	99.62	0.35	0.04	100

Table 4. Percent Distribution of U, Se, and Mo Species for LTP Wells and Sumps (Continued).

Location	Date	Uranium					Selenium			Molybdenum
		$UO_2(CO_3)_3^{4-}$	$CaUO_2(CO_3)_3^{2-}$	$Ca_2UO_2(CO_3)_3$	$MgUO_2(CO_3)_3^{2}$	$UO_2(CO_3)_2^{2}$	SeO_3^{2-}	$HSeO_3^{-}$	SeO_4^{2-}	MoO_4^{2-}
East 2 Sump	5/7/2018	99.92	0.08	0.00	0.00	0.00	99.34	0.58	0.08	100
East 2 Sump	7/17/2018	99.96	0.04	0.00	0.00	0.00	99.38	0.56	0.07	100
East 2 Sump	9/11/2018	99.93	0.06	0.00	0.00	0.00	91.14	0.64	8.21	100
North 1 Sump	3/20/2018	99.87	0.12	0.00	0.00	0.00	99.36	0.63	0.01	100
North 1 Sump	5/2/2018	99.81	0.18	0.00	0.00	0.00	99.19	0.79	0.02	100
North 1 Sump	7/16/2018	99.85	0.14	0.00	0.00	0.00	99.08	0.90	0.02	100
North 1 Sump	9/10/2018	99.89	0.11	0.00	0.00	0.00	98.91	1.06	0.04	100
North 3 Sump	3/20/2018	99.84	0.16	0.00	0.00	0.00	99.28	0.69	0.03	100
North 3 Sump	5/3/2018	98.88	1.06	0.05	0.01	0.00	94.27	5.69	0.04	100
North 3 Sump	7/16/2018	99.86	0.14	0.00	0.00	0.00	98.95	1.01	0.04	100
North 3 Sump	9/11/2018	99.94	0.06	0.00	0.00	0.00	98.98	0.95	0.07	100
South 1 Sump	3/20/2018	77.84	18.4	3.58	0.16	0.03	86.76	13.19	0.06	100
South 1 Sump	5/3/2018	75.90	20.1	3.83	0.15	0.04	85.12	14.81	0.07	100
South 1 Sump	7/16/2018	73.77	22.9	3.09	0.21	0.08	82.25	17.66	0.09	100
South 1 Sump	9/11/2018	74.45	22.1	3.23	0.19	0.03	92.31	7.64	0.04	100
West 1 Sump	3/20/2018	99.81	0.19	0.00	0.00	0.00	99.36	0.60	0.04	100
West 1 Sump	5/2/2018	99.81	0.19	0.00	0.00	0.00	99.01	0.91	0.08	100
West 1 Sump	7/16/2018	98.57	1.37	0.04	0.01	0.00	97.90	1.96	0.15	100
West 1 Sump	9/11/2018	99.95	0.05	0.00	0.00	0.00	98.08	1.08	0.84	100

[1] Percent distribution for a given species is calculated as (species molality/total molality) *100.

Table 5. Saturation Index (SI) Values for Various U, Se, and Mo Minerals for the LTP.

Location	Date	Calcite	Amorphous Aluminum Hydroxide	Ferrihydrite	Quartz	Amorphous Uranium Oxide	Uraninite	Tyuyamunite	Carnotite	Uranium Phosphate	Native Selenium	Calcium Molybdate	Rhodochrosite
		$CaCO_3$	$Al(OH)_3(am)$	$Fe(OH)_3(am)$	SiO_2	$UO_2(am)$	$UO_2(c)$	$Ca(UO_2)(VO_4)_2\cdot(5\text{-}8)H_2O$	$K_2O\cdot 2UO_3\cdot V_2O_5$	$(UO_2)_3(PO_4)_2$	Se(am)	$CaMoO_4$	$MnCO_3$
WME-1	8/21/2018	1.07	-2.69	2.85	0.09	-21.0	-15.2	-18.9	-8.47	-22.8	-19.4	-0.83	0.95
WME-1	10/25/2018	0.65	-2.25	2.96	0.08	-21.2	-15.4	-18.3	-7.92	-23.1	-19.6	-1.25	1.14
WME-1	12/14/2018	1.31	-3.27	1.54	0.28	-21.6	-15.7	-18.7	-8.46	-22.4	-20.3	-0.56	-0.58
WME-1	2/26/2019	0.84	-4.23	1.37	-0.20	-20.8	-15.0	-17.7	-7.68	-22.5	-20.8	-1.13	0.80
WME-1	4/9/2019	0.90	-4.01	1.50	-0.12	-20.8	-15.0	-20.1	-9.02	-22.5	-20.5	-1.02	-0.36
WME-1	6/21/2019	1.41	-3.99	1.86	-0.14	-22.9	-17.2	-18.8	-8.71	-22.1	-24.6	-0.62	-0.30
WME-2	8/21/2018	0.73	-2.41	3.13	0.20	-19.9	-14.1	-13.4	-6.38	-18.4	-19.5	-1.25	0.54
WME-2	10/25/2018	0.89	-2.72	2.57	0.04	-20.5	-14.6	-13.6	-6.28	-18.8	-21.4	-1.21	0.82
WME-2	12/14/2018	1.01	-3.47	1.78	0.07	-20.5	-14.7	-15.5	-7.40	-18.9	-22.3	-1.25	0.67
WME-2	2/26/2019	1.14	-3.56	1.55	-0.05	-18.2	-12.4	-14.7	-6.93	-19.2	-19.3	-1.20	0.62
WME-2	4/9/2019	0.76	-3.58	1.51	-0.19	-18.2	-12.3	-14.2	-6.52	-19.2	-18.9	-1.59	0.29
WME-2	6/21/2019	1.17	-3.61	1.79	-0.06	-18.5	-12.7	-13.8	-6.69	-18.8	-17.9	-1.06	0.32
WME-2	12/12/2019	0.77	-3.64	1.50	-0.21	-18.3	-12.5	-13.2	-5.95	-19.3	-18.4	-1.62	0.01
WME-3	8/21/2018	0.67	-3.20	2.86	-0.07	-21.0	-15.2	-15.9	-7.04	-19.5	-22.2	-1.95	0.29
WME-3	10/25/2018	0.49	-3.21	2.40	-0.35	-21.2	-15.5	-14.8	-6.60	-19.1	-23.6	-2.21	0.93
WME-3	12/14/2018	0.90	-3.70	1.73	-0.38	-21.0	-15.2	-14.6	-6.69	-18.7	-24.8	-1.76	0.24
WME-3	2/26/2019	1.12	-4.05	1.44	-0.62	-17.4	-11.6	-13.1	-6.16	-17.8	-18.4	-1.54	-0.05
WME-3	4/9/2019	0.40	-3.71	1.87	-0.59	-17.1	-11.4	-14.2	-6.36	-18.2	-17.3	-2.26	0.08
WME-3	6/21/2019	1.19	-4.09	1.39	-0.57	-17.5	-11.7	-12.6	-5.92	-17.7	-18.8	-1.45	0.11
WME-3	12/11/2019	0.89	-3.66	1.33	-0.82	-16.9	-11.1	-13.1	-5.84	-17.7	-19.6	-1.91	0.10
WME-3	2/20/2020	0.41	-3.89	1.44	-0.55	-17.6	-11.8	-13.7	-5.98	-18.3	-19.4	-2.38	0.34
WME-4	8/21/2018	1.65	-3.51	2.43	-0.08	-21.4	-15.7	-21.2	-9.56	-24.3	-18.4	-0.22	0.12
WME-4	10/25/2018	1.15	-2.40	2.84	-0.15	-24.2	-18.4	-20.2	-8.71	-24.3	-25.1	-0.67	1.72
WME-4	12/14/2018	1.96	-3.51	1.85	0.05	-21.5	-15.7	-24.1	-11.11	-24.0	-18.0	0.17	0.29
WME-4	2/26/2019	0.98	-4.20	1.51	-0.19	-21.0	-15.1	-21.0	-9.02	-24.5	-18.7	-0.85	0.34
WME-4	4/9/2019	0.78	-4.29	1.37	-0.45	-20.8	-14.9	-22.8	-9.84	-24.4	-19.5	-0.99	0.13
WME-4	6/21/2019	1.98	-3.65	2.90	-0.47	-20.4	-14.8	-21.8	-10.12	-23.9	-17.4	0.05	0.75
WME-4	12/11/2019	1.45	-5.05	1.43	-0.75	-20.0	-14.2	-21.9	-9.64	-23.0	-20.1	-0.43	0.42
WME-4	2/20/2020	1.16	-4.76	1.50	-0.46	-20.4	-14.6	-22.8	-9.96	-23.7	-19.6	-0.61	0.33
WME-5	8/22/2018	0.72	-3.68	0.32	-0.55	-16.4	-10.6	-11.8	-4.30	-19.1	-18.4	-1.48	0.01
WME-5	10/25/2018	0.73	-3.52	1.55	-0.34	-16.9	-11.1	-11.9	-4.24	-19.0	-18.6	-1.25	1.25
WME-5	12/14/2018	1.21	-4.55	0.69	-0.28	-17.8	-12.0	-13.2	-5.27	-19.3	-19.7	-0.86	-0.06
WME-5	2/26/2019	0.47	-4.16	1.29	0.39	-19.3	-13.5	-15.2	-5.91	-21.0	-18.4	-1.59	0.94
WME-5	4/9/2019	0.95	-4.13	2.19	0.23	-19.3	-13.6	-15.6	-6.51	-20.5	-17.7	-1.06	0.23
WME-5	6/21/2019	1.63	-4.53	1.11	-0.18	-18.2	-12.4	-14.8	-6.37	-19.6	-19.0	-0.45	0.31
WME-5	12/12/2019	1.09	-5.48	0.41	-0.39	-17.6	-11.8	-16.4	-6.82	-19.2	-20.6	-1.00	-0.11
WME-5	2/20/2020	0.67	-5.09	0.31	-0.31	-17.6	-11.8	-15.2	-6.04	-19.1	-20.4	-1.33	0.29

Table 5. Saturation Index (SI) Values for Various U, Se, and Mo Minerals for the LTP (Continued).

Location	Date	Calcite	Amorphous Aluminum Hydroxide	Ferrihydrite	Quartz	Amorphous Uranium Oxide	Uraninite	Tyuyamunite	Carnotite	Uranium Phosphate	Native Selenium	Calcium Molybdate	Rhodochrosite
		$CaCO_3$	$Al(OH)_3(am)$	$Fe(OH)_3(am)$	SiO_2	$UO_2(am)$	$UO_2(c)$	$Ca(UO_2)(VO_4)_2\cdot(5\text{-}8)H_2O$	$K_2O\cdot 2UO_3\cdot V_2O_5$	$(UO_2)_3(PO_4)_2$	Se(am)	$CaMoO_4$	$MnCO_3$
WME-6	8/22/2018	0.48	-3.82	1.17	-0.10	-19.1	-13.3	-18.7	-8.07	-21.3	-18.6	-1.87	0.13
WME-6	10/25/2018	0.49	-3.08	2.34	-0.26	-18.7	-12.9	-16.0	-6.62	-20.5	-18.7	-1.72	1.28
WME-6	12/14/2018	1.27	-3.85	1.09	-0.24	-19.1	-13.2	-17.7	-7.95	-20.5	-19.5	-1.09	0.15
WME-6	2/26/2019	0.79	-4.39	1.90	-0.37	-18.7	-12.9	-16.8	-7.28	-20.8	-19.2	-1.55	0.36
WME-6	4/9/2019	0.79	-4.57	1.42	-0.47	-18.5	-12.8	-17.7	-7.84	-20.8	-18.0	-1.58	0.38
WME-6	6/21/2019	1.58	-4.87	1.19	-0.64	-18.5	-12.8	-16.7	-7.77	-20.3	-19.1	-0.86	0.45
WME-6	12/12/2019	1.06	-5.25	0.64	-0.75	-17.9	-12.1	-18.3	-8.05	-19.9	-20.1	-1.34	-0.06
WME-6	2/20/2020	0.78	-4.74	0.75	-0.53	-18.4	-12.6	-17.8	-7.71	-20.5	-19.8	-1.61	0.26
WE9	4/16/2018	1.18	-4.55	1.49	-0.27	-17.7	-11.9	-12.2	-5.79	-17.4	-18.9	-1.26	-0.61
WE9	5/23/2018	0.90	-3.17	2.45	0.25	-18.9	-13.1	-12.9	-6.20	-17.6	-18.1	-1.14	-0.98
WE9	6/6/2018	-----	-----	2.19	0.19	-18.9	-13.1	-13.8	-6.60	-17.5	-18.2	-1.13	-0.86
WE9	8/13/2018	0.82	-4.12	1.72	-0.01	-18.5	-12.7	-13.1	-6.12	-18.1	-17.5	-1.48	-0.69
WE9	10/2/2018	0.96	-----	1.43	0.07	-18.6	-12.9	-13.5	-6.41	-17.6	-18.3	-1.30	-0.74
WE9	10/30/2018	1.02	-2.89	3.03	0.12	-18.7	-12.9	-13.0	-6.00	-16.9	-18.3	-1.08	0.23
WE9	11/27/2018	1.09	-3.70	1.51	0.00	-18.7	-12.9	-13.9	-6.58	-18.4	-18.6	-1.25	-----
WE9	12/18/2018	1.06	-3.79	1.13	-0.05	-18.6	-12.8	-14.3	-6.80	-18.6	-18.9	-1.33	-0.14
WF2	4/11/2018	0.95	-4.05	1.63	0.05	-20.3	-14.5	-13.5	-6.30	-18.3	-20.5	-1.17	-0.67
WF2	5/23/2018	1.10	-3.64	1.90	0.00	-18.6	-12.8	-15.1	-7.10	-18.7	-17.3	-1.00	-0.69
WF2	6/6/2018	1.06	-3.84	2.03	-0.04	-20.6	-14.9	-14.4	-6.90	-18.3	-21.8	-1.12	-0.33
WF2	8/13/2018	0.89	-----	1.20	-0.09	-20.5	-14.7	-14.4	-6.73	-18.0	-21.8	-1.39	-0.60
WF2	10/2/2018	0.93	-----	1.18	-0.20	-20.7	-14.9	-14.7	-6.79	-18.3	-24.1	-1.34	-0.55
WF2	10/30/2018	1.03	-3.32	2.06	-0.11	-18.2	-12.4	-13.6	-6.24	-17.1	-17.7	-1.02	0.37
WF2	11/26/2018	1.12	-4.13	1.13	-0.20	-18.2	-12.3	-14.5	-6.78	-18.1	-18.1	-1.19	-0.52
WF2	12/18/2018	1.12	-4.00	0.98	-0.18	-20.8	-15.0	-15.5	-7.30	-18.4	-23.7	-1.18	-0.53
WF9	4/10/2018	0.90	-3.91	1.29	0.00	-18.2	-12.4	-11.4	-5.33	-17.7	-18.0	-1.17	-0.36
WF9	5/7/2018	1.12	-4.03	2.79	0.01	-18.2	-12.4	-11.3	-5.39	-16.9	-17.9	-1.02	-0.30
WF9	6/6/2018	1.23	-4.00	1.94	0.02	-18.3	-12.5	-11.4	-5.53	-17.1	-17.7	-0.91	-0.19
WF9	7/18/2018	1.20	-4.18	1.67	-0.07	-17.8	-12.1	-11.0	-5.43	-17.1	-17.0	-1.06	-0.26
WF9	8/16/2018	1.14	-----	1.37	-0.11	-18.0	-12.2	-11.3	-5.47	-17.3	-17.7	-1.06	-0.15
WF9	10/2/2018	1.13	-4.24	1.16	-0.22	-17.8	-12.0	-11.3	-5.32	-17.2	-18.5	-1.10	-0.21

Table 5. Saturation Index (SI) Values for Various U, Se, and Mo Minerals for the LTP (Continued).

Location	Date	Calcite	Amorphous Aluminum Hydroxide	Ferrihydrite	Quartz	Amorphous Uranium Oxide	Uraninite	Tyuyamunite	Carnotite	Uranium Phosphate	Native Selenium	Calcium Molybdate	Rhodochrosite
		$CaCO_3$	$Al(OH)_3(am)$	$Fe(OH)_3(am)$	SiO_2	$UO_2(am)$	$UO_2(c)$	$Ca(UO_2)(VO_4)_2\cdot(5\text{-}8)H_2O$	$K_2O\cdot 2UO_3\cdot V_2O_5$	$(UO_2)_3(PO_4)_2$	$Se(am)$	$CaMoO_4$	$MnCO_3$
WF9	10/30/2018	1.23	-3.25	2.05	-0.15	-17.9	-12.1	-11.1	-5.17	-16.6	-18.4	-0.92	0.32
WF9	11/26/2018	1.38	-3.71	1.33	-0.13	-18.1	-12.3	-12.6	-6.04	-17.6	-18.1	-0.91	-0.03
WF9	12/17/2018	1.23	-3.88	1.83	-0.24	-17.8	-12.0	-11.9	-5.67	-17.6	-18.4	-1.09	-0.31
WF11	4/5/2018	1.00	-3.15	2.62	0.28	-18.5	-12.7	-11.2	-5.42	-17.4	-17.3	-1.15	-0.12
WF11	5/23/2018	1.10	-3.14	2.30	0.31	-18.7	-12.9	-13.0	-6.27	-17.6	-17.7	-1.09	-0.08
WF11	6/5/2018	1.08	-3.03	2.41	0.32	-18.9	-13.1	-12.9	-6.46	-16.8	-17.0	-1.07	0.10
WF11	7/18/2018	0.92	-----	2.17	0.27	-18.8	-13.1	-13.1	-6.53	-17.1	-17.5	-1.18	-0.09
WF11	8/16/2018	1.01	-3.76	1.94	0.19	-18.6	-12.9	-13.7	-6.71	-17.8	-17.4	-1.28	0.00
WF11	10/1/2018	1.08	-----	-----	0.20	-18.7	-12.9	-12.3	-6.09	-16.9	-17.1	-1.11	0.06
WF11	10/30/2018	1.10	-2.46	3.16	0.32	-18.9	-13.1	-11.6	-5.65	-15.5	-17.7	-0.89	0.10
WF11	11/26/2018	1.49	-----	1.46	0.19	-18.8	-13.0	-13.1	-6.54	-19.2	-18.0	-0.90	0.74
WF11	12/17/2018	1.42	-3.23	2.10	0.28	-19.1	-13.3	-13.3	-6.58	-19.2	-18.4	-0.93	0.64
East 1 Sump	3/20/2018	0.71	-3.97	1.49	-0.25	-20.2	-14.3	-18.5	-7.89	-23.0	-18.4	-1.23	0.22
East 1 Sump	5/7/2018	0.73	-3.95	1.73	-0.16	-22.6	-16.8	-18.5	-7.96	-23.0	-22.0	-1.18	0.67
East 1 Sump	7/17/2018	0.72	-3.70	2.23	-0.24	-20.6	-14.8	-18.1	-7.79	-22.8	-17.8	-1.24	0.64
East 1 Sump	9/11/2018	0.42	-4.10	1.59	-0.30	-20.3	-14.6	-19.0	-8.26	-22.9	-16.4	-1.62	0.01
East 2 Sump	3/20/2018	0.99	-3.65	1.57	-0.11	-20.5	-14.6	-19.3	-8.54	-22.2	-19.2	-1.00	0.15
East 2 Sump	5/7/2018	1.00	-3.55	2.34	-0.04	-20.9	-15.1	-19.6	-8.79	-22.2	-18.4	-1.10	0.25
East 2 Sump	7/17/2018	0.69	-3.52	2.07	-0.07	-20.6	-14.8	-18.8	-8.25	-22.1	-18.1	-1.31	0.26
East 2 Sump	9/11/2018	0.87	-3.80	2.48	-0.08	-22.4	-16.7	-19.0	-8.60	-22.0	-20.9	-1.19	0.63
North 1 Sump	3/20/2018	0.91	-3.63	1.81	-0.07	-19.6	-13.8	-16.7	-7.34	-21.3	-17.7	-0.95	0.22
North 1 Sump	5/2/2018	1.08	-3.19	2.42	0.02	-20.0	-14.1	-17.1	-7.71	-20.6	-17.7	-0.76	0.21
North 1 Sump	7/16/2018	1.00	-3.39	2.29	-0.06	-19.8	-14.1	-16.8	-7.51	-20.7	-16.9	-0.85	0.21
North 1 Sump	9/10/2018	0.92	-3.85	2.55	-0.26	-19.6	-14.1	-16.7	-7.64	-21.0	-15.7	-0.98	0.40
North 3 Sump	3/20/2018	0.95	-3.43	1.60	0.04	-20.4	-14.5	-17.0	-7.47	-21.1	-19.9	-0.81	0.21
North 3 Sump	5/3/2018	0.78	-2.48	3.10	0.22	-19.8	-14.0	-15.0	-6.88	-17.6	-17.8	-0.63	-0.24
North 3 Sump	7/16/2018	0.91	-3.34	2.67	-0.15	-19.6	-13.9	-16.3	-7.39	-20.5	-16.1	-0.97	0.24
North 3 Sump	9/11/2018	0.99	-3.39	2.56	-0.07	-20.8	-15.1	-17.1	-7.77	-21.5	-17.6	-0.85	0.70
South 1 Sump	3/20/2018	1.02	-2.53	3.42	0.48	-18.3	-12.5	-10.7	-4.99	-16.1	-17.1	-0.16	0.42
South 1 Sump	5/3/2018	0.99	-2.71	3.47	0.44	-18.3	-12.5	-10.5	-5.02	-14.5	-16.0	-0.17	0.32

Table 5. Saturation Index (SI) Values for Various U, Se, and Mo Minerals for the LTP (Continued).

Location	Date	Calcite	Amorphous Aluminum Hydroxide	Ferrihydrite	Quartz	Amorphous Uranium Oxide	Uraninite	Tyuyamunite	Carnotite	Uranium Phosphate	Native Selenium	Calcium Molybdate	Rhodochrosite
		$CaCO_3$	$Al(OH)_3(am)$	$Fe(OH)_3(am)$	SiO_2	$UO_2(am)$	$UO_2(c)$	$Ca(UO_2)(VO_4)_2\cdot(5\text{-}8)H_2O$	$K_2O\cdot 2UO_3\cdot V_2O_5$	$(UO_2)_3(PO_4)_2$	Se(am)	$CaMoO_4$	$MnCO_3$
South 1 Sump	7/16/2018	0.83	-1.73	3.96	0.24	-17.5	-11.9	-8.9	-4.34	-13.5	-14.7	-0.32	0.99
South 1 Sump	9/11/2018	1.20	-----	3.13	0.25	-17.6	-11.9	-10.8	-5.22	-14.9	-15.1	-0.30	0.51
West 1 Sump	3/20/2018	1.17	-1.65	2.74	0.35	-20.7	-14.7	-16.8	-7.38	-21.1	-20.7	-0.63	1.16
West 1 Sump	5/2/2018	1.11	-2.83	2.23	-0.06	-20.8	-14.9	-16.9	-7.58	-20.7	-19.1	-0.67	0.20
West 1 Sump	7/16/2018	1.26	-2.53	3.48	0.09	-19.6	-13.9	-14.5	-6.76	-18.5	-16.6	-0.54	0.59
West 1 Sump	9/11/2018	0.88	-3.41	2.55	-0.10	-22.1	-16.3	-17.6	-7.92	-21.7	-19.7	-0.92	0.47

Table 6. Semi-Quantitative X-ray Diffraction Mineralogy Results (% by Weight) for Tailings and Alluvium Samples.

Sample ID	Sample Type	Quartz	Potassium Feldspar	Plagioclase	Calcite	Pyrite	Smectite	Illite	Kaolinite	Chlorite	Total Clay
		------	------	------	------	------	%	------	------	------	------
WME-1	LTP Sands	47	15	15	10	1	5	<1	6	1	12
WME-2	LTP Sands	55	14	14	8	1	3	<1	4	1	8
WME-3	LTP Sands	59	11	12	8	1	2	1	4	1	9
WME-4	LTP Slimes	46	13	14	8	1	6	1	9	2	18
WME-5	LTP Slimes	45	12	12	8	1	9	2	10	2	23
WME-6	LTP Slimes	37	9	12	13	<1	13	2	11	3	29
WME-9	STP Sands	69	11	10	2	<1	3	2	3	<1	8
WME-10	STP Slimes	53	14	14	9	<1	4	1	3	2	10
WME-8@ 110	LTP Perched Alluvium	72	10	7	4	<1	4	1	2	<1	7
WME-8@121	LTP Vadose Alluvium	74	8	7	6	<1	3	1	1	<1	5
WME-11	North Alluvium	73	7	7	9	1	1	1	1	<1	3
WME-14[1]	South Alluvium	40	5	6	21	<1	4	6	5	<1	15
WME-15	South Alluvium	72	7	5	11	<1	3	1	1	<1	5
WME-16	Adjacent Alluvium	77	8	7	6	<1	1	<1	1	<1	2
WME-17	Adjacent Alluvium	77	8	9	4	<1	1	<1	1	<1	2

[1] Sample WME-14 also contained 13% of amorphous (non-crystalline) material.

Table 7. Summary of Scanning Electron Microscopy (SEM) Results for Tailings and Alluvial Solids.[1]

Sample	General Description and Silicate/Oxide Occurrence	Additional Observations / COC Associations
WME-2 (LTP Sands)	Brown, very fine to medium grained, silty sand with some clay. Quartz (55%) angular and rounded. Plagioclase (14%) angular and pitted. K-spar (14%) angular and subrounded. Clay content low (8%) as coatings on quartz, feldspar and as small masses; kaolinite and smectite; lesser chlorite, illite. Trace oxides (hematite, magnetite, Cu-oxide).	Feldspars contain rare earth phosphates. Calcite (8%) as liberated grains. Pyrite (1%) as liberated fragments and quartz inclusions. Minor chalcopyrite ($CuFeS_2$) in quartz, feldspar, pyrite. Barite as liberated grains and inclusions in quartz, feldspar. Native Se, $FeSe_2$; Se and V on pyrite surfaces. U grain (~ 10µm) containing Ca, V.
WME-3 (LTP Sands)	Brown, very fine to medium grained, silty sand with some clay. Quartz (59%) angular and rounded. Plagioclase and K-spar (23%) angular to subangular with corroded grain boundaries and intragrain pitting. Clay (9%) primarily kaolinite, smectite as grain coatings and small masses. Oxides include hematite, magnetite, Cu-Sn oxide.	Feldspars with barite, zircon, and rare earth phosphates. Calcite (8%) as aggregates, liberated grains. Pyrite as liberated grains and with quartz, feldspar; chalcopyrite. Native Se, $FeSe_2$, Pb-Cu selenide. U associated with yttrium phosphate containing V, As. U-Ti phase containing V, Fe.
WME-5 (LTP Slimes)	Grey with clayey silt texture. Quartz (45%) angular and rounded. Plagioclase/K-feldspar (24%) as angular fragments. Clay (>20%) primarily kaolinite, smectite; lesser chlorite, illite.	Calcite (8%) as fine dispersed grains (2-100 µm). Pyrite (1%) only sulfide identified. Trace iron oxide, barite, zircon. Native Se as liberated grains; Cu- and Pb-selenide. U-Ca-V within a grain of native Se.
WME-10 (STP Slimes)	Brown with fine to medium sand and moderate clay (smectite, kaolinite). Quartz (53%) angular and rounded, plagioclase and K-spar (28%) angular to subangular. Feldspars show mild grain boundary corrosion and intragrain pitting.	Feldspars contain small barite, zircon, rare earth phosphates, and pyrite. Pyrite shows replacement goethite (FeOOH) and chalcopyrite by Cu and Fe oxide. Calcite (9%) as small angular grains. Se, Pb-Se, and Cu-Se phases. U in association with Ti and Fe attached to Fe-oxide surfaces.
WME-14 (South Alluvium)	Brown coarse gravelly sand with appreciable clay (15%), mica/illite, kaolinite, smectite. Quartz (40%) angular to well-rounded. Plagioclase and K-spar as angular fragments. Volcanic glass (13%).	Major calcite (20%) with trace pyrite, chalcopyrite, barite, rutile, zircon. Se not apparent. No U-bearing phases could be identified.
WME-16 (Adjacent Alluvium)	Fine-medium grained sand with low clay (2%) (kaolinite, smectite). Angular to well-rounded quartz (77%) is the main silicate along with plagioclase (7%) and K-spar (8%).	Feldspars contain small pyrite, barite, rutile, zircon, and rare earth phosphate inclusions. Calcite (6%) is the sole carbonate. No U-bearing phases could be identified.

Table 8. General Solid Phase Characterization Results for Tailings and Alluvium Samples.

Sample ID	Sample Type	Depth	Acid Generation Potential	Acid Neutralization Potential	Net Neutralization Potential	pH	Sulfide-Sulfur	Sulfate -Sulfur	Total-Sulfur	Cation Exchange Capacity	Total Organic Carbon
		ft. bgs	--------------kg $CaCO_3$/t --------------			s.u.	-------------- % --------------			$cmol_c$/kg	%
WME-1	LTP Sands	55	9.7	64	54.3	9.9	0.31	0.11	0.42	10.2	0.2
WME-2	LTP Sands	61	11.3	39	27.8	9.7	0.36	0.06	0.42	5.3	<0.10
WME-3	LTP Sands	65	7.2	41	33.8	9.9	0.23	0.01	0.24	3.4	<0.10
WME-4	LTP Slimes	65	6.6	61	54.4	10.3	0.21	0.12	0.33	12.6	0.3
WME-5	LTP Slimes	75	5.6	68	62.4	10.2	0.18	0.05	0.23	14.2	0.2
WME-6	LTP Slimes	65	8.8	79	70.3	10.2	0.28	0.11	0.39	14.4	0.3
WME-9	STP Sands	30	0.6	24.0	23.4	8.6	0.02	0.02	0.04	9.5	0.1
WME-10	STP Slimes	35	2.5	73.0	70.5	9.5	0.08	0.04	0.12	10.0	0.3
WME-7@108	LTP Perched Alluvium	108	<0.31	33	33	9.7	<0.01	0.01	0.01	7.0	<0.1
WME-7@114	LTP Vadose Alluvium	114	<0.31	31	31	9.6	<0.01	<0.01	<0.01	4.5	<0.1
WME-8@110	LTP Perched Alluvium	110	<0.31	28.0	28.0	8.7	<0.01	<0.01	<0.01	4.1	<0.10
WME-8@121	LTP Vadose Alluvium	121	<0.31	49.0	49.0	8.4	<0.01	<0.01	<0.01	4.2	<0.10
WME-11	North Alluvium	65	<0.31	95	95	8.4	<0.01	<0.01	<0.01	2.9	<0.10
WME-14	South Alluvium	45	<0.31	118	118	8.3	<0.01	<0.01	<0.01	7.7	0.10
WME-15	South Alluvium	55	<0.31	60	60	8.5	<0.01	0.02	0.02	4.2	<0.10
WME-16	Adjacent Alluvium	65	<0.31	49	49	8.7	<0.01	0.03	0.03	3.1	<0.10
WME-17	Adjacent Alluvium	55	<0.31	61	61	8.4	<0.01	0.04	0.04	6.1	<0.10

Table 9. Summary of the Selective Chemical Extraction Procedures for Tailings and Aquifer Solids.

Extraction Step	Description	Reagent	Procedure
I	Water Soluble	Distilled water	1. Prepare sample by drying at 105 °C and grinding in agate mortar. 2. Weigh 2.0 g soil into 50 mL centrifuge tube. 3. Add 30 mL deionized H_2O. 4. Shake for 1 hr. 5. Centrifuge @ 12,000 g for 30 minutes. 6. Pipette supernatant into plastic syringe and filter through 0.45 µm pore-size syringe filter. 7. Analyze supernatant for U, V, Se, Mo, Ca, Mg, Na, Al, Fe, Mn, Si.
II	Exchangeable	1 M $MgCl_2$ (pH = 7.0)	1. Add 16 mL of 1M $MgCl_2$ (pH = 7.0). 2. Shake for 1 hr. 3. Centrifuge @ 12,000 g for 30 minutes. 4. Pipette supernatant into plastic syringe and filter through 0.45 µm pore-size syringe filter. 5. Analyze supernatant for U, V, Se, Mo, Ca, Mg, Na, Al, Fe, Mn, Si. 6. Add 16 mL deionized H_2O into centrifuge tube containing the solid sample and hand shake for 1 minute. 7. Centrifuge @ 12,000 g for 30 minutes. 8. Pipette and discard supernatant.
III	Carbonate Bound	1 M NaOAc (pH = 5.0)	1. Add 16 mL of 1M NaOAc (adjusted to pH = 5 with HOAc). 2. Shake for 2.5 hr. 3. Repeat steps 3 through 8 in Extraction Step II.
IV	Oxide Bound	0.04 M $NH_2OH \cdot HCl$ in 25% (v/v) HOAc	1. Add 40 mL of 0.04 M $NH_2OH \cdot HCl$ in 25% (v/v) HOAc (pH ≈ 2). 2. Hand shake for 1 minute. 3. Place in oven at 96 ± 3 °C for 6 hrs. Hand shake every 1 hr. 4. After 6 hrs, remove from oven and hand shake. 5. Repeat steps 3 through 8 in Extraction Step II.
V	Organic Bound	0.02 M HNO_3 / 3.2 M NH_4OAc	1. Add 6 mL of 0.02 M HNO_3. 2. Add 10 mL of 30% H_2O_2 adjusted to pH = 2 with HNO_3. 3. Hand shake for 1 minute. 4. Place into oven at 85 ± 2 °C for 2 hours. 5. Hand shake for 1 minute after 1 hour and 2 hours. 6. Add 6 mL H_2O_2 (pH = 2 with HNO_3) and hand shake for 1 minute. 7. Heat to 85 ± 2 °C for 3 hours. Shake for 1 minute each hour. 8. Allow sample to cool to room temperature. 9. Add 10 mL of 3.2 M NH_4OAc in 20% (v/v) HNO_3. 10. Add 8 mL deionized H_2O. 11. Shake for 30 minutes. 12. Repeat steps 3 through 8 in Extraction Step II.
VI	Residual	HF/HNO_3	1. Digest final residue using EPA Method 3052. 2. Analyze digest for U, V, Se, Mo, Ca, Mg, Na, Al, Fe, Mn, Si.

Table 10. Percent Distribution of U, Se, and Mo Species for North, West, South, and Underlying Alluvial Wells.

Location	Date	Uranium					Selenium	Molybdenum
		$UO_2(CO_3)_3^{-4}$	$CaUO_2(CO_3)_3^{2-}$	$Ca_2UO_2(CO_3)_3$	$MgUO_2(CO_3)_3^{2-}$	$UO_2(CO_3)_2^{2-}$	SeO_4^{2-}	MoO_4^{2-}
DD	3/21/2018	1.31	18.54	79.92	0.05	0.17	100.0	99.9
DD	6/21/2018	1.15	17.15	81.56	0.04	0.09	100.0	100.0
DD	9/17/2018	0.99	18.80	80.02	0.05	0.14	100.0	99.9
DD	12/5/2018	1.44	18.63	79.78	0.06	0.09	100.0	100.0
Q	3/20/2018	0.77	18.32	80.68	0.04	0.19	100.0	100.0
Q	6/20/2018	0.75	17.38	81.71	0.04	0.12	100.0	100.0
Q	9/13/2018	0.77	17.71	81.38	0.04	0.11	100.0	100.0
Q	12/3/2018	0.98	18.93	79.96	0.05	0.10	100.0	100.0
R	3/21/2018	0.81	20.37	78.65	0.04	0.13	100.0	100.0
R	6/20/2018	0.75	19.21	79.91	0.04	0.09	100.0	100.0
R	9/12/2018	0.77	19.52	79.57	0.04	0.10	100.0	100.0
R	12/3/2018	1.02	20.78	78.01	0.04	0.14	100.0	100.0
M19	4/4/2018	0.73	22.11	76.94	0.07	0.15	100.0	99.9
M19	6/21/2018	0.67	20.89	78.25	0.06	0.13	100.0	99.9
M19	10/1/2018	0.72	20.98	78.13	0.07	0.10	100.0	99.9
M19	12/12/2018	0.78	20.92	78.13	0.07	0.10	100.0	99.9
MR	3/22/2018	0.66	22.08	76.75	0.07	0.43	100.0	99.8
MR	6/13/2018	0.67	20.81	78.33	0.06	0.13	100.0	99.9
MR	9/17/2018	0.96	21.70	77.11	0.07	0.15	100.0	99.9
S4	3/22/2018	0.82	21.23	77.48	0.06	0.39	100.0	99.8
S4	6/13/2018	0.68	21.82	77.29	0.07	0.14	100.0	99.9
S4	9/18/2018	0.90	23.27	75.62	0.07	0.14	100.0	99.9
S4	12/5/2018	0.94	23.78	75.07	0.08	0.12	100.0	100.0
D1	3/22/2018	1.35	25.77	72.34	0.07	0.46	100.0	99.9
D1	6/12/2018	0.99	23.52	75.10	0.06	0.34	100.0	99.9
D1	9/17/2018	1.12	24.93	73.68	0.06	0.19	100.0	99.9
D1	12/5/2018	1.12	25.75	72.94	0.07	0.12	100.0	100.0
X	3/22/2018	0.77	23.48	75.20	0.07	0.47	100.0	99.9
X	6/13/2018	0.65	24.60	74.47	0.07	0.22	100.0	99.9
X	9/17/2018	0.62	23.94	75.22	0.06	0.14	100.0	100.0

Table 10. Percent Distribution of U, Se, and Mo Species for North, West, South, and Underlying Alluvial Wells (Continued).

Location	Date	Uranium					Selenium	Molybdenum
		$UO_2(CO_3)_3^{-4}$	$CaUO_2(CO_3)_3^{2-}$	$Ca_2UO_2(CO_3)_3$	$MgUO_2(CO_3)_3^{2-}$	$UO_2(CO_3)_2^{2-}$	SeO_4^{2-}	MoO_4^{2-}
X	12/5/2018	0.67	25.32	73.80	0.07	0.14	100	100
F	3/24/2018	0.92	21.36	77.46	0.06	0.20	100	99.9
F	6/11/2018	0.86	22.06	76.86	0.07	0.15	100	99.9
F	9/26/2018	0.83	20.52	78.48	0.06	0.12	100	99.9
F	12/11/2018	0.89	21.07	77.85	0.07	0.12	100	99.9
I	4/4/2018	0.87	26.22	72.59	0.08	0.23	100	99.9
I	6/19/2018	0.71	25.06	73.95	0.07	0.20	100	99.9
I	9/27/2018	0.78	24.59	74.43	0.07	0.12	100	100
I	12/12/2018	0.83	25.25	73.70	0.08	0.14	100	100
T2	4/9/2018	89.19	7.11	3.61	0.07	0.02	100	100
T2	6/21/2018	87.75	7.81	4.36	0.07	0.02	100	100
T2	9/18/2018	90.37	6.61	2.94	0.06	0.01	100	100
T2	12/11/2018	90.95	6.45	2.53	0.07	0.01	100	100
T20	3/23/2018	24.62	27.77	47.11	0.10	0.41	100	99.9
T20	6/27/2018	24.47	27.54	47.59	0.09	0.30	100	99.9
T20	9/24/2018	24.89	26.00	48.92	0.08	0.11	100	100
T20	12/11/2018	26.97	25.67	47.17	0.09	0.11	100	100
T22	4/3/2018	44.68	40.06	14.87	0.24	0.15	100	100
T22	6/27/2018	62.74	19.62	17.38	0.15	0.11	100	100
T22	9/24/2018	44.70	26.09	28.98	0.19	0.04	100	100
T22	12/11/2018	62.16	19.06	18.60	0.14	0.04	100	100
WME-9	8/20/2018	2.08	39.35	58.14	0.13	0.30	100	100
WME-9	11/14/2018	2.15	41.12	56.43	0.15	0.15	100	100
WME-9	2/27/2019	0.87	29.79	69.17	0.09	0.08	100	100
WME-9	5/22/2019	0.60	29.20	70.00	0.08	0.12	100	100
WME-10	8/20/2018	0.66	27.41	71.57	0.07	0.29	100	99.9
WME-10	11/14/2018	0.66	27.62	71.52	0.07	0.13	100	100
WME-10	2/27/2019	0.64	27.09	72.09	0.07	0.11	100	100
WME-10	5/22/2019	0.60	26.96	72.31	0.07	0.07	100	100

Table 11. Saturation Index (SI) Values for Various U, Se, and Mo Minerals for North, West, South, and Underlying Alluvial Wells.

Location	Date	Calcite	Amorphous Aluminum Hydroxide	Ferrihydrite	Quartz	Amorphous Uranium Oxide	Uraninite	Tyuyamunite	Carnotite	Native Selenium	Calcium Molybdate
		$CaCO_3$	$Al(OH)_3(am)$	$Fe(OH)_3(am)$	SiO_2	$UO_2(am)$	$UO_2(c)$	$Ca(UO_2)(VO_4)_2\cdot(5\text{-}8)H_2O$	$K_2O\cdot 2UO_3\cdot V_2O_5$	Se(am)	$CaMoO_4$
DD	3/21/2018	0.24	-2.3	0.8	0.55	-34.4	-28.6	-8.0	-4.6	-57.5	-2.22
DD	6/21/2018	0.45	-2.2	1.2	0.62	-34.8	-29.0	-8.8	-5.0	-58.2	-2.88
DD	9/17/2018	0.40	-1.2	1.4	0.55	-34.1	-28.4	-8.3	-4.9	-56.5	-2.45
DD	12/5/2018	0.49	-1.3	1.3	0.63	-35.1	-29.2	-9.0	-5.1	-59.0	-1.81
Q	3/20/2018	0.18	-1.8	1.6	0.58	-33.9	-28.1	-7.9	-4.5	-55.6	-2.91
Q	6/20/2018	0.34	-1.3	2.0	0.63	-34.9	-29.1	-8.5	-4.8	-58.1	-2.98
Q	9/13/2018	0.38	-2.3	1.2	0.61	-34.8	-29.0	-8.7	-4.9	-57.7	-2.94
Q	12/3/2018	0.42	-1.4	1.4	0.65	-35.1	-29.2	-8.9	-4.9	-58.7	-2.63
R	3/21/2018	0.38	-1.6	1.5	0.60	-34.4	-28.6	-8.5	-4.9	-57.1	-2.67
R	6/20/2018	0.49	-1.4	2.3	0.64	-34.7	-29.0	-9.0	-5.3	-57.6	-1.66
R	9/12/2018	0.47	-2.8	1.3	0.62	-34.7	-28.9	-9.0	-5.3	-57.6	-2.65
R	12/3/2018	0.30	-1.4	1.5	0.67	-35.1	-29.3	-8.8	-5.1	-59.2	-2.69
M19	4/4/2018	0.34	-1.5	2.4	0.67	-33.9	-28.1	-7.4	-4.3	-57.3	-0.40
M19	6/21/2018	0.38	-1.2	1.7	0.71	-34.1	-28.4	-7.7	-4.4	-57.6	-0.40
M19	10/1/2018	0.48	-2.2	1.6	0.69	-34.3	-28.5	-8.0	-4.5	-57.9	-0.34
M19	12/12/2018	0.43	-1.2	1.8	0.74	-34.5	-28.7	-11.7	-6.4	-58.3	-0.40
MR	3/22/2018	-0.01	-1.0	1.7	0.64	-32.9	-27.3	-6.4	-3.8	-54.3	-1.23
MR	6/13/2018	0.43	-1.2	2.0	0.67	-33.8	-28.1	-7.6	-4.4	-56.2	-1.22
MR	9/17/2018	0.32	-1.2	1.6	0.79	-34.3	-28.5	-9.2	-5.0	-58.0	-1.25
S4	3/22/2018	-0.12	-1.2	1.1	0.79	-34.5	-28.7	-8.0	-4.6	-57.8	-0.53
S4	6/13/2018	0.37	-1.2	1.7	0.72	-34.7	-28.9	-8.9	-5.2	-57.4	-0.50
S4	9/18/2018	0.35	-1.2	1.6	0.79	-35.1	-29.3	-9.1	-5.2	-58.9	-0.52
S4	12/5/2018	0.40	-1.2	1.2	0.77	-35.1	-29.3	-9.2	-5.2	-59.1	-0.50
D1	3/22/2018	-0.16	-2.6	0.7	0.78	-33.5	-27.6	-6.6	-3.8	-58.6	0.31
D1	6/12/2018	-0.04	-1.1	0.9	0.73	-33.6	-27.8	-5.9	-3.7	-58.4	0.11
D1	9/17/2018	0.21	-2.7	0.9	0.82	-33.9	-28.0	-7.4	-4.4	-59.1	0.27
D1	12/5/2018	0.41	-1.3	1.3	0.76	-34.2	-28.4	-9.2	-5.3	-59.9	0.01
X	3/22/2018	-0.20	-2.5	1.9	0.46	-34.6	-28.8	-8.1	-4.5	-59.1	-1.20
X	6/13/2018	0.17	-1.9	1.2	0.49	-35.0	-29.2	-9.1	-5.1	-59.3	-1.11
X	9/17/2018	0.35	-2.4	1.7	0.54	-34.8	-29.1	-8.762	-4.9	-59.4	-0.95

Table 11. Saturation Index (SI) Values for Various U, Se, and Mo Minerals for North, West, and South Alluvial Wells (Continued).

Location	Date	Calcite	Amorphous Aluminum Hydroxide	Ferrihydrite	Quartz	Amorphous Uranium Oxide	Uraninite	Tyuyamunite	Carnotite	Native Selenium	Calcium Molybdate
		$CaCO_3$	$Al(OH)_3(am)$	$Fe(OH)_3(am)$	SiO_2	$UO_2(am)$	$UO_2(c)$	$Ca(UO_2)(VO_4)_2\cdot(5\text{-}8)H_2O$	$K_2O\cdot 2UO_3\cdot V_2O_5$	Se(am)	$CaMoO_4$
X	12/5/2018	0.36	-1.4	1.3	0.55	-35.0	-29.2	-8.9	-5.1	-59.8	-0.99
F	3/24/2018	0.13	-2.4	0.5	1.00	-35.6	-29.7	-10.4	-5.8	-59.4	-3.00
F	6/11/2018	0.30	-2.0	1.5	0.98	-35.5	-29.7	-9.7	-5.4	-59.0	-1.98
F	9/26/2018	0.36	-1.6	1.2	0.99	-35.6	-29.8	-11.1	-6.1	-59.8	-2.68
F	12/11/2018	0.33	-1.2	1.0	1.02	-35.7	-29.9	-11.2	-6.2	-59.7	-3.38
I	4/4/2018	0.14	-2.5	1.8	0.93	-35.0	-29.2	-9.6	-5.5	-59.8	-3.12
I	6/19/2018	0.21	-1.2	0.7	0.91	-34.7	-29.0	-9.3	-5.4	-59.3	-3.19
I	9/27/2018	0.39	-2.5	0.9	0.95	-35.4	-29.6	-10.3	-5.7	-60.3	-3.24
I	12/12/2018	0.35	-1.3	1.3	0.97	-35.4	-29.5	-10.4	-5.9	-60.3	-3.30
T2	4/9/2018	0.97	-1.7	2.8	0.68	-35.0	-29.2	-10.9	-5.6	-58.0	0.78
T2	6/21/2018	1.14	-1.8	2.4	0.73	-34.9	-29.1	-11.4	-5.8	-57.3	0.81
T2	9/18/2018	1.22	-2.2	3.2	0.60	-35.2	-29.4	-11.8	-6.0	-58.4	0.66
T2	12/11/2018	1.27	-1.7	2.7	0.66	-35.4	-29.6	-12.4	-6.3	-59.1	0.69
T20	3/23/2018	0.16	-1.9	3.0	0.73	-33.1	-27.3	-6.1	-3.4	-56.1	0.98
T20	6/27/2018	0.29	-1.8	3.6	0.76	-33.4	-27.6	-6.4	-3.6	-56.7	1.03
T20	9/24/2018	0.70	-1.6	3.8	0.75	-34.0	-28.2	-7.4	-4.1	-57.6	1.04
T20	12/11/2018	0.70	-1.3	3.6	0.79	-34.0	-28.2	-9.4	-5.1	-57.8	0.99
T22	4/3/2018	0.68	-2.4	2.7	0.42	-33.4	-27.7	-7.7	-4.0	-56.8	0.29
T22	6/27/2018	0.66	-1.7	------	0.68	-33.8	-28.1	-6.9	-3.5	-57.1	0.90
T22	9/24/2018	1.17	-2.6	2.4	0.66	-34.2	-28.4	-8.1	-4.1	-57.6	0.91
T22	12/11/2018	1.09	-1.4	2.6	0.72	-34.5	-28.7	-8.2	-4.2	-58.3	0.87
WME-9	8/20/2018	0.27	-1.2	2.2	0.86	-33.7	-27.9	-7.3	-4.0	-58.5	-0.15
WME-9	11/14/2018	0.59	-2.4	2.8	0.80	-33.7	-28.0	-11.0	-5.9	-59.0	-0.26
WME-9	2/27/2019	0.71	-3.1	3.2	0.39	-34.1	-28.4	-8.6	-4.7	-58.5	-0.66
WME-9	5/22/2019	0.64	-1.9	2.7	0.63	-33.6	-28.0	-8.4	-4.9	-56.2	-0.82
WME-10	8/20/2018	0.16	-2.2	1.2	0.83	-33.4	-27.7	-5.5	-3.4	-55.9	-0.69
WME-10	11/14/2018	0.49	-1.5	2.5	0.83	-34.2	-28.5	-6.4	-4.0	-57.6	-0.72
WME-10	2/27/2019	0.58	-0.8	3.3	0.85	-34.3	-28.6	-6.9	-4.1	-57.8	-0.73
WME-10	5/22/2019	0.77	-1.8	3.8	0.77	-34.3	-28.7	-7.1	-4.4	-57.5	-0.75

Table 12. Pore Volume Calculations and Leachate Results (mg/L) for MWMP Testing of Alluvium Samples.

Parameter	WME-7 (108') Perched			WME-7 (114') - Vadose			WME-8 (110') - Perched			WME-8 (121') - Vadose		
Material Mass (g)	5000			5000			5000			5000		
Total Porosity	0.3			0.3			0.3			0.3		
Particle Density (g/cm^3)	2.65			2.65			2.65			2.65		
Bulk Density (g/cm^3)	1.86			1.86			1.86			1.86		
Material Volume (L)	2.7			2.7			2.7			2.7		
Effective Porosity	0.2			0.2			0.2			0.2		
One Pore Volume (L)	0.54			0.54			0.54			0.54		
Leachate Volume (L)	5			5			5			5		
Leach No.	1	2	3	1	2	3	1	2	3	1	2	3
Pore Volumes	9	19	28	9	19	28	9	19	28	9	19	28
pH	9.8	10.3	10.3	9.7	9.9	9.9	8.9	9.5	9.4	8.7	9.2	9
Alkalinity as $CaCO_3$	422	202	141	290	165	93.6	128	90.3	59.7	114	62.3	42
Aluminum	0.12	0.29	0.24	0.35	0.73	0.43	0.08	0.1	0.07	<0.03	0.05	0.08
Calcium	1.7	0.6	0.4	0.7	0.4	0.2	5.2	1	1.9	26	3.3	4.6
Chloride	61.4	5.1	2.1	38.8	10.3	1.1	24.3	1.4	<0.5	24.4	<0.5	<0.5
Fluoride	1.28	0.73	0.37	1.92	0.79	0.27	1.24	0.63	0.39	3.02	0.91	0.47
Iron	0.25	0.21	0.16	0.45	0.56	0.28	0.12	0.1	0.06	<0.02	0.04	0.05
Magnesium	0.3	<0.2	<0.2	<0.2	<0.2	<.2	1.4	<0.2	0.4	9.3	0.9	1.3
Molybdenum	1.61	0.17	0.09	3.13	0.61	0.14	2.2	0.71	0.43	2.4	0.4	0.21
Potassium	1.5	0.7	0.7	0.7	0.6	0.5	1.5	0.9	0.9	2.5	1.3	1.6
Selenium	0.304	0.16	0.1	0.563	0.275	0.082	0.128	0.0876	0.0592	0.02	0.0117	0.008
Silicon	8.8	7.2	5.1	10.6	7.3	5.8	8.9	7.8	6	10.6	8.3	7.3
Sulfate	367	36.6	18.4	257	41.7	10.4	179	25.4	10.7	246	10.3	4.5
Sodium	379	107	71.2	262	101	46.5	149	46	27.8	130	26.2	11.8
Uranium	0.599	0.0687	0.0348	0.57	0.17	0.0495	0.25	0.06	0.0296	0.194	0.0288	0.0126
Vanadium	0.248	0.131	0.082	0.029	0.013	0.009	0.016	0.022	0.021	0.007	0.008	<0.005

Figures

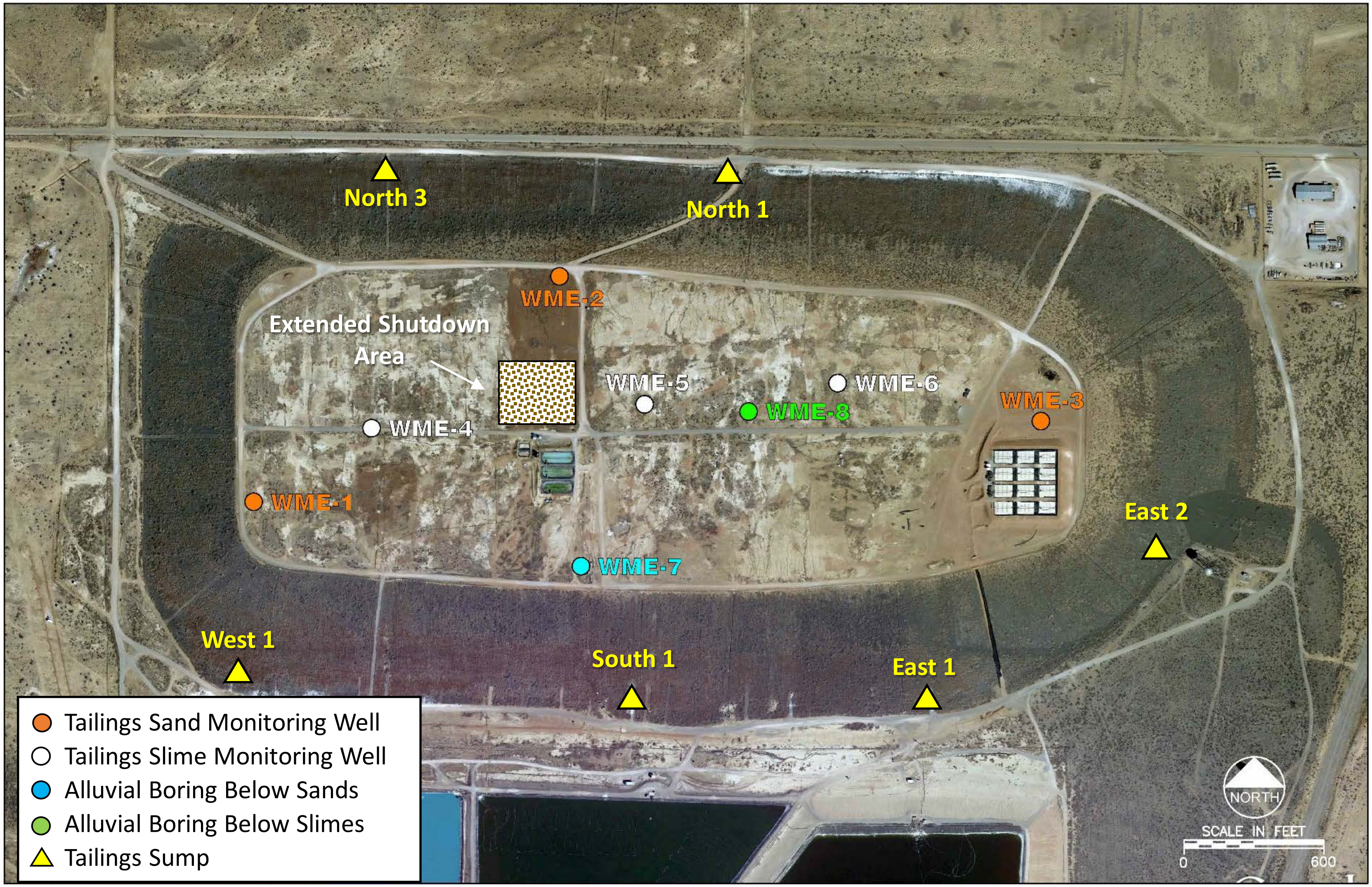


Figure 1. Location of LTP Wells and Alluvial Borings for Solids Collection and Water Quality Evaluation.

Figure 2. Location of STP Wells for Solids Collection and Water Quality Evaluation.

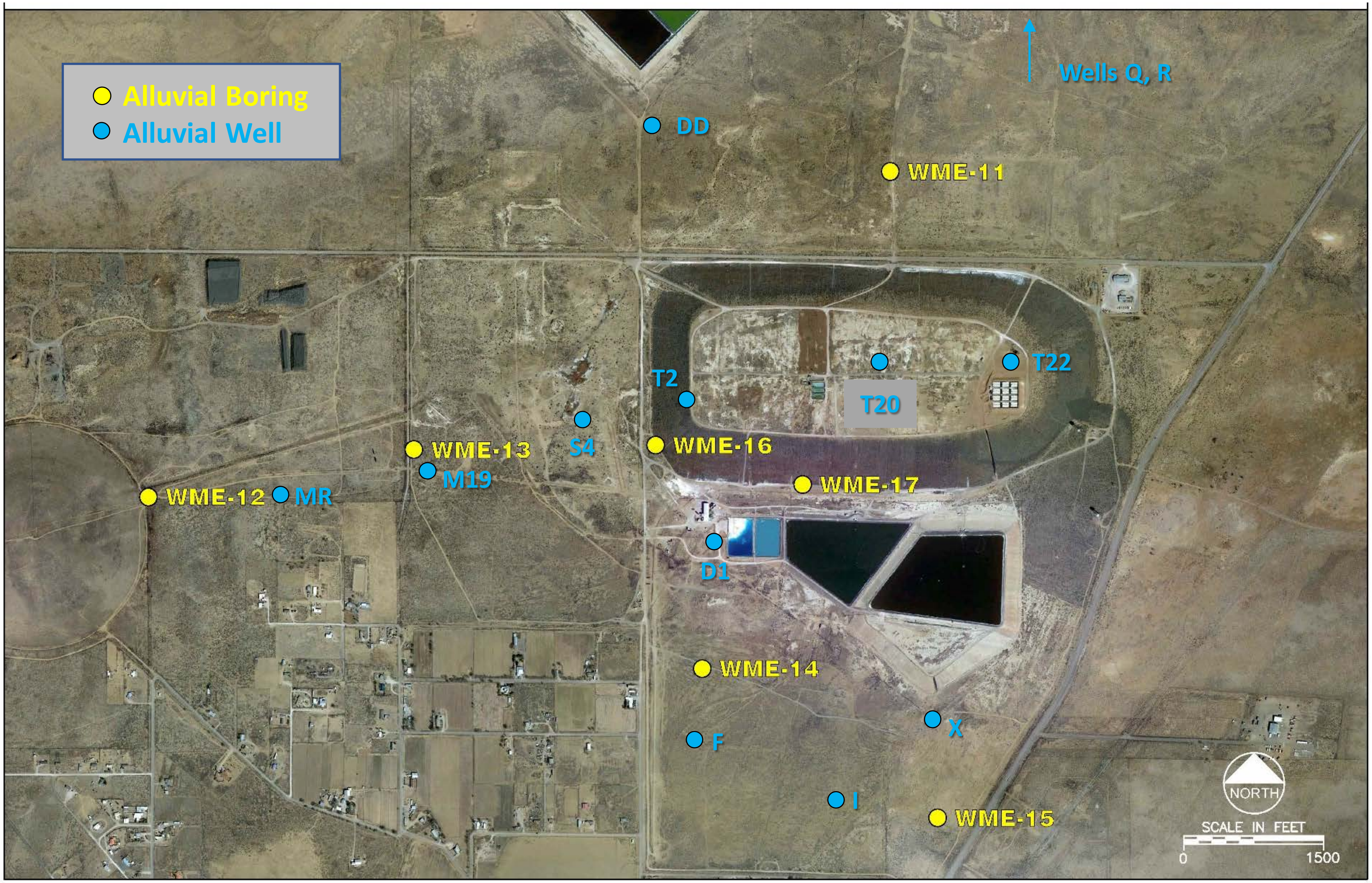


Figure 3. Location of Alluvial Borings and Wells for Solids Collection and Water Quality Evaluation.

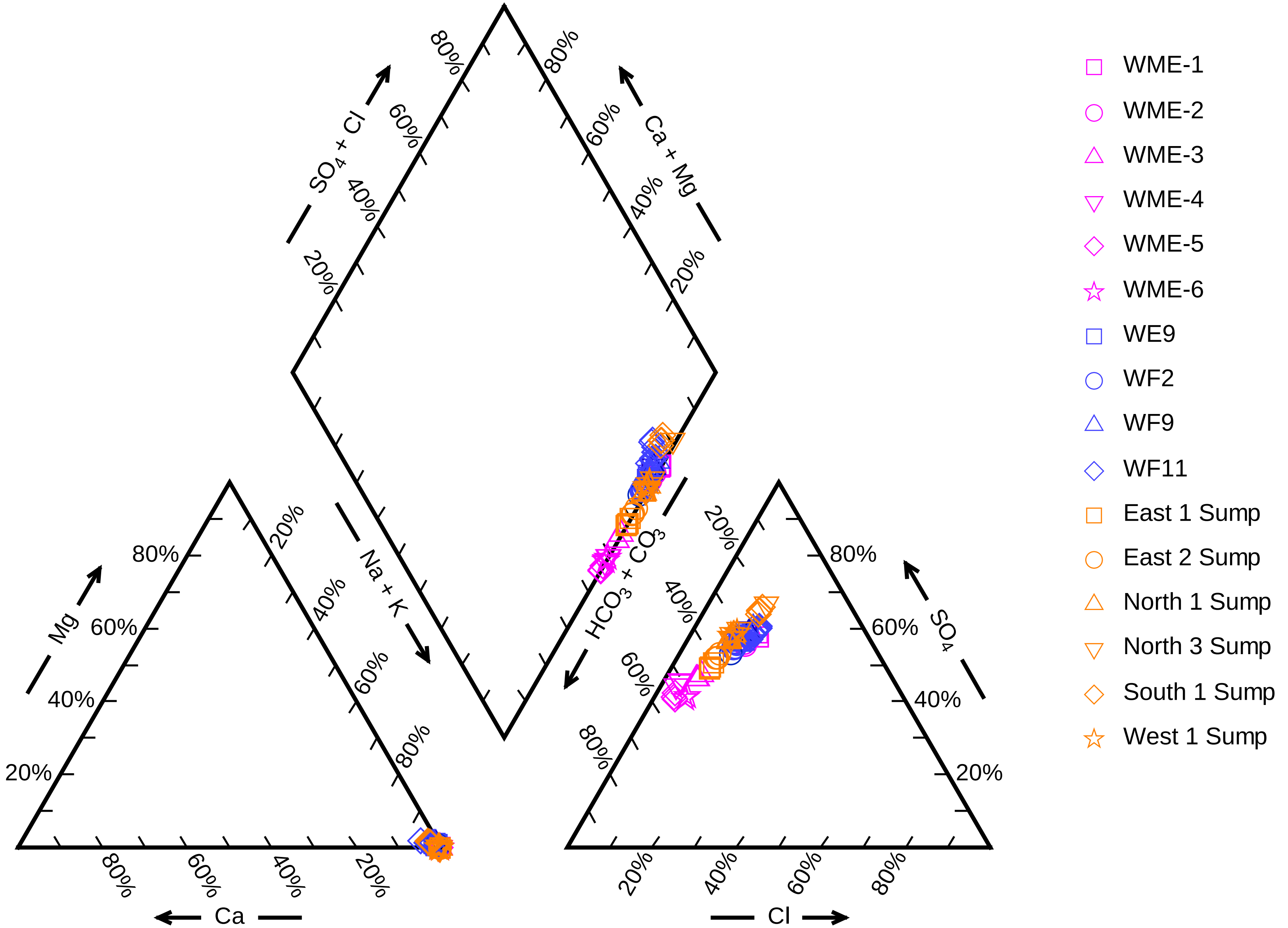
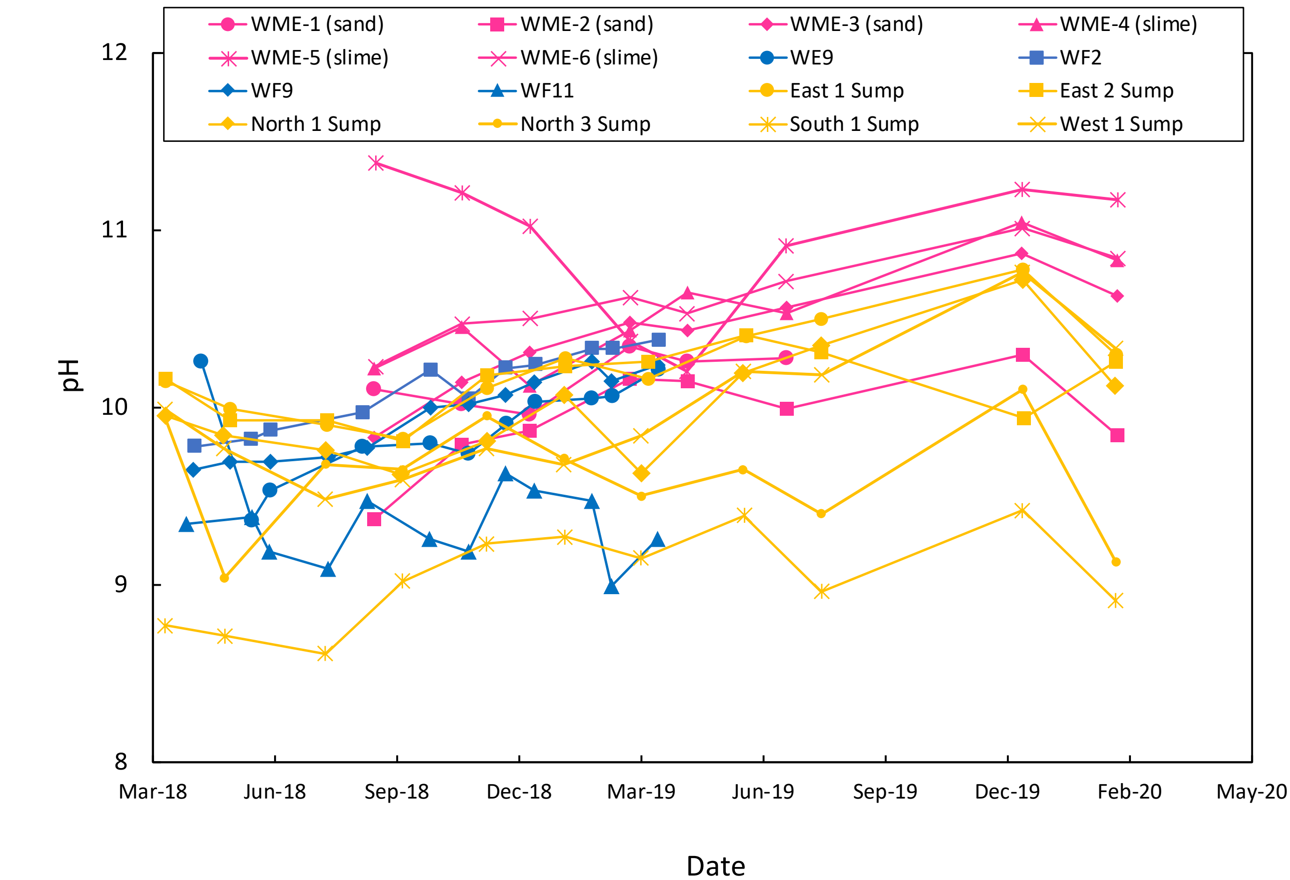


Figure 4. Trilinear Diagram for the LTP Wells and Sumps (2018).



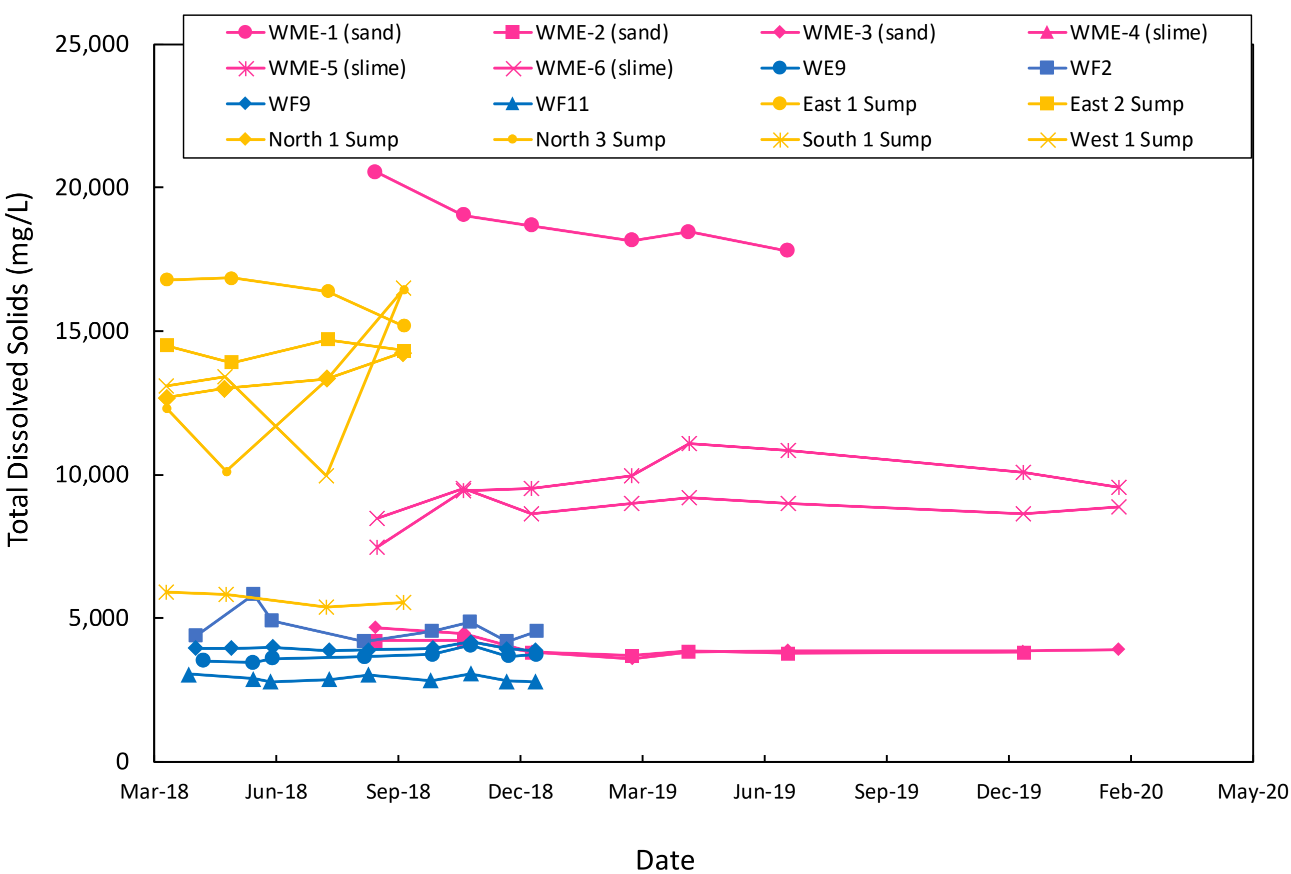


Figure 5. pH and TDS for the LTP Wells and Sumps Evaluated.

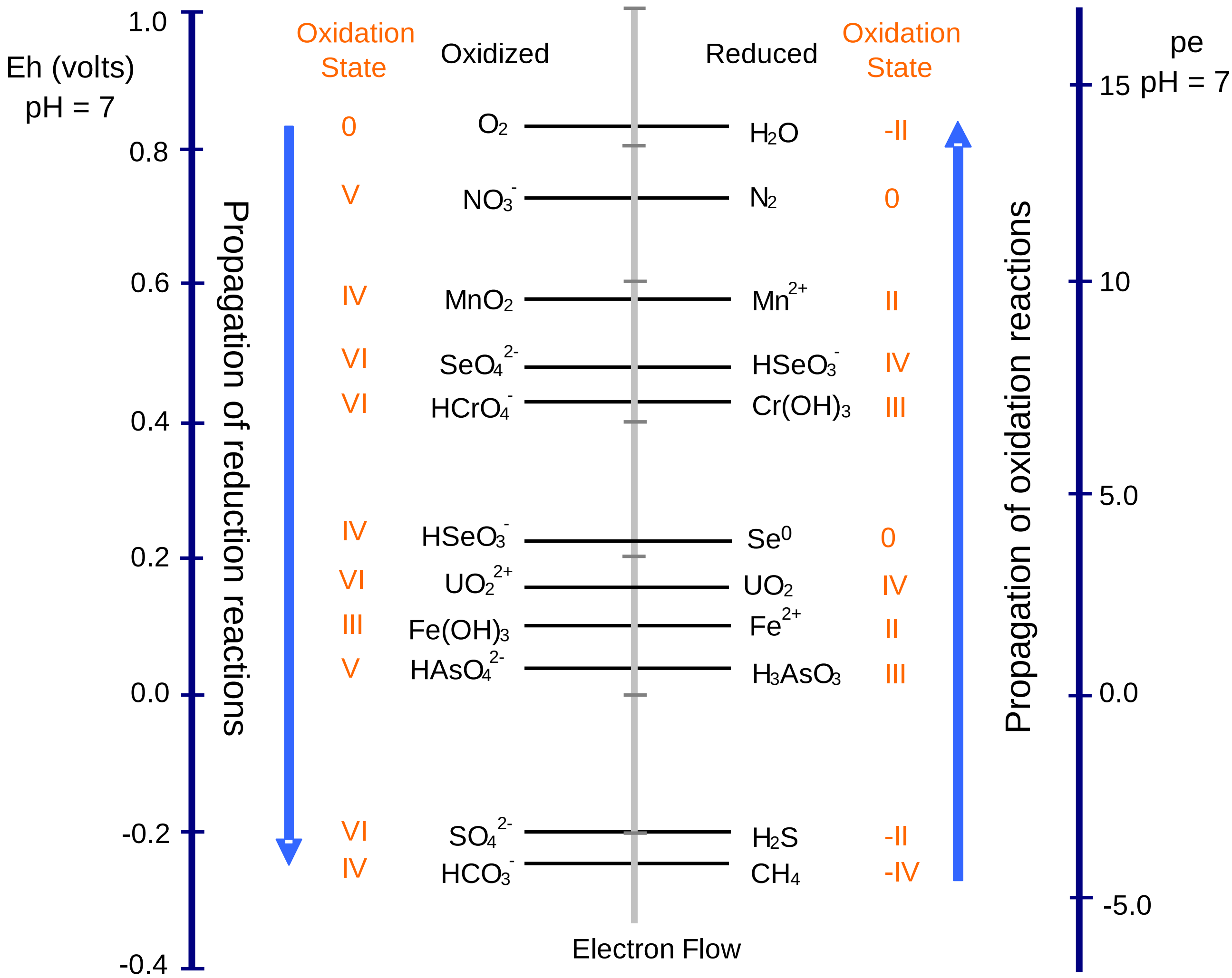


Figure 6. Generalized Redox Ladder Showing Sequence of Reduction for Various Species.

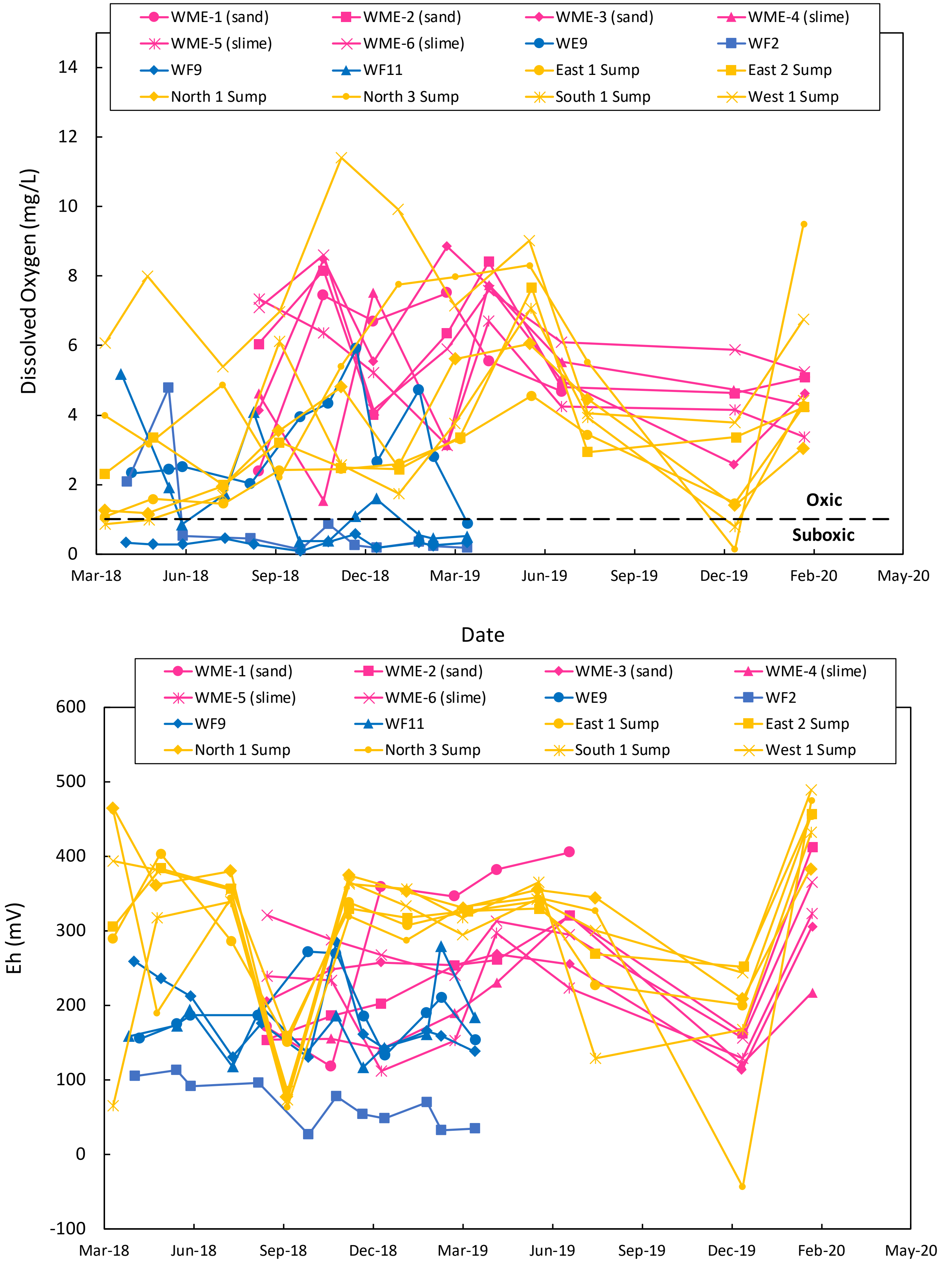


Figure 7. Dissolved Oxygen and Calculated Eh for the LTP Wells and Sumps Evaluated.

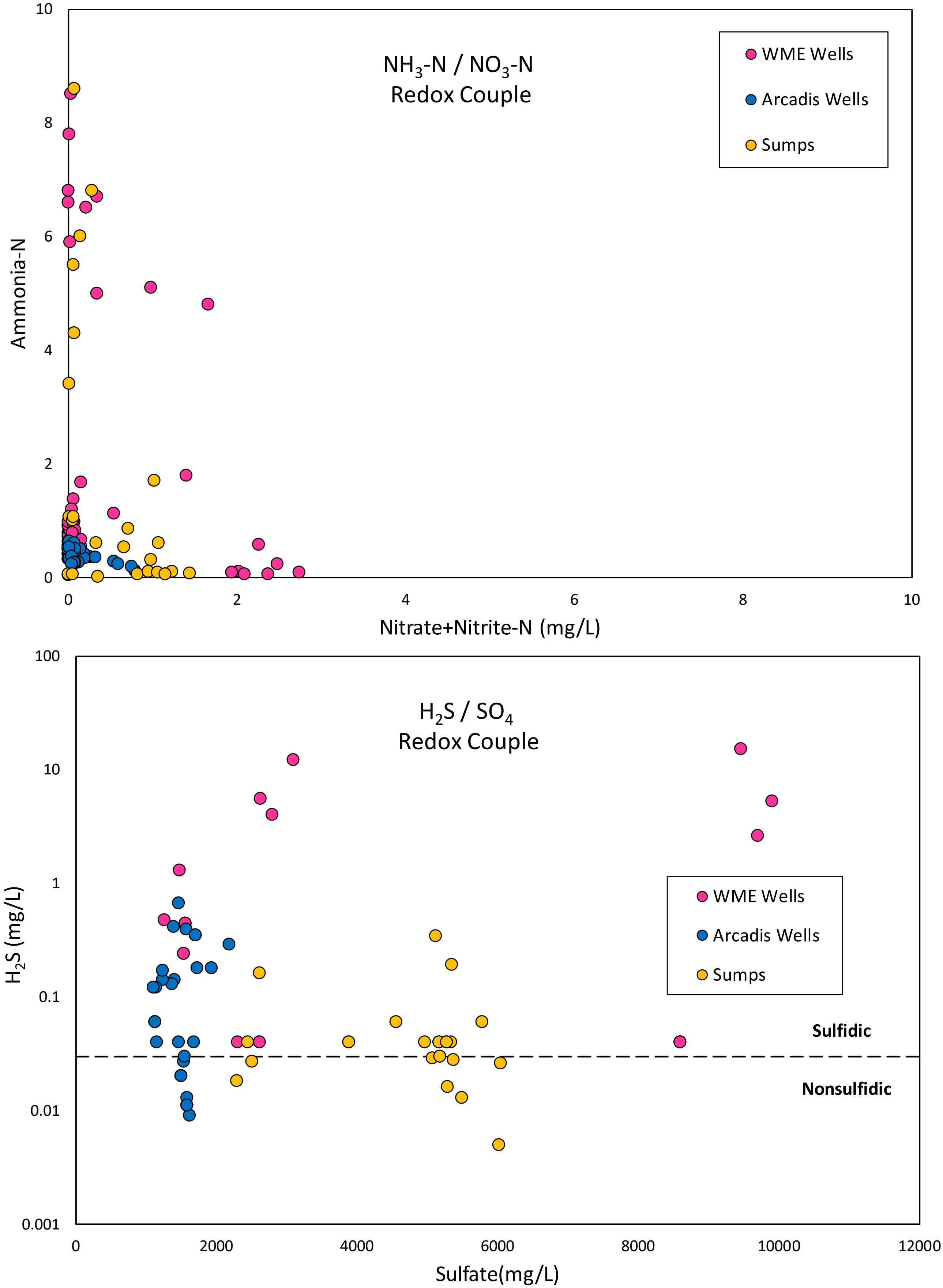


Figure 8. Comparison of Ammonia-N vs. Nitrate-N and Sulfide vs. Sulfate Concentrations in LTP Wells and Sumps.

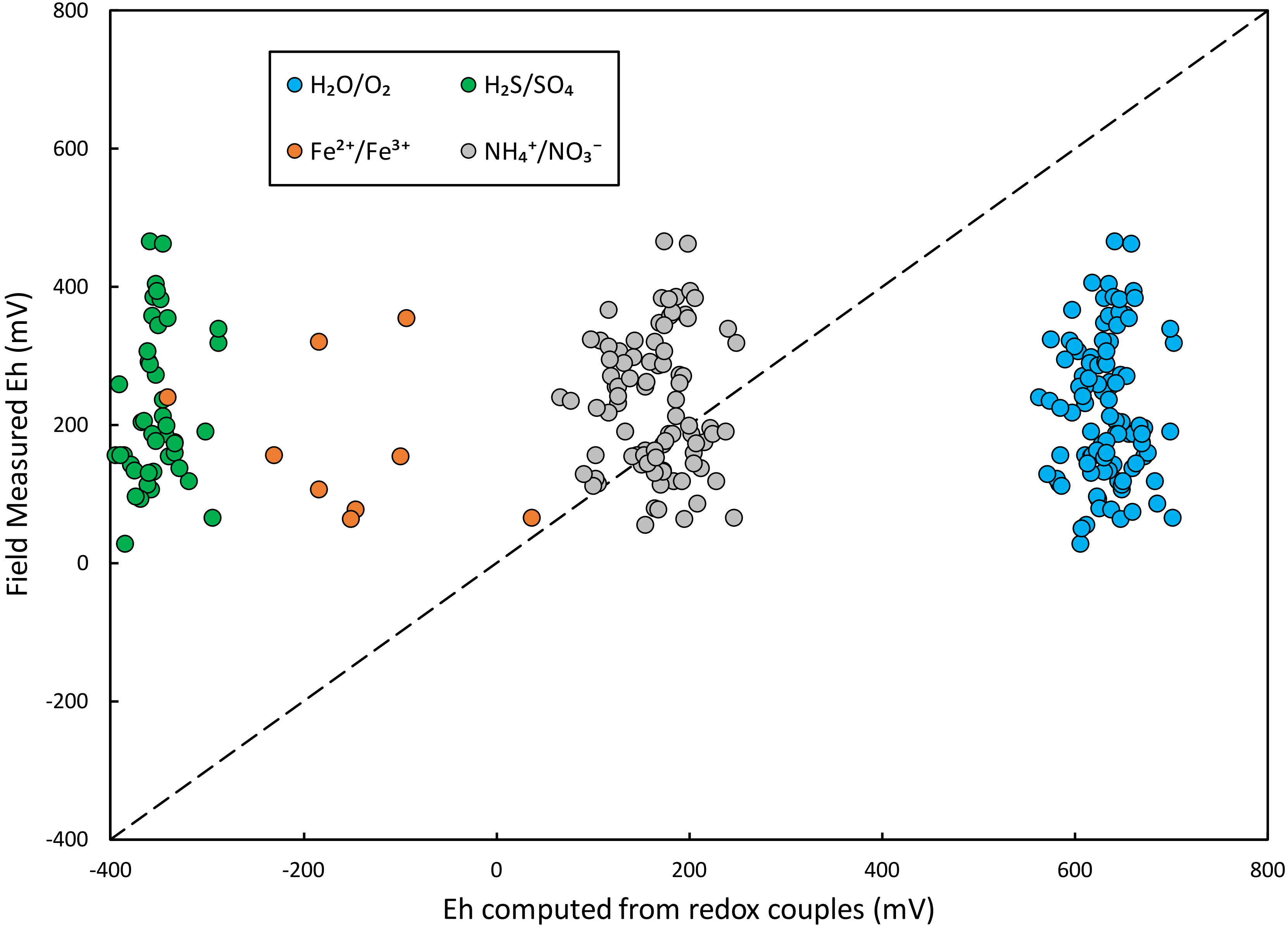


Figure 9. Comparison of Field-Measured Groundwater Eh and Potentials Computed from Individual Redox Couples for the LTP Wells and Sumps.

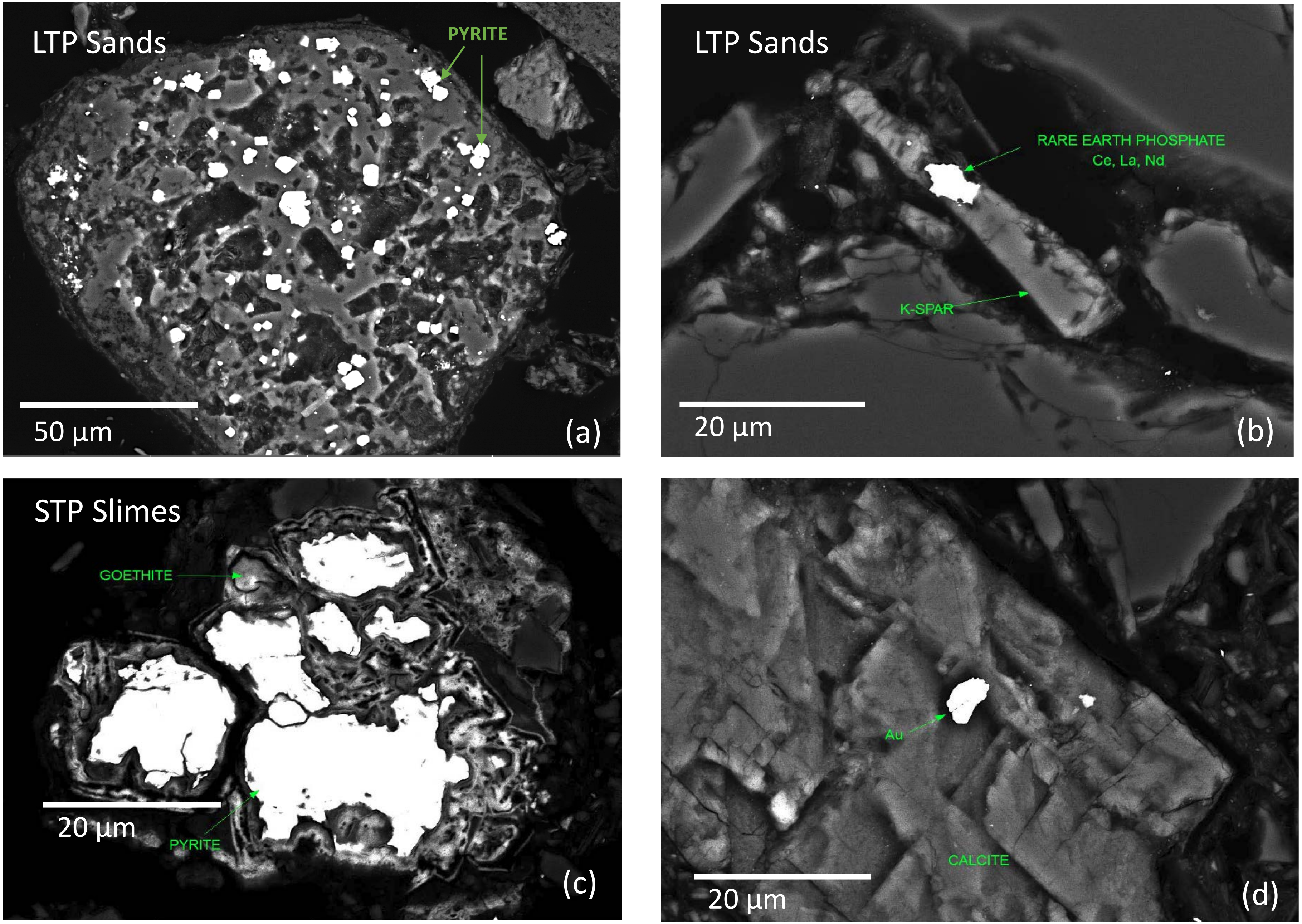


Figure 10. Example Mineralogical Occurrences as Observed Using SEM in the LTP and STP Tailing Solids.

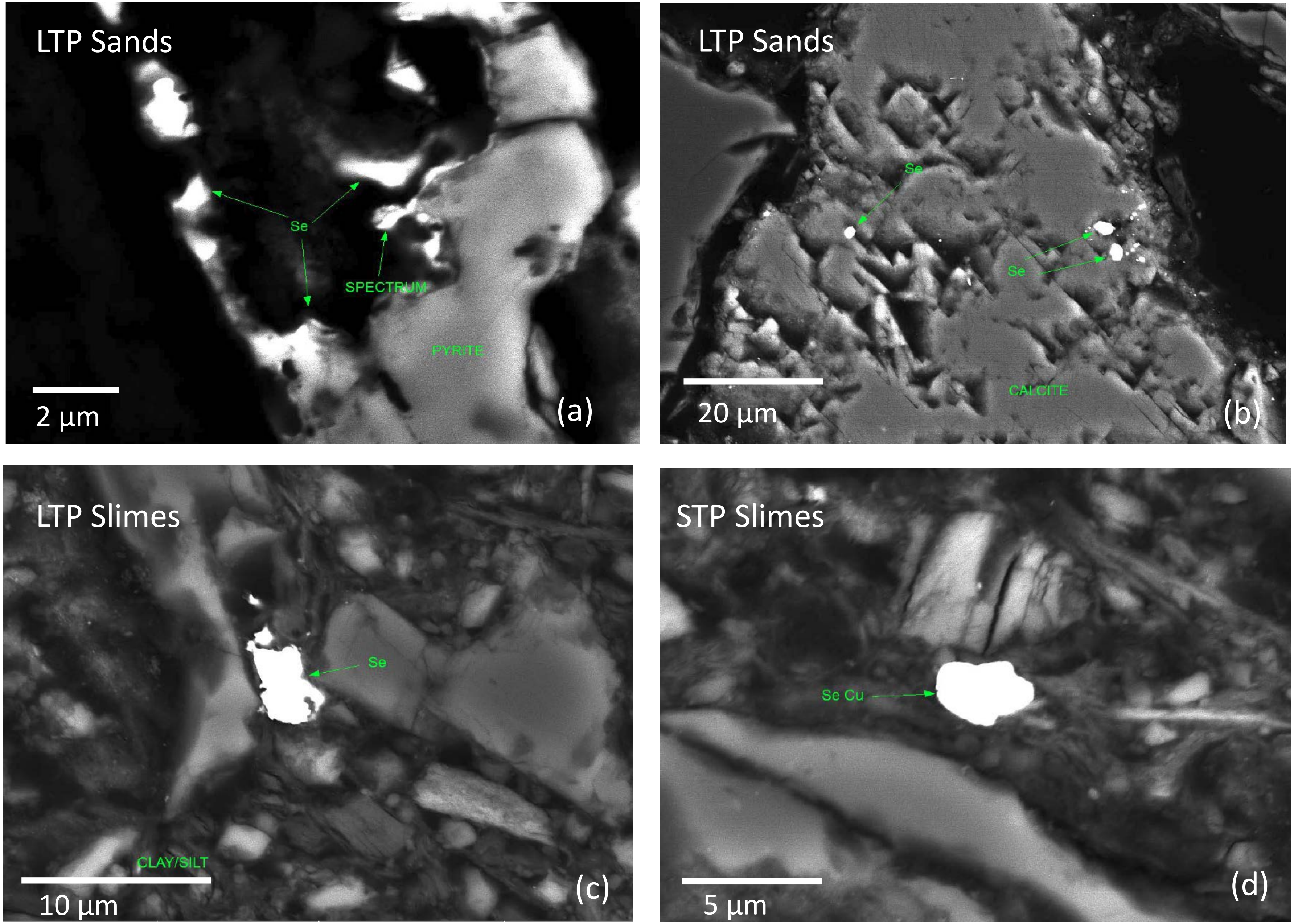


Figure 11. Various Forms of Se as Observed Using SEM in the LTP and STP Tailing Solids.

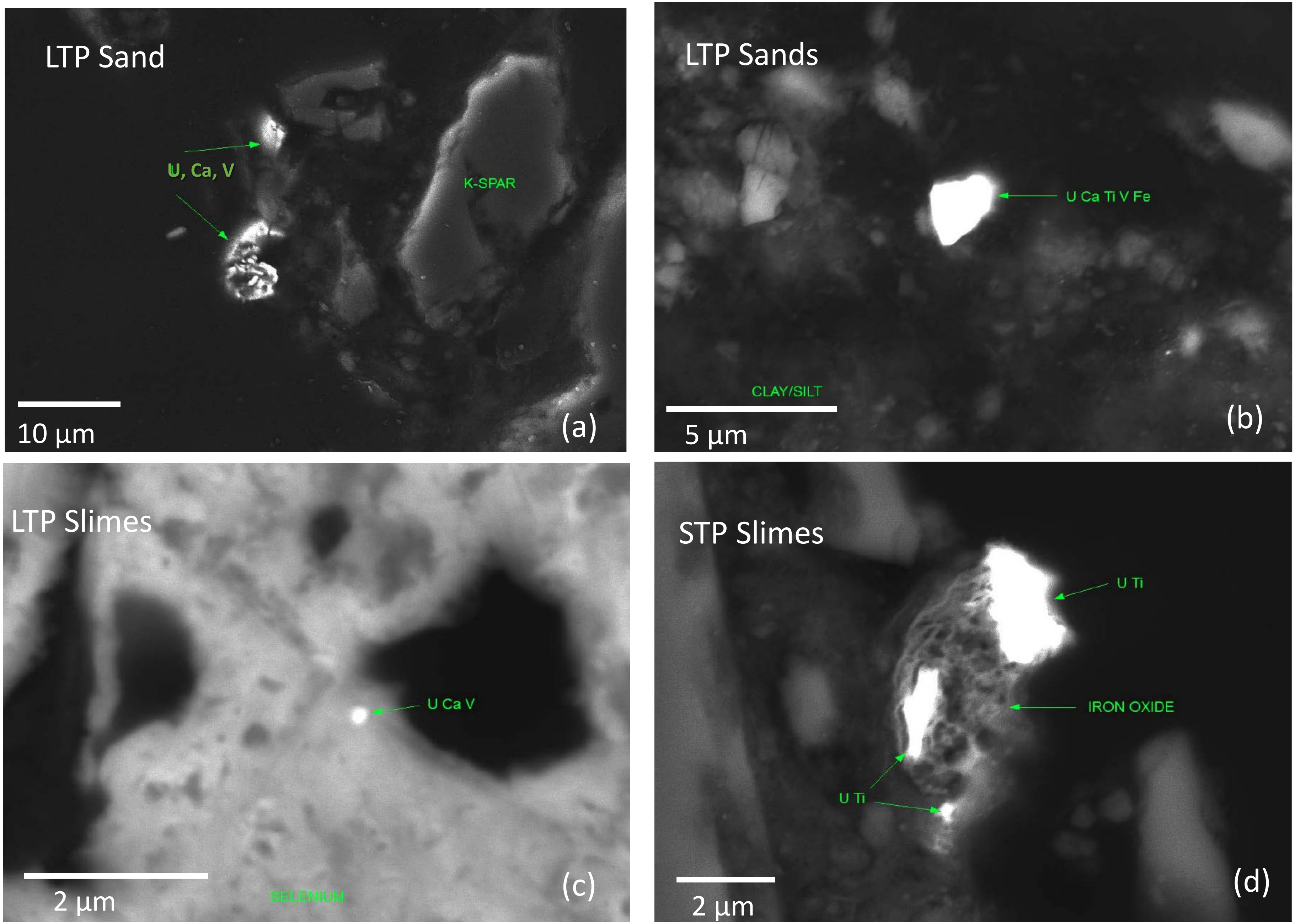


Figure 12. Various Forms of U as Observed Using SEM in the LTP and STP Tailing Solids.

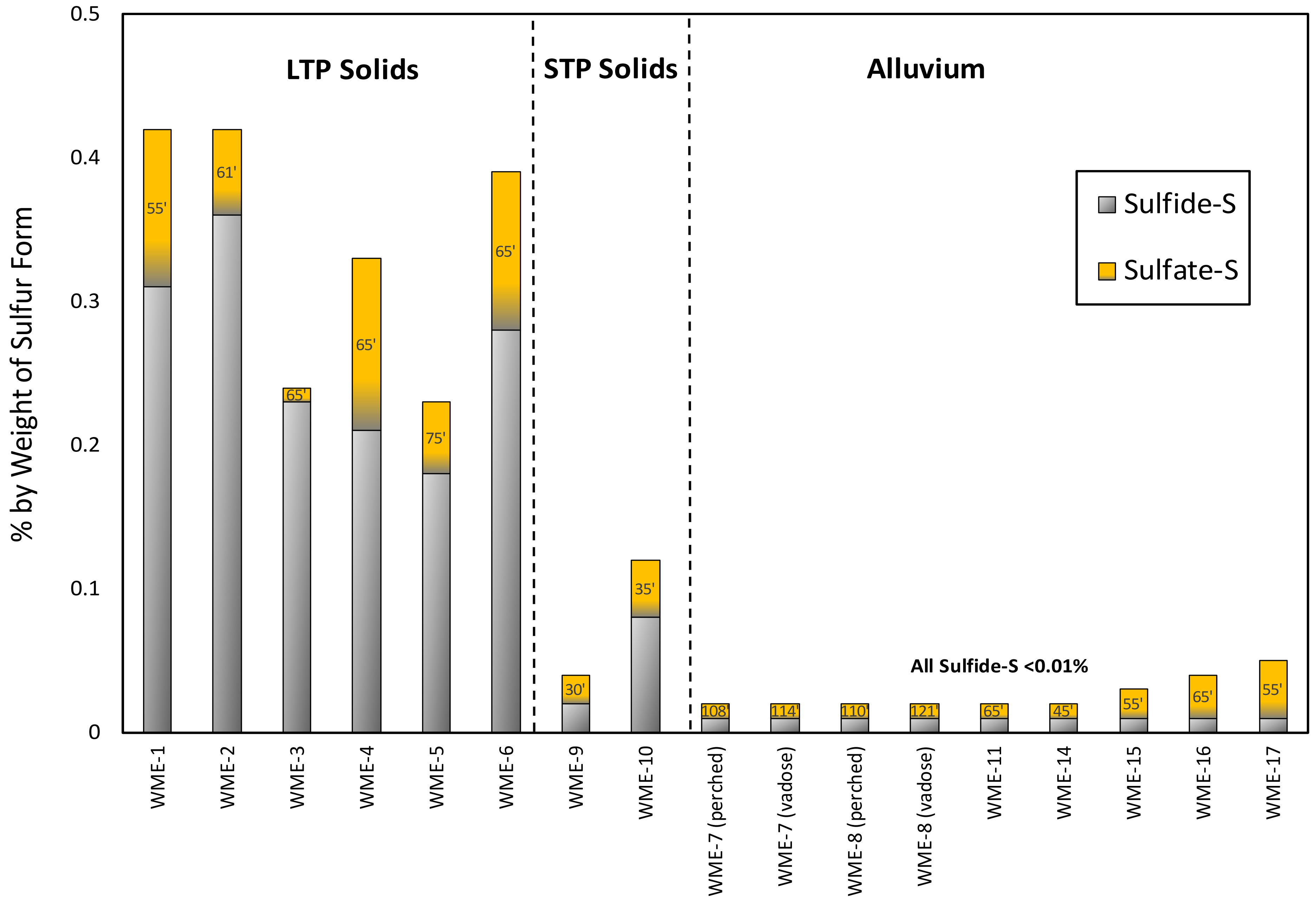


Figure 13. Acid-Base Accounting Results for Sulfur Forms in Tailings and Alluvium.

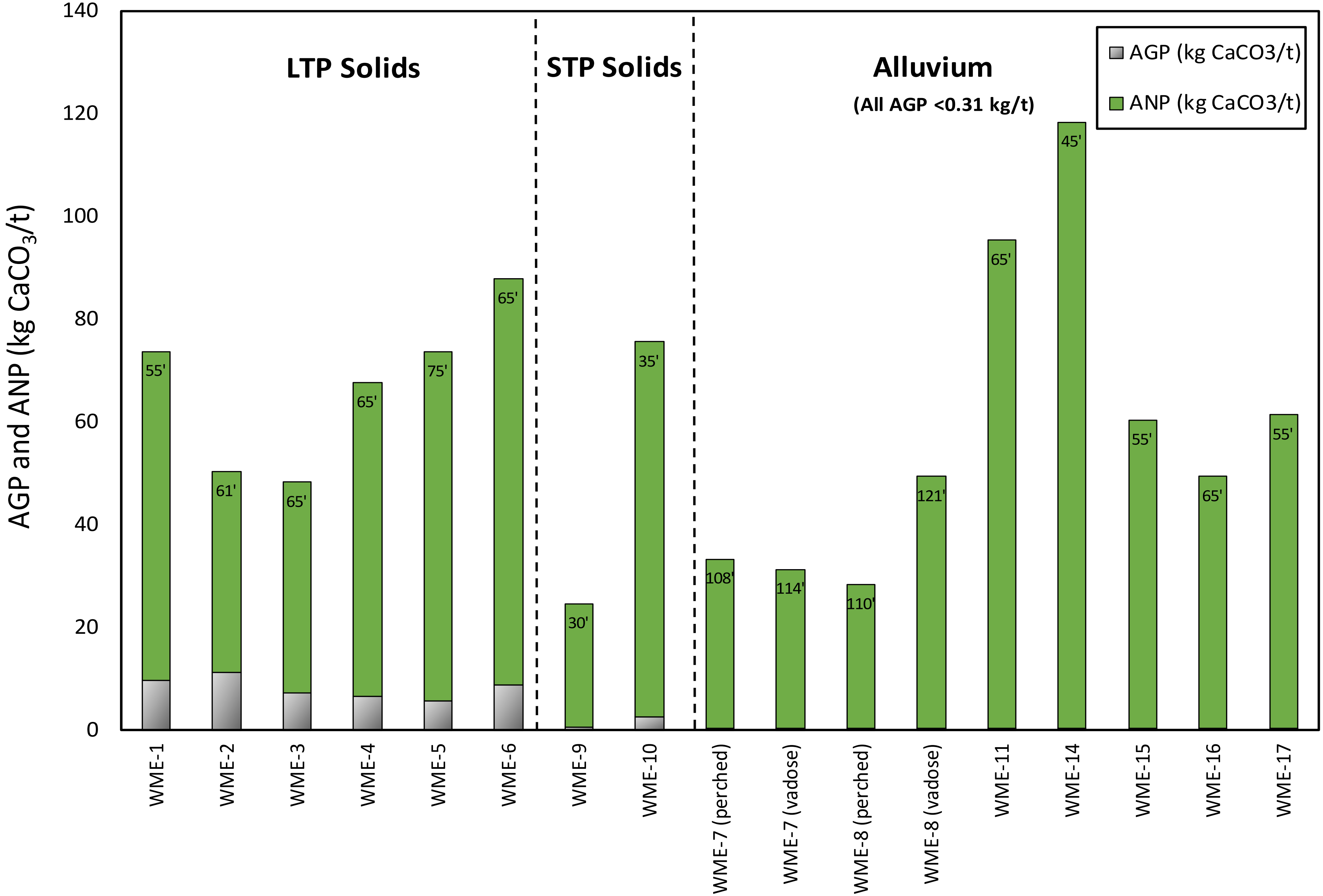


Figure 14. Acid-Base Accounting Results for AGP and ANP in Tailings and Alluvium.

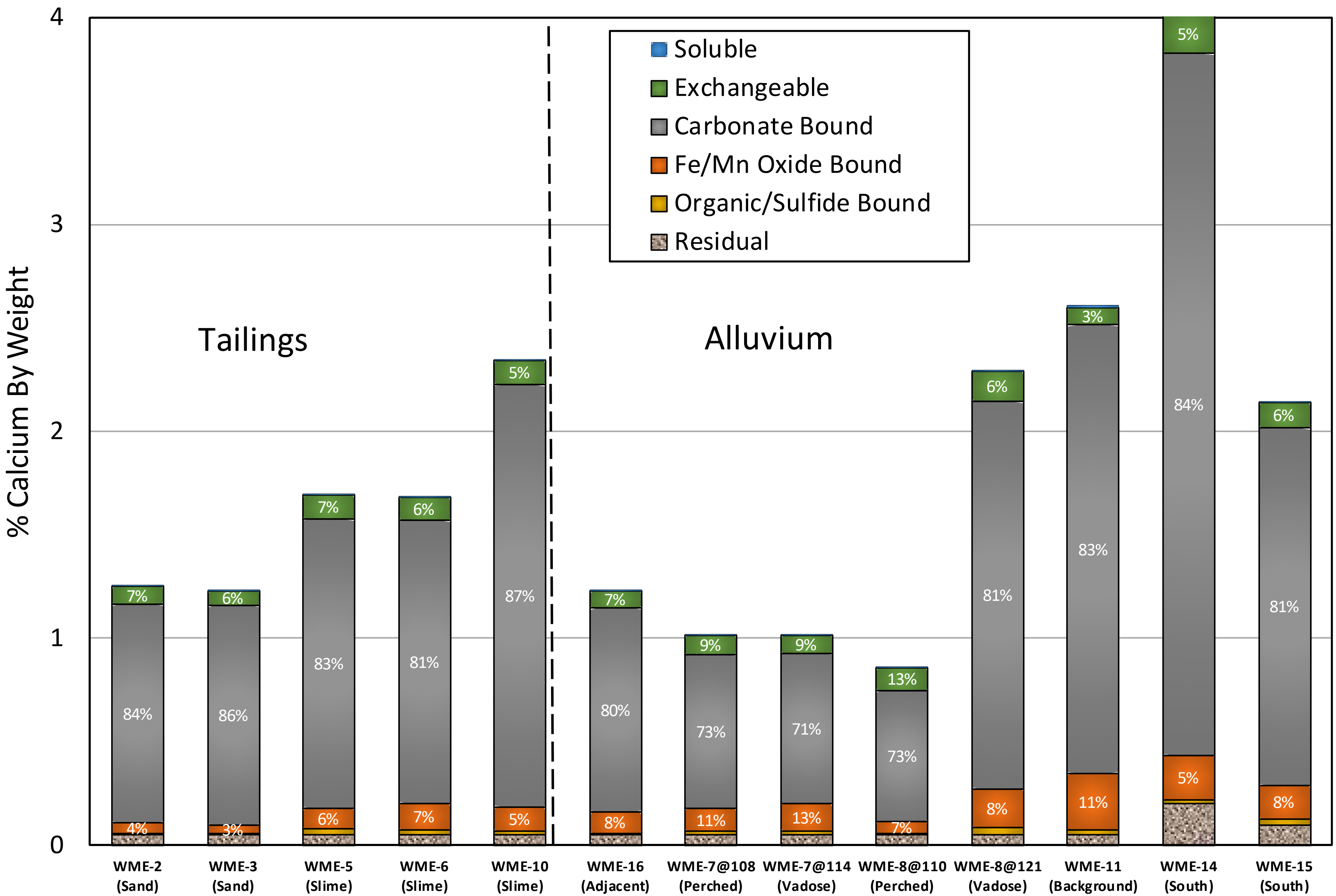


Figure 15. Selective Extraction Results for Ca Fractionation in Tailings and Alluvium.

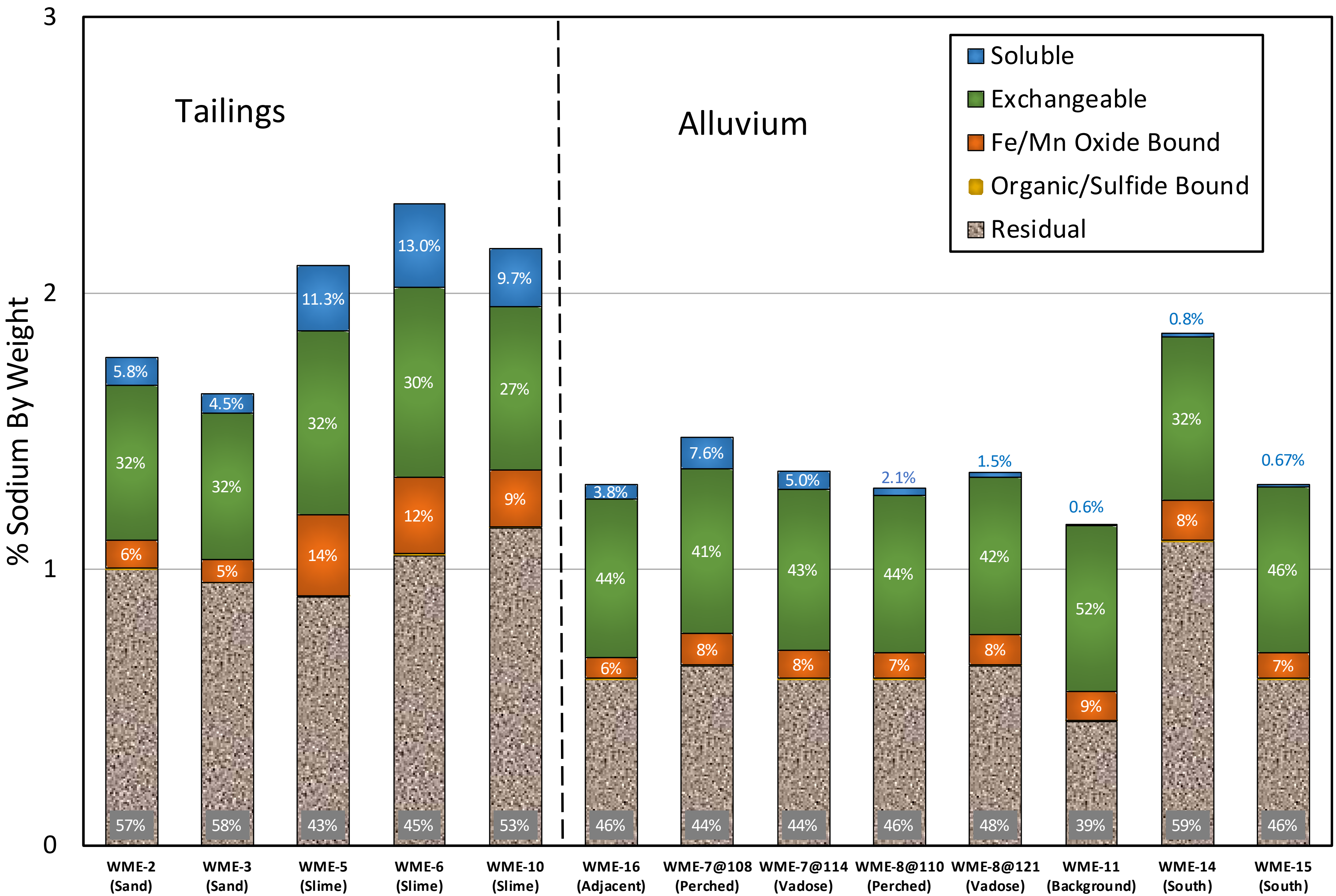


Figure 16. Selective Extraction Results for Na Fractionation in Tailings and Alluvium.

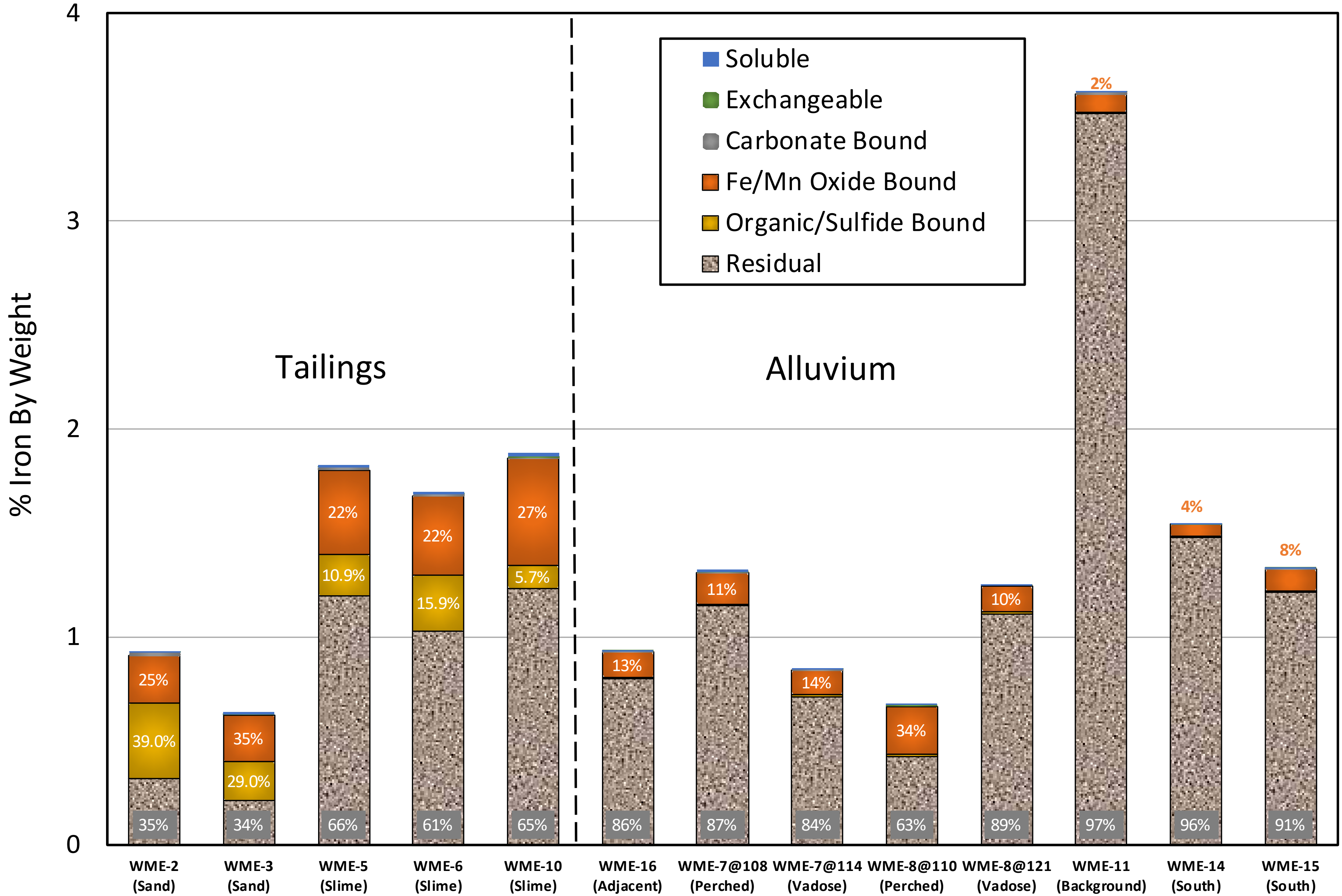


Figure 17. Selective Extraction Results for Fe Fractionation in Tailings and Alluvium.

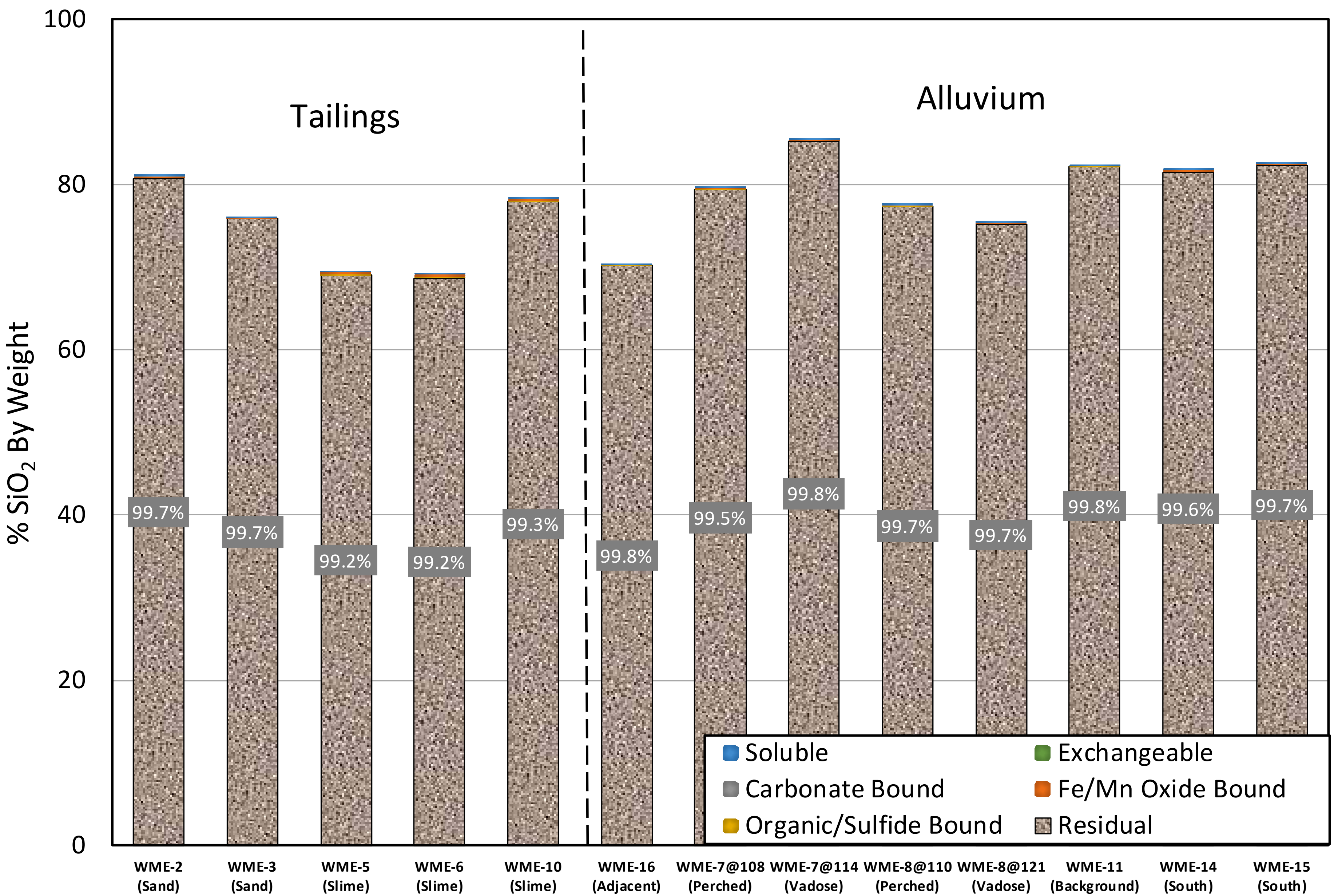


Figure 18. Selective Extraction Results for SiO_2 Fractionation in Tailings and Alluvium.

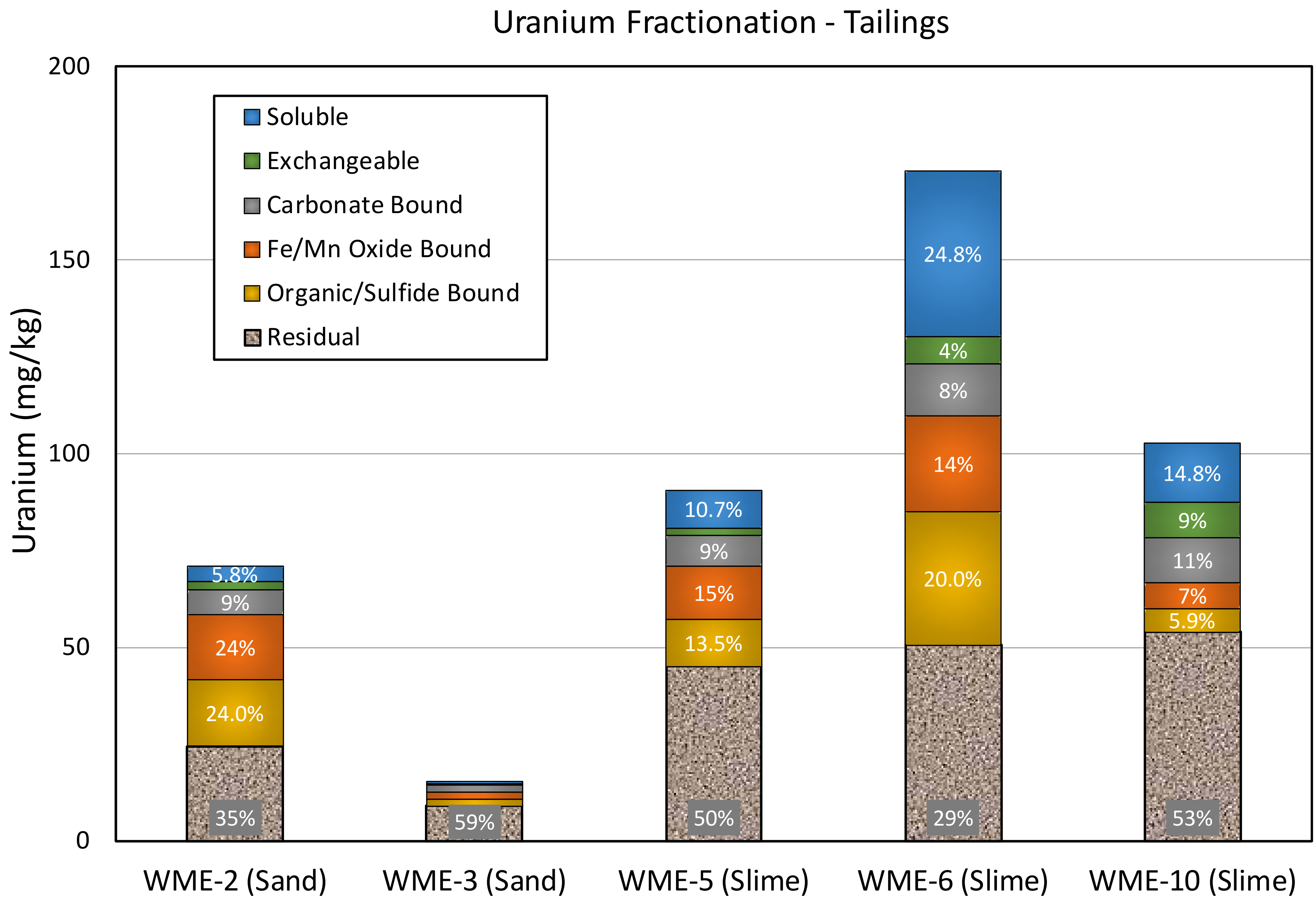


Figure 19. Selective Extraction Results for U in Tailings.

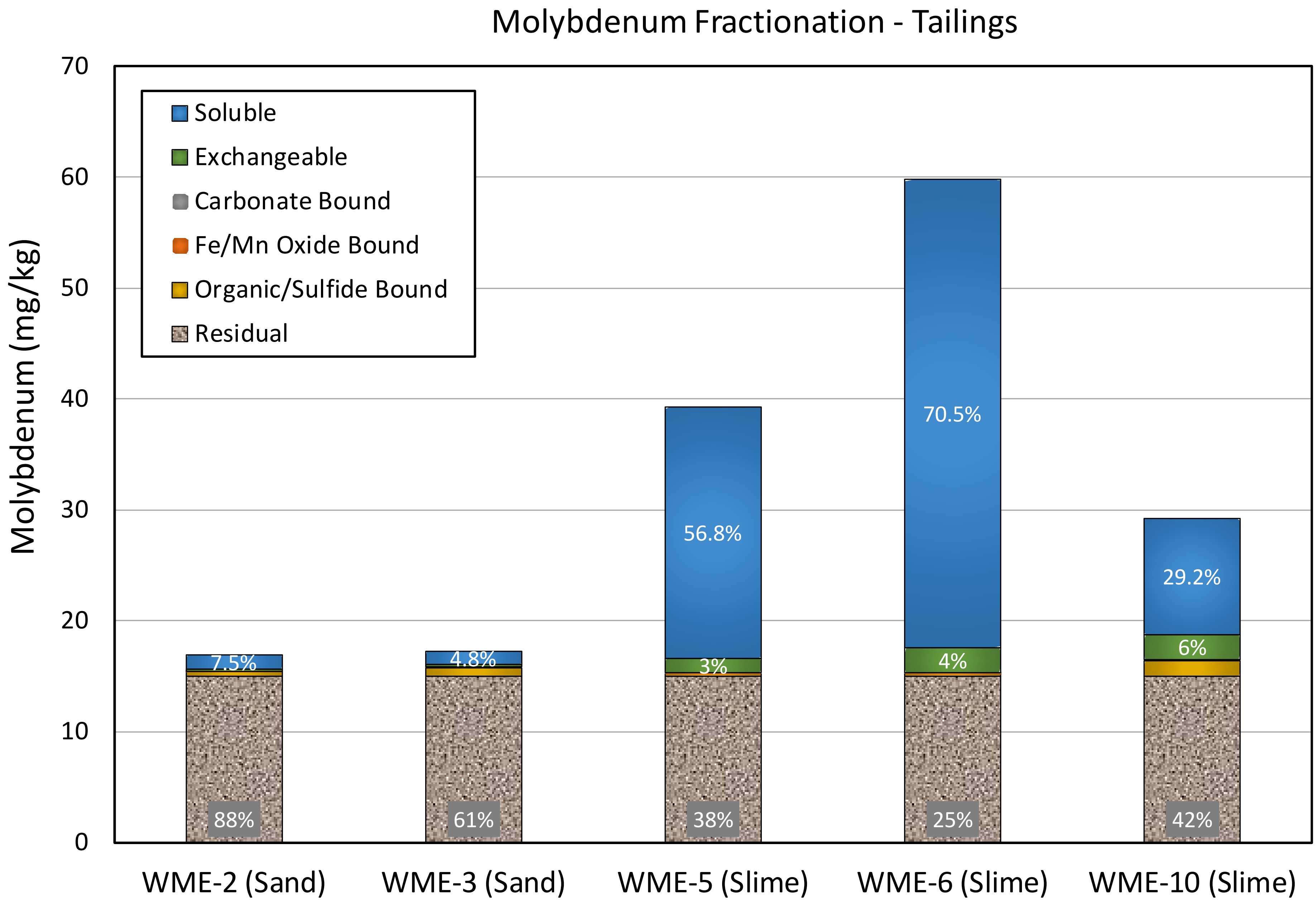


Figure 20. Selective Extraction Results for Mo in Tailings.

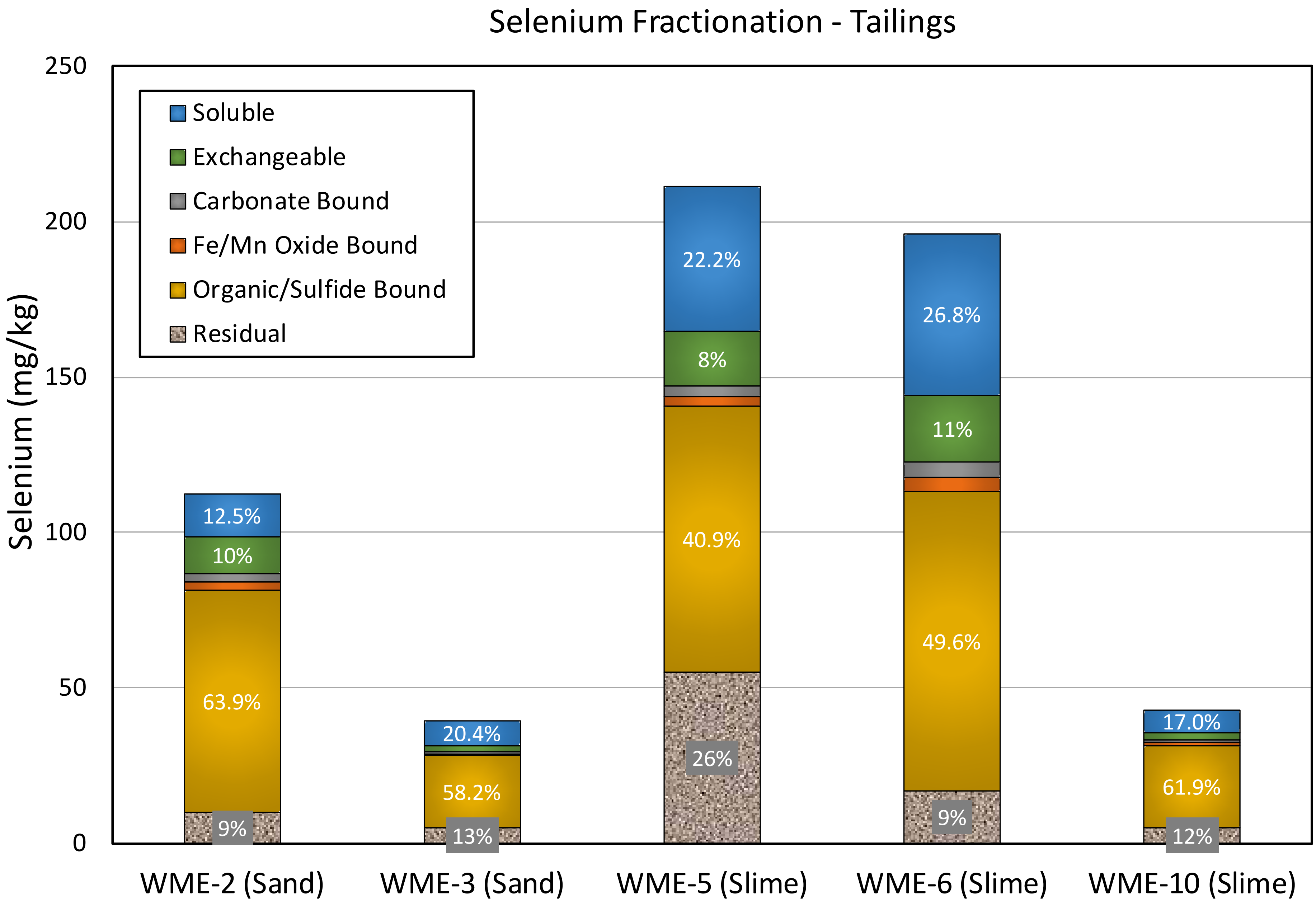


Figure 21. Selective Extraction Results for Se in Tailings.

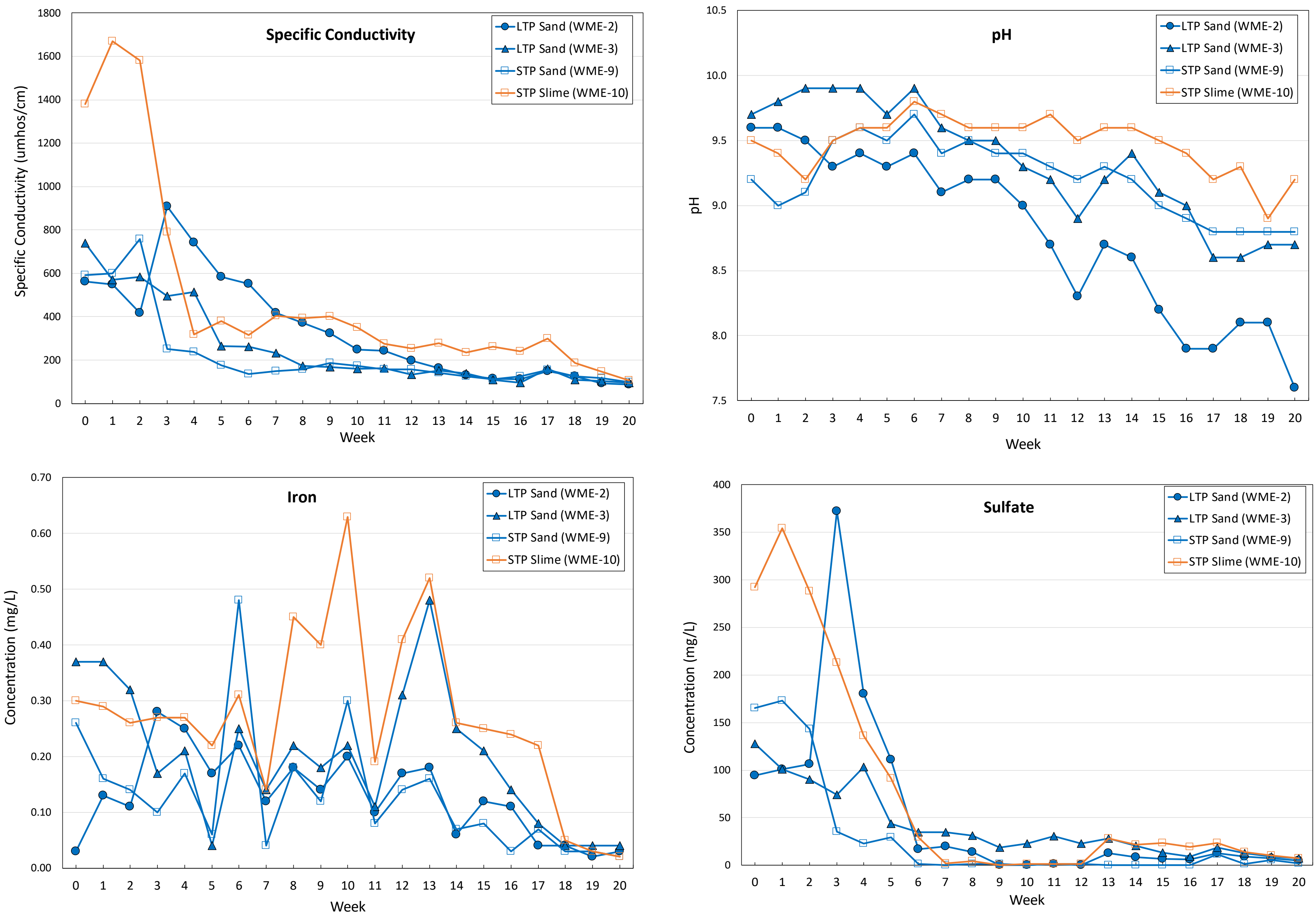


Figure 22. Humidity Cell Test Results for Specific Conductivity, pH, Iron, and Sulfate.

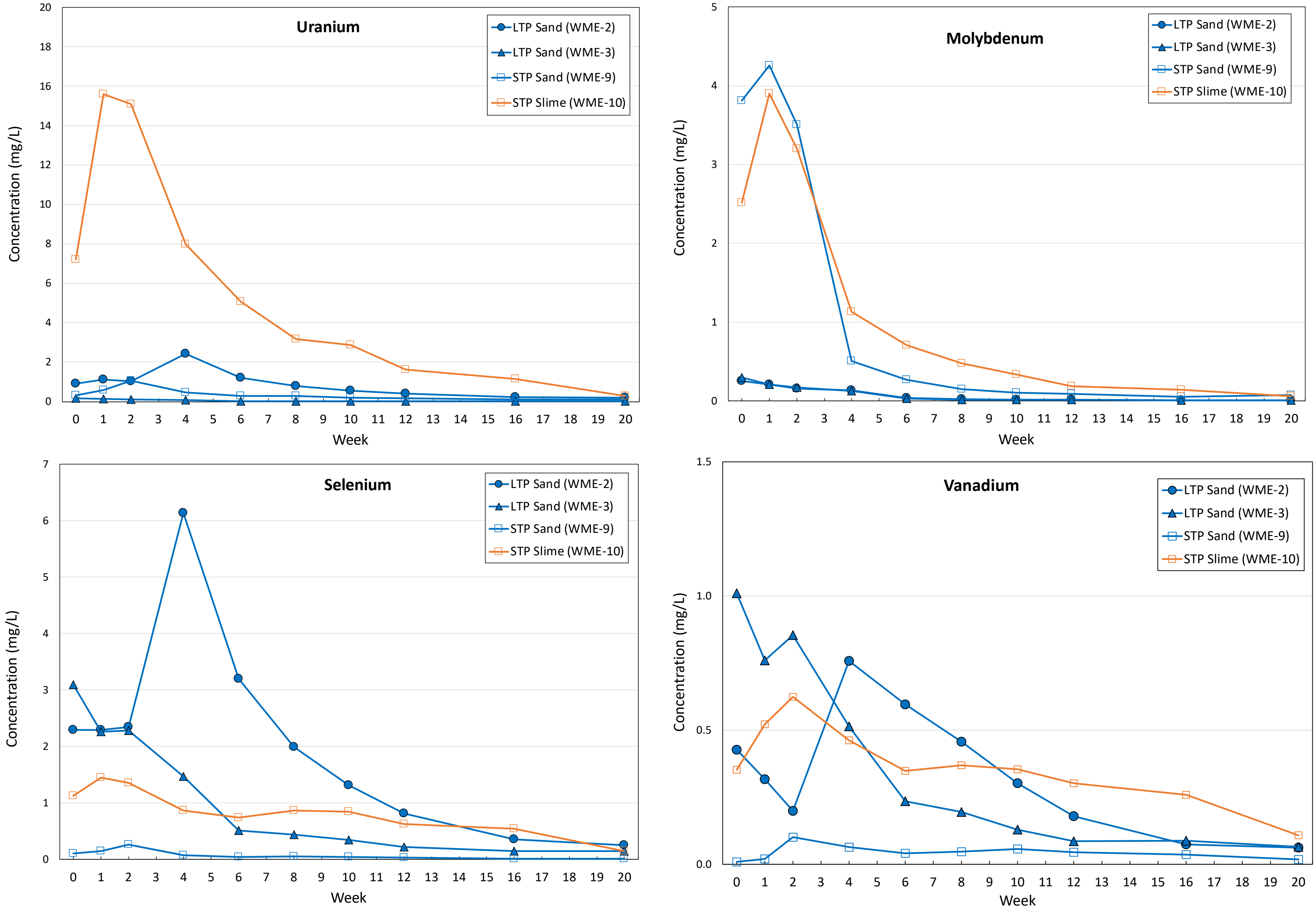


Figure 23. Humidity Cell Test Results for U, Mo, Se, and V.

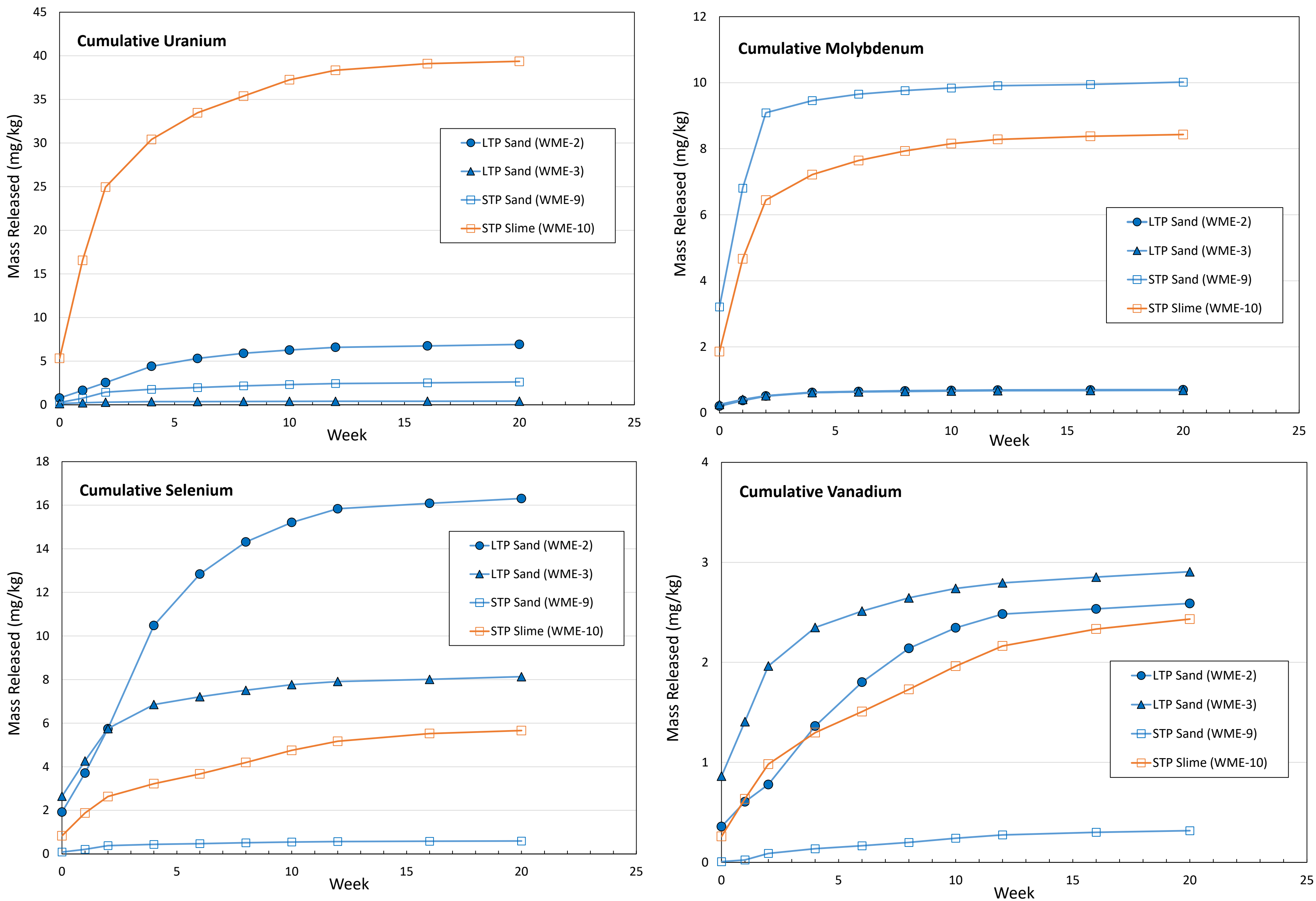


Figure 24. Cumulative U, Mo, Se, and V Released from Humidity Cell Tests.

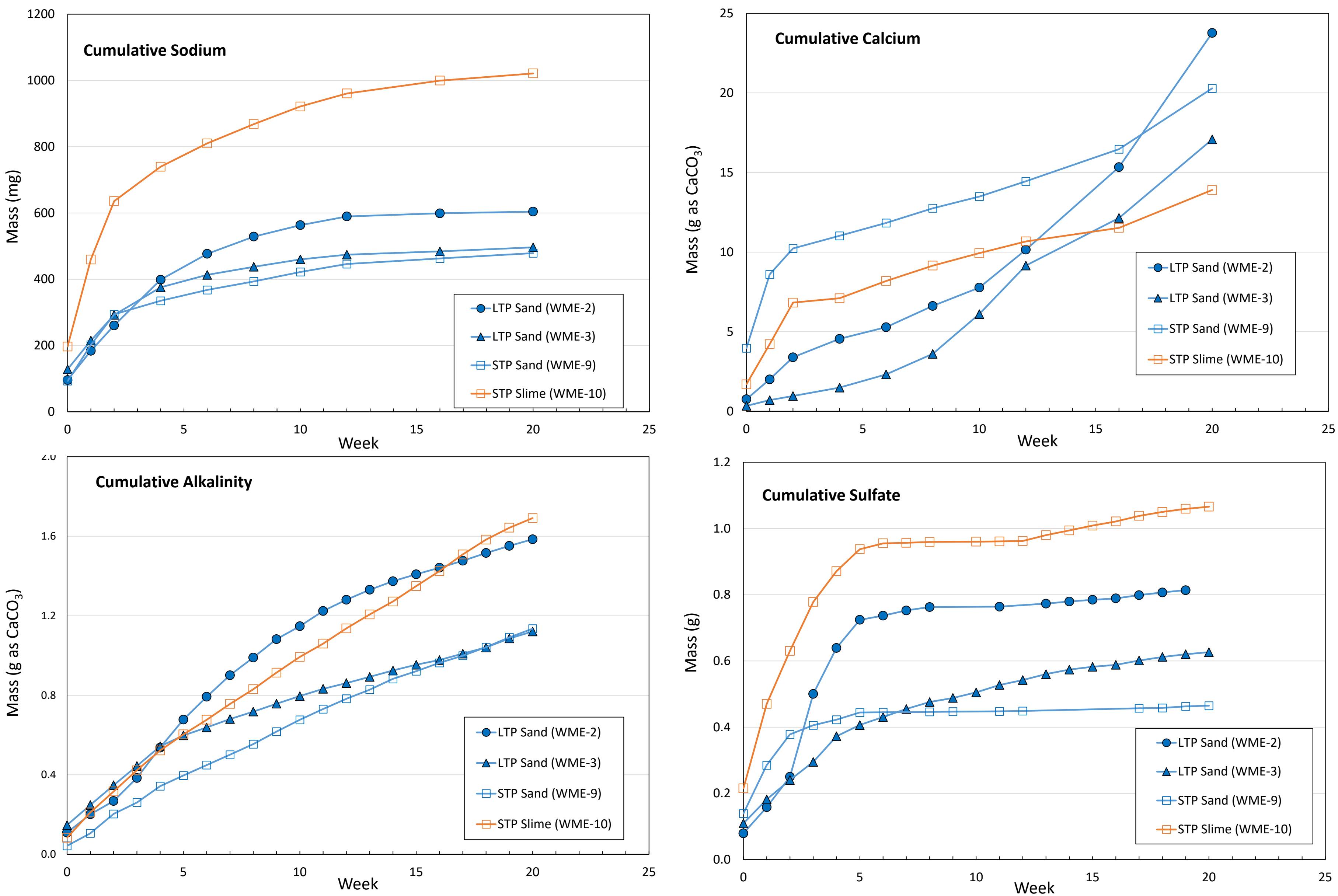


Figure 25. Cumulative Na, Ca, Alkalinity and Sulfate Released from Humidity Cell Tests.

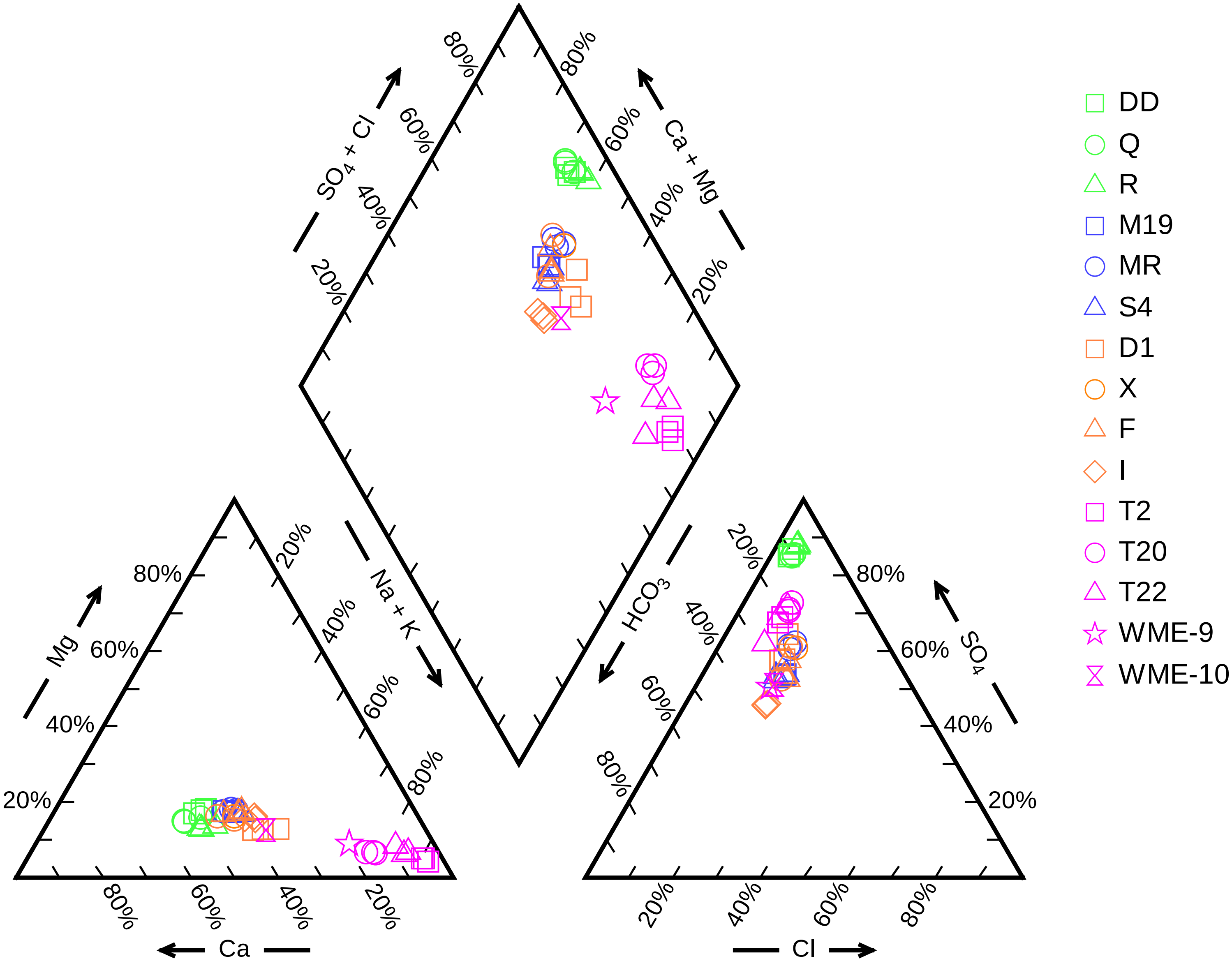


Figure 26. Trilinear Diagram for Alluvial Wells (2018).

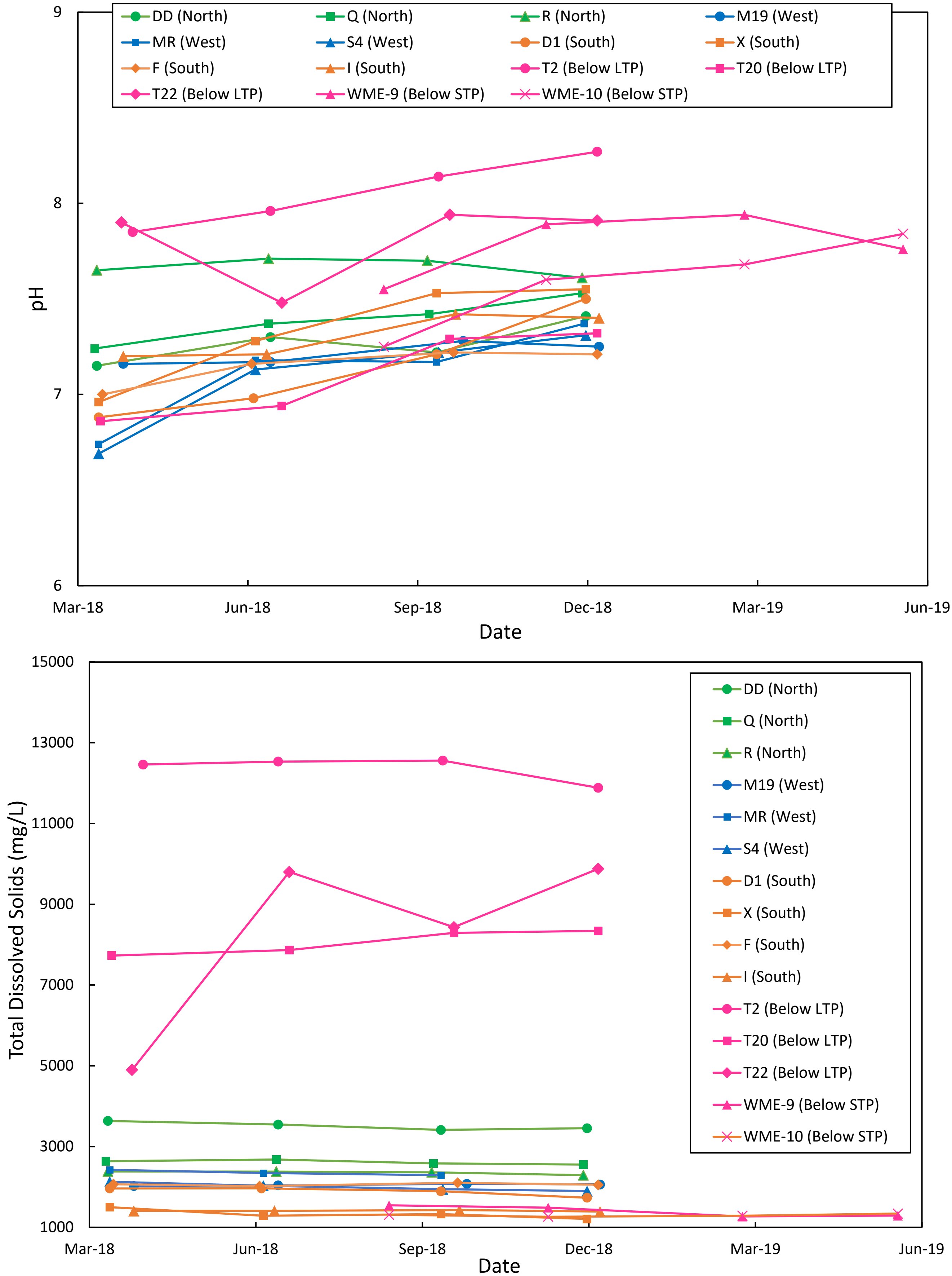


Figure 27. pH and Total Dissolved Solids for the Alluvial Wells Studied.

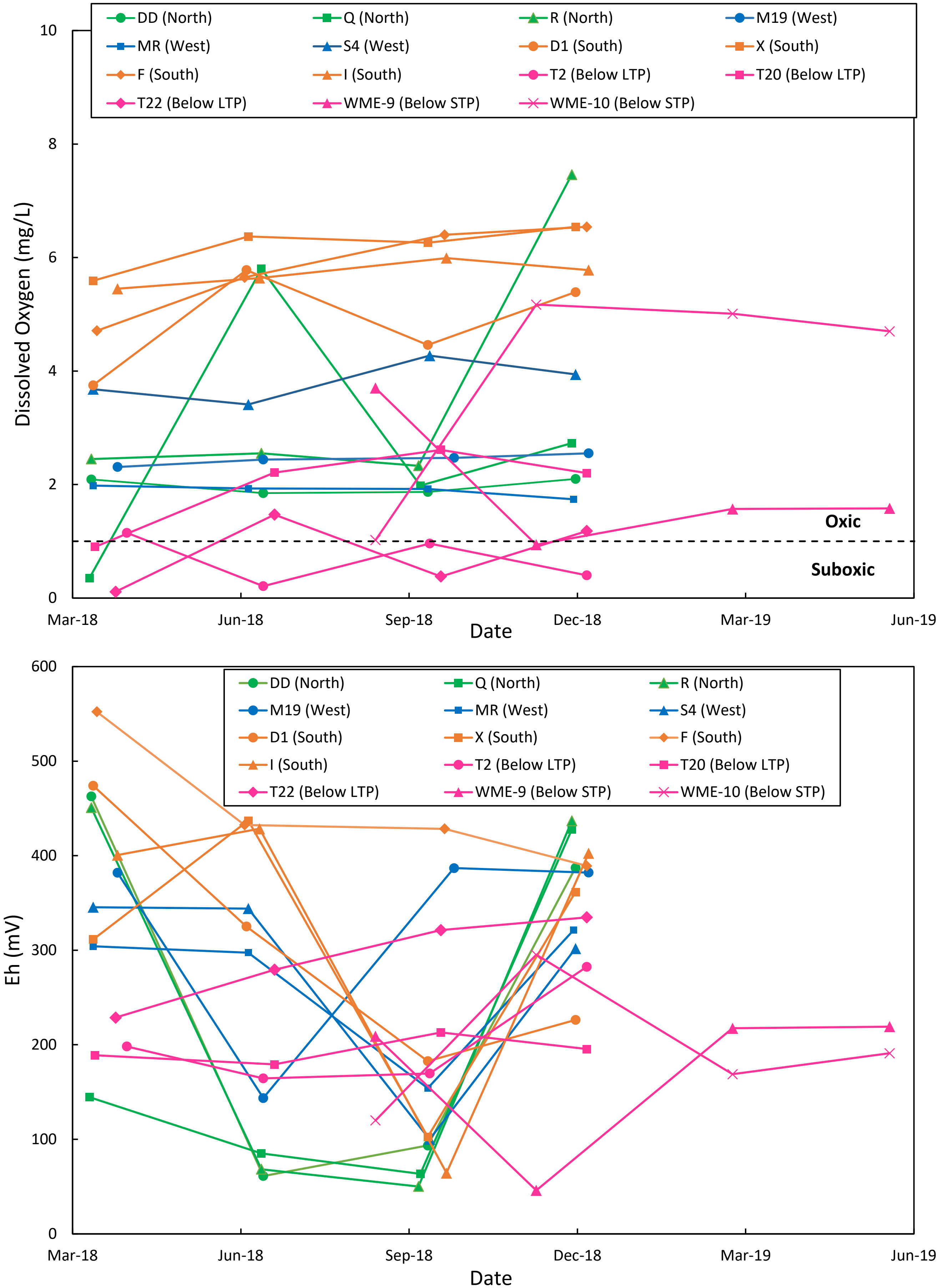


Figure 28. Dissolved Oxygen and Calculated Eh for the Alluvial Wells Studied.

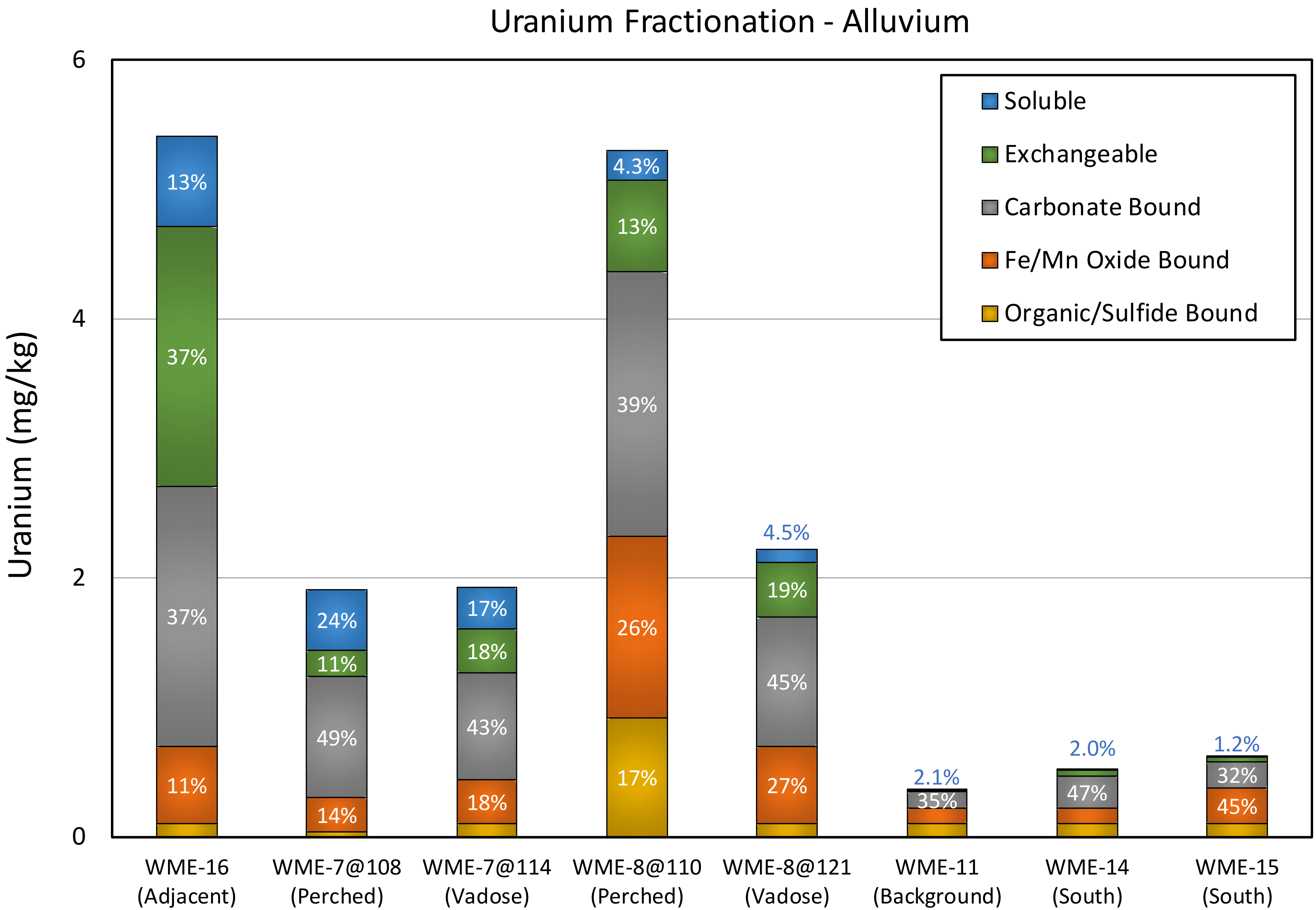


Figure 29. Selective Extraction Results for U in Alluvium.

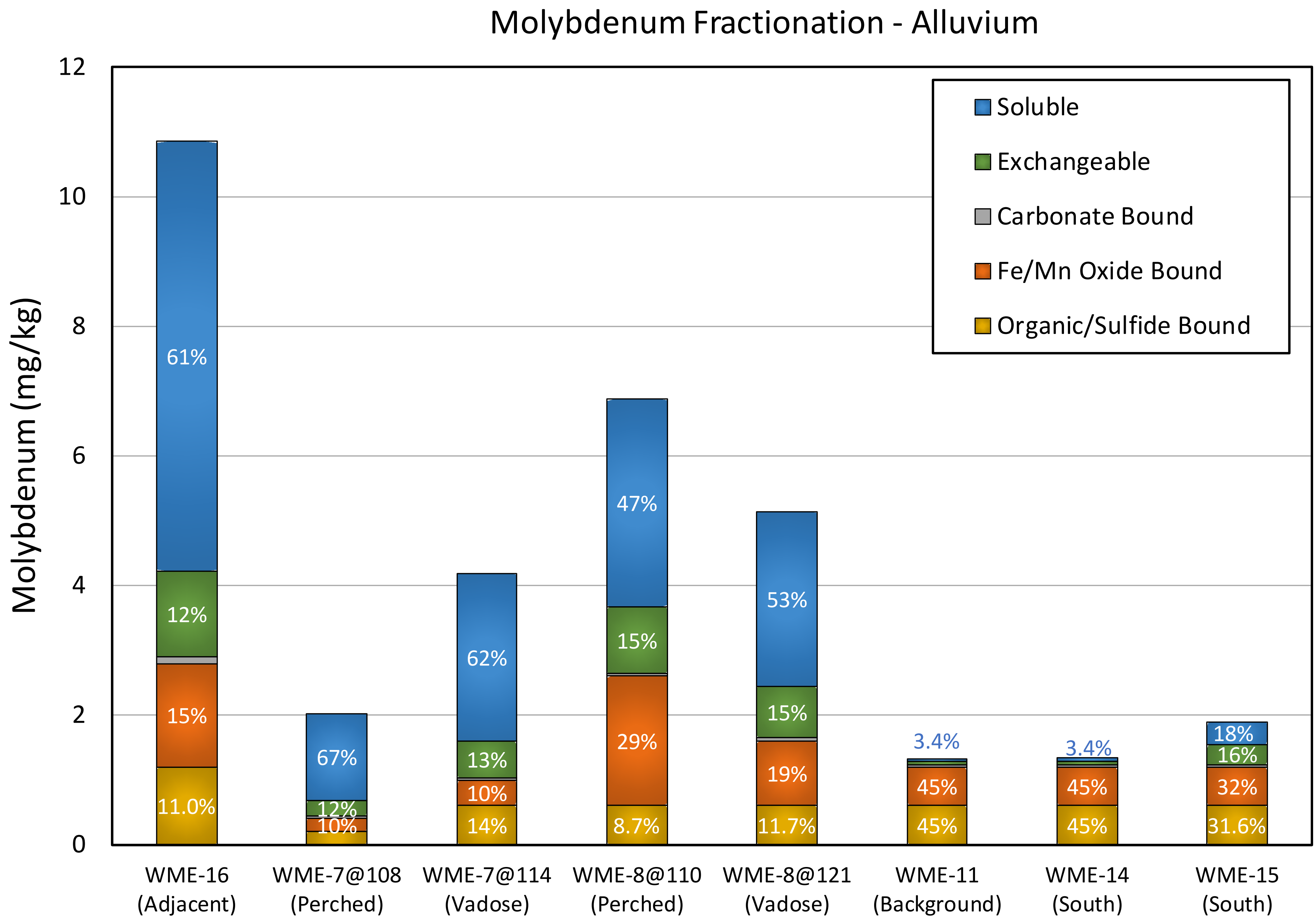


Figure 30. Selective Extraction Results for Mo in Alluvium.

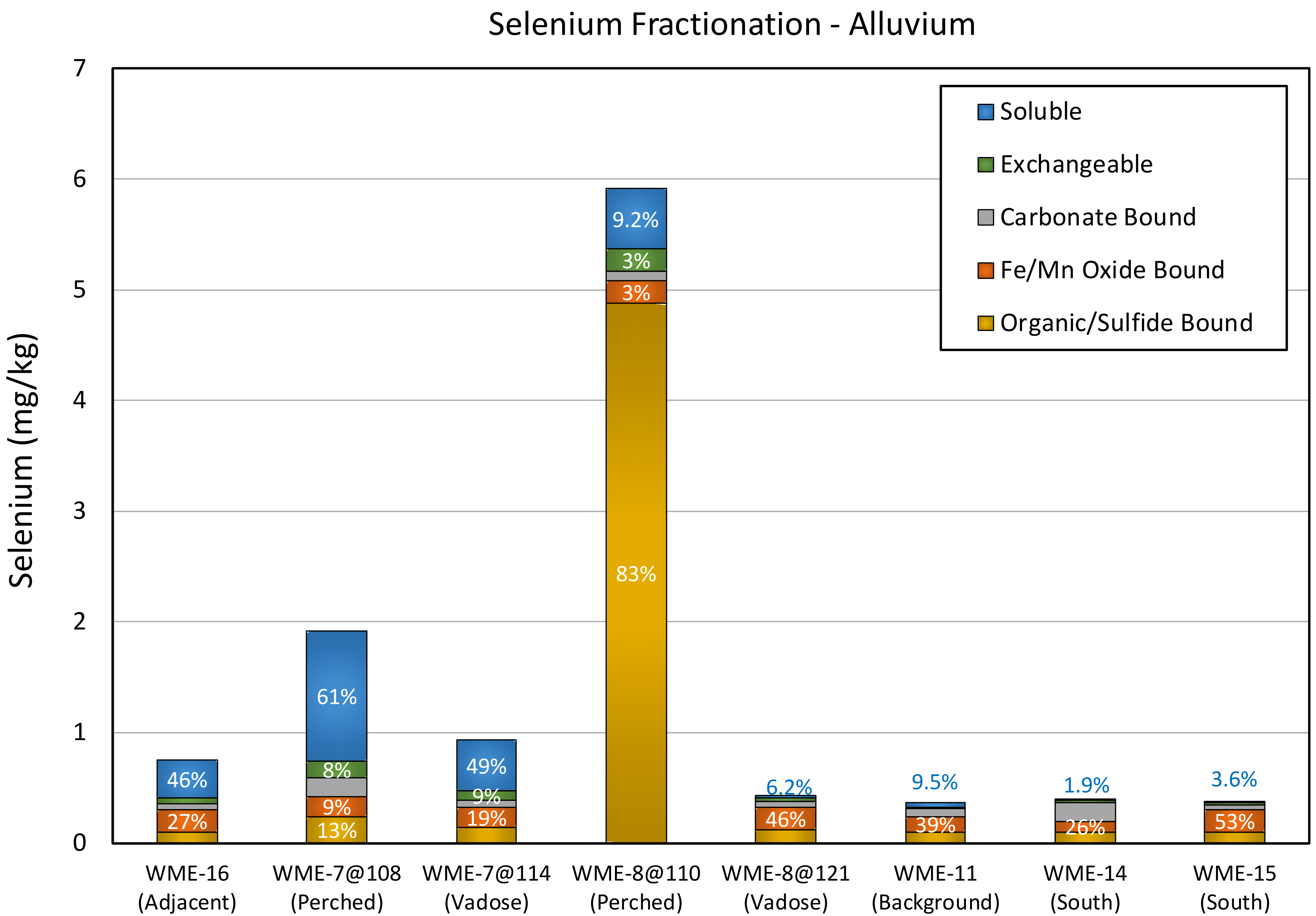


Figure 31. Selective Extraction Results for Se in Alluvium.

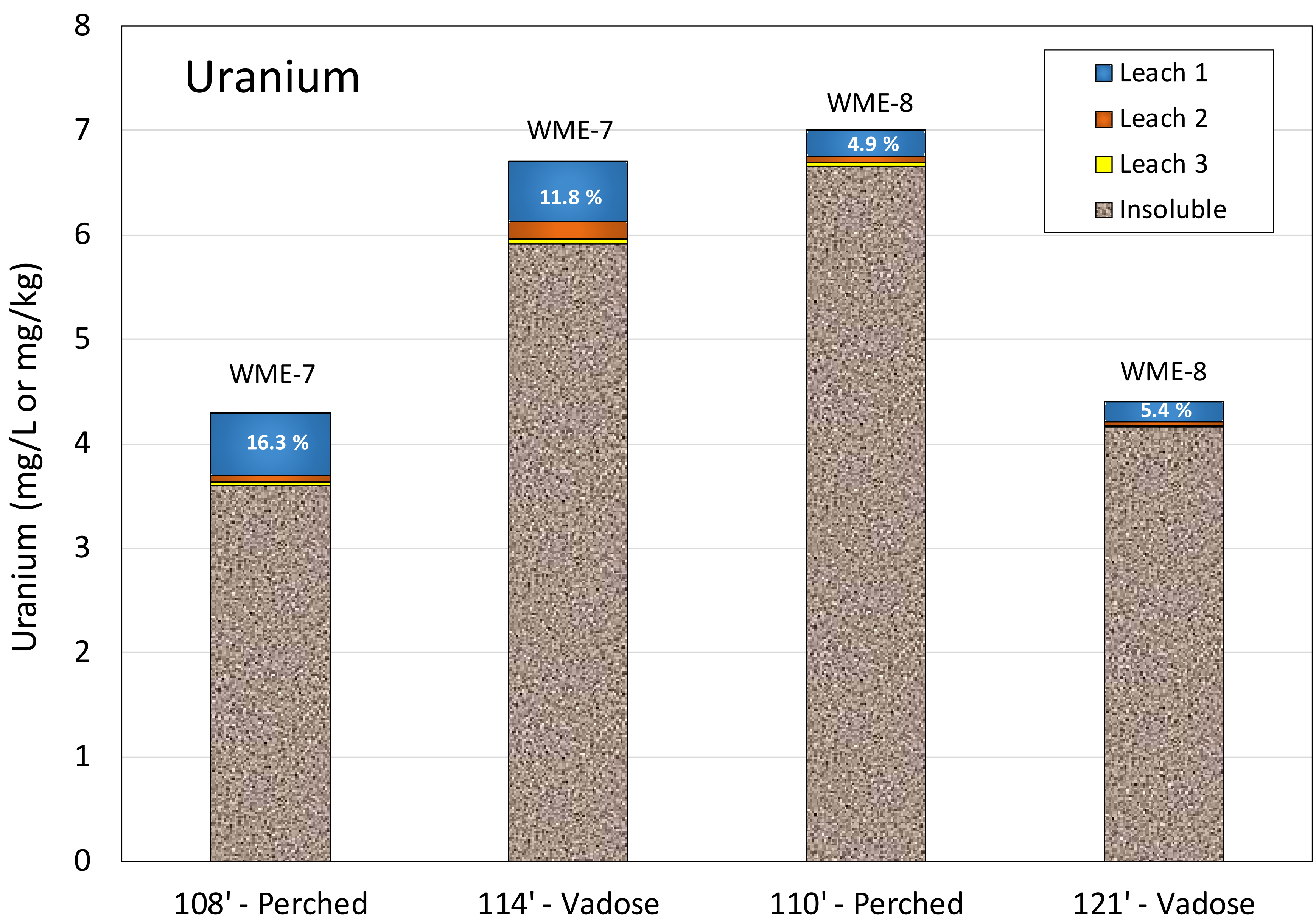


Figure 32. MWMP Results for U in Alluvium.

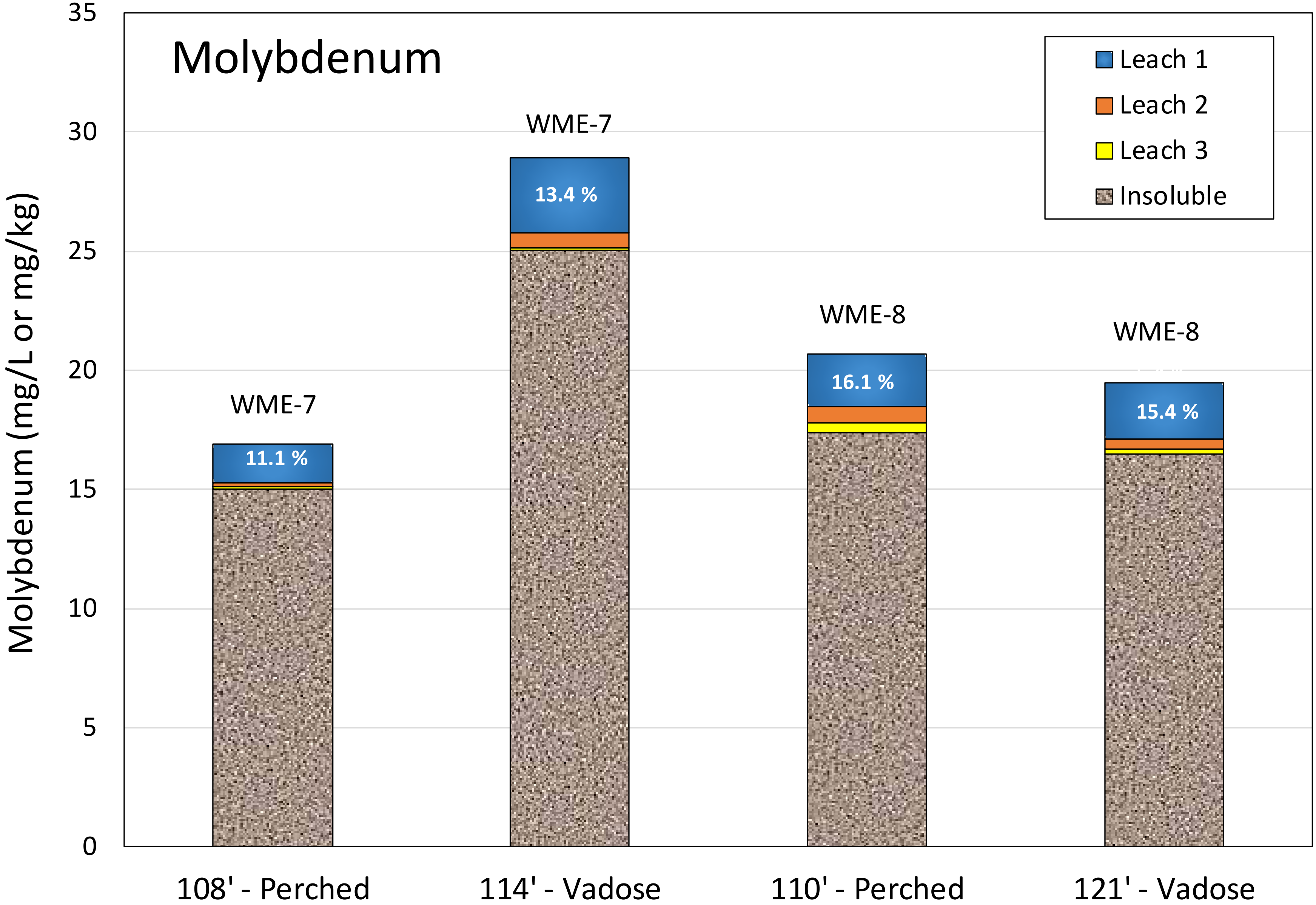


Figure 33. MWMP Results for Mo in Alluvium.

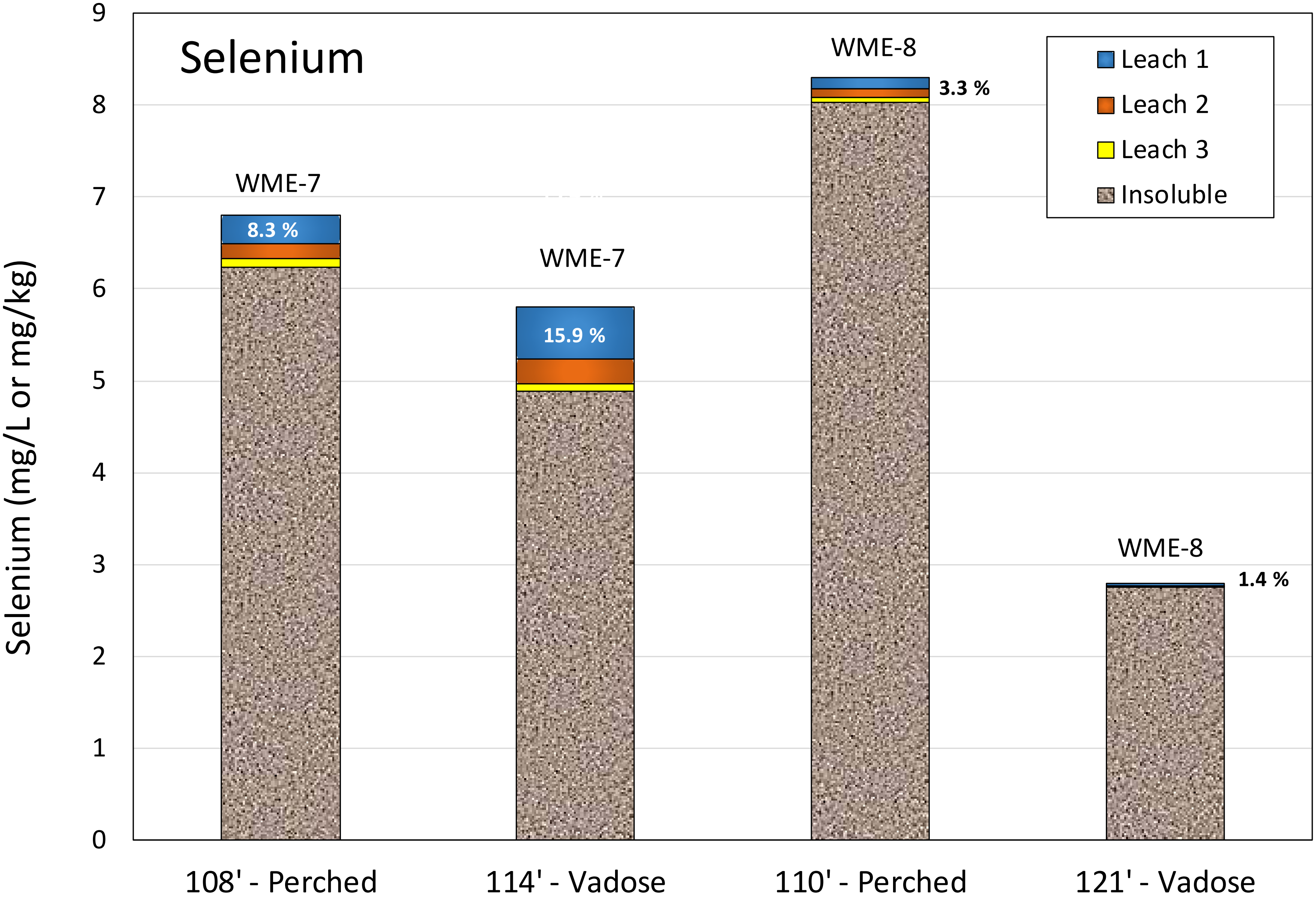


Figure 34. MWMP Results for Se in Alluvium.

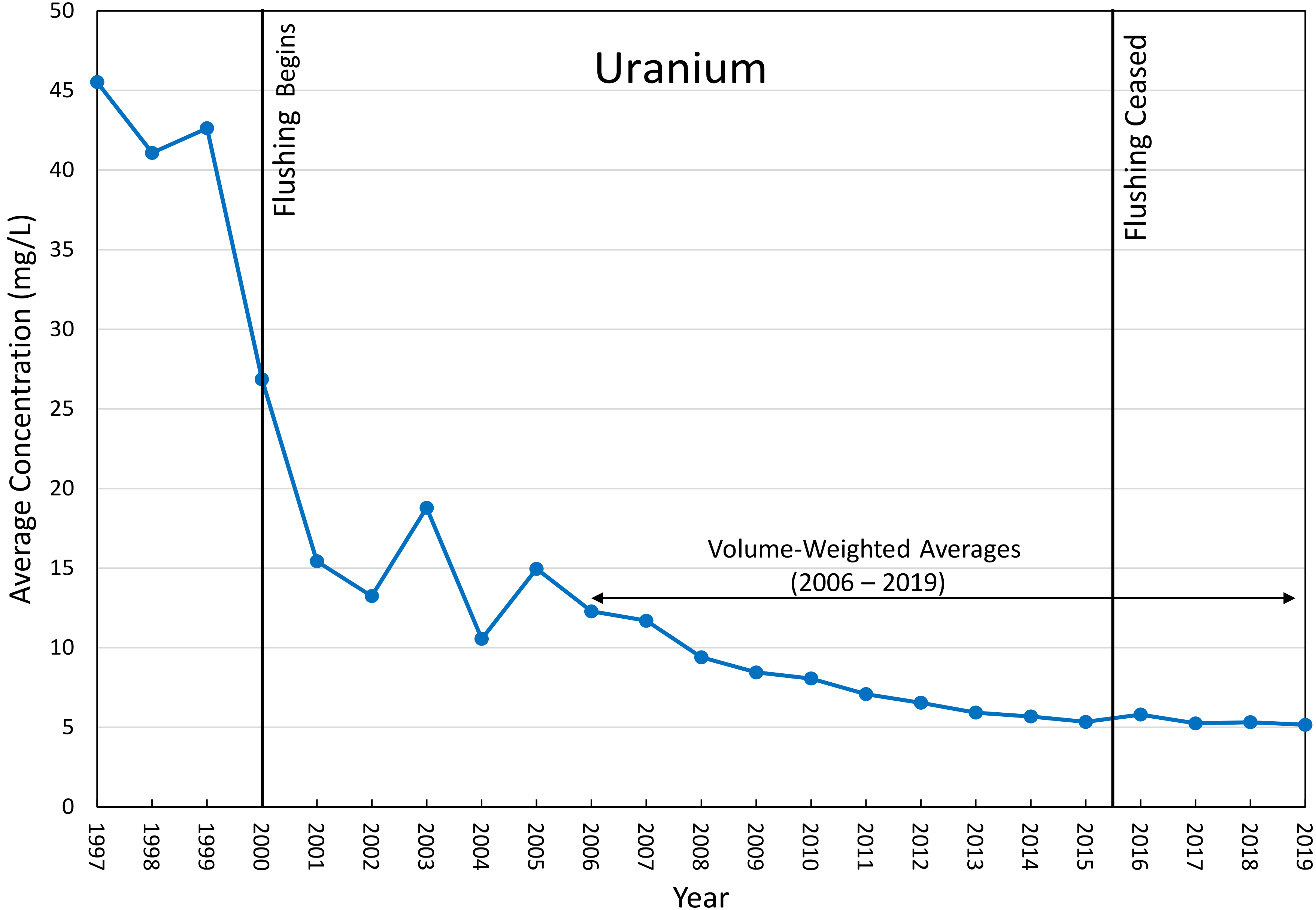


Figure 35. Average U Concentrations for LTP Wells (1997-2019).

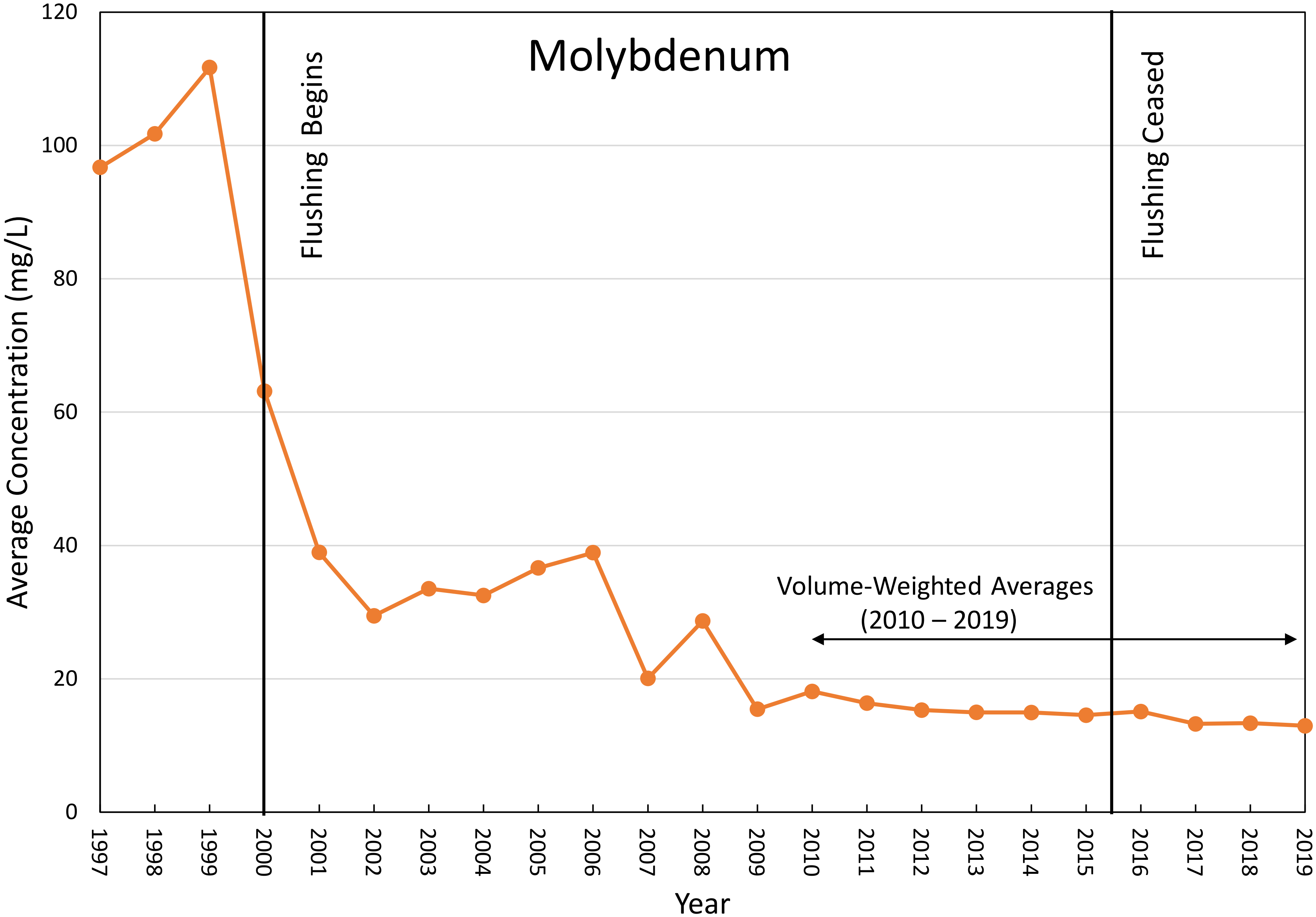


Figure 36. Average Mo Concentrations for LTP Wells (1997-2019).

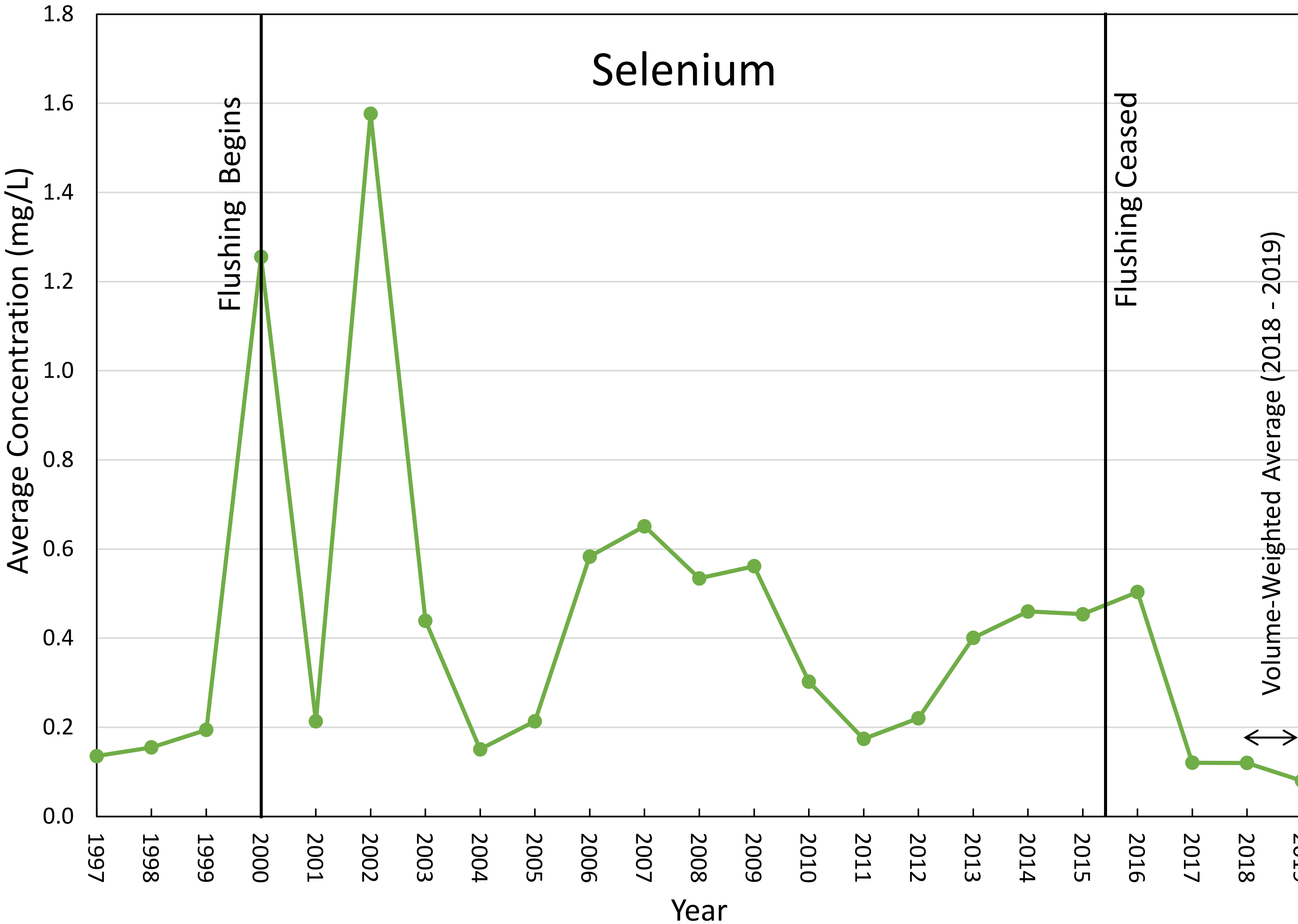


Figure 37. Average Se Concentrations for LTP Wells (1997-2019).

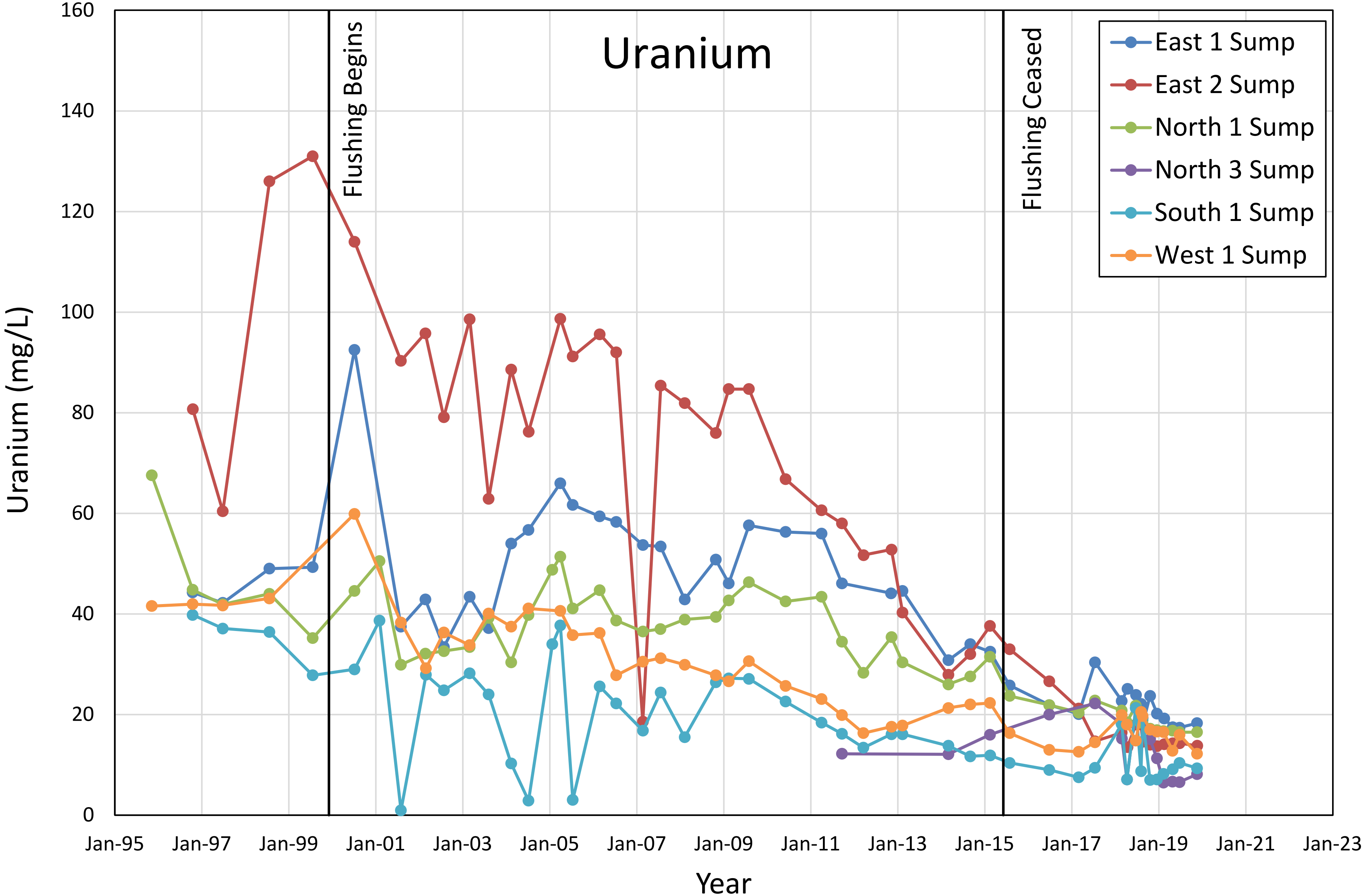


Figure 38. Uranium Concentrations for LTP Sumps (1995-2019).

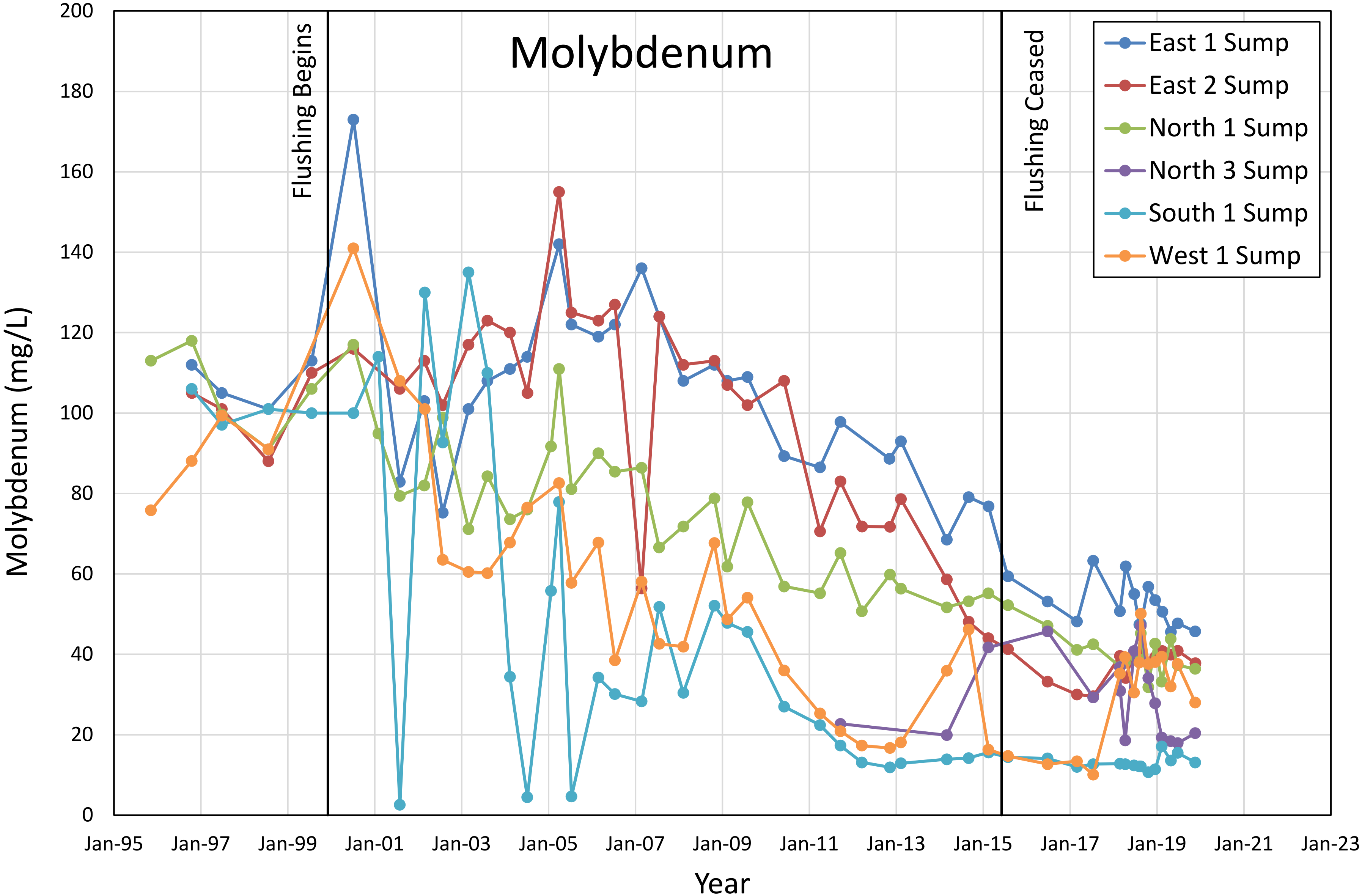


Figure 39. Molybdenum Concentrations for LTP Sumps (1995-2019).

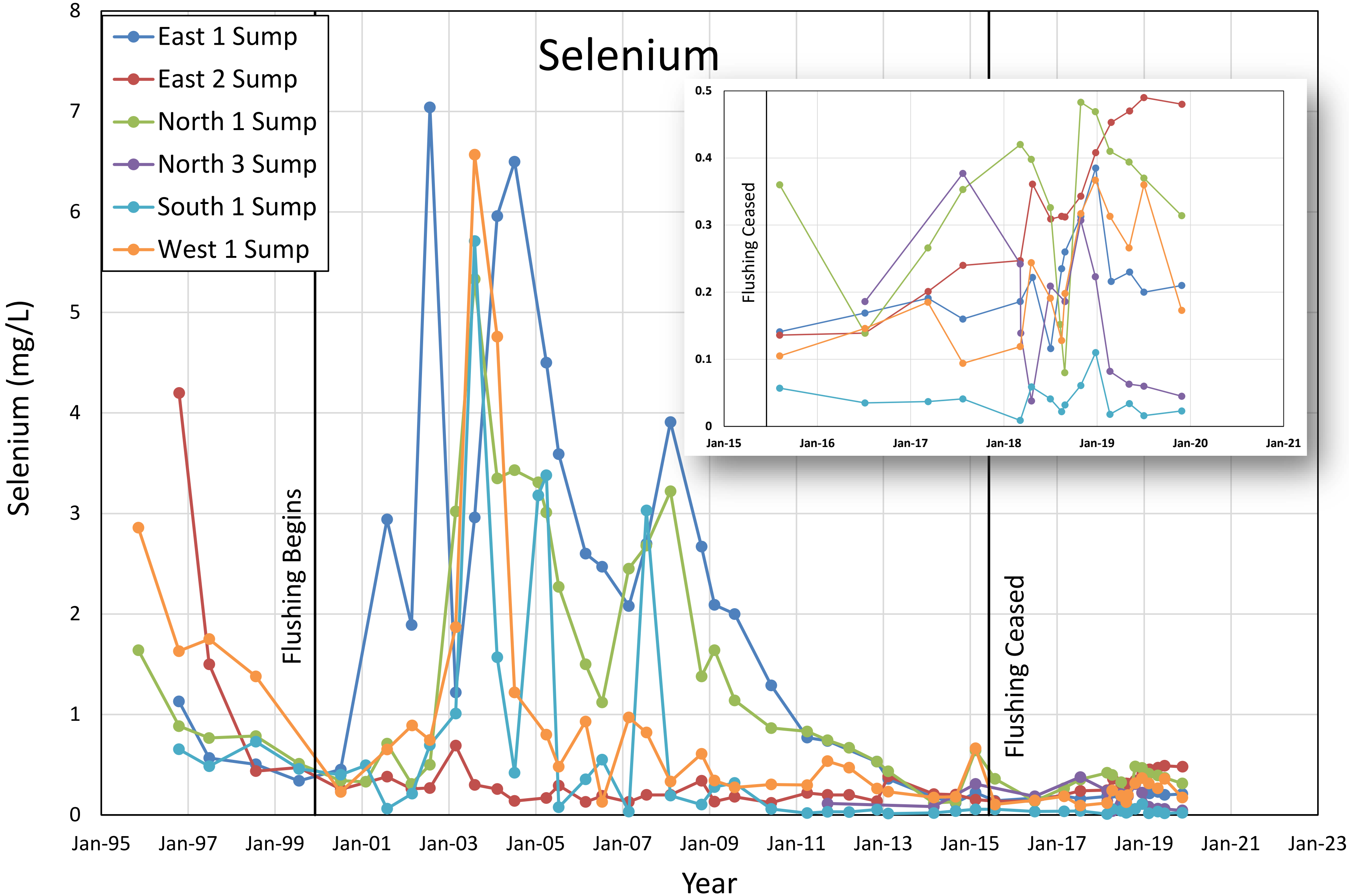


Figure 40. Selenium Concentrations for LTP Sumps (1995-2019).

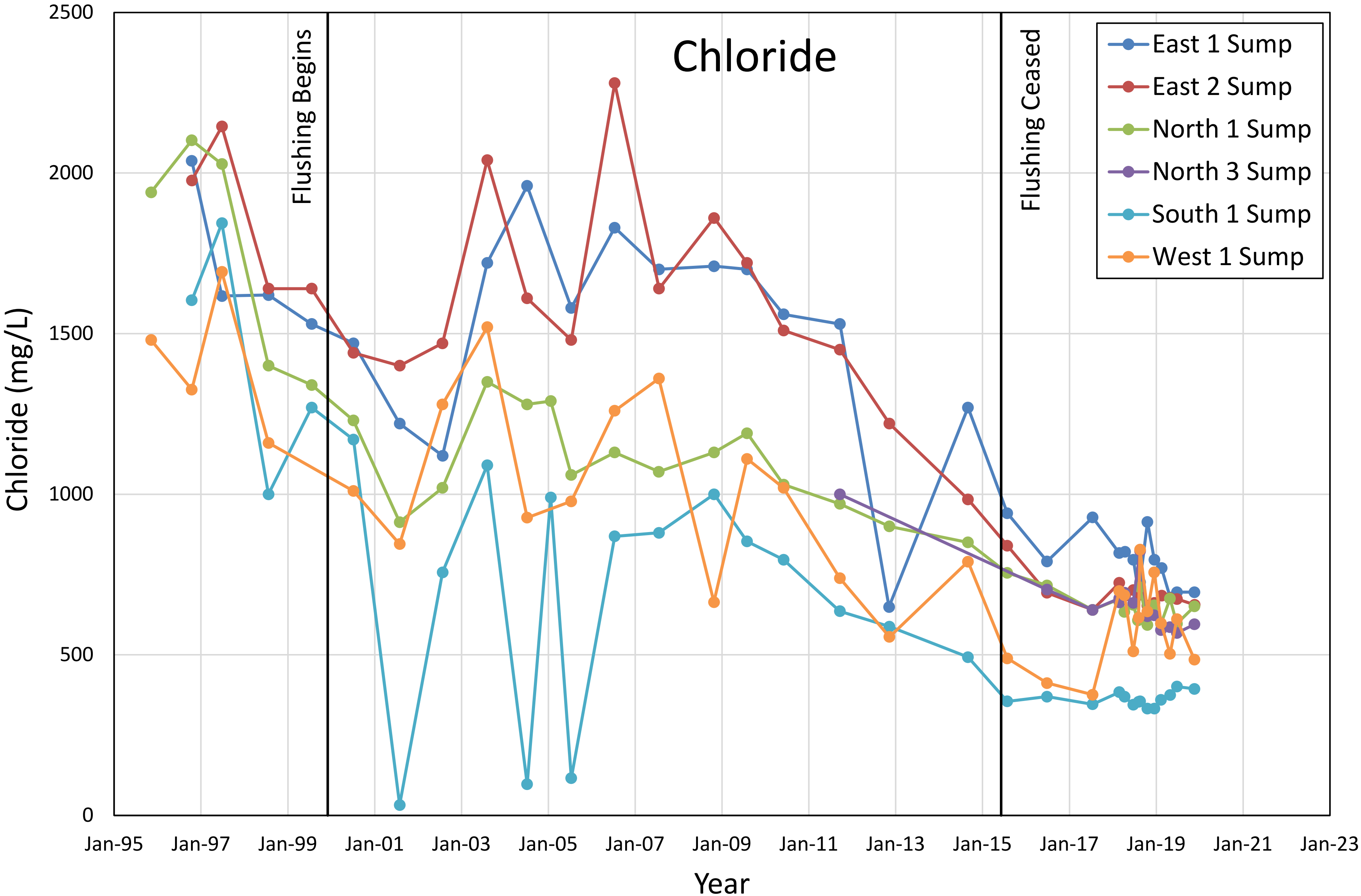


Figure 41. Chloride Concentrations for LTP Sumps (1995-2019).

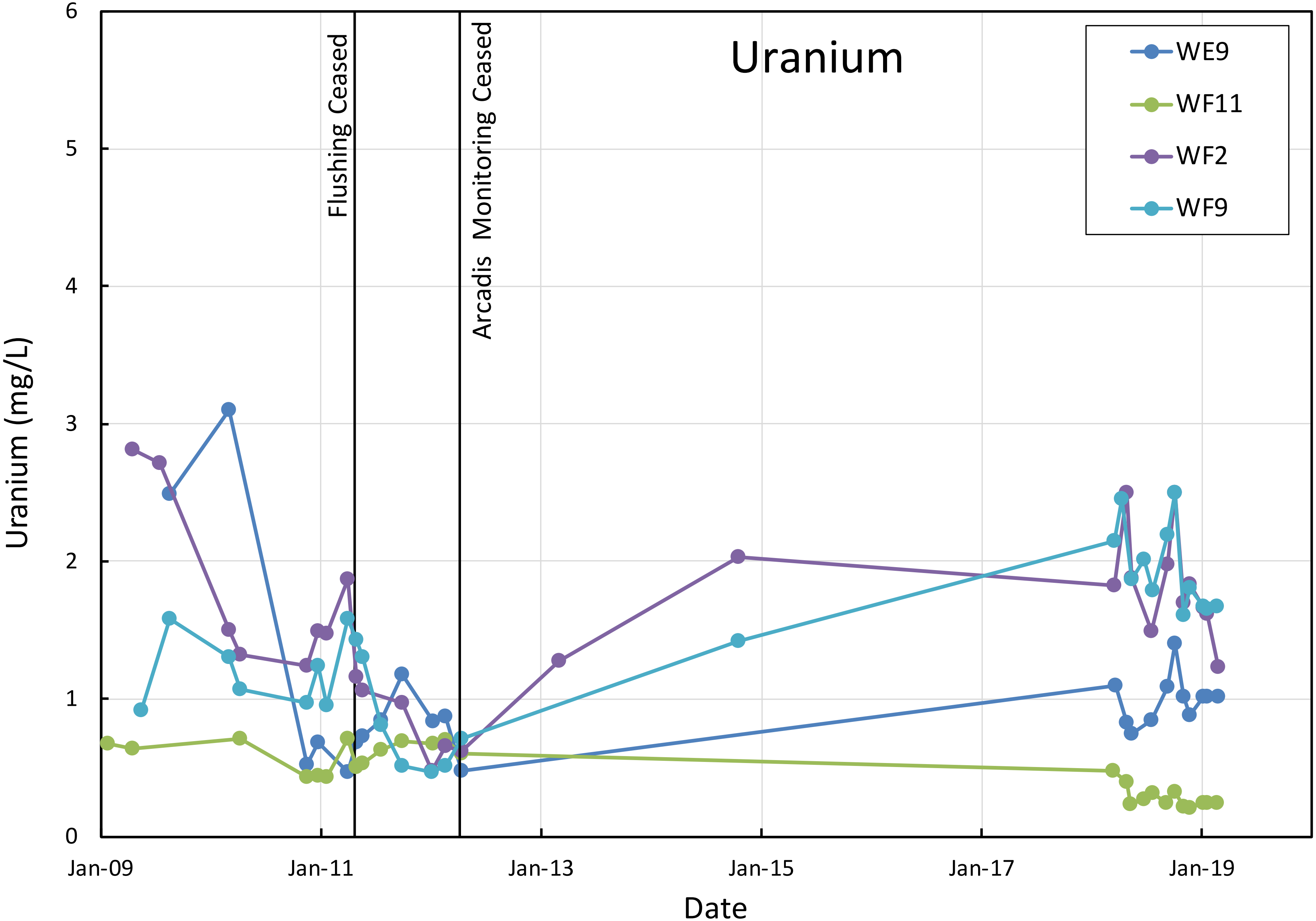


Figure 42. Uranium Concentrations for LTP Arcadis Wells (2009-2019).

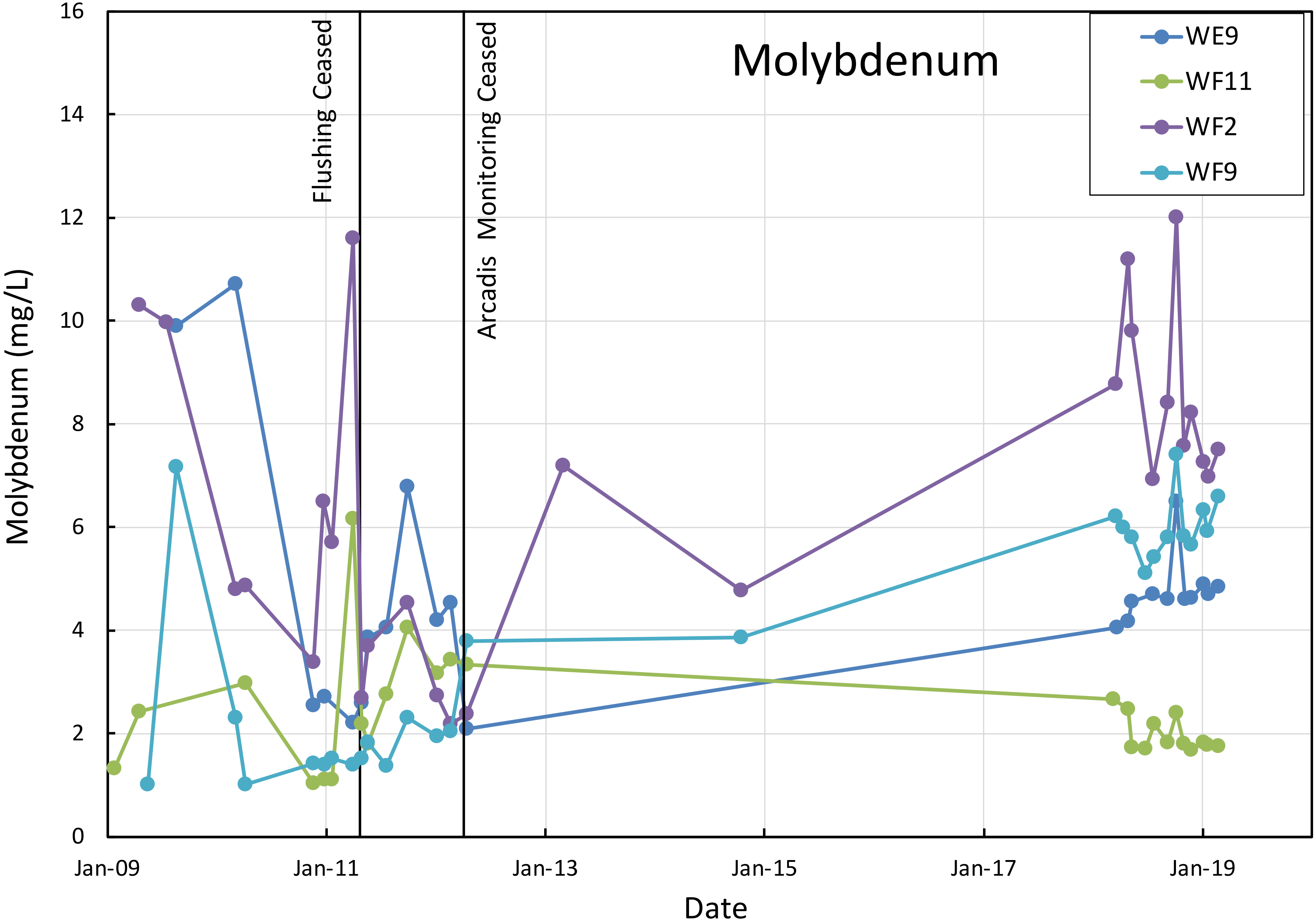


Figure 43. Molybdenum Concentrations for LTP Arcadis Wells (2009-2019).

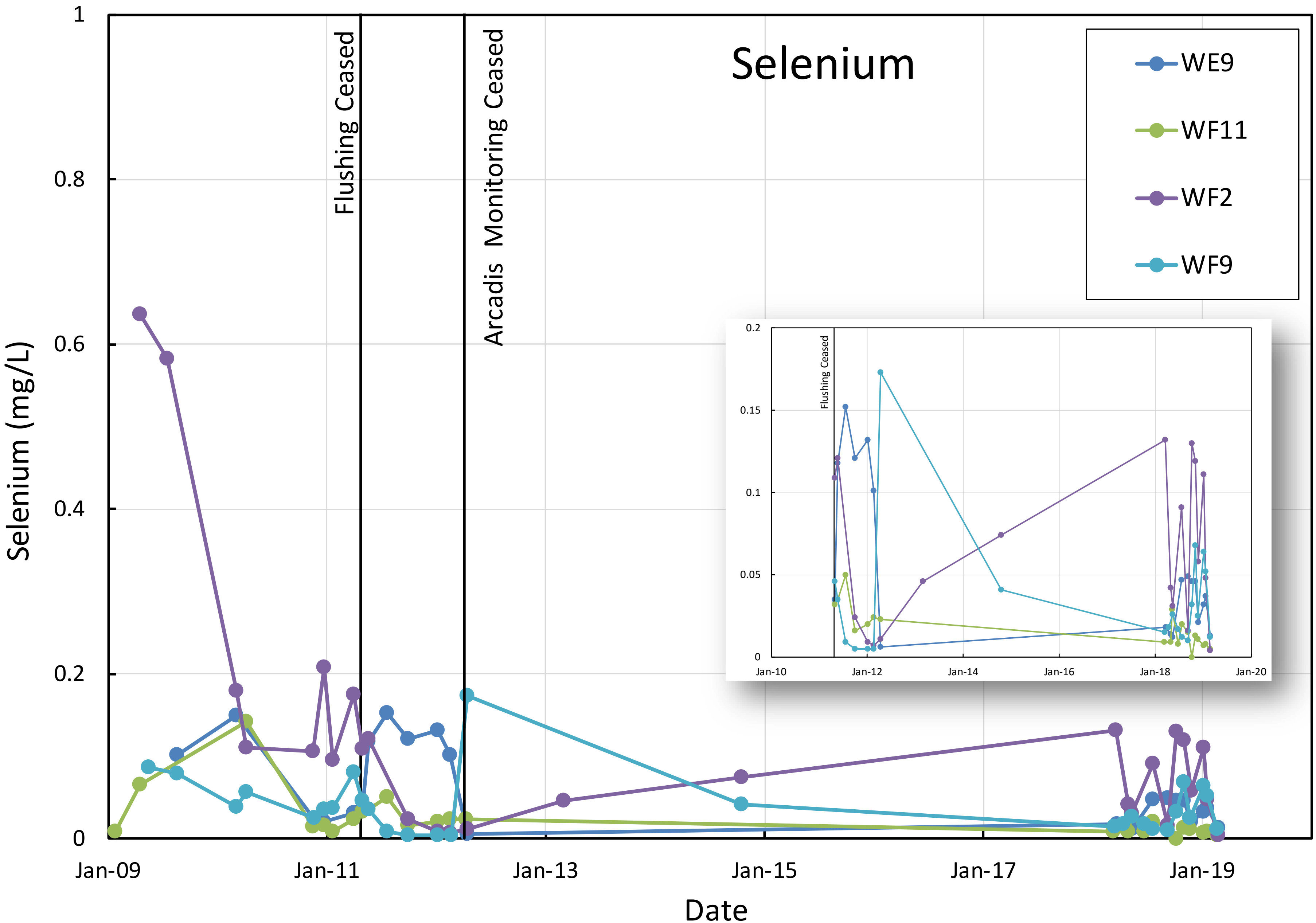


Figure 44. Selenium Concentrations for LTP Arcadis Wells (2009-2019).

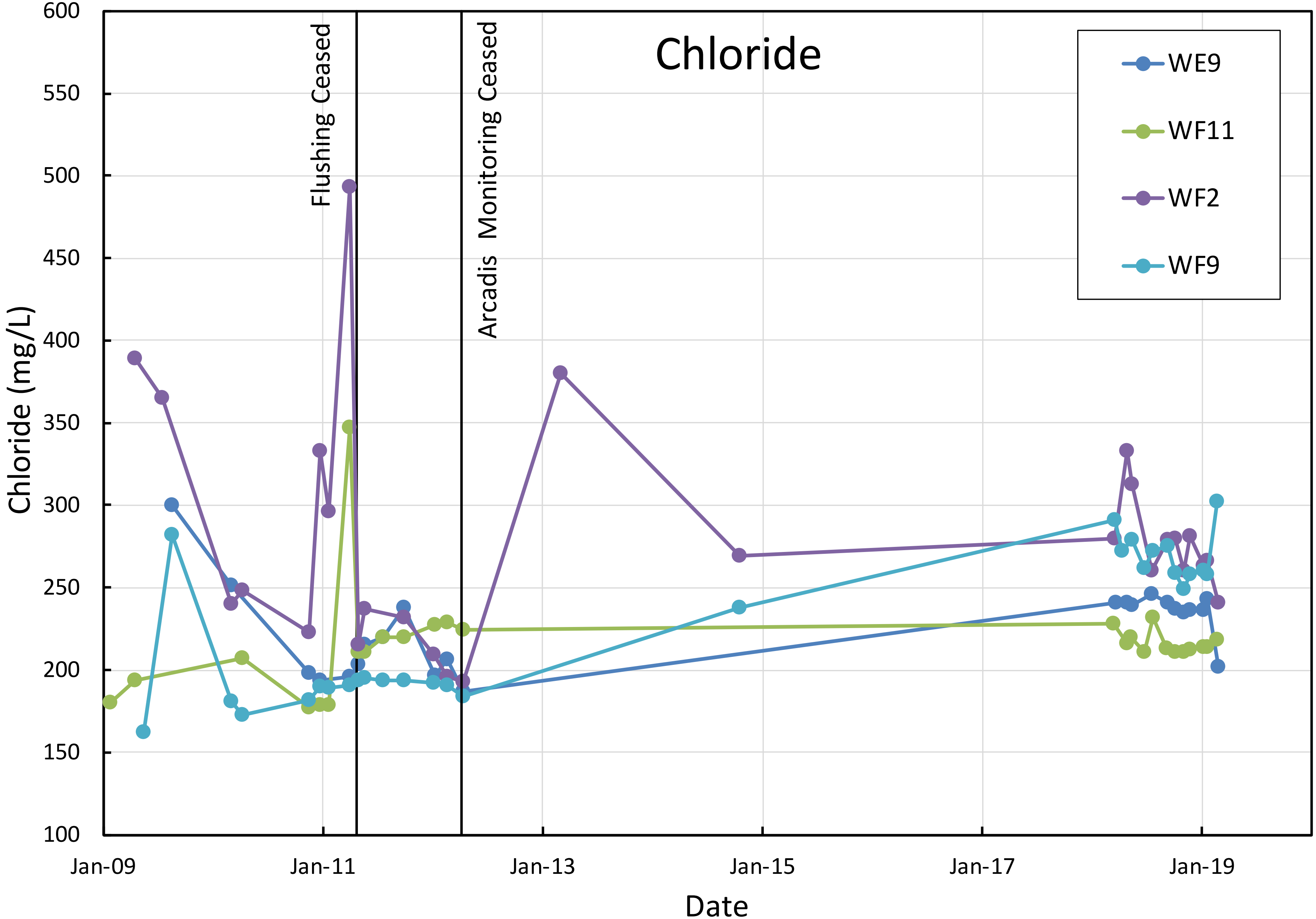


Figure 45. Chloride Concentrations for LTP Arcadis Wells (2009-2019).

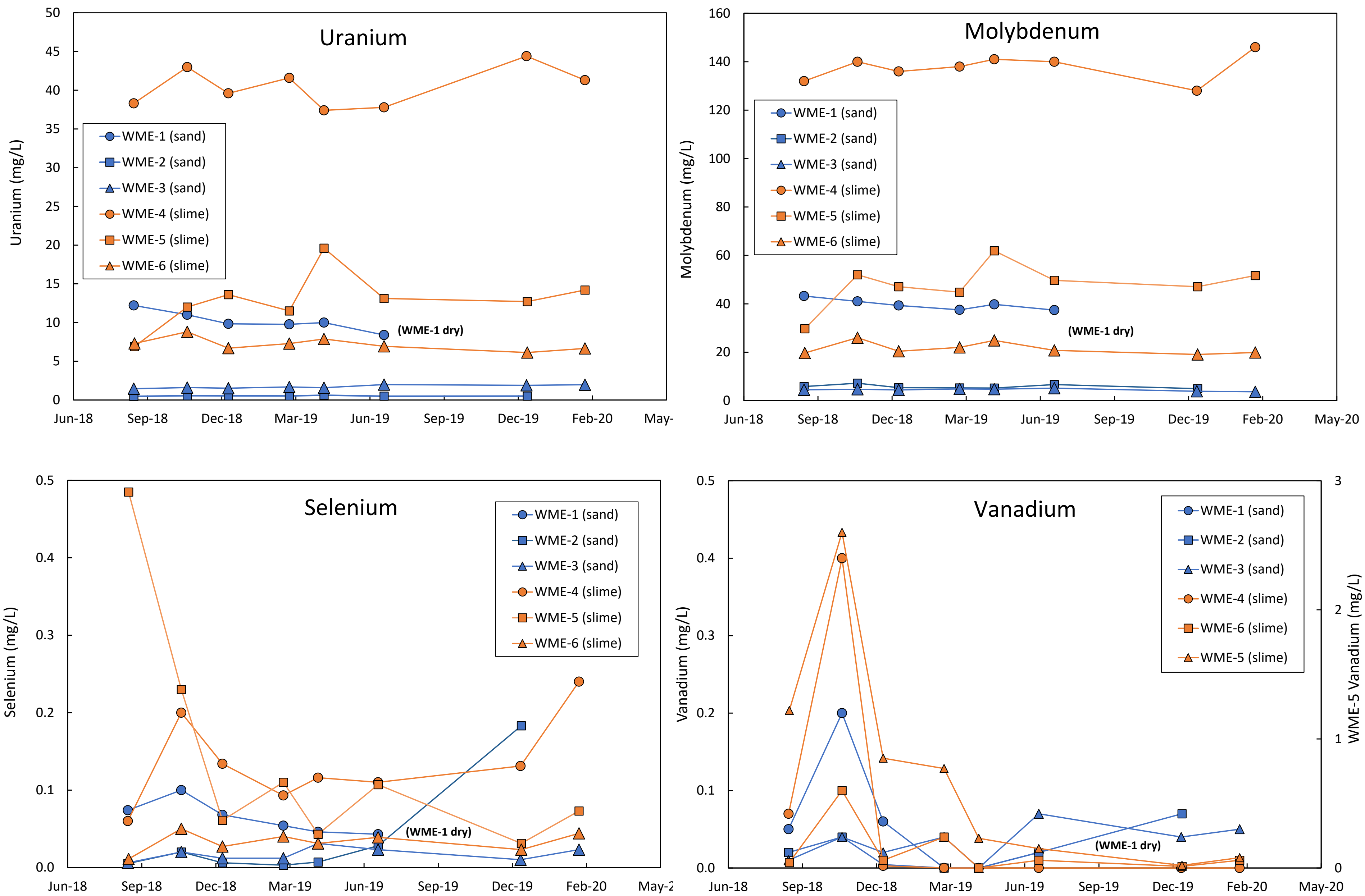


Figure 46. Concentration Trends for U, Mo, Se, and V in Short-Screen LTP Wells.

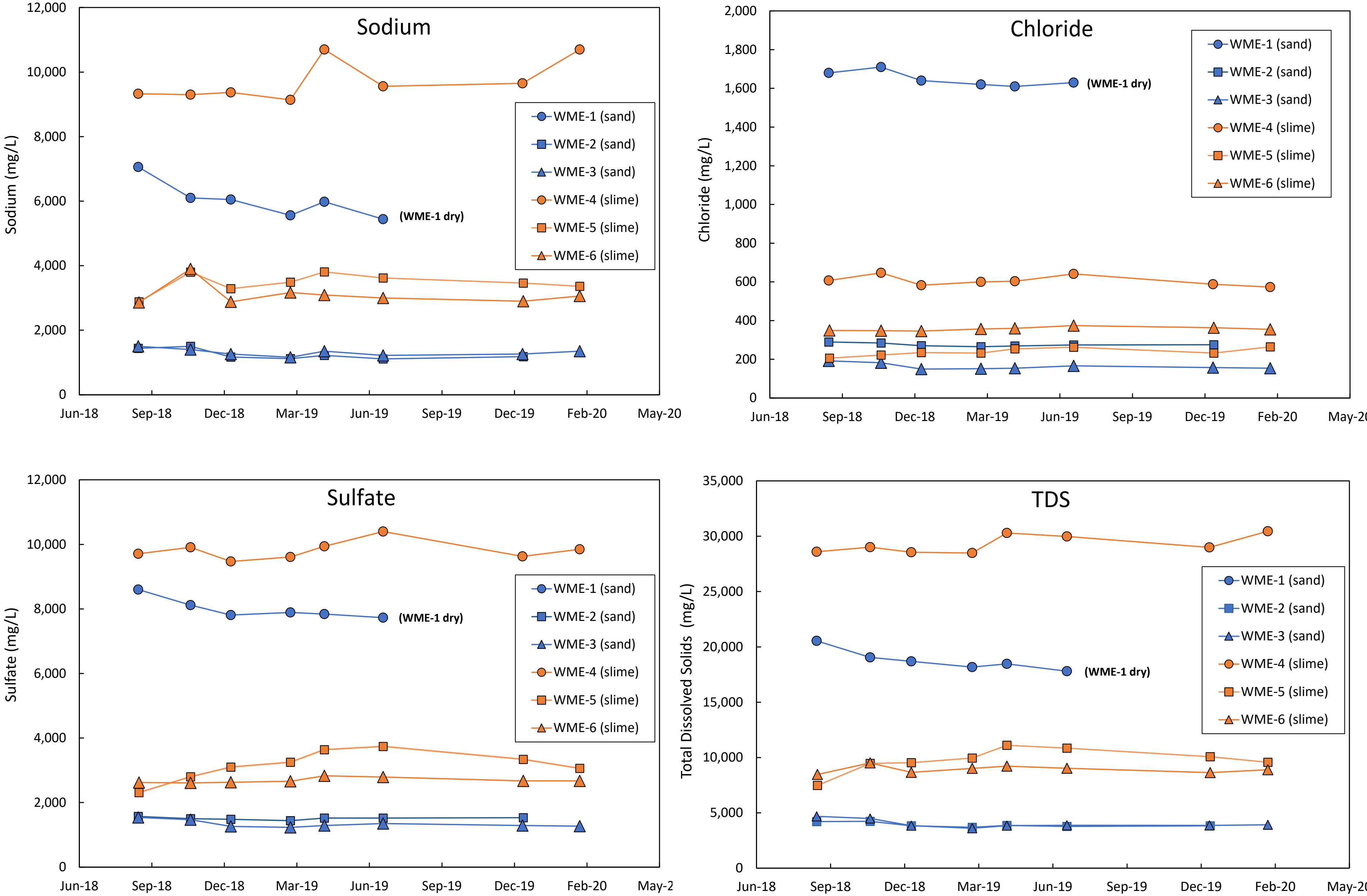


Figure 47. Concentration Trends for Na, Cl, SO_4, and TDS in Short-Screen LTP Wells.

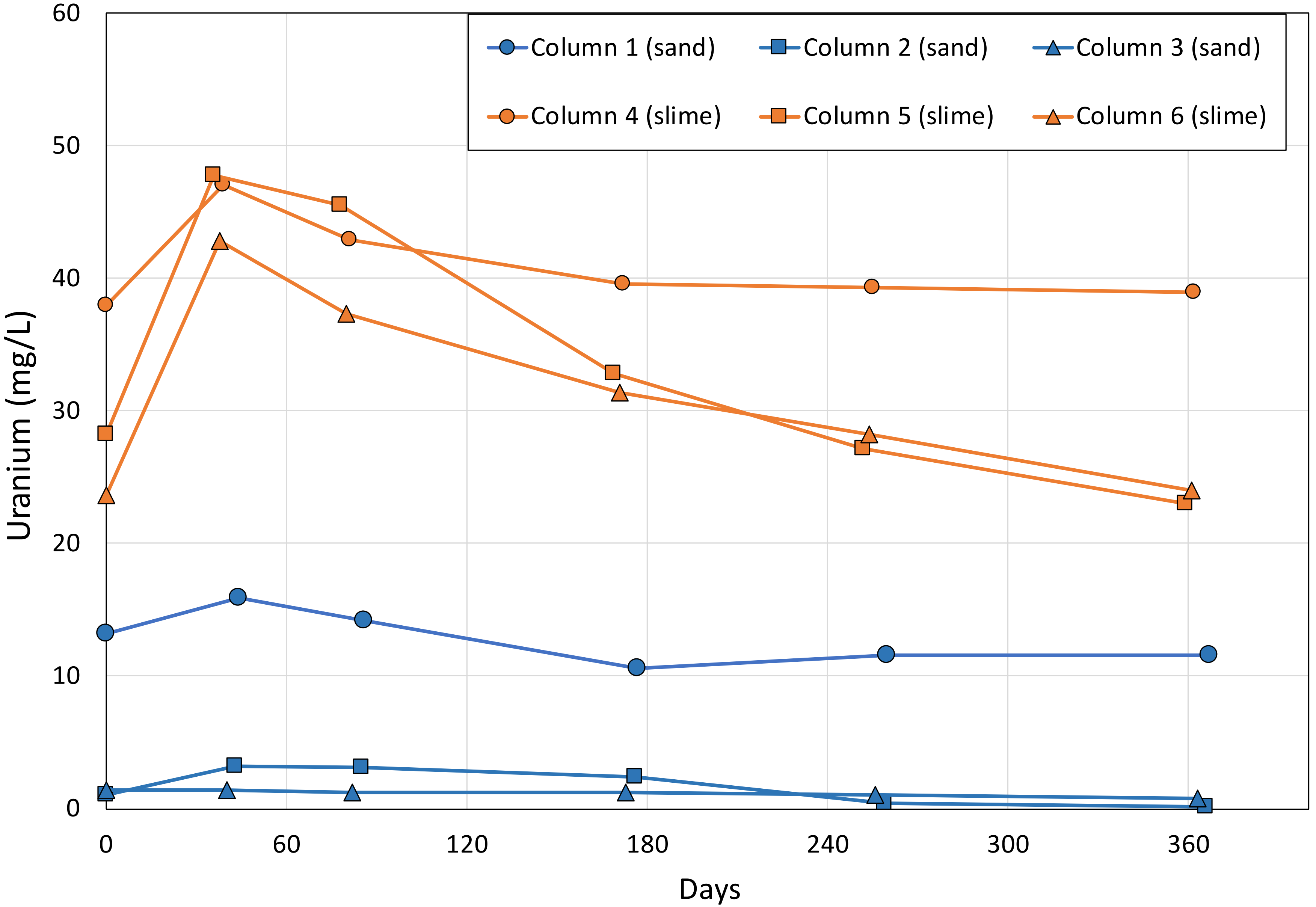


Figure 48. Uranium Concentrations in LTP Static Columns.

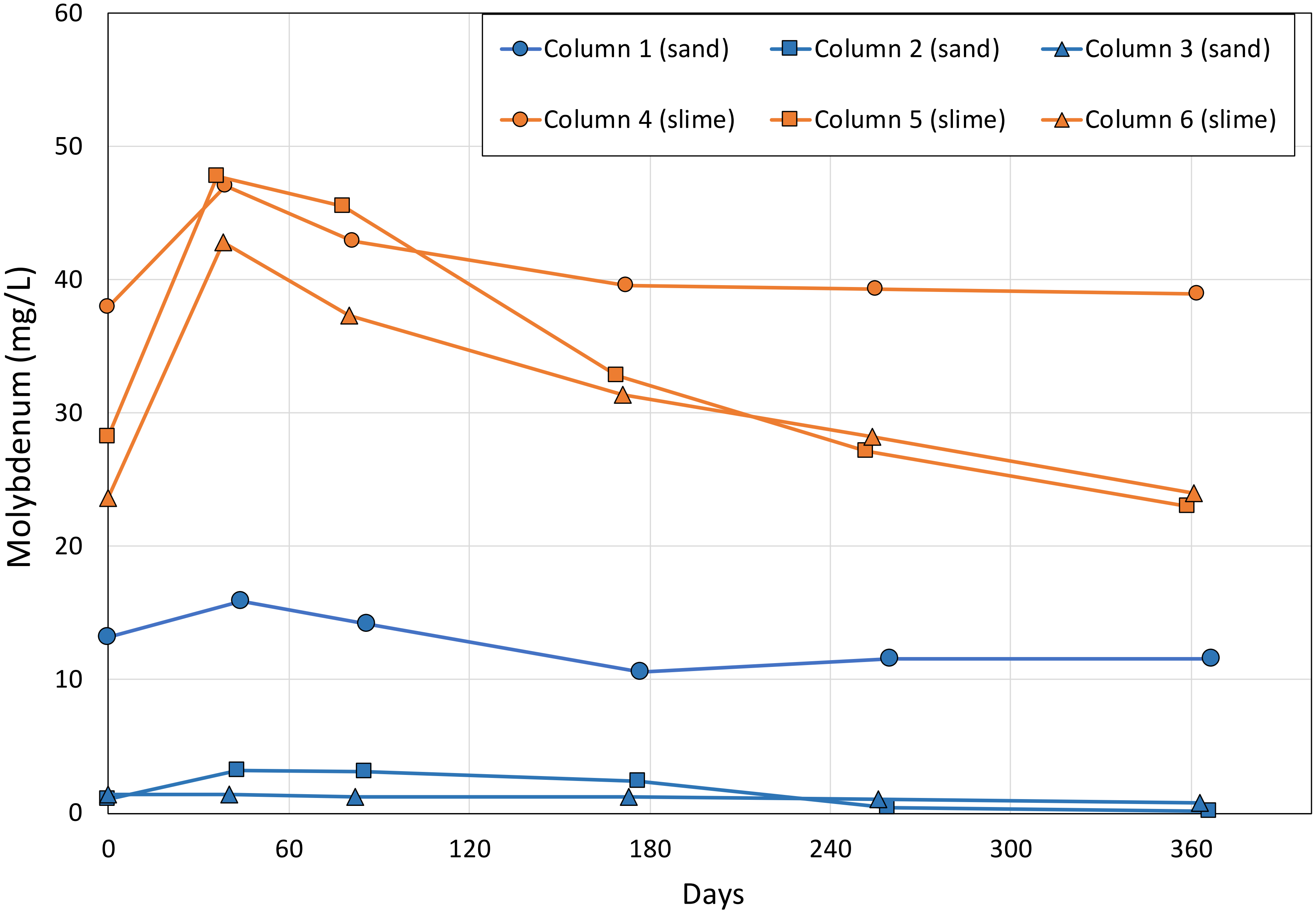


Figure 49. Molybdenum Concentrations in LTP Static Columns.

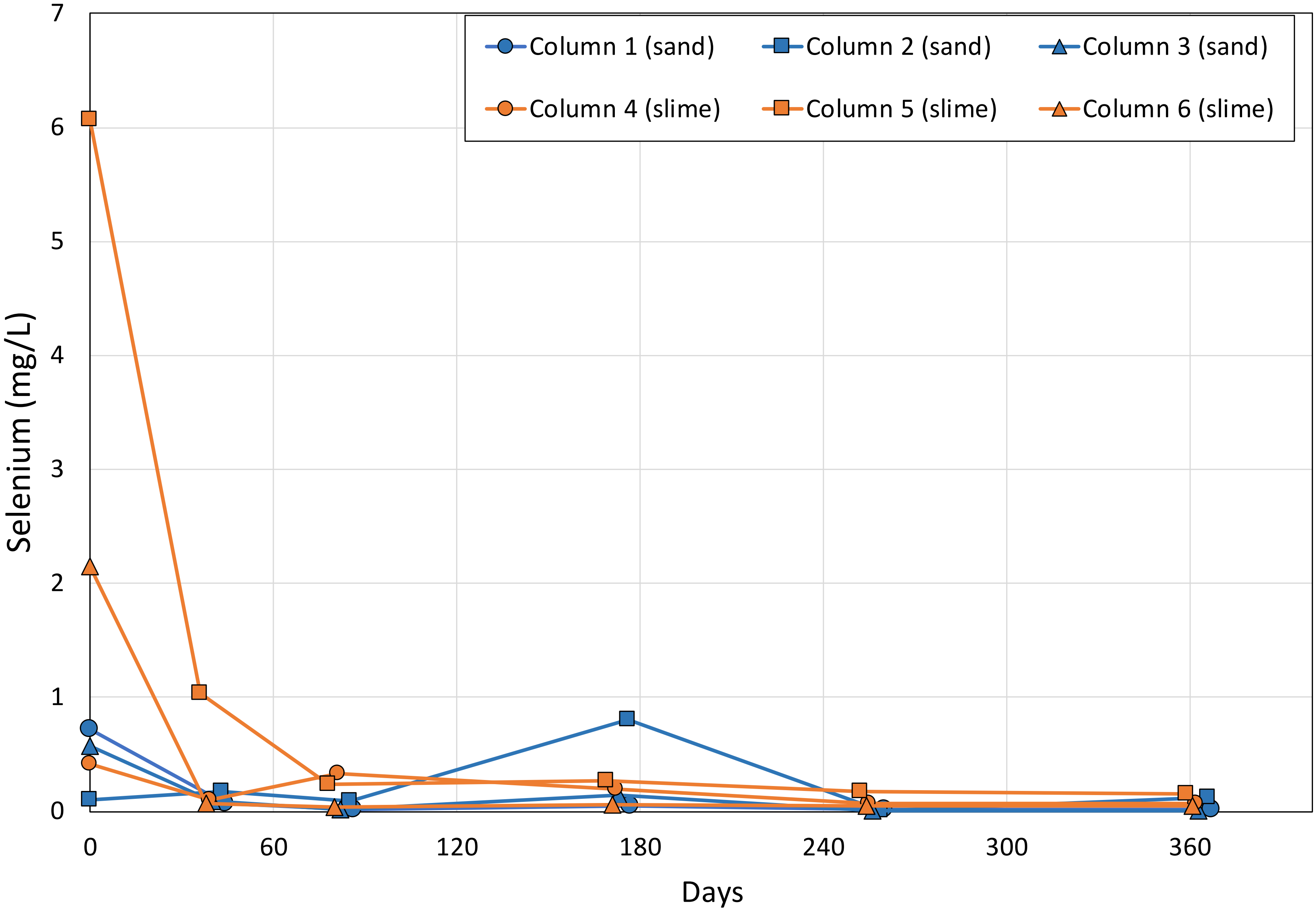


Figure 50. Selenium Concentrations in LTP Static Columns.

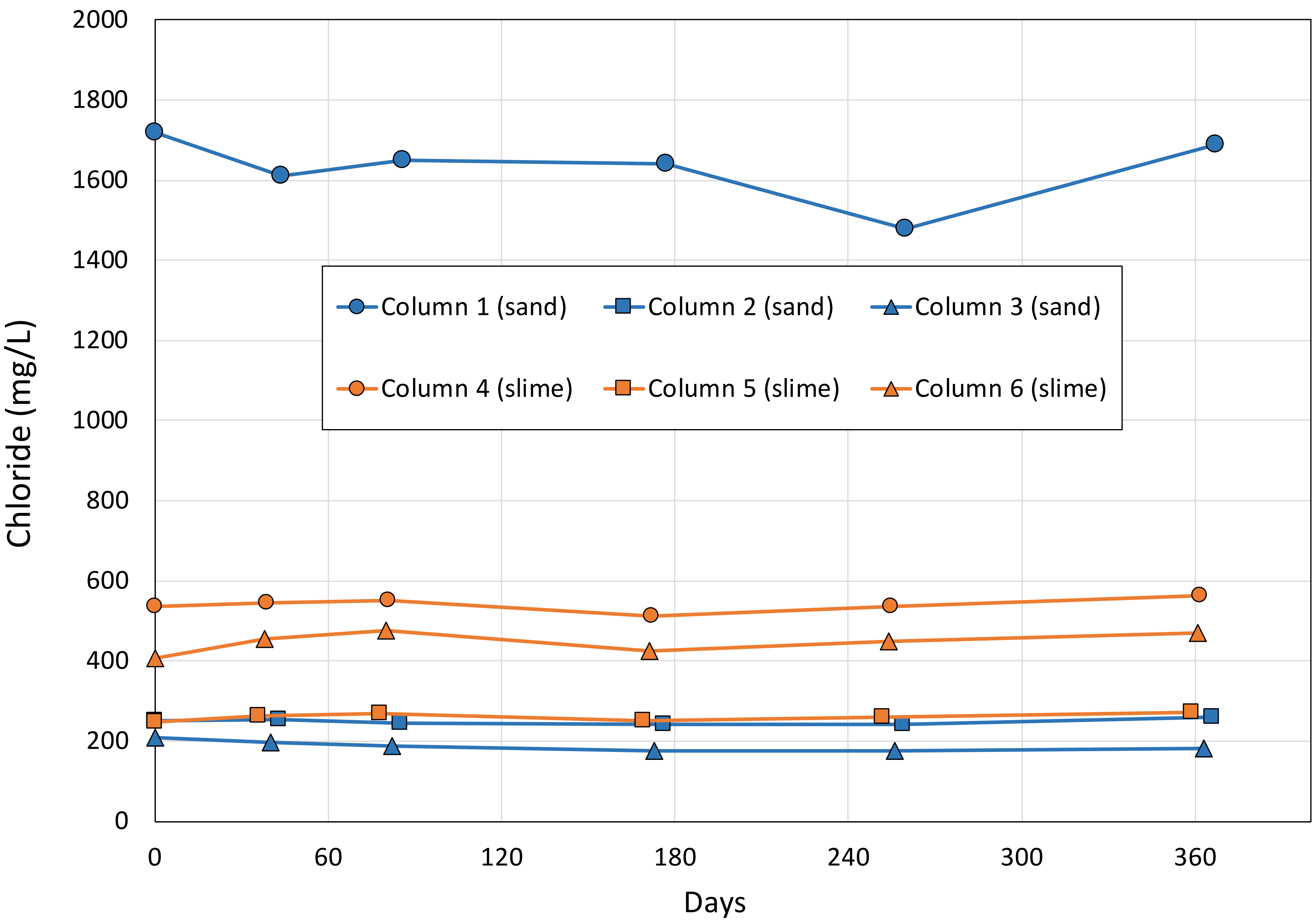


Figure 51. Chloride Concentrations in LTP Static Columns.

Attachment 1
Drilling Completion Memorandum

DRILLING COMPLETION MEMORANDUM

TO: THOMAS WOHLFORD, CLOSURE MANAGER, HOMESTAKE MINING COMPANY

FROM: ROB NOBLE, P.G., AND DAVID LEVY, PH.D., WORTHINGTON MILLER ENVIRONMENTAL

SUBJECT: COMPLETION REPORT FOR MONITORING WELL INSTALLATION AND ALLUVIAL BORING SAMPLE COLLECTION FOR GEOCHEMICAL CHARACTERIZATION AT THE HOMESTAKE GRANTS RECLAMATION PROJECT, CIBOLA COUNTY, NEW MEXICO.

DATE: JULY 17, 2018

1.0 Introduction

Between June 13, 2018 and June 25, 2018, six monitoring wells were installed in the Large Tailings Pile (LTP), two monitoring wells were installed in the Small Tailings Pile (STP), and seven borings were drilled into the alluvial aquifer for solids sample collection and analyses at the Homestake Grants Reclamation Project Site (Site). All work was performed according to the *Draft Geochemical Characterization Work Plan*, Version 2 (WME, 2018) which describes the project objectives.

2.0 Monitoring Well Drilling and Installation

Six new monitoring wells were installed in the LTP at predetermined locations (Figure 1). Wells WME-1, WME-2 and WME-3 were drilled and completed in tailings sands material in the LTP. Wells WME-4, WME-5 and WME-6 were completed in tailings slimes material in the LTP. In addition, two new monitoring wells were installed in the STP (Figure 2). Well WME-9 was completed in the alluvium below the STP sands, while WME-10 was completed in the alluvium below the STP slimes.

Boreholes were drilled by Cascade Drilling using a Sonic drill rig with temporary casing advance capability. Nine-inch diameter temporary steel casing was advanced during drilling to prevent borehole collapse. Drill cuttings were collected with an 8-inch diameter core barrel. All wells were completed with flush-threaded 4-inch schedule 40 PVC pipe. All well screens are 5-foot lengths with 0.010 slot size. Filter pack material consists of clean 10-20 silica sand. One foot of #60 silica sand was placed on top of the filter pack to prevent grout from entering the filter pack. Boreholes were sealed with a high-solids bentonite grout and finished with bentonite chips. The surface completion for each well consists of an 8-inch diameter steel protective casing with a locking lid and a cement pad. Table 1 provides construction information for each new monitoring well. Well completion diagrams are provided in Appendix A. Field notes are provided in Appendix B. Photographs of drill cuttings in chip trays are provided in Appendix C.

2.1 Monitoring Well Development

All monitoring wells were developed by Cascade Drilling. Wells were surged with a surge block, bailed with a PVC bailer and pumped with a small down-hole pump. Table 2 provides development records for each well, including depth to water before and after development, total volume purged and final field parameters.

2.2 Column Test Filling and Sampling

The six wells drilled and completed in the LTP each have an associated column test that is set up on Site (WME, 2018). Each PVC column is 8-inch diameter by 4-feet tall. Each column was filled with material excavated during drilling from the screened interval of each well. After each well was developed, a sample was collected and the corresponding column was filled with the tailings water. Table 3 provides information related to the columns including depth of the sample, the filling date for each column and pH of the first sample taken 24 hours after filling.

2.3 Tailings Sample Collection

In addition to the tailings material collected for the column tests, material was collected for additional geochemical characterization (WME, 2018). Table 4 provides sample dates, depths, amount of material collected and the laboratory analyses that will be performed on each sample.

3.0 Alluvial Aquifer Drilling and Sample Collection

Nine alluvial borings were drilled at pre-determined sites (Figure 3) to collect alluvial solids for geochemical testing (WME, 2018). Table 4 provides sample date, depths, sample amount and laboratory analyses to be performed on each sample. Note that an alluvial sample was not collected from locations WME-12 and WME-13 as originally proposed (WME, 2018) because the drill stem hit refusal on igneous bedrock before groundwater was encountered.

4.0 References

Worthington Miller Environmental LLC (WME). 2018. Draft Geochemical Characterization Work Plan, Grants Reclamation Project. Version 2. Prepared for Homestake Mining Company of California. May.

Table 1: Well Completion Information.

Well ID	Completion Lithology	Well Total Depth (Feet TOC)	Top Screen (Feet TOC)	Depth To Water (Feet TOC)	Saturated Thickness (Feet)	Well Volume (Gallons)
WME-1	LTP Sands	57.30	51.80	53.45	3.85	2.5
WME-2	LTP Sands	64.60	59.10	57.25	7.35	4.8
WME-3	LTP Sands	72.65	67.15	61.30	11.35	7.4
WME-4	LTP Slimes	67.60	62.10	57.49	10.11	6.6
WME-5	LTP Slimes	77.32	71.82	66.98	10.34	6.8
WME-6	LTP Slimes	67.25	61.75	54.95	12.30	8.0
WME-9	Alluvium	73.20	67.70	58.50	14.70	9.6
WME-10	Alluvium	76.70	71.20	58.90	17.80	11.6

Table 2: Well Development Information.

Well ID	Initial Depth to Water (feet TOC)	Casing Volume (gallons)	Total Volume Purged (gallons)	Final pH	Final Specific Conductivity (µS/cm)	Final Temp (°C)	Final Depth to Water (feet TOC)
WME-1	53.25	2.8	8.5	9.92	22,274	14.8	53.45
WME-2	59.29	3.8	19	9.42	4,881	14.4	57.25
WME-3	59.30	7.3	23	9.63	3,880	16.1	61.30
WME-4	57.95	6.3	12	10.06	26,220	14.6	57.49
WME-5	59.86	11.3	19	9.42	3,354	14.5	66.98
WME-6	55.67	7.5	22	10.37	12,312	13.2	54.95
WME-9	55.90	11.3	20	7.52	1,938	18.9	58.50
WME-10	58.53	11.8	25	7.44	2,244	17.4	58.90

Table 3: LTP Column Setup Information.

Location	Description	Sample Depth	Solid-Phase Collection Date	Tailings Water Fill Date	24-hour Sample pH
WME-1	LTP Sands	50'-54'	6/14/2018	6/17/2018	9.96
WME-2	LTP Sands	56'-60'	6/15/2018	6/18/2018	9.64
WME-3	LTP Sands	61'-65'	6/15/2018	6/21/2018	9.68
WME-4	LTP Slimes	61'-65'	6/17/2018	6/22/2018	9.96
WME-5	LTP Slimes	70'-74'	6/18/2018	6/25/2018	10.25
WME-6	LTP Slimes	60'-64'	6/19/2018	6/23/2018	10.19

Table 4: Summary of Solids Sample Collection.

Location	Description	Sample Depth	Sample Mass Collected	ACZ Quote No.					
				ABA-PH-CEC-TOC	XRD	HCT	TESSIER-6-STEP	SEM	MWMP-COLUMN
WME-1	LTP Sands	55'	1 kg	X	X				
WME-2	LTP Sands	61'	3 kg	X	X	X	X	X	
WME-3	LTP Sands	65'	1 kg	X	X		X		
WME-4	LTP Slimes	65'	1 kg	X	X				
WME-5	LTP Slimes	75'	3 kg	X	X	X	X	X	
WME-6	LTP Slimes	65'	1 kg	X	X		X		
WME-7	Perched Alluvium	108'	6 kg	X	X		X		X
WME-7	Vadose Alluvium	113'	6 kg	X	X		X		X
WME-8	Perched Alluvium	110'	6 kg	X	X			X	X
WME-8	Vadose Alluvium	121'	6 kg	X	X				X
WME-9	STP Sands	30'	3 kg	X	X	X	X		
WME-10	STP Slimes	35'	3 kg	X	X	X	X	X	
WME-11	Alluvium	65'	1 kg	X	X		X		
WME-12	Alluvium	No Sample							
WME-13	Alluvium	No Sample							
WME-14	Alluvium	45'	1 kg	X	X		X		
WME-15	Alluvium	55'	1 kg	X	X				
WME-16	Alluvium	65'	1 kg	X	X		X	X	
WME-17	Alluvium	55'	1 kg	X	X				
Total				**17**	**17**	**4**	**11**	**5**	**4**

Figures

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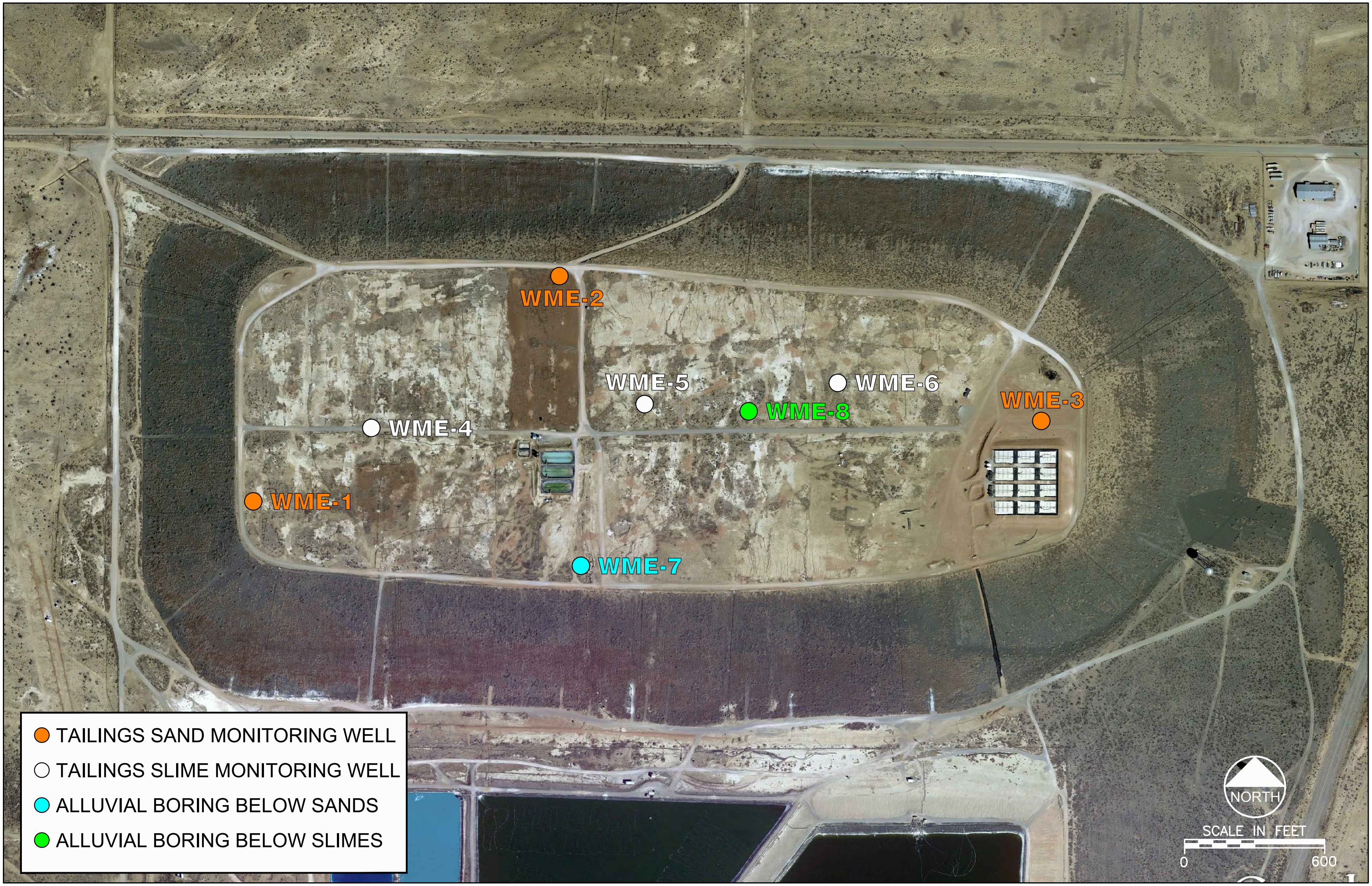

WORTHINGTON MILLER ENVIRONMENTAL, LLC.

FIGURE 1
LOCATION OF NEW LTP WELLS AND ALLUVIAL BORINGS FOR SOLIDS COLLECTION AND WATER QUALITY EVALUATION

Date:	JULY 2018
Project:	HOMESTAKE
File:	WELL-LOCATIONS-JULY-18

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WORTHINGTON MILLER ENVIRONMENTAL, LLC.

FIGURE 2
LOCATIONS OF NEW STP SAND AND SLIME WELLS FOR TAILINGS SOLIDS COLLECTION AND WATER QUALITY EVALUATION

Date:	JULY 2018
Project:	HOMESTAKE
File:	WELL-LOCATIONS-JULY-18

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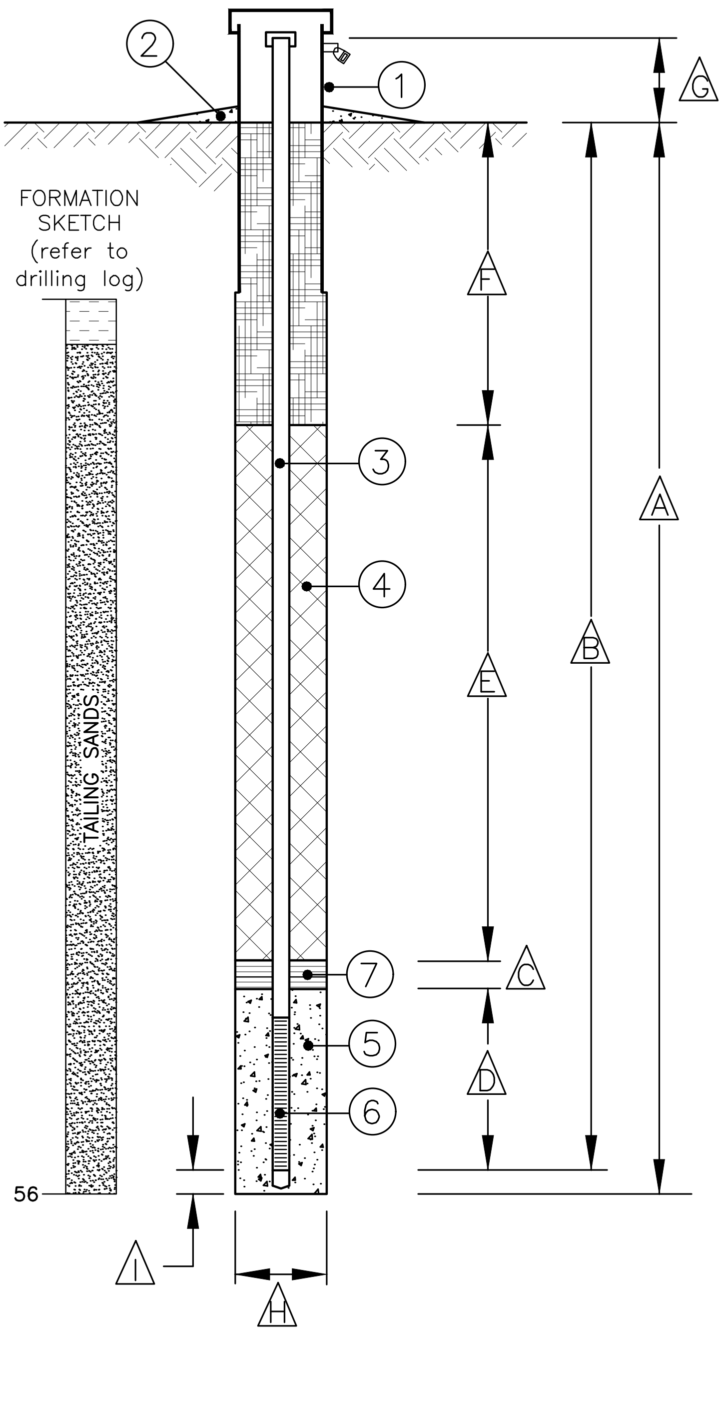
WORTHINGTON MILLER ENVIRONMENTAL, LLC.

FIGURE 3
LOCATIONS FOR ALLUVIAL AQUIFER SOLIDS COLLECTION

Date:	JULY 2018
Project:	HOMESTAKE
File:	WELL-LOCATIONS-JULY-18

Appendix A

WME-1
MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP
Well number WME-1
Date 06-28-2018
Drilling company CASCADE
Location LTP SAND
Date drilled 06-14-2018
Date completed 06-15-2018

Materials:

1. Protective casing? (Yes) No
   Height above ground 2.5 ft
   Type STEEL Length 5' Dia. 8"
2. Cement pad? (Yes) No
3. Solid pipe: Type PVC Length 51.8' Dia. 4"
4. Seal type: HIGH SOLIDS BENTONITE GROUT
5. Filter pack: 10-20 SILICA SAND
6. Well screen: Type PVC Length 5' Dia. 4"
   Slot size 0.010
7. Sand type: #60 SILICA

Dimensions:

A	Total depth of boring	56.0	ft
B	Total depth of finished well	55.6	ft
C	Sand: Interval	46-47	ft
D	Filter pack: Interval	47-56	ft
E	Seal: Interval	15-46	ft
F	Bentonite chip seal: Interval	3-15	ft
G	Height of stick-up	1.7	ft
H	Borehole diameter	8.0	in
I	Length of endcap	0.5	ft

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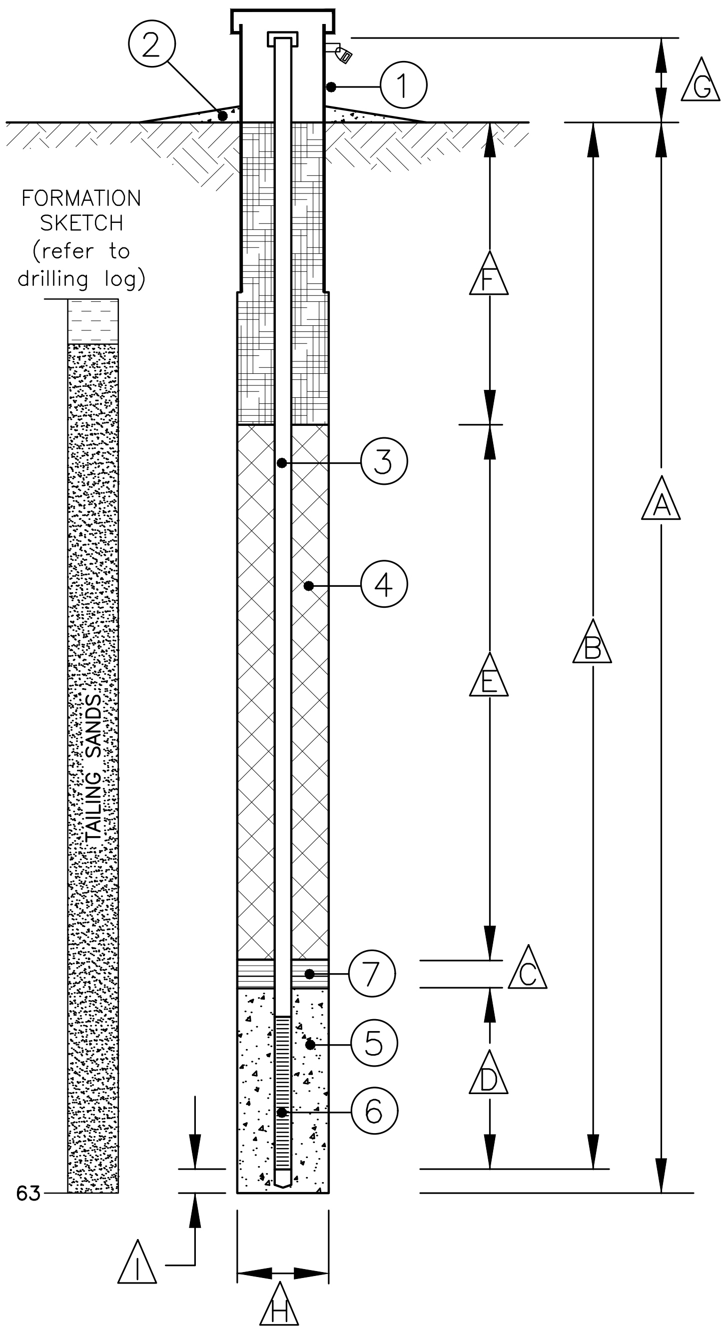
WME-2
MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP
Well number WME-2
Date 06-28-2018
Drilling company CASCADE
Location LTP SAND
Date drilled 06-14-2018
Date completed 06-15-2018

Materials:

1. Protective casing? (Yes) No
   Height above ground 2.5 ft
   Type STEEL Length 5' Dia. 8"
2. Cement pad? (Yes) No
3. Solid pipe: Type PVC Length 59.1' Dia. 4"
4. Seal type: HIGH SOLIDS BENTONITE GROUT
5. Filter pack: 10-20 SILICA SAND
6. Well screen: Type PVC Length 5' Dia. 4"
   Slot size 0.010
7. Sand type: #60 SILICA

Dimensions:

A	Total depth of boring	63.0	ft
B	Total depth of finished well	62.5	ft
C	Sand: Interval	53-54	ft
D	Filter pack: Interval	54-63	ft
E	Seal: Interval	15-53	ft
F	Bentonite chip seal: Interval	3-15	ft
G	Height of stick-up	2.1	ft
H	Borehole diameter	8.0	in
I	Length of endcap	0.5	ft

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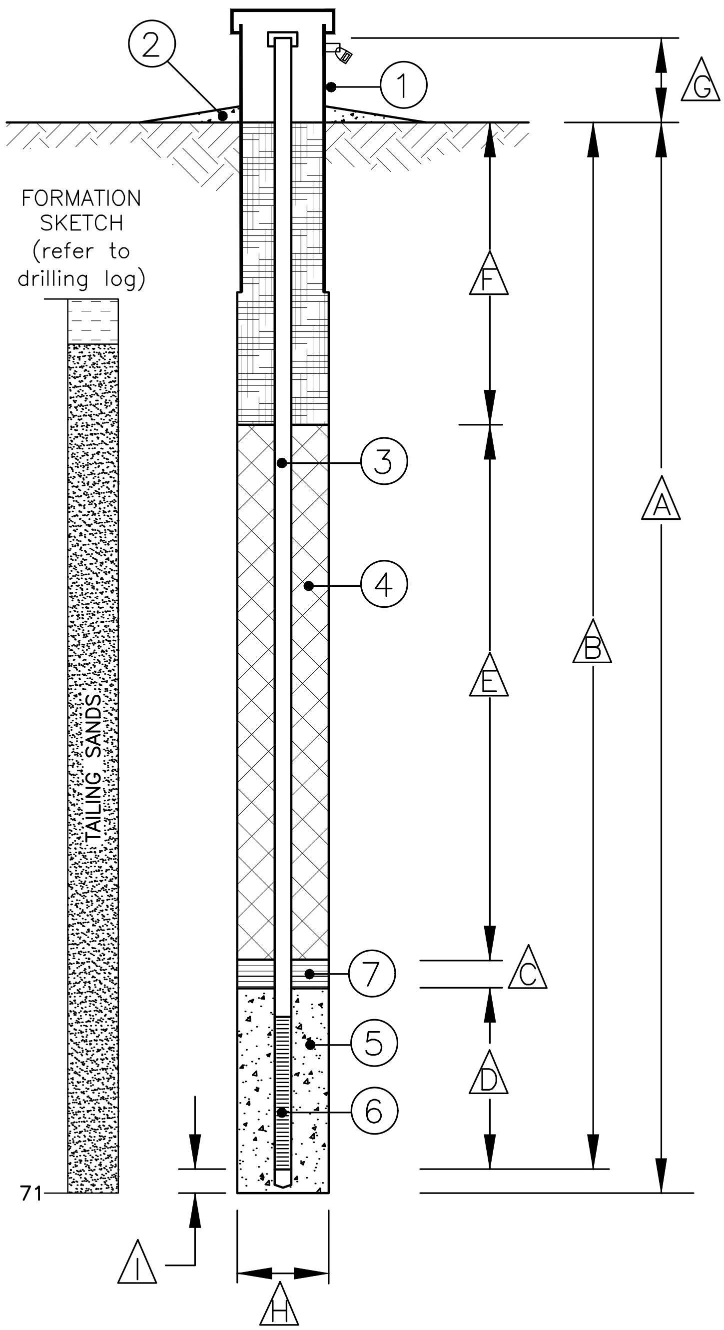
WME-3
MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP
Well number WME-3
Date 06-28-2018
Drilling company CASCADE
Location LTP SAND
Date drilled 06-15-2018
Date completed 06-17-2018

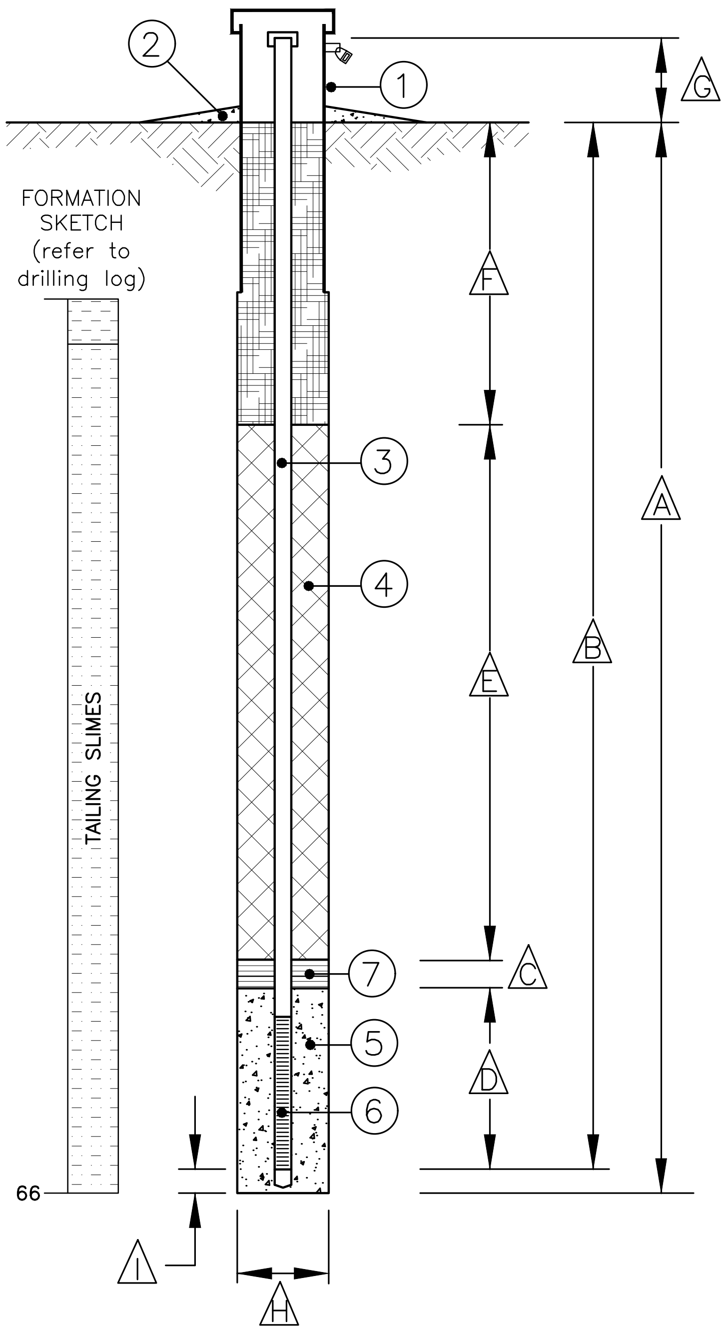
Materials:

1. Protective casing? (Yes) No
   Height above ground 2.5 ft
   Type STEEL Length 5' Dia. 8"
2. Cement pad? (Yes) No
3. Solid pipe: Type PVC Length 67.15' Dia. 4"
4. Seal type: HIGH SOLIDS BENTONITE GROUT
5. Filter pack: 10-20 SILICA SAND
6. Well screen: Type PVC Length 5' Dia. 4"
   Slot size 0.010
7. Sand type: #60 SILICA

Dimensions:

A	Total depth of boring	71.0	ft
B	Total depth of finished well	70.5	ft
C	Sand: Interval	61.5-62.5	ft
D	Filter pack: Interval	62.5-70.5	ft
E	Seal: Interval	15-61.5	ft
F	Bentonite chip seal: Interval	3-15	ft
G	Height of stick-up	2.15	ft
H	Borehole diameter	8.0	in
I	Length of endcap	0.5	ft

WME-4
MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP
Well number WME-4
Date 06-28-2018
Drilling company CASCADE
Location LTP SLIME
Date drilled 06-17-2018
Date completed 06-17-2018

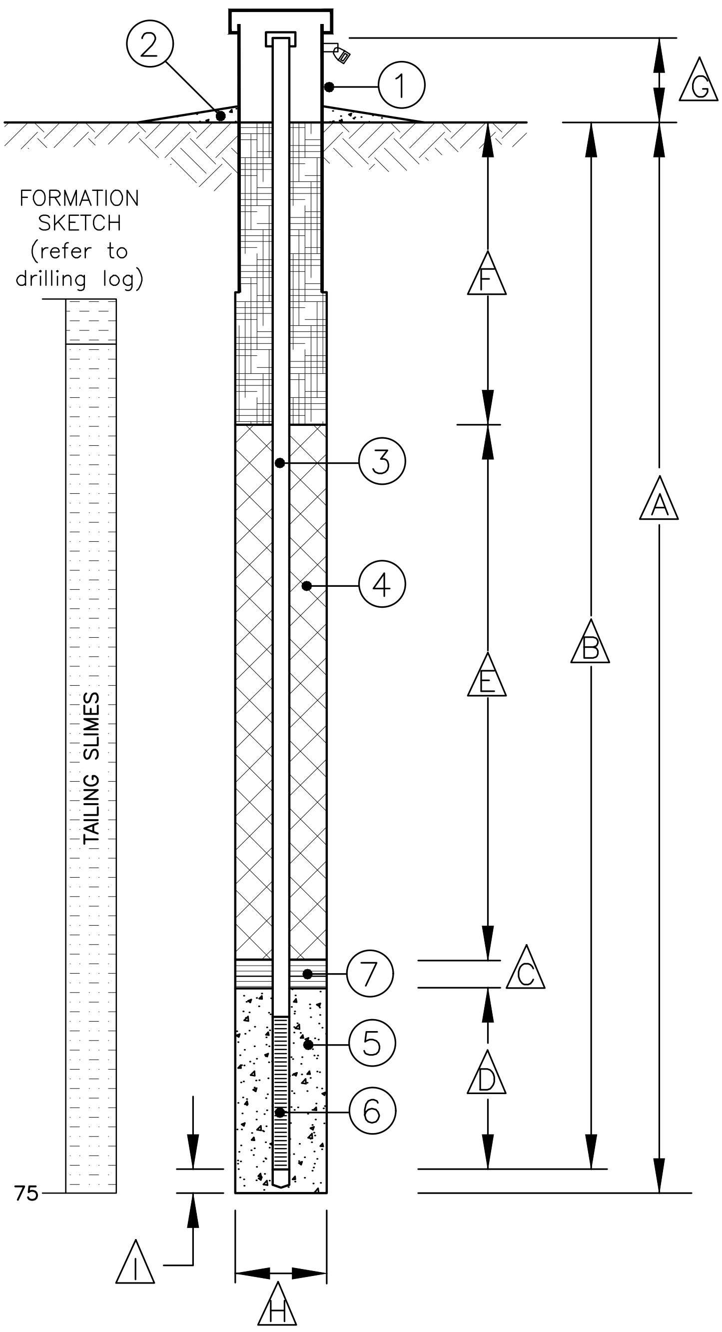
Materials:

1. Protective casing? (Yes) No
   Height above ground 2.5 ft
   Type STEEL Length 5' Dia. 8"
2. Cement pad? (Yes) No
3. Solid pipe: Type PVC Length 62.1' Dia. 4"
4. Seal type: HIGH SOLIDS BENTONITE GROUT
5. Filter pack: 10-20 SILICA SAND
6. Well screen: Type PVC Length 5' Dia. 4"
   Slot size 0.010
7. Sand type: #60 SILICA

Dimensions:

A	Total depth of boring	66.0	ft
B	Total depth of finished well	65.5	ft
C	Sand: Interval	56-57	ft
D	Filter pack: Interval	57-66	ft
E	Seal: Interval	15-56	ft
F	Bentonite chip seal: Interval	3-15	ft
G	Height of stick-up	2.1	ft
H	Borehole diameter	8.0	in
I	Length of endcap	0.5	ft

WME-5
MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP
Well number WME-5
Date 06-28-2018
Drilling company CASCADE
Location LTP SLIME
Date drilled 06-18-2018
Date completed 06-18-2018

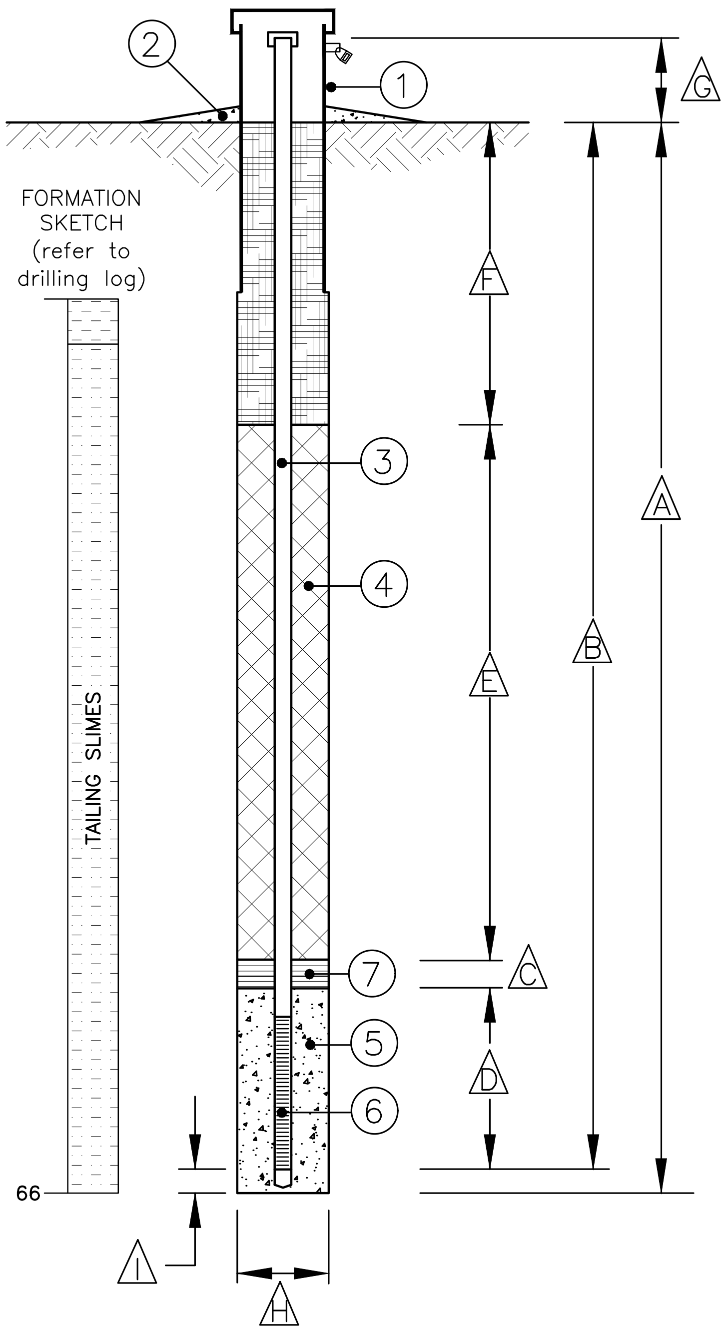
Materials:

1. Protective casing? (Yes) No
   Height above ground 2.5 ft
   Type STEEL Length 5' Dia. 8"
2. Cement pad? (Yes) No
3. Solid pipe: Type PVC Length 71.82' Dia. 4"
4. Seal type: HIGH SOLIDS BENTONITE GROUT
5. Filter pack: 10-20 SILICA SAND
6. Well screen: Type PVC Length 5' Dia. 4"
   Slot size 0.010
7. Sand type: #60 SILICA

Dimensions:

A	Total depth of boring	75.0	ft
B	Total depth of finished well	75.0	ft
C	Sand: Interval	65.5-66.5	ft
D	Filter pack: Interval	66.5-75	ft
E	Seal: Interval	17-65.5	ft
F	Bentonite chip seal: Interval	3-17	ft
G	Height of stick-up	2.32	ft
H	Borehole diameter	8.0	in
I	Length of endcap	0.5	ft

WME-6
MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP
Well number WME-6
Date 06-28-2018
Drilling company CASCADE
Location LTP SLIME
Date drilled 06-19-2018
Date completed 06-19-2018

Materials:

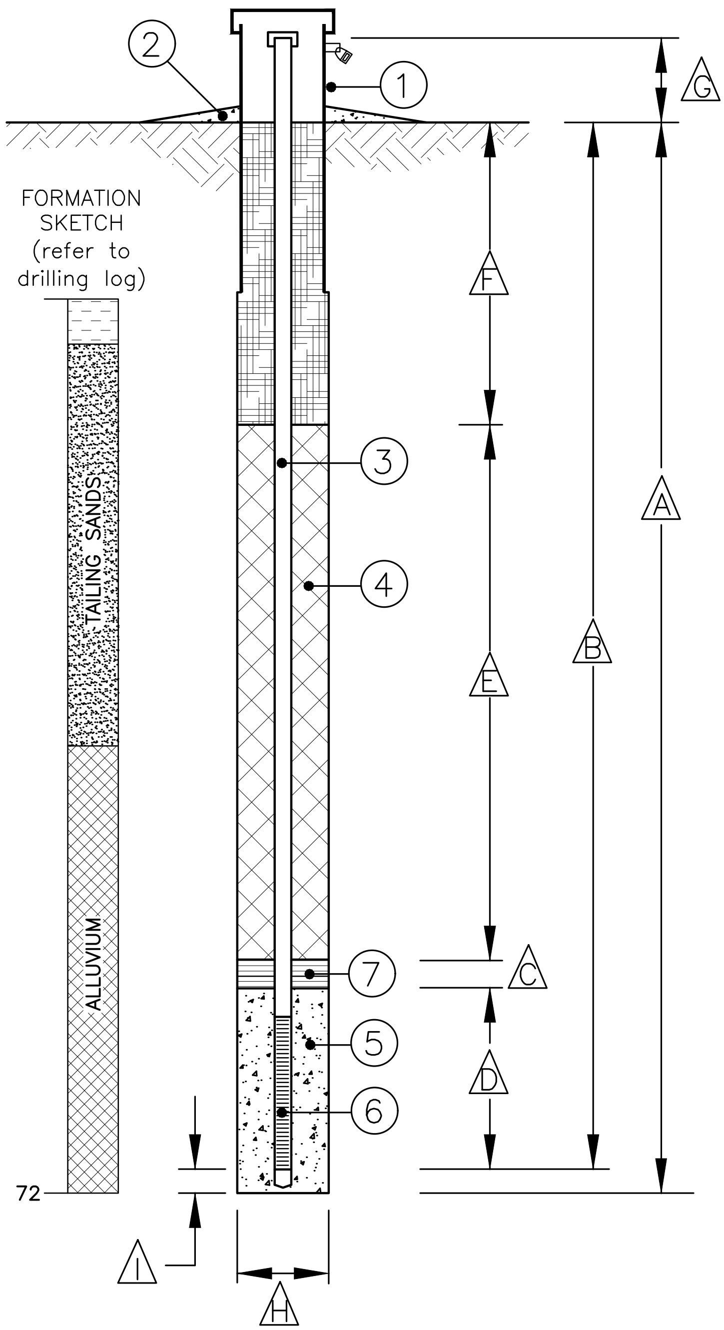
(1) Protective casing? (Yes) No
Height above ground 2.5 ft
Type STEEL Length 5' Dia. 8"
(2) Cement pad? (Yes) No
(3) Solid pipe: Type PVC Length 61.75' Dia. 4"
(4) Seal type: HIGH SOLIDS BENTONITE GROUT
(5) Filter pack: 10-20 SILICA SAND
(6) Well screen: Type PVC Length 5' Dia. 4"
Slot size 0.010
(7) Sand type: #60 SILICA

Dimensions:

A	Total depth of boring	66.0	ft
B	Total depth of finished well	65.5	ft
C	Sand: Interval	55.5-56.5	ft
D	Filter pack: Interval	56.5-65.5	ft
E	Seal: Interval	15-55.5	ft
F	Bentonite chip seal: Interval	3-15	ft
G	Height of stick-up	1.75	ft
H	Borehole diameter	8.0	in
I	Length of endcap	0.5	ft

WME-9

MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP

Well number WME-9

Date 06-28-2018

Drilling company CASCADE

Location STP SAND

Date drilled 06-19-2018

Date completed 06-20-2018

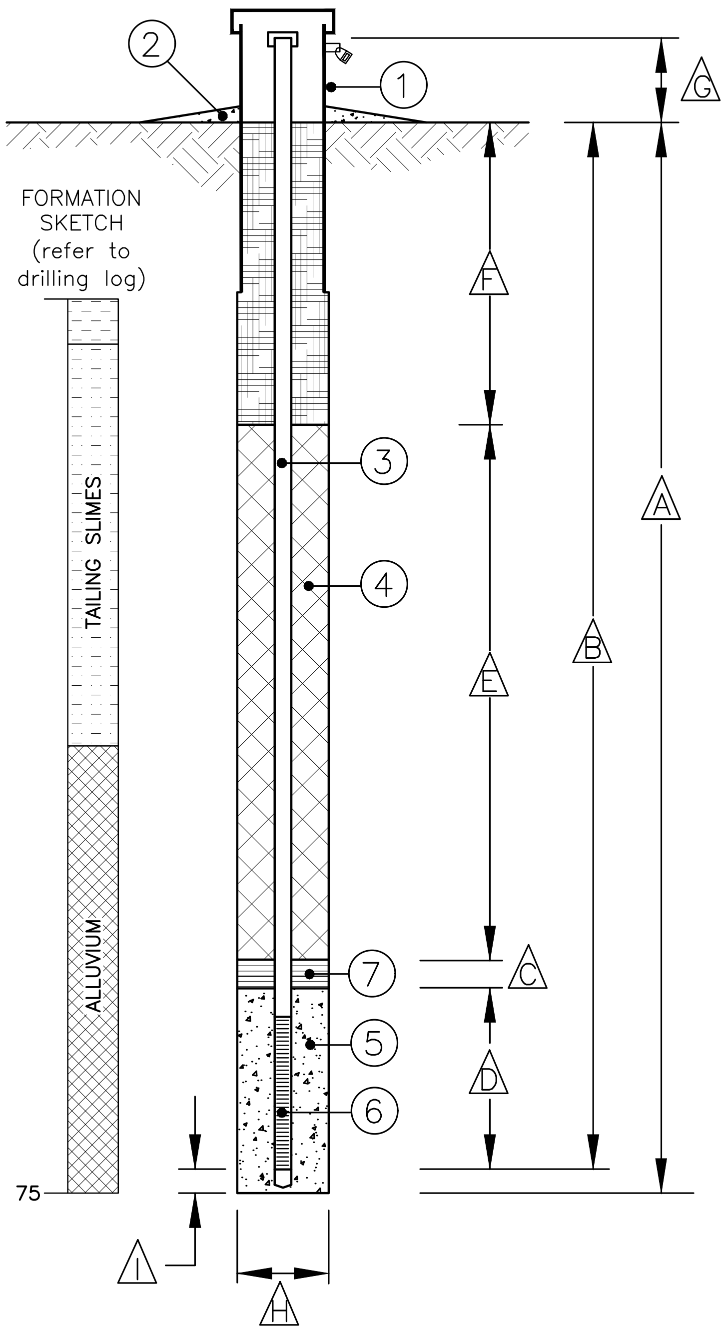
Materials:

1. Protective casing? (Yes) No
   Height above ground 2.5 ft
   Type STEEL Length 5' Dia. 8"
2. Cement pad? (Yes) No
3. Solid pipe: Type PVC Length 67.7' Dia. 4"
4. Seal type: HIGH SOLIDS BENTONITE GROUT
5. Filter pack: 10-20 SILICA SAND
6. Well screen: Type PVC Length 5' Dia. 4"
   Slot size 0.010
7. Sand type: #60 SILICA

Dimensions:

A	Total depth of boring	72.0	ft
B	Total depth of finished well	71.5	ft
C	Sand: Interval	63-64	ft
D	Filter pack: Interval	64-72	ft
E	Seal: Interval	16-63	ft
F	Bentonite chip seal: Interval	3-16	ft
G	Height of stick-up	1.7	ft
H	Borehole diameter	8.0	in
I	Length of endcap	0.5	ft

WME-10
MONITORING WELL CONSTRUCTION INFORMATION SHEET



Project HOMESTAKE GRP
Well number WME-10
Date 06-28-2018
Drilling company CASCADE
Location STP SLIME
Date drilled 06-20-2018
Date completed 06-21-2018

Materials:

(1) Protective casing? (Yes) No
Height above ground 2.5 ft
Type STEEL Length 5' Dia. 8"
(2) Cement pad? (Yes) No
(3) Solid pipe: Type PVC Length 71.2' Dia. 4"
(4) Seal type: HIGH SOLIDS BENTONITE GROUT
(5) Filter pack: 10-20 SILICA SAND
(6) Well screen: Type PVC Length 5' Dia. 4"
Slot size 0.010
(7) Sand type: #60 SILICA

Dimensions:

A	Total depth of boring		75.0	ft
B	Total depth of finished well		75.0	ft
C	Sand:	Interval	65.5-66.5	ft
D	Filter pack:	Interval	66.5-75	ft
E	Seal:	Interval	15-65.5	ft
F	Bentonite chip seal:	Interval	3-15	ft
G	Height of stick-up		1.7	ft
H	Borehole diameter		8.0	in
I	Length of endcap		0.5	ft

Appendix B

CONTENTS

THURSDAY JANUARY 4, 2018

0900 ARRIVE @ SITE

1103 @ WME-9 - BACKGROUND
~~N 40° 32' 11.5"~~ OLD GPS
~~W 105° 01' 16.3"~~ READING.

1116 WME-13 - ~~LTP SAND~~
ALLUVIAL BORING.
N 35° 14' 25.4"
W 107° 51' 56.5

1122 WME-12 - ALLUVIAL BORING.
N 35° 14' 30.1"
W 107° 52' 16.0"

1137 WME-11 ALLUVIAL BORING
N 35° 14' 29.2"
W 107° 52' 46.8"

1147 WME-10 ALLUVIAL BORING
N. 35° 14' 24.2"
W 107° 53' 21.1"

THURSDAY JANUARY 4, 2018

1210 WME-~~14~~ ALLUVIAL BORING.
N 35° 14' 06.1"
W 107° 52' 09.5"

1225 WME-15 ALLUVIAL BORING.
N 35° 13' 51.3"
W 107° 51' 50.7"

1242 WME-1 LTP - SAND
N 35° 14' 34.1"
W 107° 52' 10.3"

1249 WME-4 LTP - SLIME
N 35° 14' 37.2"
W 107° 52' 04.2"

1254 WME-5 LTP - SLIME
N 35° 14' 38.2"
W 107° 51' 50.1"

1304 WME-6 LTP - SLIME
N. 35° 14' 39.1"
W 107° 51' 40.1"

THURSDAY JANUARY 4, 2018

1312 WME-3 LTP-SANDS
N. 35° 14' 37.5"
W 107° 51' 29.6"

1318 WME-2 LTP-SAND
N 35° 14' 43.6"
W 107° 51' 54.5"

1328 WME-7 STP-SAND
N 35° 14' 06.4"
W 107° 51' 37.7"

1333 WME-8 STP-SLIME
N 35° 14' 07.4"
~~W~~ W 107° 51' 39.5"

1348 WME-9 - BACKGROUND
N 35° 14' 58.5"
W 107° 51' 45.2"

Homestake Tailings and Alluvium Sampling Summary
Sample Intervals and Suggested Mass Requirements
Updated 6-10-18

Location	Description	Site Columns 4' x 8" core (60 kg)	Remaining Sample Depths	ACZ Laboratories 1 kg (2.2 lbs)	3 kg (6.6 lbs)	6 kg (13.2 lbs)
WME-1	LTP Sands	50' – 54'	>54'	X		
WME-2	LTP Sands	50'-54'	>54'		X	
WME-3	LTP Sands	55'-59'	>59'	X		
WME-4	LTP Slimes	50'-54'	>54'	X		
WME-5	LTP Slimes	58'-62'	>62'		X	
WME-6	LTP Slimes	58-62'	>62'	X		
WME-7	Perched Alluvium		82'-105'	X		X
WME-7	Vadose Alluvium		105'-119'	X		X
WME-8	Perched Alluvium		94'-111'	X		X
WME-8	Vadose Alluvium		111'-122'	X		X
WME-9	STP Sands		10'-15'		X	
WME-10	STP Slimes		10'-15'		X	
WME-11	Alluvium		55'-60'	X		
WME-12	Alluvium		75'-80'	X		
WME-13	Alluvium		73'-78'	X		
WME-14	Alluvium		30'-35'	X		
WME-15	Alluvium		40'-45'	X		
WME-16	Alluvium		60'-65'	X		
WME-17	Alluvium		60'-65'	X		
	Total			15	4	4

D.T.W.' 50 50 55 30 48 38

T.D. 62 1, 62 2, 67 3, 62 4, 70 5, 70 6

56 61 60 65 69 8 31 41 X41

71 76 SAT. THICK 60 35 20 50 38 64 X

ACZ Sample Analysis Summary
Chain of Custody Information
Updated 6-10-18

Location	Description	ABA-PH-CEC-TOC	XRD	HCT	TESSIER-6-STEP	SEM	MWMP – column
WME-1	LTP Sands	X	X				
WME-2	LTP Sands	X	X	X	X	X	
WME-3	LTP Sands	X	X		X		
WME-4	LTP Slimes	X	X				
WME-5	LTP Slimes	X	X	X	X	X	
WME-6	LTP Slimes	X	X		X		
WME-7	Perched Alluvium	X	X		X		X
WME-7	Vadose Alluvium	X	X		X		X
WME-8	Perched Alluvium	X	X			X	X
WME-8	Vadose Alluvium	X	X				X
WME-9	STP Sands	X	X	X	X		
WME-10	STP Slimes	X	X	X	X	X	
WME-11	Alluvium	X	X		X		
WME-12	Alluvium	X	X				
WME-13	Alluvium	X	X		X	X	
WME-14	Alluvium	X	X		X		
WME-15	Alluvium	X	X				
WME-16	Alluvium	X	X		X	X	
WME-17	Alluvium	X	X				
	Total	19	19	4	12	6	

WEDNESDAY JUNE 13, 2018
HOMESTAKE GEOCHEM DRILLING.
CASCADE DRILLING.
DRILLING CREW:
ALVIN ANDERSON - DRILLER
PAUL DICKENSON - HELPER
TOM DEVICK - HELPER

0800 RADIATION SAFETY TRAINING
0930 SIGN OUT RAD BADGE
0940 UNLOAD DRILLING EQUIPMENT
IN LAYDOWN AREA.

GATE CODE: 2986

1120 FILL WATER TRUCK.
1210 RIG @ WME-1
1345 TOWER UP ON WME-1
1410 SPUD IN WME-1 (LTP SAND)
0'-4' STIFF CLAY. DRY.
REDDISH BROWN.
1425 @15'
4'-15' SAND. LOOSE. DRY.
LIGHT BROWN.
1530 @25' SAND. LOOSE. DRY.
LIGHT BROWN TO LT. GRAY.
STRONG REACTION TO
10% HCl.

THURSDAY JUNE 14, 2018
HOMESTAKE GEOCHEM
0615 ARRIVE @ SITE
0700 SAFETY MTG.
- LIGHTNING POLICY
- SHIFT SCHEDULE
- SAMPLE HANDLING
0715 PREPARE CUTTING TORCH.
NEED TO REMOVE COUPLER
FROM DRILL HEAD.
0750 DRILL 8" CORE FROM 25'
0800 @ 35'
25'-35': SAND w/ SOME
CLAY LENSES. LOOSE.
WELL SORTED FINE SAND.
LIGHT BROWN. SOFT CLAY.
SMALL LENSES. GRAY.
(margin: STRONG HCl)
0805 PUSH 10" CASING TO
25'.
0808 DRILL 8" FROM 35'
0830 @45'
35'-45': CLAYEY SAND. SOFT.
LOOSE. WELL SORTED FINE
SAND. MED. DARK GRAY.
WET! MASSIVE
STRUCTURE.
NO LENSES.

THURSDAY JUNE 14, 2018
HOMESTAKE GEOCHEM DRILLING.

0840 CLEAN OUT BORE HOLE TO 45'
0900 @ 55' TD.
0920 COLLECT SAMPLE WME-1
FROM 54'-55'.
0922 FILL COLUMN WME-1
FLUSH w/ NITROGEN @ 3L/min
FOR 5 MINUTES.

45'-55': SAME AS ABOVE
SOME MED-STIFF
CLAY. MED-DARK
GRAY. WET.
MILD REACTION TO
10% HCL.

0930 PUSH 10" CASING TO 45'
0940 CLEAN OUT BOREHOLE. TO 55'
1020 CLEAN TO 54'.
PREPARE TO SET WELL.
1030. PVC COUNT
5' SCREEN: I
10' BLANK: ~~IIII~~ I

THURSDAY JUNE 14, 2018
HOMESTAKE GEOCHEM WELLS
WME-2, (LTP SAND)
1050 WELL SET TO 55' BGS.
ADD SAND FILTER PACK.
1100 FILTER PACK SET TO
47' BGS.
1120 SCAN OUT... GO TO LUNCH.
1210 RETURN TO SITE.
PREPARE TO GROUT WME-1
1300 ALL CASING OUT OF HOLE.
1320 GROUT COMPLETE
MOBILIZE TO WME-2
1340 @ WME-2
1410 SPUD IN WME-10
1415 0'-4': CLAY. DENSE. DRY.
BROWNISH RED.
1425 4'-15'
SAND. LOOSE. WELL SORTED
FINE SAND. DRY. LIGHT
BROWN. STRONG REACTION
TO 10% HCl.
1430 10" CASING TO 15'
CLEAN OUT w/ 8" CORE.
TO 15'

THURSDAY JUNE 14. 2018
HOMESTAKE GEOCHEM WELLS.
WME-2, (LTP SAND)

1440 15-25 : SAME AS ABOVE.
1445 25'-35' : SAND w/ TRACE CLAY LENSES. LOOSE FINE. WELL SORTED. MED. BROWN AND RED. 10% CLAY. SOFT INTERBEDDED LENSES. DRY. MED. GRAY.

1448 ADVANCE 10" CASING. TO 25'... CLEAN OUT TO 35'
1510 35'-45': SAME AS ABOVE. NO RED. MED GRAY

1530 STORM SHUTDOWN!
1550 LEAVE SITE

RNL

FRIDAY JUNE 15, 20
HOMESTAKE GEOCHEM WELLS
0530 ARRIVE @ SITE
0540 SAFETY MEETING.
0550 LOAD WELL SUPPLIES IN YARD.
0615 @ WME-1. INSTALL MONUMENT. ADD 2' TO 55' 57' TOTAL PVC.
0710 WME-1 DTW = 53.25' T.O.C. T.D. = 57.60' T.O.C.

0715 @ WME-2
45-55': SAND w/ SOME CLAY. <20%. LOOSE. WELL SORTED FINE SAND. SOME CLAY STRINGERS. WEAK - NO REACTION w/ 10% HCl. MED GRAY. MOIST.

FRIDAY JUNE 15, 2018
HOMESTAKE GEOCHEM WELLS
WME-2 (LTP SAND)

0740 SAMPLE 62'-57' in BARREL.
WAIT TO TAKE WATER LEVEL.
0800 DTW = 48' ~~TO.~~ B.G.S.
0805 NO SAMPLE IN CORE BARREL. TRIP BACK IN.
0815 COLLECT WME-2 61-62'
COLLECT WME-2 COLUMN 56'-61',
55-62: SAME AS ABOVE. WET.
0820 PURGE WME-2 COLUMN w/ NITROGEN
0821 CLEAN OUT HOLE.
0855 HOLE CLEAN/OPEN TO 62' BGS.
0900 PVC COUNT - WME-2
SCREEN 5': I
BLANK 10': IIII
T.D. = 62' BGS.
0940 SAND TO 54' BGS
FINE SAND 54'-52'.

FRIDAY JUNE 15, 2018
HOMESTAKE GEOCHEM WELLS
WME-2 + WME-3

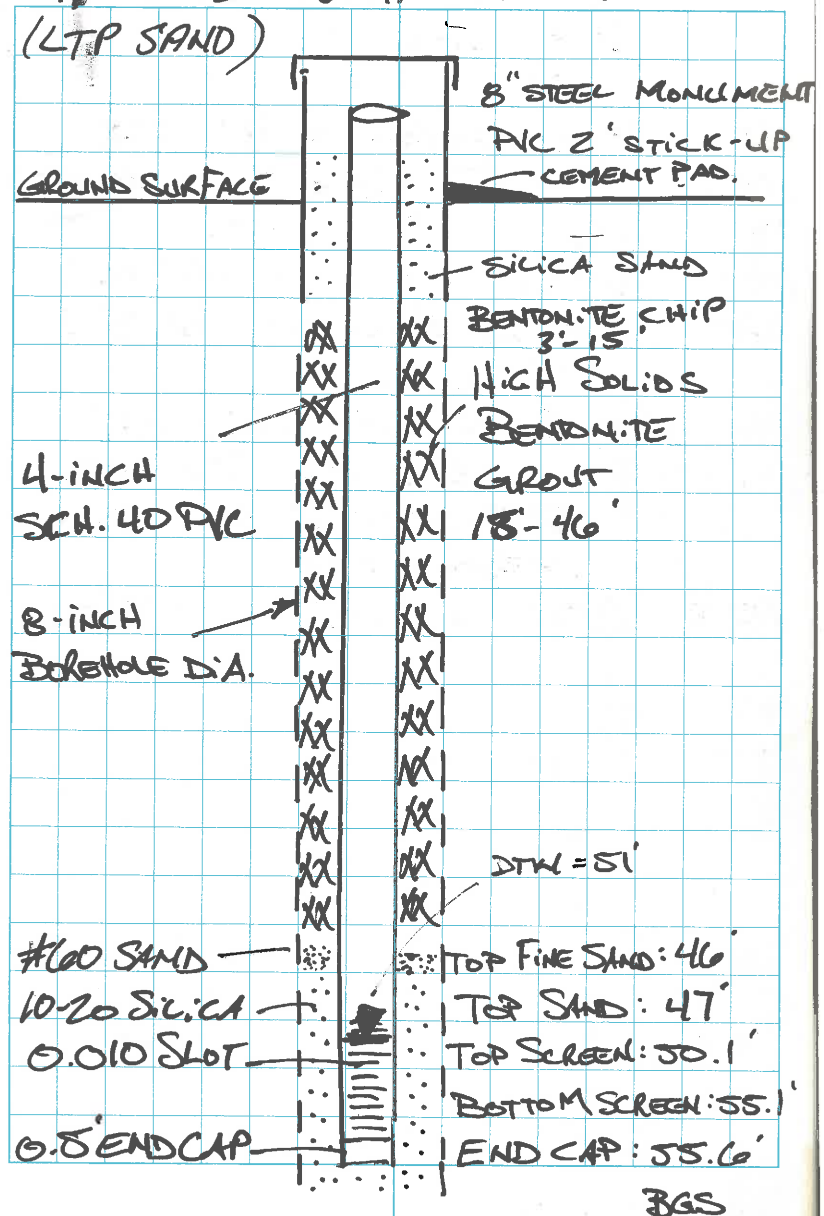
1030 HIGH SOLIDS BENTONITE INSTALLED TO 15' BGS
1031 DEMOBE/MOBILIZE TO WME-3
1115 @ WME-3
SCAN OUT FOR LUNCH.
1200 SET UP ON WME-3
1230 0'-4': CLAY. HARD. DRY. REDDISH BROWN.
1245 4'-15': SAND. LOOSE. WELL SORTED. FINE. DRY. MED. RED BROWN.
1315 15'-25': CLAY. STIFF/HARD. DRY. STRONG REACTION TO 10% HCl. MED. BROWN.
1335 25'-33' SAME AS ABOVE.
33'-35' SAND. LOOSE. DRY. WELL SORTED. FINE. VERY LIGHT BROWN. STRONG RXN TO 10% HCl.
1340 ADD 10' 10" CASING
1343 TRIP IN w/ 8" CORE BARREL

FRIDAY JUNE 15, 2018
HOMESTAKE GEOCHEM WELLS
WME-3 (LTP SAND)

1350 HOLE CLEAN TO 35' BGS.
1400 35'-45': SAME AS ABOVE.
1402 ADD 10' 10" CASING.
1410 HOLE CLEAN TO 45' BGS.
1500 COLLECT COLUMN WME-3
65'-61'
SAND w/ SOME CLAY.
LOOSE. FINE. WELL SORTED.
20% CLAY. SOFT. WET.
MEDIUM GRAY.
1505 DTW in WME-3 = ~~58'~~ BGS.
58'
1530 OVERDRILL TO 67'
1540 SIGN OUT

KW

WME-1 COMPLETION
(LTP SAND)



N.T.S.

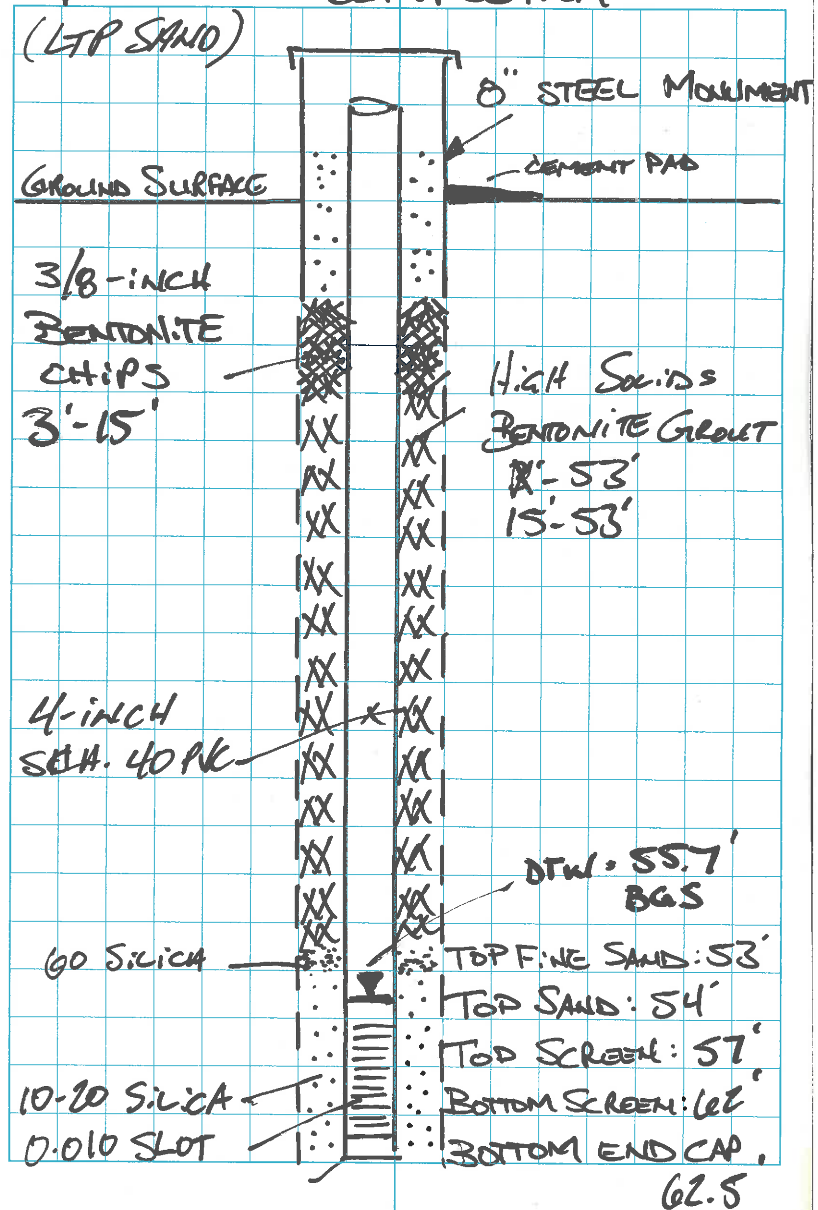
SATURDAY JUNE 16, 2018
HOMESTAKE ~~GEOCHEM~~ WELLS

0530 @ BACK GATE
WEATHER: RAIN!
FORECAST: RAIN.

NOTE: TOO MUDDY TO WORK SAFELY. DECIDE TO CALL A REST DAY.

RW

WME-2 COMPLETION



SUNDAY JUNE 17, 2018
HOMESTAKE GEOCHEM WELLS
* HAPPY FATHER'S DAY *

0600 STILL WATER ON GROUND
WAIT TO START.
0750 @ BACK GATE. CODE: 2986
0800 @ YARD. MEET w/ JASON
* WILL LEAVE BACK GATE OPEN.
0820 SAFETY MEETING.
- NEW PPE TYVEK + BOOTS & GLOVES.
- NO CROSS CONTAMINATION.
- CLEAN GLOVES FOR WELL CONST.

WEATHER: 70°F. PARTLY CLOUDY.
NO WIND.

0830 WME-3 DTW = 57' BGS
TD = 67'.
OVERDRILL TO 70'.
0900 67-70': SAME AS ABOVE
WET!
0902 TAG HOLE TD = 70' BGS.
PREPARE TO SET WELL

SUNDAY JUNE 17, 2018
WME-3 & WME-4

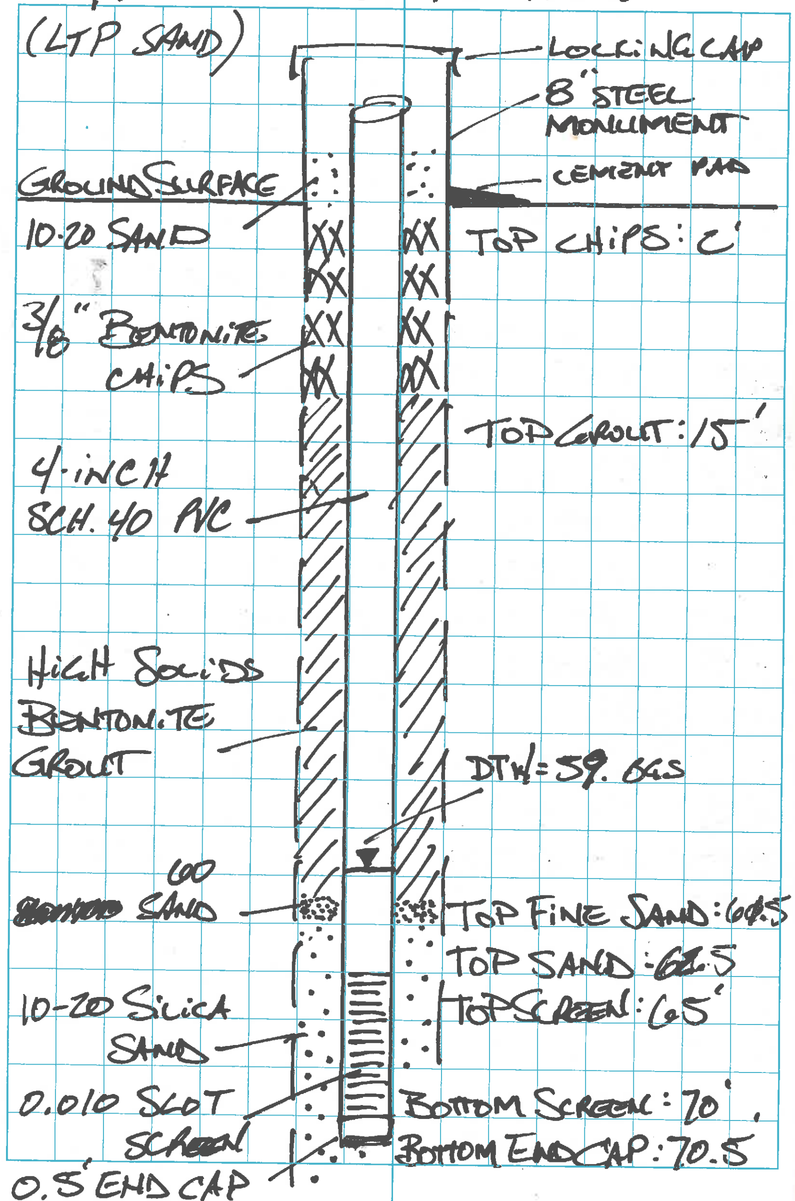
PVC COUNT: 4" SCH. 40
5' SCREEN: 1
10' BLANK: ||||| ||

0930 WME-3 SET TO 70' BGS.
1000 SAND IN TO 62.5' BGS.
FINE SAND TO 61.5' BGS.
1030 HIGH SOLIDS BENTONITE
GROUT IN TO 15' BGS.
1051 MOBILIZE TO WME-4.
1135 @ WME-4.
1145 LUNCH BREAK.
1225 GO TO YARD FOR WELL SUPPLIES.
1240 RETURN TO WME-4
SET-UP RIG.
1300 SPUD IN.
1305 0-4': CLAY. STIFF/HARD.
DRY. MED. RED BROWN.
1315 4'-15': SAND. LOOSE. DRY.
WELL SORTED. FINE.
LIGHT YELLOWISH BROWN.
STRONG. RXN TO 10% HCL

SUNDAY JUNE 17, 2018
WME-4 (LTP SLIME)

(18)
1340 15'-25': CLAY. MED STIFF. 10%
MOIST. TRACE FINE SAND.
VERY DARK ~~BROWN~~ GRAY TO
BLACK. MASSIVE. NO LAYERS.
STRONG ~~WEAK~~ RXN TO 10% HCl.
1350 25'-35' SAME AS ABOVE.
1352 ADVANCE 10" CASING TO 25'
1415 35'-45' CLAY. MED STIFF-STIFF.
MOIST. NO SAND. MED GRAY-
DARK GRAY. STRONG RXN TO 10%
HCl. SULFER SMELL.
1440 45-55': SAME AS ABOVE.
WET!
1445 ADVANCE 10" CASING TO 45'
1455 CLEAN HOLE TO 55'.
1530 55'-65': SAME AS ABOVE.
1530 COLLECT WME-4 @ 65'
FILL WME-4 COLUMN
61'-64'
1540 PURGE WME-4 COLUMN
w/ NITROGEN.

WME-3 COMPLETION

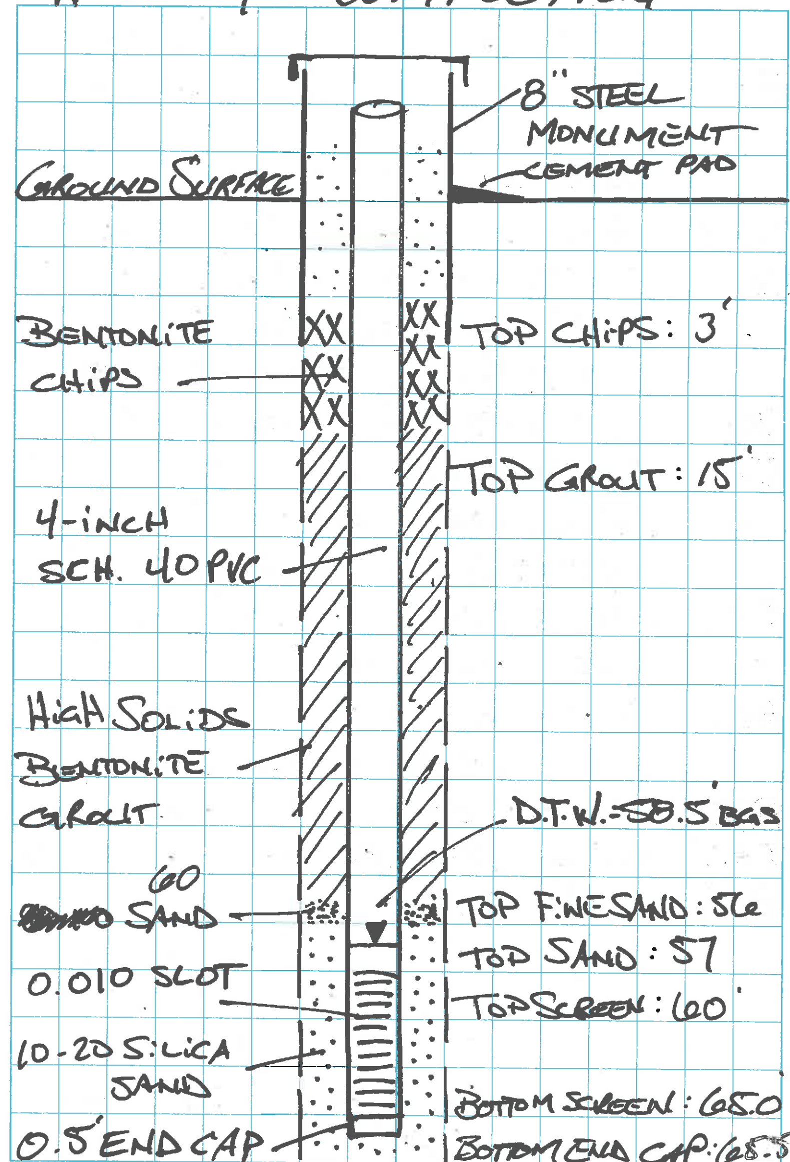


SUNDAY JUNE 17, 2018
WME-4 (LTP SLIME)

1600 WME-4 DTW IN BOREHOLE = 50' BGS.
PREPARE TO SET WELL.
1630 HOLE CLEAN TO 65'
1650 WME-4 PVC COUNT
5' SCREEN: |
10' BLANK: ||||
1700 PVC SET TO 65' B.G.S.
1731 SAND UP TO 57' BGS
FINE SAND TO 56' BGS
PREPARE TO GROUT.
1805 GROUT IN TO 35' BGS
PULL 10" CASING.
1820 GROUT UP TO 15' BGS
PULL 10" CASING
1835 CASING OUT. SHUT DOWN.
1845 SIGN IN BADGE
1855 OFF SITE.

RN

WME-4 COMPLETION



MONDAY JUNE 18, 2018
HOMESTAKE GEOCHEM WELLS
WME-5 (LTP SLIME)

0530 ARRIVE @ SITE
* CLEAR LATE DEPARTURE PROTOCOL w/ KYLE & BILLY.
0535 SAFETY MEETING
- PPE / CONTAMINATION
- SITE CONTROL
- MOBILIZATION TO WME-5
0545 @ YARD. PICK UP WELL SUPPLIES. INVENTORY PIC.
- MORE TO BE SHIPPED.
0600 SIGN OUT BADGE.
0610 DEMOB / MOBILIZE TO WME-5.
* DISCUSS BEING MINDFUL NOT TO GET CUTTINGS ON RIG WHEN MOVING OFF HOLE w/ DRILLER / ALVIN.
0700 @ WME-5 - FUEL RIG.
0800 SPUD IN 10-INCH CASING.
0'-3': CLAY. STIFF / HARD. DRY. MED. REDDISH BROWN. (CAP).

MONDAY JUNE 18, 2018

WATER LEVELS:

		T.D. (BGS)
WME-1	51.4' BGS	55.5
WME-2	55.7' BGS	62.5
WME-3	59.3' BGS	70.5
WME-4	58.5' BGS	65.5

FEET OF WATER IN WELLS:

			WELL VOLUME
WME-1	= 4.1'	=	2.2 GAL
WME-2	= 6.8'	=	3.6 GAL
WME-3	= 11.2'	=	6.0 GAL
WME-4	= 7.0	=	3.8 GAL

WME-5
0810 ADD 2ND 10' 10-INCH CASING.
0815 3'-15': SAND w/ TRACE CLAY. FINE - V. FINE. LOOSE. DRY. 10% SOFT CLAY. REDDISH BROWN. STRONG. RXN TO 10% HCl.
0818 - CLEAN OUT w/ 8" CORE.

MONDAY JUNE 18, 2018
WME-5 (LTP SLIME)

0820 15'-18': SAME AS ABOVE.
18'-25': CLAY. MED STIFF-SOFT
SLIGHTLY MOIST. TRACE
V. FINE SAND. GREENISH-
GRAY. MED. RXN TO 10% HCl.
0835 25'-35': CLAY. MED STIFF. MOIST
MED-DARK GRAY. MOD.
RXN TO 10% HCl.
NO SULFUR SMELL.
0900 35'-45': SAME AS ABOVE. WET!
SLIGHT ORGANIC SULFUR
SMELL. SLIGHT-NO RXN
w/ 10% HCl.
0905 ADVANCE 10-INCH CASING.
0908 CLEAN OUT TO 45' w/ 8" CORE
0930 NO CUTTINGS 45'-55'.
TAG HOLE @ 88'.. HOLE NOT
STAYING OPEN.
ADD "HULA SKIRT" TO AUGER BIT.
0945 - NO RETURNS.
PREPARE TO ADVANCE
10-INCH CASING.
*FIRST FORMATIONAL ISSUES.

MONDAY JUNE 18, 2018
WME-5 (LTP SLIME)

1010 45'-65': CLAY w/ TRACE
SAND. MED. STIFF-SOFT.
~~MED~~ DARK GRAY. WET.
NO-SLIGHT RXN TO 10% HCl.

1030 COLLECT WME-5 @ 75'
COLLECT COLUMN
70'-74'
SAME AS ABOVE.

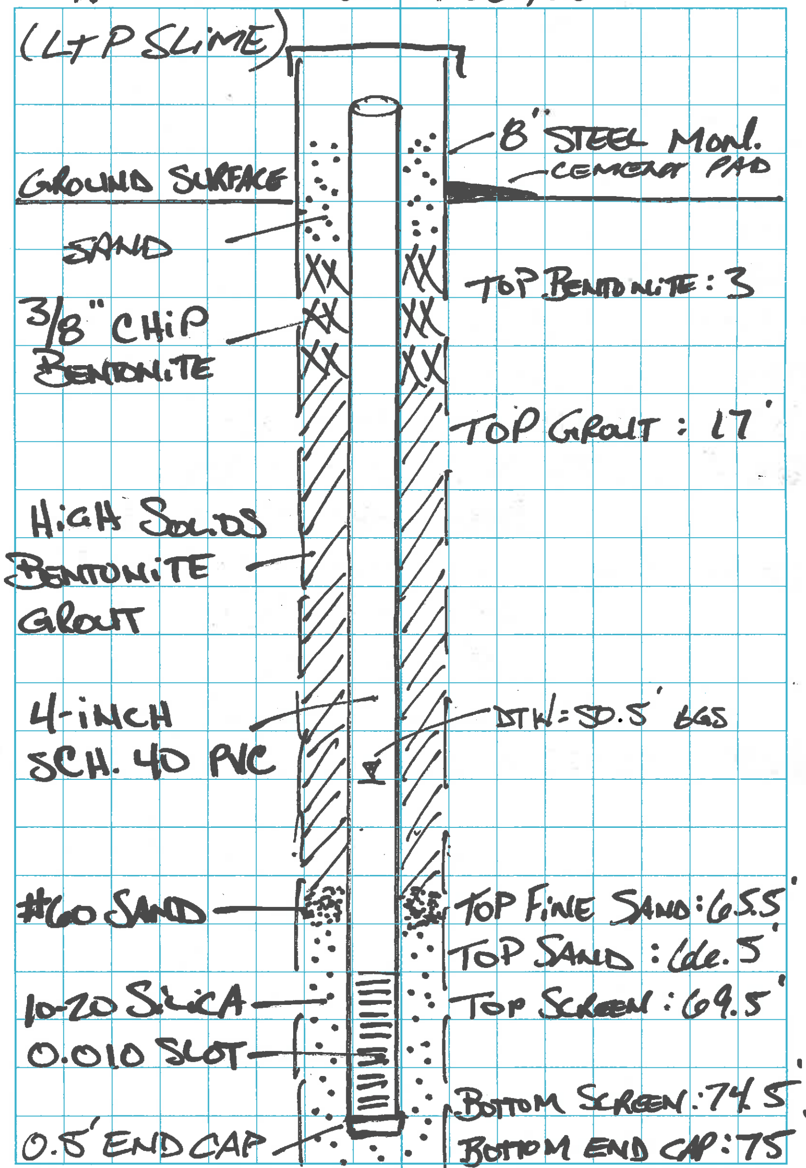
1035 PURGE COLUMN w/ N.
1110 BREAK FOR LUNCH
1200 RETURN TO WME-5.
1210 HOLE COLLAPSED TO 57'
1215 ADVANCE 10" CASING.
1300 HOLE CLEAN TO 75'
INSTALL PVC.
WME-5 PVC COUNT
5' SLOT SCREEN : 1
10' BLANK : 卌 IIII
1315 PVC IN TO ~~75~~ BGS.
74.5'

MONDAY JUNE 18, 2018
WME-5 + WME-6

1320 INSTALL SAND PACK.
1345 SAND TO 71.5' BGS
FINE SAND TO 70.5'
1350 GROUT HOLE.
1500 GROUT TO 17' BGS.
1504 MOBILIZE TO WME-6.
1600 @ WME-6.
1640 SPUD IN WME-6
1645 0-3': CLAY. STIFF / HARD.
DRY. MED. REDDISH BROWN.
1655 3'-10': SAND. LOOSE. V. FINE - FINE.
DRY. NO CLAY. STRONG.
RXN TO 10% HCl.
LIGHT BROWN.
1730 LEAVE SITE

RN

WME-5 COMPLETION



TUESDAY JUNE 19, 2018
HOMESTAKE GEOCHEM WELLS
WME-6 (LTP SLIME)

0525 ARRIVE @ SITE
0535 SAFETY TALK & DAILY TASKS
0600 @ WME-6
0625 10'-15': SAME AS ABOVE
0635 15'-20': SAME AS ABOVE.
(*) 20'-35': CLAY. NO SAND.
MED. DENSE - SOFT.
MOTTLED w/ BLACK
STRINGERS. MED-DARK
GRAY. NONE-MILD RXN
w/ 10% HCl. SULFUR
SMELL. MOIST.
0650 35'-45': CLAY w/ ~~TRACE~~ SOME SAND.
MED DENSE. V. FINE
SAND 10%. NO STRINGERS.
MED GRAY. WET!
NO SULFUR SMELL.
STRONG RXN TO 10% HCl.

0730 COLLECT WME-6
SAMPLE @ 65'

TUESDAY JUNE 19, 2018
WME-6 (LTP SLIME)

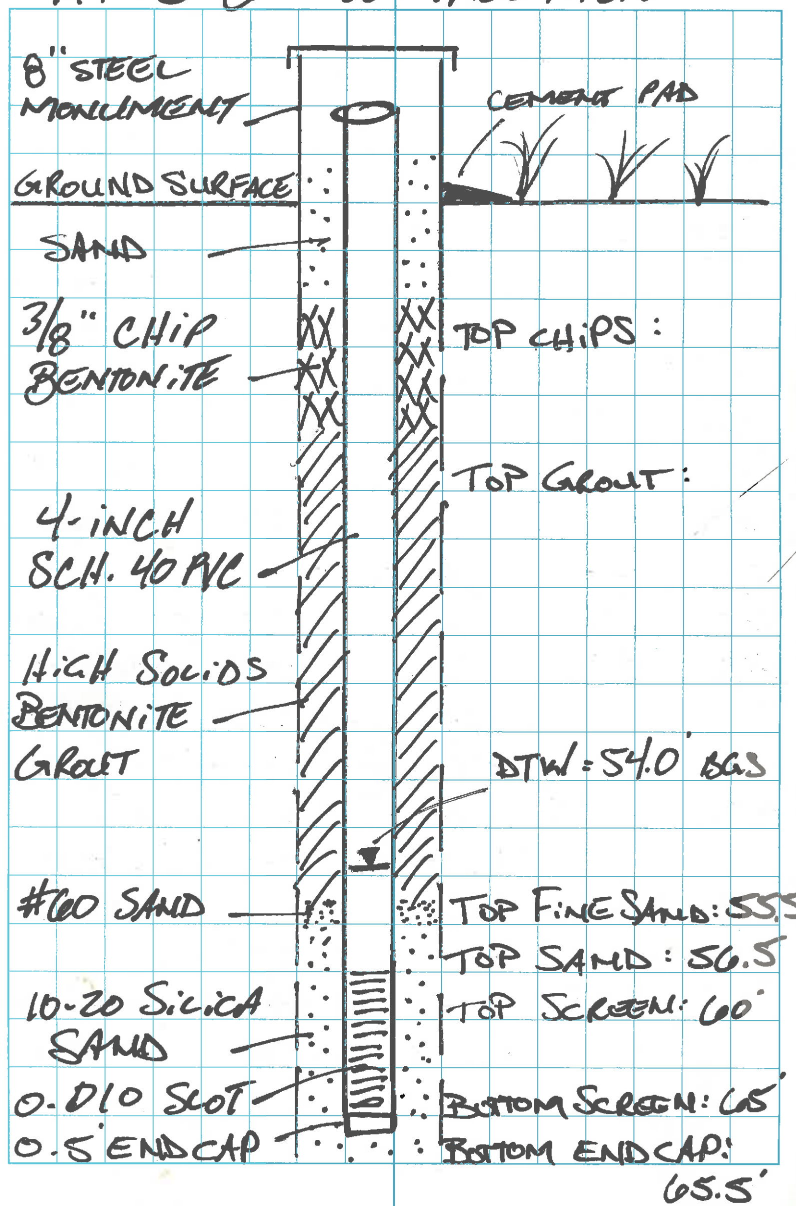
0730 FILL COLUMN #6
60'-64' BGS.

35'
45'-55': SAME AS ABOVE.
55'-65': SILTY CLAY. MED
DENSE - DENSE.
30-40% SILT.
MED. GRAY. THIN
BEDDING. NO SULFUR.
WET.
0750 MEASURE WATER IN
HOLE @ 44' BGS.
PREPARE TO SET WELL
@ 65'
0800 LOCATE WME-9 & WME-10
ON SMALL TAILINGS PILE
0840 PVC COUNT - WME-6
5' SLOT SCREEN: I
10' BLANK: IIII I
0845 WELL SET @ 65'
0850 DEVELOPER ON SITE.

TUESDAY JUNE 19, 2018
WME-6 (LTP SLIME)

0930 SAND UP TO 56.5' BGS.
0935 FINE SAND UP TO 55.5' BGS.
0938 PREPARE TO MIX GROUT.
1100 GROUT IN TO 15' BGS
PREPARE TO MOBILIZE TO WME-9.
1130 LUNCH BREAK - SCAN OUT
1220 RETURN TO LTP.
1250 MOBILIZE TO STP/WME-9
1310 FILL WATER TRUCK.
1350 SET UP ON WME-9 (STP)
1410 0-3': CLAY. STIFF/HARD DRY. MASSIVE. MED. REDDISH BROWN.
1420 3-15': SILTY CLAY. DRY MED. STIFF. 40% SILT. REDDISH BROWN. STRONG RXN TO 10% HCl.
15-20': CLAY. MOIST. STIFF DARK GRAY - BLACK. SULFUR SMELL STRONG RXN TO 10% HCl.

WME-6 COMPLETION



TUESDAY JUNE 19, 2018
WME-9 (STP SAND)

1445 20'-30': SILTY SAND w/ TRACE CLAY. DRY. LOOSE. V. FINE - FINE SAND. 30% SILT 10% CLAY. LIGHT BROWN. STRONG RXN TO 10% HCl.

1445 COLLECT WME-9 FROM 30'

1530 30'-40': SAND. LOOSE. POORLY SORTED. FINE-COARSE. STRONG RXN TO 10% HCl. NO CLAY. YELLOWISH BROWN.

40-45': SILTY SAND w/ SOME CLAY. LOOSE. WELL SORTED. FINE - VERY FINE. SLIGHT MOISTURE. STRONG RXN TO 10% HCl. BROWNISH RED!

1600 45-48': SAME.

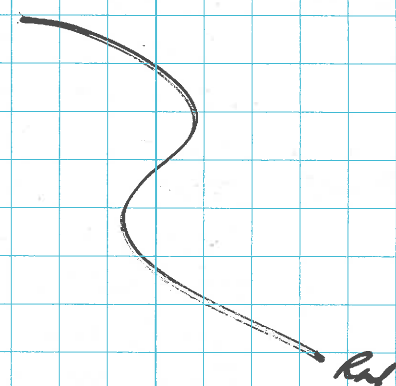
1620 48'-55' SAME AS ABOVE.

1645 55-57': CLAYEY SAND. MED STIFF-STIFF. V. FINE - FINE. LOOSE. STRONG RXN TO 10% HCl. BROWNISH RED. WET!

TUESDAY JUNE 19. 2018
MWE-9 (STP SAND)

1645 57'-60': GRAVELLY SAND. LOOSE. V. FINE - V. COARSE. 1/4" GRAVEL WELL ROUNDED. POORLY SORTED. ~~YELLOWISH~~ REDDISH BROWN. WET.

1710 LEAVE SITE



WEDNESDAY JUNE 20, 2018
GEOCHEM WELL INSTALLATION.
WME-9 (STP SAND)

0525 ON SITE
0535 SAFETY TALK
- UNSECURE LOADS
- LIFT ASSIST.
- TAILINGS CONTAINMENT.

0600 @ WME-6
DTW = 54.0' BGS.
T.D. = 65.5' BGS.
SAT. WT. = 11.5'
WELL VOLUME = 6.21 GALLONS.

0630 WME-9

60-65': SAME AS ABOVE. w/ SOME CLAY 20%
0650 65-72': GRAVELLY SAND w/ CLAY AND COBBLES. LOOSE. VERY POORLY SORTED. ROUNDED GRAVEL & COBBLES UP TO 3" DIA. BROWNISH RED. WET!

WEDNESDAY JUNE 20, 2018
WME-9 & WME-10

0653 ADD 10" CASING. TO 65'
0750 CASING TO 71'.
HOLE OPEN TO 71.5'
PREPARE TO SET WELL

WME-9 PVC COUNT
5' SLOT SCREEN : 1
10' BLANK : ~~||||~~ ||

0800 SCREEN/WELL SET TO 71.5'
0910 SAND TO 64' BGS
0913 FINE #60 SAND TO 63'
1040 GROUT UP TO 16' BGS.
MOBILIZE TO WME-10
1055 @ WME-10
(STP SLIME)
1115 LUNCH BREAK
1210 WME-9
DTW = 32.0' BGS.
* POSSIBLE INJECTION ISSUES.
← SEE WATER LEVEL 6-21-2018

WEDNESDAY JUNE 20, 2018

WME-10 (STP SLIME)

1220 SPUD IN WME-10.

1225 0'-3': CLAY. STIFF/HARD. DRY. MASSIVE. REDDISH BROWN.

1240 3'-15' SANDY CLAY. HARD/DENSE. DRY. 30% V. FINE SAND. MOSTLY BROWNISH RED. SOME INTERBEDDED GRAY/BLACK SANDS. STRONG RXN W 10% HCl.

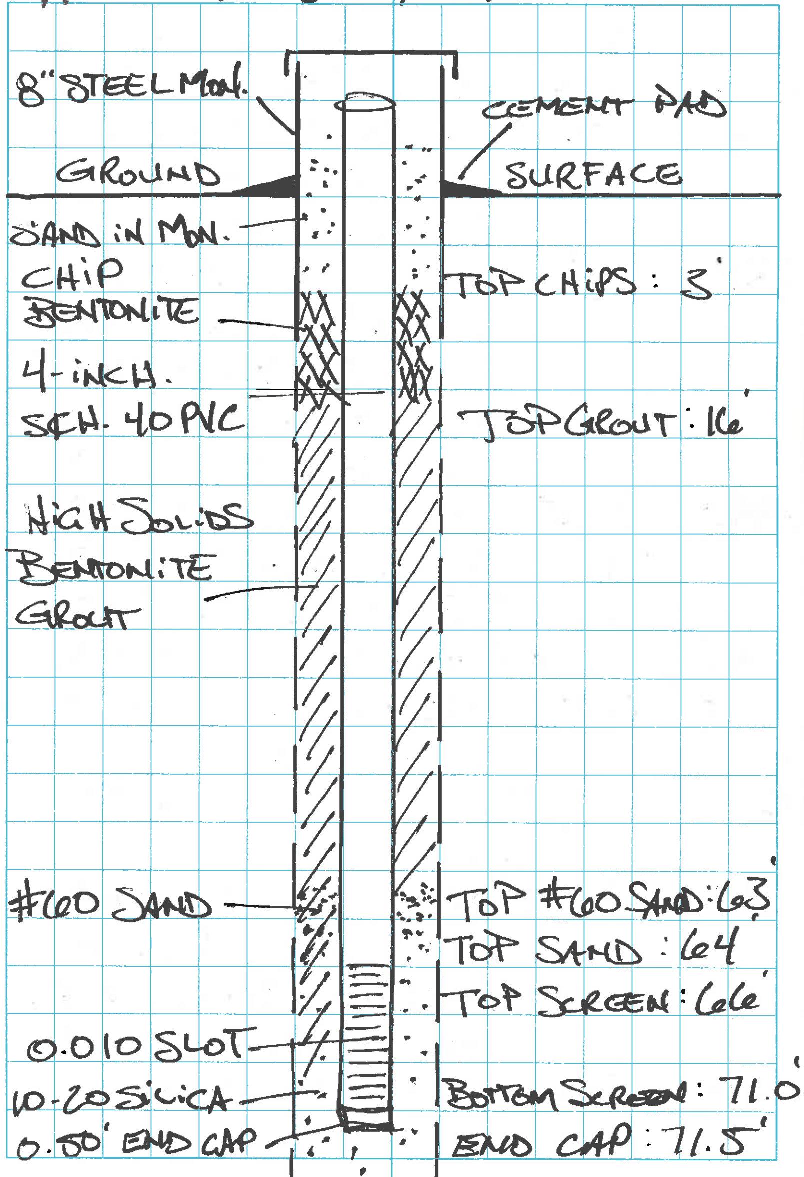
1250 15'-35' SANDY CLAY. DENSE/STIFF SLIGHT MOISTURE. 30-40% V. FINE SAND. VERY THIN BEDDING STRUCTURE. GRAYS, BLACK, LIGHT GRAY TAN/BROWN.

1250 COLLECT SAMPLE WME-10 FROM 35'.

1315 35'-45': SAND. LOOSE. WELL SORTED V. FINE - FINE. V. SLIGHT MOISTURE. BROWNISH RED. STRONG RXN TO 10% HCl.

1345 45-55': SAME AS ABOVE.

WME-9 COMPLETION



WEDNESDAY JUNE 20, 2018
WME-10 (STP SLIME)

1405 55'-60': SAME AS ABOVE
60'-65': ALLUVIUM.
GRAVELLY SAND w/ TRACE CLAY. LOOSE. WET. POORLY SORTED WELL ROUNDED. 10% CLAY. GRAVEL UP TO 1/4" DIA. REDDISH BROWN.

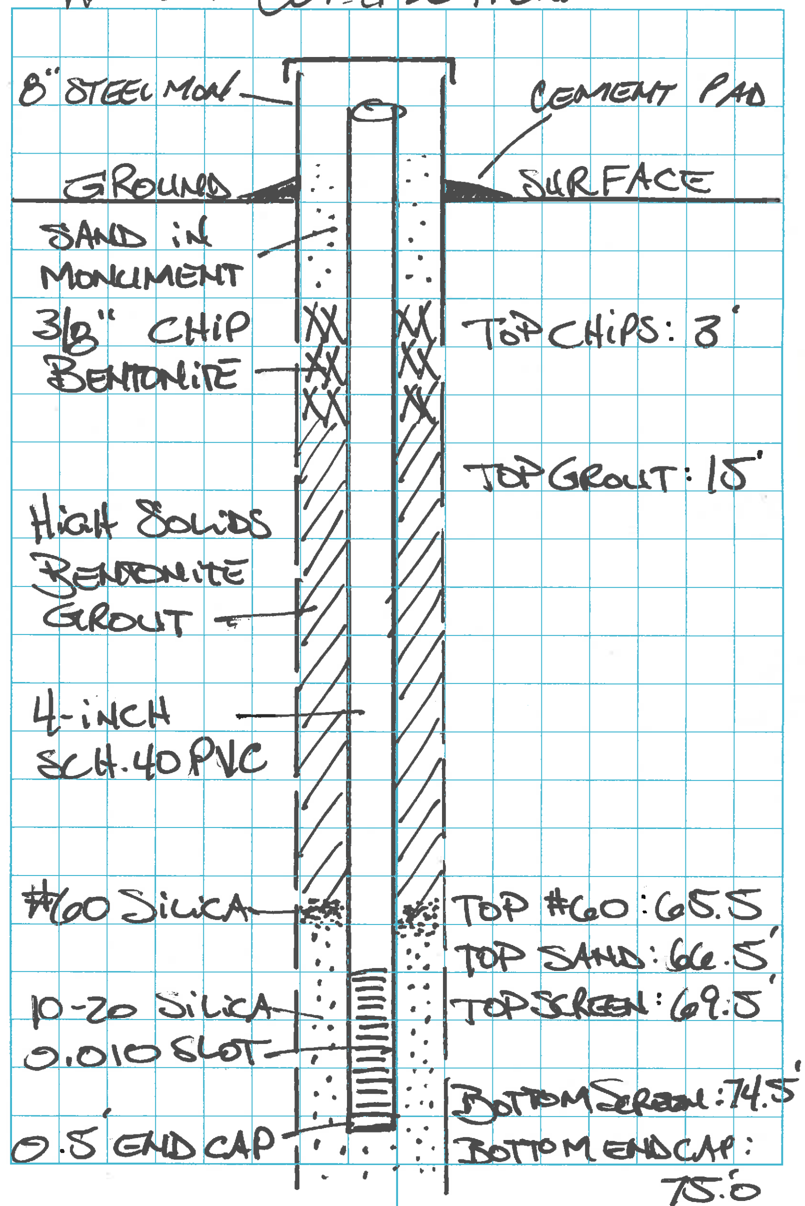
1430 65'-75': SAME AS ABOVE.
~~PREPARE TO SET WELL~~
CLEAN HOLE TO 75'.

1600 HOLE CLEAN.

1630 LEAVE SITE

KM

WME-10 COMPLETION



THURSDAY JUNE 21, 2018
HOMESTAKE GEOCHEM WELLS
WME-10

0530 ARRIVE @ SITE
0540 SAFETY TALK & OPS.
- COMPLETE WME-10
- MOB TO WME-7
- DEVELOP WME-2
- DEVELOP & SAMPLE WME-3 & 4
0605 @ WME-10
0630 WME-10 PVC COUNT
5' SLOT : 1
10' BLANK : 卌 11

0640 WME-9 DTW = 51.4' BGS.
0645 RECON WME-11 - 17
0830 ALL LOCATIONS IDENTIFIED
· KEY FOR #11 ON WALL
· DRILL #17 ON WEEKEND.
· NEED ACCESS FOR #15.
0845 10-20 SILICA UP TO
66.5' BGS
T.D. = 75' BGS
BOTTOM SCREEN = 74.5' BGS

THURSDAY JUNE 21, 2018
WME-7 (LTP ALLUVIAL BORING).
THROUGH SANDS
1030 MAST UP ON WME-7.
1045 SPUD IN WME-7.
8-INCH CASING
w/ 6-INCH CORE.
SAMPLE INTERVALS
- PERCHED ALLUVIUM
82'-105'
- VADOSE ALLUVIUM
105'-119'

1115 @ 35'. BREAK FOR LUNCH
1120 - PICK UP CHRIS (DEV.)
WME-3 SAMPLE
COLLECTED. TAKE TO
LAB TO ALLOW TO
SETTLE.
1215 @ WME-4 DEVELOPMENT.
1320 WME-7 @ 55' - TAILINGS
1335 WME-7 @ 65' - TAILINGS.
1355 @ 75' - TAILINGS.
START TO BAG > 75'.
FOR LOGGING / SAMPLES.

THURSDAY JUNE 21, 2018
WME-7

1430 @ 85' - TAILINGS.
1520 CLEAN OUT TO 85'
8" CASING TO 85'.
1620 COLUMN 3 FILLED
w/ 1.5 GALLONS WATER.
pH = 9.63
SC = 3880
TEMP = 16.1

FRIDAY JUNE 22, 2018
HOMESTAKE GEOCHEM BORINGS.
WME-7

0530 ARRIVE @ SITE
0535 SAFETY MEETING.
0600 PREPARE SAMPLES FOR SHIPPING.
0620 @ WME-4
DTW = 58.60 T.O.C.
TD = 67.63 T.O.C.
640 COLLECT SAMPLE FOR WME-4 COLUMN.
pH = 10.06
EC = 26,220 mS/cm
TEMP = 14.6 °C
6 GALLONS PURGED.
PURGED DRY.
0700 WME-5
DTW = 71.65' T.O.C
T.D. = 77.0' T.O.C.

0800 WME-4 COLUMN FILLED.
~~2.75~~ GALLONS.
3.50

FRIDAY JUNE 22, 2018
WMIE-7

75'-85': SAND. LOOSE.
FINE - V. FINE.
TAILINGS → MASSIVE BEDDING.
WET. MED. DARK
GRAY. MOD. HCl RXN.

85'-86': CLAY. DENSE. HARD.
NATIVE → MOTTLED. ROOT
STRONG HCl → MATERIAL. LIGHT TO
V. DARK BROWN. DRY.

86'-88': SAND. SOFT-LOOSE.
VERY WELL SORTED.
MOD HCl RXN → FINE SAND. DRY.
LIGHT - DARK GRAY.

88'-98': SAND. SOFT-LOOSE.
VERY WELL SORTED.
FINE. DRY. MOTTLED/
NO-WEAK HCl RXN → IRON STAINING.
LIGHT YELLOWISH BROWN
w/ ORANGE - RED
STAINING.

FRIDAY JUNE 22, 2018
WMIE-7

98'-99': SAND. LOOSE. VERY WELL
SORTED. FINE. NO STAINING.
STRONG HCl → MEDIUM BROWN. WET.

99'-105': SAND. SOFT-LOOSE.
WELL SORTED. FINE.
IRON STAINING AND
MOTTLING. LIGHT BROWN
STRONG HCl → w/ ORANGE STAINING.
WET.

105'-109': SAND. LOOSE. VERY WELL
SORTED. FINE. NO STAIN.
MEDIUM BROWN. WET.
STRONG HCl RXN → (SAMPLE @ 108')
PERCHED ZONE

109-113': CLAY. V. DENSE. SLIGHT
MOISTURE. BROWNISH
RED. STRONG HCl RXN
116' (CONFINING LAYER)

113'-~~116~~: SAND. LOOSE. V. WELL SORTED.
FINE. MED. BROWN. NO
STAIN. DRY. STRONG HCl RXN.

FRIDAY JUNE 22, 2018
WME-7 (LTP SAND BORING)
WME-8 (LTP SLIME BORING).

116'-120': SAME AS ABOVE.
- WET

0845 GROUT WME-7
1010 MAST UP ON WME-8
1130 LUNCH BREAK @ 35'
1220 RELINQUISH SAMPLES COLLECTED TO DATE TO CHUCK FARR. - WILL SHIP.
1240 RESUME DRILLING WME-8
1440 @105' - COLLECT CORE FROM 85'
1530 @120' - COLLECT CORE FROM 105'
1420 @140' - COLLECT CORE FROM 120'

85'-87': TAILINGS: SANDY CLAY. MED DENSE. V. FINE SAND 20-30%. MEDIUM GRAY. WET. MODERATE RXN TO 10% HCl.

87'-90' TRANSITION ZONE. SAND w/ SOME TAILINGS CLAY. FINE SAND LOOSE. MEDIUM BROWN w/ GRAY CLAY STRINGERS. STRONG HCl RXN.

FRIDAY JUNE 22, 2018
WME-8

90'-92': NATIVE SAND. NO TAILINGS. FINE-MED SAND. LOOSE. WET. MED. BROWN. STRONG HCl RXN.

92'-95': NATIVE CLAY. HARD. DENSE. DRY. MOTTLED. GRAYS-BLACK. STRONG HCl RXN.

95'-98': SAND. SOFT-LOOSE. VERY WELL SORTED. FINE. DRY. LIGHT TO DARK GRAY. MODERATE HCl RXN.

98-105 SAND. SOFT-LOOSE. VERY WELL SORTED FINE SAND. MOTTLED. IRON STAINING ORANGE → RED. MODERATE BROWN. NO RXN TO 10% HCl. DRY.

105-110' ; SAME AS ABOVE. WET. STRONG HCl RXN. COLLECT WME8 @ 110'

111-121: CLAY. STIFF/HARD. MOIST. HCl RXN.

121-123: SAND. LOOSE. FINE. DRY. COLLECT WME-8 @ 121'

123-130 - SAME AS ABOVE. WET.

SATURDAY JUNE 23, 2018
HOMESTAKE GEOCHEM BORINGS.

0530 ARRIVE @ SITE
0535 SAFETY MEETING.
- GROUT WME-8
- MOBILIZE TO DECON PAD
- GET SCANNED OUT.
- COLLECT SAMPLE @ #6
0555 PREPARE TO GROUT #8
@ WME-6
DTW = 55.7' T.O.C.
PURGED DRY 6-22-2018
@ 17:00
0610 COLLECT SAMPLE FOR
(*) WME-6 COLUMN. (*)
0650 WME-6 FILL - 3.75 GALLONS
0730 MOBILIZE TO DECON PAD.
0800 @ DECON PAD.
1045 DEVELOPER RIG CLEARED
TO LEAVE.
1140 DRILL RIG & WATER TRUCK
CLEARED TO MOVE TO
ALLUVIAL BORINGS.
1200 TOWER UP ON WME-17
* IN ROAD SOUTH OF LTP.

SATURDAY JUNE 23, 2018
WME-17 (ALLUVIAL BORING)
1300 @ 25' GRAVELLY SAND. DRY.
YELLOWISH BROWN.
1310 @ 35'. SAND w/ TRACE CLAY.
MOIST. REDDISH BROWN.
1330 @ 40': SAND. LOOSE. FINE.
DRY. VERY LIGHT BROWN.
1355 @ 55. SAND w/ ~~[illegible]~~ TRACE CLAY.
STRONG RXN LOOSE. WELL SORTED.
TO HCl → FINE. WET MOD.
REDDISH BROWN. → BROWN.
1400 COLLECT WME-17 @
55'.
NOTE: DENSE RED CLAY
LAYER @ 48-52'.
1402 - MOBILIZE TO WME-16
1440 MAST UP ON WME-16
TARGET = 60'-65'
1500 TAKE 24-HOUR SAMPLE
ON WME-4.
pH = 9.97

* TAKE WME-6 24-HOUR
TOMORROW A.M.

SATURDAY JUNE 23, 2018
WME-16

1515 @ 35': SAND. LOOSE. DRY.
LIGHT BROWN.
DENSE CLAY ABOVE ~30'.
SLIGHT. MOIST.
1550 55': SAND. LOOSE. FINE-MED.
LIGHT BROWN WET.
1600 65' SAME AS ABOVE.
COLLECT WME-16
@ 65'
1630 LEAVE SITE.

RN

SUNDAY JUNE 24, 2018
HOMESTAKE GEOCHEM ALLUVIAL
BORINGS.
WME-14

0530 ARRIVE @ SITE.
0535 SAFETY & OPS MEETING.
2-MAN CREW.
MOB. TO 14 & 15.
0645 @ WME-14.
0700 COLLECT SAMPLE FROM
COLUMN #6. (24-HOUR)
pH = 10.19
0730 @ 5' WME-14.
SAND. LOOSE. FINE. DRY.
VERY LIGHT BROWN / CREAM.
0745 NO RETURNS 5'-15'.
0800 - DRY @ 25' SAND. LOOSE.
0805 - MOIST @ 35' CLAY @ ~30'
0818 - COLLECT WME-14 FROM
0820 45'. WET. ~~SA~~
GRAVELLY SAND w/ CLAY.
STRONG RXN TO HCl.
LIGHT BROWNISH GRAY.

SUNDAY JUNE 24, 2018
WME-15

0900 @ WME-15.
ESTIMATED DEPTH TO G.W.
= 31'
ESTIMATE SAMPLE INT. = 40'-45'
0935 @ 18': SAND w/ TRACE GRAVEL
FINE - V. FINE SAND.
<10% GRAVEL. DRY.
0950 @ 28': SAND w/ TRACE CLAY.
SLIGHTLY MOIST.
1000 @ 35': SAME AS ABOVE. DRY.
1035 @ 55': SAND w/ TRACE OF CLAY.
REDDISH BROWN. FINE SAND
WET. WATER @ 45'
1100 @ 60': CLAY. HARD. SLIGHTLY
MOIST. BOTTOM OF SATURATION.
COLLECT SAMPLE FROM 55'
SAND w/ TRACE CLAY. LOOSE.
POORLY SORTED. FINE-COARSE.
STIFF CLAY LENSES. <10%
STRONG RXN TO HCL
1105 PREPARE TO GROUT HOLE.
1230 HOLE GROUTED AS PER
PLUGGING PLAN.

SUNDAY JUNE 24, 2018
WME-13

1230 PULL REMAINING CASING.
1240 PREPARE TO MOBILIZE
TO WME-13.
1320 MAST UP ON MWE-13
PROJECTED DTW = 69' BGS
PROJECTED SAMPLE DEPTH = 78'.
1415 @ 35'. DRY LOOSE FINE SAND.
HOLE COLLAPSING. MIX GEL
SLURRY TO IMPROVE BOREHOLE
STABILITY.
NOTE: DRY, LOOSE, FINE DRY
SAND IS WORST CONDITIONS
FOR SONIC DRILLING.
1445 @ 47': SAND. LOOSE. DRY.
1500 @ 55': LOOSE DRY SAND.
1525 @ 57': VERY HARD DRILLING.
1545 VOLCANIC BEDROCK @
57' BGS.
CALL DAVID LEVY.
- DECIDE TO ABANDONE HOLE
AND MOVE TO #12.
- COLLECT SAMPLE OF BEDROCK
FROM 57'.

MONDAY JUNE 25, 2018
HOMESTAKE GEOCHEM BORINGS.
WME-12

0530 ARRIVE @ SITE.
0535 SAFETY & OPS.
- TEMP WORKER FOR CASCADE MUST BE ESCORTED AT ALL TIMES.
- MOB TO WME-12.
- DECON AFTER #11.
0550 @ WME-13.
- PULL CASING & ABANDON HOLE.
0635 MOBILIZE TO WME-12
0650 TOWER UP ON WME-12.
* PREDICTED DTW = 65'
* SAMPLE @ 75'-85',
* SAT. THICKNESS = 35'
0845 BEDROCK @ 25'.
MOVE FURTHER EAST.
0930 RIG @ NEW WME-12.
1005 BEDROCK @ 20' BGS
1010 CONSULT DAVE LEVY & ADAM @ HOMESTAKE.
1030 ADAM ON SITE

MONDAY JUNE 25. 2018
WME-11

1035 : ADAM CONFIRMS THAT ALLUVIAL AQUIFER IS BELOW 30'-50' OF LAVA FLOWS IN WME-12 + WME-13 AREA. SONIC CANNOT PENETRATE. MOVE ON TO WME-11
1100 @ WME-11.
- TARGET 65'
1115 @ WME-5.
COLLECT SAMPLE FOR COLUMN #5.
pH = 10.44
1200 COLUMN #5 FULL.
4.0 GALLONS OF WATER.
1215 WME-11
@55'. WET. SAND. LOOSE. MED. BROWN.
1230 WME-11
@65'. SAND w/ GRAVEL. LOOSE. POORLY SORTED. FINE-COARSE. 10% GRAVEL. STRONG HCl. RXN. MED. BROWN w/ BLACK.

WELL I.D.	D.T.W. (T.O.C)	T.D. (T.O.C)	SAT. THICK.	WELL VOLUME
WME-1	53.45	57.30	3.85	2.51
WME-2	57.25	64.60'	7.35	4.8
WME-3	61.30	72.65	11.35	7.41
WME-4	57.49	67.60	10.11	6.60
WME-5	66.98	77.32	10.34	6.75
WME-6	54.95	67.25	12.30	8.0
WME-9	58.50	73.30	13.80	9.0
WME-10	58.90	76.70	17.80	11.6

* MEASURED JUNE 25, 2018

MONDAY JUNE 25, 2018

HOMESTAKE GEOCHEM WELLS & BORINGS.

1250 FINAL CHECK LIST:

- ✓ EXIT BIO ASSAY
- ✓ BADGE BOOK RETURNED. & BADGE.
- ✓ COLUMN #5 FILLED.
- ✓ ALL COLUMNS FILLED & SECURE.
- ✓ WATER LEVEL METER RETURNED.
- ✓ SCALE RETURNED.
- ✓ COC COMPLETE.
- ✓ SAMPLES READY FOR SHIPPING.
- ✓ BARBRA GALLEGOS WILL SAMPLE #5 6/26/2018.
- ✓ BADGE RETURNED
- ✓ FINAL WATER LEVELS + TD's.
- ✓ 7 & 8 CUTTINGS WILL BE PICKED UP BY BILLY.
- ✓ NITROGEN RETURNED * KEEP REGULATOR!
- ✓ #4 & #6 SAMPLES GIVEN TO BARBRA.

- EMAIL CHUCK FARR = SAMPLE PICK UP.

Appendix C

Photos

PICTURE DESCRIPTORS:
Location (ID or description):
WME-1 on LTP

Date:
June 14, 2018

Details or Comments:
Tailings Sands from WME-1. Dry tailings are on the bottom with wet tailings on top.
45'-55'
Sand with Some Clay. 10%-20%. Loose. Well Sorted. Fine Sand. Stiff Clay. Weak Reaction to 10% HCl. Moist to Wet. Medium to Dark Gray.

Photo 1. LTP Tailings Sands from WME-1

PICTURE DESCRIPTORS:
Location (ID or description):
WME-2 on LTP

Date:
June 15, 2018

Details or Comments:
Tailings Sands from WME-2.
45'-55'
Sand with Some Clay. <20%. Loose. Well Sorted. Fine Sand. Some Clay Stringers. Weak to No Reaction to 10% HCL. Moist to Wet. Medium Gray.

Photo 2. LTP Tailings Sands from WME-2

PICTURE DESCRIPTORS:
Location (ID or description):
WME-4 on LTP

Date:
June 17, 2018

Details or Comments:
Tailings Slimes from WME-4.
45'-55'
Clay. Medium Stiff to Stiff. Thin Laminations. No Sand. Moist to Wet. Medium to Dark Gray.. Strong Reaction to 10% HCl. Sulfur Smell.

Photo 3. LTP Tailings Slimes from WME-4

PICTURE DESCRIPTORS:
Location (ID or description):
WME-4 on LTP

Date:
June 17, 2017

Details or Comments:
Filling Column 4 with undisturbed 8-inch diameter core of Tailings Slimes from WME-4.

Photo 4. Filling Column 4 with LTP Tailings Slimes

PICTURE DESCRIPTORS:
Location (ID or description):
WME-5 on LTP

Date:
June 18, 2018

Details or Comments:
Tailings Slimes from WME-5
65'-75'
Clay with Trace Sand. <10%.
Medium Stiff to Soft. Wet. Medium Dark Gray. Mild Reaction to 10% HCl.

Photo 5. LTP Tailings Slimes from WME-5

PICTURE DESCRIPTORS:
Location (ID or description):
WME-9 on STP

Date:
June 20, 2018

Details or Comments:
Tailings Sands from WME-9 on STP.
30'
Silty Sand with Trace of Clay.
Loose. Very Fine to Fine Sand.
30% Silt. 10% Clay. Light Brown.
Strong Reaction to 10% HCl.

Photo 6. STP Tailings Sands from WME-9

PICTURE DESCRIPTORS:
Location (ID or description):
WME-10 on STP

Date:
June 20, 2018

Details or Comments:
Tailings Slimes from WME-10
35'
Sandy Clay. Hard. Dense. Stiff. Slight Moisture. 30% Very Fine Sand. Very Thin Bedding. Grays. Light Brown. Black. Strong Reaction to 10% HCl.

Photo 7. STP Tailings Slimes from WME-10

PICTURE DESCRIPTORS:
Location (ID or description):
[Click here to add location]

Date:
June 22, 2018

Details or Comments:
Left to Right. Top to Bottom.
75'-85': Tailings Sands
85'-86': Clay. Dense. Mottled. Roots.
86'-88': Native Sand. Loose. Dry.
88'-98': Sand. Mottled. Stain. Dry.
98'-109': "Perched Alluvium" Sand. Stain. Wet.
109'-113': Clay. Stiff.
113'-116': "Vadose Alluvium" Sand. Loose. Fine. Dry.
116'-120': Sand. Loose. Fine. Wet.

Photo 8. Boring WME-7 Alluvial Material Below LTP

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-7 on LTP

Date:
June 22,2018

Details or Comments:
98'-105'
Perched Alluvium
Fine Sand. Loose. Very Well Sorted. Iron Staining and Mottling. Light Brown with Orange Stain. Wet. Strong Reaction to 10% HCl.

Photo 9. Perched Alluvium Below LTP from WME-7

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-7 on LTP

Date:
June 22, 2018

Details or Comments:
109'-113'
Confining Layer.
Clay. Very Stiff. Slight Moisture. Brownish Red. Strong Reaction to 10% HCl.

113'-114'
Vadose Alluvium.
Sand. Loose. Very Well Sorted. Fine Sand. Medium Brown. No Stain. Dry. Strong Reaction to 10% HCl.

Photo 10. Vadose Alluvium Below LTP from WME-7

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-8 on LTP

Date:
June 23, 2018

Details or Comments:
105'-111'
Perched Alluvium
Find Sand. Loose. Very Well Sorted. Mottled and Iron Staining. Orange to Red. Medium Brown. Wet. Strong Reaction to 10% HCl.

Photo 11. Perched Alluvium Below LTP from WME-8

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-8 on LTP

Date:
June 23, 2018

Details or Comments:
111'-121'
Confining Layer.
Clay. Very Stiff. Slight Moisture. Medium Brown. Strong Reaction to 10% HCl.

121'-123'
Vadose Alluvium.
Sand. Loose. Very Well Sorted. Fine Sand. Medium Brown. No Stain. Dry. Strong Reaction to 10% HCl.

Photo 12. Vadose Alluvium Below LTP from WME-8

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-13 @ 65’

Date:
June 25, 2018

Details or Comments:
WME-11 @ 65’
Sand with Some Gravel. Loose. Poorly Sorted. Fine to Very Coarse. 10% Gravel. Medium Brown with Black. Strong Reaction to 10% HCL.

Photo 13. **Alluvial Boring WME-11 @ 65’**

PICTURE DESCRIPTORS:
Location (ID or description):
Boring WME-13

Date:
June 25, 2018

Details or Comments:
Igneous Bedrock Encountered at 20’ in WME-13.
No Alluvial Sample was collected in WME-12 or WME-13 due to drilling refusal before groundwater was encountered.

Photo 14. **Bedrock Encountered @ 20’ in WME-13**

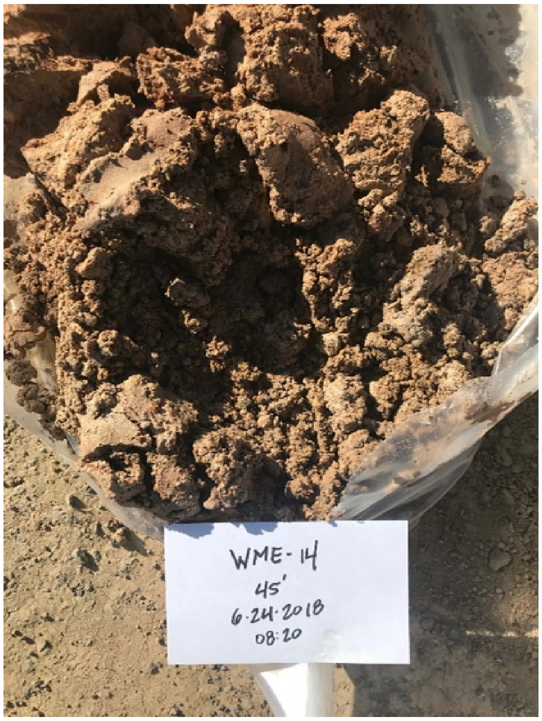


Photo 15. Alluvial Boring WME-14 @ 45’

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-14 @ 45’

Date:
June 24, 2018

Details or Comments:
WME-14 @ 45’
Gravelly Sand with Some Clay. Loose. Poorly Sorted. Fine to Very Coarse. 20% Gravel. <10% Clay. Light Brownish Gray. Strong Reaction to 10% HCl.

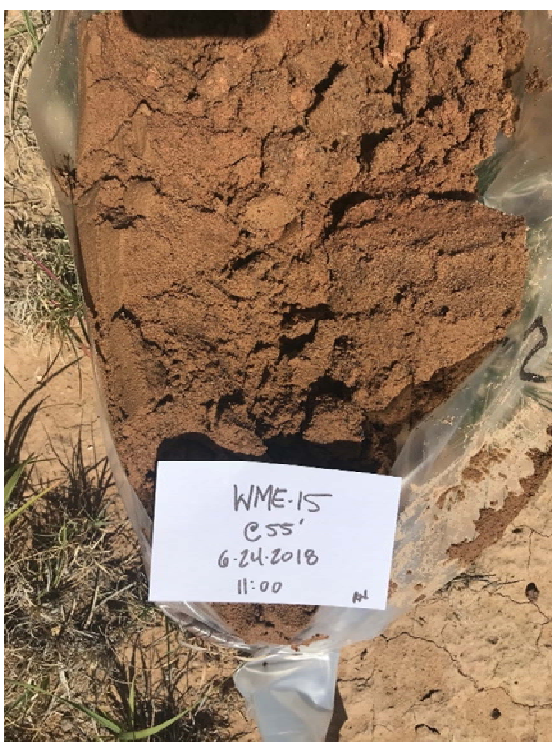


Photo 16. Alluvial Boring WME-15 @ 55’

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-15 @ 55’

Date:
June 24, 2018

Details or Comments:
WME-15 @ 55”
Sand with Trace of Clay. Loose. Very Well Sorted. Fine. Wet. Strong Reaction to 10% HCl.

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-16 @ 65’

Date:
June 23, 2018

Details or Comments:
WME-16 @ 65’
Sand. Loose. Fine to Medium. No Clay. Light Brown. Wet. Strong Reaction to 10% HCl.

Photo 17. Alluvial Boring WME-16 @ 65’

PICTURE DESCRIPTORS:
Location (ID or description):
Alluvial Boring WME-17 @ 55’

Date:
June 23, 2018

Details or Comments:
WME-17 @ 55’
Fine Sand with Trace of Clay. Loose. Very Well Sorted. Wet. Reddish Brown to Brown. Strong Reaction to 10% HCl.

Photo 18. Alluvial Boring WME-17 @ 55’

Attachment 2

Tailings and Alluvial Water Quality Data

Attachment 2: Tailings and Alluvial Water Quality Data.

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Location	Laboratory ID	Date	Temp	pH	Specific Conductivity	Dissolved Oxygen	Fe^{+2}	ORP	E_{ref}	Eh	pe	Alkalinity	CO_3	HCO_3	DOC	Cl	F	SO_4	Ca	Mg	K	Na	H_2S	NH_3-N	NO_3+NO_2 N	Al	Ba	Fe	Mn	Mo	P	Se	SiO_2	U	V
			°C	s.u.	µS/cm	mg/L	mg/L	mV	mV	mV		mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
WME-1	C18080853-001	8/21/2018	15.9	10.10	22493	2.38	<0.02	-71.8	242.8	171.0	2.9	3900	1610	1480	9.8	1680	3.0	8600	6.0	<1	20	7060	<0.04	0.10	2.02	0.570	<0.05	0.70	0.069	43.2	2.0	0.074	16.0	12.2	0.050
WME-1	C18100884-004	10/25/2018	13.1	10.02	211	7.44	<0.02	-128.8	246.5	117.7	2.0	3790	1560	1450	9.4	1710	3.0	8120	2.3	1.00	18	6100	<0.91	0.24	2.48	1.00	0.045	1.0	0.100	41.0	2.5	0.100	12.0	11	0.200
WME-1	C18120507-001	12/14/2018	11.3	9.96	162	6.70	<0.02	110.1	248.8	358.9	6.1	3700	1380	1700	7.8	1640	3.0	7810	11	0.40	17	6050	<0.45	0.090	1.94	<0.07	0.010	0.04	0.002	39.3	2.5	0.068	15.8	9.84	0.060
WME-1	C19020706-001	2/26/2019	12.0	10.34	180	7.51	-----	98.1	247.9	346.0	5.8	3630	1370	1640	-----	1620	5.0	7890	3.4	<1	18	5560	-----	0.090	2.74	0.020	0.012	0.060	0.040	37.5	2.4	0.054	10.0	9.76	<0.2
WME-1	C19040509-001	4/9/2019	13.1	10.26	342	5.55	-----	135.3	246.5	381.8	6.4	3570	1370	1570	-----	1610	8.0	7840	4.0	<1	16	5980	-----	0.060	2.09	<0.03	<0.05	0.060	0.003	39.8	2.3	0.046	11.0	10	<0.01
WME-1	C19060868-001	6/21/2019	17.6	10.28	10523	4.68		164.2	240.6	404.8	6.8	3500	1320	1580	-----	1630	7.0	7730	12	0.30	15	5440	-----	<0.05	2.37	0.050	0.013	0.090	0.003	37.4	1.9	0.043	14.0	8.38	0.020
WME-2	C18080853-002	8/21/2018	17.6	9.37	4972	6.04	0.090	-87.4	240.6	153.2	2.6	805	105	767	9.1	289	2.0	1570	5.0	2.0	6.00	1440	0.44	0.41	<0.01	0.210	0.030	0.30	0.032	5.81	0.50	0.005	10.0	0.465	0.020
WME-2	C1800884-005	10/25/2018	14.2	9.79	44	8.16	<0.02	-59.3	245.0	185.7	3.1	851	127	779	5.5	284	2.0	1500	4.9	2.0	7.5	1500	<0.91	0.78	<0.01	0.200	0.033	0.20	0.036	7.20	0.71	0.020	8.50	0.54	0.040
WME-2	C18120507-002	12/14/2018	13.7	9.87	5108	4.01	<0.02	-43.2	245.7	202.5	3.4	835	145	723	4.8	270	1.0	1480	6.0	1.0	5.00	1170	1.3	0.54	<0.01	0.040	0.024	0.040	0.022	5.35	0.50	0.006	9.60	0.536	0.0043
WME-2	C19020706-003	2/26/2019	12.9	10.16	4936	6.34	-----	6.7	246.7	253.4	4.3	814	151	686	-----	265	1.0	1440	7.0	0.86	6.00	1120	-----	0.90	0.01	0.060	0.023	0.050	0.016	5.25	0.40	0.003	10.4	0.518	<0.01
WME-2	C19040509-002	4/9/2019	13.8	10.15	1308	8.41	-----	15.3	245.6	260.9	4.4	806	153	672	-----	269	2.0	1520	3.0	<1	6.00	1220	-----	0.76	0.02	0.060	<0.05	0.040	0.008	5.21	0.40	0.007	7.80	0.611	<0.02
WME-2	C19060868-002	6/21/2019	16.7	9.99	70	4.80	-----	77.9	241.8	319.7	5.4	811	152	680	-----	274	1.0	1520	8.0	0.91	5.00	1110	-----	0.47	0.1	0.050	0.018	0.040	0.009	6.66	0.50	0.028	9.70	0.488	0.020
WME-2	C19120721-002	12/12/2019	13.1	10.30	4518	4.63	-----	-83.8	246.5	162.7	2.7	791	145	669	-----	275	1.0	1530	3.0	<1	7.00	1180	-----	0.49	0.12	0.070	0.019	0.060	0.004	4.94	0.40	0.183	9.00	0.496	0.070
WME-2	--------	2/20/2020	11.9	9.84	43	5.08	--------	163.9	248.0	411.9	7.0	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
WME-3	C18080853-003	8/21/2018	17.7	9.83	5831	4.13	<0.02	-35.6	240.5	204.9	3.5	1510	423	978	12.8	192	2.0	1540	2.0	0.60	12	1500	0.24	0.33	<0.01	0.100	0.020	0.30	0.006	4.48	1.1	0.006	8.00	1.45	0.010
WME-3	C18100884-001	10/25/2018	17.9	10.14	47	8.48	<0.02	7.9	240.2	248.1	4.2	1530	453	947	6.3	182	2.0	1470	1.2	0.44	6.8	1400	<0.91	0.73	<0.01	0.200	0.024	0.20	0.020	4.70	2.2	0.02	6.60	1.6	0.040
WME-3	C18120507-003	12/14/2018	14.4	10.31	5211	5.54	<0.02	12.6	244.8	257.4	4.3	1310	440	700	5.3	149	2.0	1260	3.0	0.32	6.0	1260	0.47	0.51	<0.01	0.070	0.017	0.090	0.004	4.45	1.2	0.012	6.70	1.52	0.020
WME-3	C19020706-006	2/26/2019	17.4	10.48	61	8.85	----	12.5	240.9	253.4	4.3	1230	452	580	-----	151	2.0	1230	5.0	0.16	5.0	1160	-----	0.83	0.03	0.060	0.018	0.050	0.002	4.87	1.5	0.012	6.10	1.68	0.040
WME-3	C19040509-003	4/9/2019	19.2	10.43	90	7.72	----	30.4	238.5	268.9	4.5	1220	453	561	-----	154	2.0	1290	1.0	<1	6.0	1350	-----	0.91	0.01	0.140	<0.05	0.10	0.003	4.74	1.6	0.031	6.70	1.58	<0.02
WME-3	C19060868-003	6/21/2019	16.3	10.56	497	5.01	-----	12.6	242.3	254.9	4.3	1280	443	665	-----	166	2.0	1350	6.0	0.33	5.0	1220	-----	0.58	0.07	0.060	0.015	0.060	0.003	5.18	1.7	0.023	7.50	1.98	0.070
WME-3	C19120575-001	12/11/2019	15.9	10.87	4638	2.58	-----	-129.7	242.8	113.1	1.9	1330	485	636	-----	157	2.0	1290	3.0	0.34	7.0	1260	-----	0.67	0.05	0.320	0.023	0.110	0.003	3.89	1.6	0.010	7.80	1.89	0.040
WME-3	C20020511-005	2/20/2020	15.0	10.63	277	4.62	-----	61.4	244.0	305.4	5.2	1320	474	646	-----	154	2.0	1270	1.0	0.18	6.0	1350	-----	0.55	0.16	0.100	0.020	0.090	0.005	3.69	1.7	0.023	8.50	1.96	0.050
WME-4	C18080853-004	8/21/2018	18.1	10.22	398	4.62	0.080	-85.7	240.0	154.3	2.6	11200	4850	3810	49	607	4.0	9710	14	<1	30	9330	2.6	0.040	0.01	0.140	<0.05	0.36	<0.005	132	7.0	0.060	15.0	38.3	0.070
WME-4	C18100884-006	10/25/2018	13.4	10.45	330	1.54	<0.02	-91.1	246.1	155.0	2.6	11400	4900	3970	30	647	5.0	9910	4.5	2.0	28	9300	5.2	6.8	<0.01	2.00	0.090	2.0	0.200	140	8.7	0.200	15.0	43	0.400
WME-4	C18120507-004	12/14/2018	12.9	10.12	12695	7.52	<0.02	-105.7	246.7	141.0	2.4	11600	5200	3620	27	583	4.0	9470	29	0.90	28	9370	15	6.6	0.01	<0.07	0.025	0.10	0.008	136	8.4	0.134	13.0	39.6	0.0027
WME-4	C19020706-002	2/26/2019	13.3	10.43	408	3.14	-----	-57.0	246.2	189.2	3.2	11500	4930	3940	-----	600	26	9610	3.0	0.57	28	9140	-----	5.9	0.03	0.030	0.027	0.090	0.008	138	8.3	0.093	13.0	41.6	<0.2
WME-4	C19040509-004	4/9/2019	13.1	10.65	1791	7.74	-----	-16.3	246.5	230.2	3.9	11400	4980	3830	-----	603	14	9940	2.0	<1	29	10700	-----	1.37	0.07	0.040	<0.05	0.11	0.006	141	8.00	0.116	11.0	37.4	<0.02
WME-4	C19060868-004	6/21/2019	22.2	10.53	245	5.53	-----	86.5	234.6	321.1	5.4	11800	5080	4040	-----	641	5.0	10400	30	<1	26	9560	-----	1.2	0.05	0.300	<0.05	1.1	0.020	140	7.3	0.110	14.0	37.8	<0.02
WME-4	C19120575-002	12/11/2019	14.8	11.04	27174	4.73	-----	-123.9	244.3	120.4	2.0	11600	5120	3760	-----	588	4.0	9630	10	0.49	36	9650	-----	1.12	0.54	0.020	0.024	0.26	0.010	128	9.1	0.131	13.9	44.4	<0.01
WME-4	C20020511-001	2/20/2020	12.9	10.83	276	4.26	-----	-29.9	246.7	216.8	3.7	11800	5200	3870	-----	573	4.0	9850	5.0	0.54	32	10700	-----	5.0	0.35	0.019	0.024	0.23	0.009	146	8.9	0.240	15.4	41.3	<0.01
WME-5	C18080926-001	8/22/2018	15.0	11.38	85	7.33	0.020	-4.7	244.0	239.3	4.0	3190	1910	14	20	206	5.0	2310	2.0	<1	37	2880	<0.04	8.5	0.04	0.950	<0.05	0.060	0.003	29.7	2.0	0.485	45.0	6.9	1.22
WME-5	C18100884-003	10/25/2018	14.3	11.21	8811	6.35	<0.02	-11.6	244.9	233.3	3.9	3810	2150	284	21	222	5.0	2800	2.3	0.50	47	3800	4.0	7.8	0.02	0.890	0.024	0.50	0.050	52.0	4.5	0.230	48.0	12	2.60
WME-5	C18120507-005	12/14/2018	13.4	11.02	11438	5.21	<0.02	-134.8	246.1	111.3	1.9	4060	2150	576	19	235	5.0	3100	6.0	0.383	30	3290	12	6.5	0.22	0.050	0.029	0.050	0.002	47.1	4.5	0.061	34.4	13.6	0.850
WME-5	C19020706-004	2/26/2019	14.4	10.37	12784	3.12	-----	-92.3	244.8	152.5	2.6	4110	2110	716	-----	232	7.0	3250	1.0	0.38	33	3490	-----	6.7	0.35	0.030	0.040	0.040	<0.02	44.8	4.4	0.110	45.4	11.5	0.770
WME-5	C19040509-005	4/9/2019	21.1	10.20	26	6.69	-----	60.2	236.1	296.3	5.0	4560	2250	984	-----	254	10	3640	3.0	<1	31	3810	-----	1.79	1.4	0.040	<0.05	0.11	0.004	61.9	4.9	0.043	33.7	19.6	0.230
WME-5	C19060868-005	6/21/2019	15.7	10.91	12757	4.24	-----	-19.7	243.1	223.4	3.8	4270	2070	1000	-----	262	6.0	3740	15	0.80	27	3620	-----	1.68	0.16	0.050	0.037	0.080	0.005	49.7	4.3	0.107	39.0	13.1	0.150
WME-5	C19120721-001	12/12/2019	13.9	11.23	11515	4.14	-----	-117.0	245.4	128.4	2.2	4170	2130	756	-----	232	6.0	3340	5.0	0.21	30	3460	-----	5.1	0.98	0.014	0.043	<0.04	0.002	47.1	5.0	0.031	43.9	12.7	0.020
WME-5	C20020511-003	2/20/2020	13.2	11.17	10601	3.36	-----	76.6	246.3	322.9	5.5	3820	1880	849	-----	264	4.0	3060	2.0	0.28	29	3360	-----	4.8	1.66	0.020	0.030	0.030	0.005	51.7	5.1	0.073	44.3	14.2	0.080
WME-6	C18080926-002	8/22/2018	15.2	10.23	116	7.08	<0.02	77.0	243.7	320.7	5.4	3340	1450	1120	9	349	4.0	2620	1.0	1.0	15	2860	<0.04	0.97	0.01	0.050	0.030	0.020	0.003	19.7	2.0	0.011	12.0	7.3	0.007
WME-6	C18100884-002	10/25/2018	15.5	10.47	79	8.60	<0.02	44.3	243.4	287.7	4.9	3420	1550	1020	8.7	348	4.0	2610	1.1	1.2	18	3900	<0.91	0.98	0.08	0.500	0.033	0.50	0.050	26.0	3.0	0.050	13.0	8.8	0.100
WME-6	C18120507-006	12/14/2018	12.8	10.50	186	4.14	<0.02	19.9	246.9	266.8	4.5	3450	1440	1280	7.5	346	3.0	2630	6.0	0.7	13	2880	5.5	0.95	0.07	<0.07	0.025	0.040	0.003	20.4	2.1	0.027	12.3	6.68	0.010
WME-6	C19020706-005	2/26/2019	14.0	10.62	11000	5.89	-----	-4.8	245.3	240.5	4.1	3540	1490	1280	-----	357	4.0	2660	2.0	1.0	12	3170	-----	1.02	0.06	0.030	0.030	0.30	0.005	22.0	2.0	0.040	12.4	7.28	0.040
WME-6	C19040509-006	4/9/2019	20.9	10.53	37	7.58	-----	76.2	236.3	312.5	5.3	3690	1570	1300	-----	360	4.0	2830	2.0	<1	14	3090	-----	0.67	0.16	<0.03	<0.05	0.040	0.005	24.9	2.0	0.031	12.4	7.88	<0.01
WME-6	C19060868-006	6/21/2019	19.6	10.71	7248	6.09	-----	56.2	238.0	294.2	5.0	3550	1490	1300	-----	374	3.0	2790	12	0.90	12	3000	-----	0.58	2.26	0.016	0.025	0.040	0.006	20.8	1.4	0.039	11.0	6.92	0.010
WME-6	C19120575-003	12/12/2019	14.0	11.01	9522	5.88	-----	-89.6	245.3	155.7	2.6	3290	1330	1310	-----	363	3.0	2670	4.0	0.83	17	2900	-----	0.83	0.09	0.011	0.024	<0.04	0.002	19.1	2.1	0.023	11.6	6.13	0.002
WME-6	C20020511-004	2/20/2020	12.8	10.84	109	5.24	-----	118.1	246.9	365.0	6.2	3500	1470	1280	-----	355	3.0	2670	2.0	0.88	13	3060	-----	0.79	0.06	0.020	<0.05	0.040	0.004	19.9	2.2	0.044	12.6	6.66	0.010
WE9	C18040620-001	4/16/2018	15.8	10.26	4630	2.33	<0.02	-87.6	243.0	155.4	2.6	711	132	599	2.6	241	0.80	1400	8.0	7.0	6.0	1100	0.41	0.36	0.28	0.005	-----	0.040	0.001	4.04	<0.7	0.018	8.5	1.1	0.030
WE9	C18050896-001	5/23/2018	15.9	9.36	4592	2.42	<0.02	-68.5	242.8	174.3	2.9	695	115	615	1.9	241	1.0	1410	8.0	7.0	6.0	1040	0.14	0.28	0.54	<0.03	0.010	0.050	0.001	4.17	0.30	0.014	10.4	0.823	0.009
WE9	C18060342-001	6/6/2018	15.6	9.53	4705	2.51	<0.02	-56.9	243.2	186.3	3.1	746	141	623	2	239	0.90	1370	8.0	6.0	6.0	1190	0.13	0.37	0.25	0.004	0.010	0.040	0.001	4.56	<0.7	0.012	10.0	0.743	0.007
WE9	C18080508-002	8/13/2018	17.2	9.78	4977	2.02	<0.02	-54.7	241.1	186.4	3.1	816	186	616	3.4	246	1.0	1470	4.0	6.0	6.0	1100	0.040	0.42	0.2	0.007	0.010	0.020	0.0007	4.69	0.7	0.047	8.5	0.849	0.030
WE9	C18100128-005	10/2/2018	16.0	9.80	4828	3.94	<0.02	29.0	242.7	271.7	4.6	740	132	635	2.7	241	1.0	1500	6.0	6.0	6.0	1200	0.020	0.12	0.79	0.003	0.010	0.012	0.0009	4.59	<0.7	0.049	10.0	1.09	<0.01
WE9	C18110007-005	10/30/2018	15.1	9.74	4851	4.33	-----	25.5	243.9	269.4	4.6	812	154	678	3.1	237	0.80	1450	7.0	7.4	8.3	1500	<1.8	0.23	0.59	0.130	0.016	0.47	<0.01	6.50	<1.5	0.046	10.0	1.4	<0.02
WE9	C18110736-004	11/27/2018	15.2	9.91	4913	5.92	-----	-58.6	243.7	185.1	3.1	805	167	642	2.9	235	0.90	1430	7.0	5.00	6.0	1160	<0.91	0.19	0.75	<0.03	0.009	<0.02	0.0003	4.59	0.40	0.046	9.2	1.02	<0.01
WE9	C18120551-004	12/18/2018	14.4	10.03	4976	2.66	-----	-112.5	244.8	132.3	2.2	840	182	655	3.1	236	1.0	1470	6.0	4.00	5.0	1160	0.67	0.36	0.33	<0.03	0.009	0.012	0.003	4.63	0.50	0.021	9.3	0.885	<0.01
WE9	C19010798-004	1/29/2019	14.1	10.05	4934	4.72	-----	-55.5	245.2	189.7	3.2	-----	-----	-----	-----	236	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.88	-----	0.032	-----	1.02	-----
WE9	C19020406-004	2/13/2019	14.8	10.06	5014	2.79	-----	-34.1	244.3	210.2	3.6	-----	-----	-----	-----	243	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.70	-----	0.037	-----	1.02	-----
WE9	C19030552-002	3/19/2019	14.0	10.21	5234	0.88	-----	-92.6	245.3	152.7	2.6	-----	-----	-----	-----	202	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.84	-----	0.013	-----	1.02	-----
WF2	C18040477-002	4/11/2018	15.2	9.78	5504	2.07	0.010	-139.0	243.7	104.7	1.8	1040	274	709	3.9	280	2.0	1730	5.0	6.0	6.0	1350	0.18	0.50	<0.01	0.006	-----	0.030	0.001	8.78	0.80	0.132	9.0	1.82	0.030
WF2	C18050896-002	5/23/2018	15.7	9.82	5816	4.78	<0.02	-130.5	243.1	112.6	1.9	1300	331	911	2.7	333	1.2	2190	7.0	6.0	7.0	2020	0.29	0.58	0.007	<0.03	0.013	0.040	0.001	11.2	1.0	0.042	8.6	2.5	0.010
WF2	C18060342-002	6/6/2018	19.6	9.87	6286	0.53	<0.02	-147.1	238.0	90.9	1.5	1140	319	748	2.1	313	1.0	1940	6.0	6.0	6.0	1560	0.18	0.64	<0.01	<0.03	0.010	0.040	0.002	9.79	0.90	0.031	10.0	1.88	0.010
WF2	C18080508-001	8/13/2018	16.6	9.97	5421	0.45	<0.02	-146.3	241.9	95.6	1.6	998	279	651	3.4	260	1.0	1580	4.0	6.0	6.0	1370	0.39	0.40	<0.01	0.003	0.009	0.010	0.0006	6.92	1.1	0.091	8.8	1.49	0.010
WF2	C18100128-004	10/2/2018	15.1	10.21	5930	0.13	<0.02	-217.7	243.9	26.2	0.4	1080	310	691	3.5	279	1.0	1710	4.0	6.0	7.0	1500	0.35	0.42	<0.01	0.004	0.010	0.019	0.0007	8.40	0.90	0.016	9.0	1.98	0.0080

Attachment 2: Tailings and Alluvial Water Quality Data.

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Location	Laboratory ID	Date	Temp	pH	Specific Conductivity	Dissolved Oxygen	Fe^{+2}	ORP	E_{ref}	Eh	pe	Alkalinity	CO_3	HCO_3	DOC	Cl	F	SO_4	Ca	Mg	K	Na	H_2S	NH_3-N	NO_3+NO_2 N	Al	Ba	Fe	Mn	Mo	P	Se	SiO_2	U	V
			°C	s.u.	µS/cm	mg/L	mg/L	mV	mV	mV		mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
WF2	C18110007-004	10/30/2018	15.2	10.05	5570	0.87	<0.02	-166.4	243.7	77.3	1.3	1070	259	773	3.5	280	0.90	1700	5.7	7.9	8.5	1800	<1.8	0.49	0.10	<0.1	0.012	<0.1	<0.01	12.0	2.6	0.13	8.8	2.5	<0.02
WF2	C18110736-003	11/26/2018	13.8	10.22	5576	0.25	-----	-192.2	245.6	53.4	0.9	1060	300	678	3.3	260	0.80	1550	6.0	6.00	6.0	1380	<0.91	0.47	0.05	0.020	0.011	0.020	0.001	7.58	1.0	0.119	8.4	1.7	<0.01
WF2	C18120551-003	12/18/2018	14.3	10.24	5982	0.18	-----	-196.5	244.9	48.4	0.8	1120	308	742	3.7	281	1.0	1760	6.0	6.00	6.0	1420	<0.45	0.48	<0.01	<0.03	0.011	0.014	0.0007	8.23	0.90	0.058	9.4	1.83	0.0038
WF2	C19010798-003	1/29/2019	14.2	10.33	5575	0.35	-----	-175.8	245.0	69.2	1.2	-----	-----	-----	-----	263	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	7.25	7.25	0.111	-----	1.66	-----
WF2	C19020406-003	2/13/2019	15.0	10.33	5615	0.22	-----	-211.7	244.0	32.3	0.5	-----	-----	-----	-----	266	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.97	-----	0.048	-----	1.62	-----
WF2	C19030552-001	3/19/2019	13.8	10.38	5992	0.19	-----	-211.3	245.6	34.3	0.6	-----	-----	-----	-----	241	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	7.50	-----	0.004	-----	1.23	-----
WF9	C10040477-01	4/10/2018	15.1	9.65	5098	0.33	<0.02	15.0	243.9	258.9	4.4	756	159	598	3.3	291	1.0	1690	6.0	7.0	6.0	1190	<0.04	0.37	0.04	0.007	-----	0.007	0.003	6.21	<0.7	0.015	7.0	2.15	0.070
WF9	C18050511-003	5/7/2018	17.0	9.69	5460	0.28	<0.02	-5.6	241.4	235.8	4.0	798	175	617	3.7	272	1.0	1590	9.0	8.0	6.0	1270	0.013	0.34	0.2	0.010	-----	0.20	0.003	6.00	<0.7	0.018	8.0	2.45	0.060
WF9	C18060342-003	6/6/2018	16.4	9.69	5112	0.28	<0.02	-30.4	242.2	211.8	3.6	788	175	604	1.8	279	1.0	1620	12	9.0	6.0	1280	0.009	0.50	0.15	0.005	0.010	0.030	0.004	5.80	<0.7	0.026	8.0	1.87	0.060
WF9	C18070809-002	7/18/2018	20.2	9.72	5089	0.45	<0.02	-106.6	237.2	130.6	2.2	805	180	617	3.3	262	1.0	1540	10	8.0	5.0	1240	0.027	0.45	0.09	0.0054	<0.05	0.012	0.003	5.10	0.60	0.017	8.0	2.01	0.070
WF9	C18080701-002	8/16/2018	16.0	9.77	5093	0.28	<0.02	-67.4	242.7	175.3	3.0	776	165	611	3.1	272	1.0	1550	9.0	7.0	5.0	1270	0.030	0.64	0.02	0.0021	0.009	0.010	0.004	5.41	0.60	0.012	6.3	1.79	0.080
WF9	C18100128-003	10/2/2018	14.4	10.00	5028	0.09	<0.02	-114.8	244.8	130.0	2.2	777	176	590	3.0	275	1.0	1590	8.0	6.0	6.0	1290	0.011	0.53	0.02	0.005	0.010	0.012	0.003	5.81	<0.7	0.01	6.0	2.19	0.090
WF9	C18110007-001	10/30/2018	14.3	10.02	5167	0.36	<0.02	40.2	244.9	285.1	4.8	834	192	627	3.0	259	1.0	1560	10	8.7	7.0	1500	<1.8	0.60	0.08	<0.10	0.011	<0.1	<0.01	7.40	<1.5	0.032	7.2	2.5	0.120
WF9	C18110736-001	11/26/2018	14.7	10.07	5245	0.58	-----	-83.4	244.4	161.0	2.7	848	209	609	3.1	249	1.0	1540	13	7.0	6.0	1280	<0.91	0.50	0.09	0.040	0.010	0.020	0.004	5.82	0.70	0.068	8.3	1.61	0.030
WF9	C18120551-001	12/17/2018	14.0	10.14	5235	0.18	-----	-103.1	245.3	142.2	2.4	832	204	600	3.3	258	1.0	1570	9.0	6.0	5.0	1200	<0.45	0.53	0.02	<0.03	0.007	0.080	0.002	5.65	0.70	0.025	6.8	1.81	0.070
WF9	C19010798-001	1/29/2019	12.6	10.26	5394	0.33	-----	-81.7	247.1	165.4	2.8	-----	-----	-----	-----	260	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.32	-----	0.064	-----	1.67	-----
WF9	C19020406-001	2/12/2019	15.2	10.15	5304	0.25	-----	-84.8	243.7	158.9	2.7	-----	-----	-----	-----	258	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.92	-----	0.052	-----	1.65	-----
WF9	C19030498_R1-001	3/18/2019	15.1	10.24	5864	0.33	-----	-105.9	243.9	138.0	2.3	-----	-----	-----	-----	302	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.60	-----	0.012	-----	1.67	-----
WF11	C18040387-002	4/5/2018	16.0	9.34	4155	5.19	<0.02	-84.2	242.7	158.5	2.7	594	94	534	2.8	228	0.56	1240	11	8.0	6.0	926	0.14	0.33	0.01	<0.03	-----	0.070	0.008	2.66	0.30	0.009	11.2	0.476	0.050
WF11	C18050896-003	5/23/2018	14.8	9.38	4065	1.92	<0.02	-71.6	244.3	172.7	2.9	591	93	532	1.3	216	0.50	1150	13	8.0	7.0	867	0.12	0.34	0.02	<0.03	0.010	0.040	0.008	2.46	0.30	0.009	11.6	0.399	0.0080
WF11	C18060342-004	6/5/2018	16.7	9.19	3876	0.85	<0.02	-47.3	241.8	194.5	3.3	493	38	523	0.8	220	0.50	1160	18	7.0	5.0	812	<0.04	0.26	0.13	<0.03	0.010	0.030	0.019	1.73	<0.4	0.029	11.5	0.231	0.0050
WF11	C18070809-001	7/18/2018	16.3	9.09	3824	1.72	<0.02	-124.9	242.3	117.4	2.0	523	52	532	2.0	211	0.60	1110	14	7.0	5.0	922	0.12	0.26	0.08	0.0017	0.010	0.015	0.014	1.70	0.20	0.008	9.8	0.271	0.0030
WF11	C18080701-001	8/16/2018	16.0	9.47	3932	4.09	<0.02	-45.0	242.7	197.7	3.3	560	79	522	2.1	232	1.0	1240	10	7.0	5.0	918	0.17	0.37	0.05	0.0052	0.010	0.019	0.009	2.18	0.30	0.020	9.8	0.311	0.0050
WF11	C18100128-002	10/1/2018	17.9	9.26	3796	0.37	0.020	-103.7	240.2	136.5	2.3	490	39	519	1.6	213	0.50	1130	16	7.0	6.0	898	0.060	0.25	0.09	0.003	0.013	0.016	0.015	1.82	<0.4	0.015	9.6	0.24	<0.01
WF11	C18110007-006	10/30/2018	15.4	9.19	3785	0.38	<0.02	-57.6	243.5	185.9	3.1	506	45	526	2.3	211	0.60	1150	20	9.0	7.4	1100	<0.91	0.26	0.09	<0.10	0.018	0.19	0.020	2.40	<1.5	<0.01	11.0	0.32	<0.02
WF11	C18110736-002	11/26/2018	15.8	9.63	3896	1.09	-----	-126.2	243.0	116.8	2.0	473	20	537	1.5	211	0.40	1150	28	10	6.0	836	<0.91	0.27	0.08	0.003	0.014	0.009	0.046	1.79	0.080	0.013	11.0	0.219	<0.01
WF11	C18120551-002	12/17/2018	13.3	9.53	3878	1.60	-----	-102.8	246.2	143.4	2.4	490	30	537	1.5	212	0.40	1160	27	9.0	6.0	803	<0.45	0.23	0.05	<0.03	0.015	0.040	0.041	1.68	0.080	0.011	11.2	0.21	<0.01
WF11	C19010798-002	1/29/2019	13.1	9.47	3823	0.54	-----	-85.4	246.5	161.1	2.7	-----	-----	-----	-----	214	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.82	-----	0.007	-----	0.247	-----
WF11	C19020406-002	2/12/2019	14.7	8.99	3777	0.45	-----	35.2	244.4	279.6	4.7	-----	-----	-----	-----	214	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.77	-----	0.008	-----	0.242	-----
WF11	C19030498_R1-002	3/18/2019	15.8	9.26	3833	0.52	-----	-58.9	243.0	184.1	3.1	-----	-----	-----	-----	218	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.74	-----	0.005	-----	0.246	-----
East 1 Sump	C18030669-001	3/20/2018	10.5	10.15	18052	1.08	-----	40.1	249.9	290.0	4.9	4980	1720	2580	9.0	817	6.0	6050	2.0	3.0	20	5500	0.026	3.4	0.02	0.016	-----	0.060	0.007	50.7	1.6	0.186	6.0	22.7	0.090
East 1 Sump	C18050511-002	5/7/2018	14.0	9.99	18951	1.58	<0.02	157.9	245.3	403.2	6.8	5300	1980	2440	7.8	821	6.0	6020	2.0	3.0	20	5460	0.005	<0.05	<0.01	0.020	-----	0.050	0.019	61.9	<2	0.222	7.0	25.1	0.100
East 1 Sump	C18070731-005	7/17/2018	17.5	9.90	16663	1.45	<0.02	45.1	240.8	285.9	4.8	5030	1850	2370	4.9	796	7.0	5790	<2	2.0	22	5470	0.060	0.060	0.06	0.040	<0.05	0.090	0.018	55.0	<2	0.116	6.0	23.9	0.100
East 1 Sump	C18090462-004	9/11/2018	22.3	9.82	17399	2.41	<0.02	-83.1	234.5	151.4	2.6	4750	1730	2270	6.9	726	5.0	5340	1.0	3.0	19	5020	<0.04	0.53	0.66	0.017	<0.05	0.011	0.004	47.6	2.0	0.260	6.0	18.1	0.030
East 1 Sump	C18110483-002	11/12/2018	11.2	10.11	20362	2.45	-----	88.9	248.9	337.8	5.7	-----	-----	-----	-----	914	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	56.8	-----	0.313	-----	23.7	-----
East 1 Sump	C19010314-003	1/9/2019	11.9	10.28	19041	2.59	-----	59.5	248.0	307.5	5.2	-----	-----	-----	-----	796	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	53.5	-----	0.385	-----	20.2	-----
East 1 Sump	C19030304-001	3/11/2019	10.3	10.16	17872	3.31	-----	75.8	250.1	325.9	5.5	-----	-----	-----	-----	770	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	50.6	-----	0.216	-----	19.2	-----
East 1 Sump	C19050913-001	5/22/2019	11.4	10.40	16536	4.56	-----	91.5	248.7	340.2	5.7	-----	-----	-----	-----	678	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	45.6	-----	0.230	-----	17.5	-----
East 1 Sump	C19070871-005	7/17/2019	22.6	10.50	16307	3.43	-----	-7.1	234.1	227.0	3.8	-----	-----	-----	-----	695	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	47.7	-----	0.200	-----	17.4	-----
East 1 Sump	C19120721-005	12/12/2019	11.2	10.78	5591	1.46	-----	-49.1	248.9	199.8	3.4	-----	-----	-----	-----	695	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	45.7	-----	0.210	-----	18.3	-----
East 1 Sump	C20020490-005	2/19/2020	9.5	10.30	14809	4.25	-----	204.0	251.2	455.2	7.7	-----	-----	-----	-----	802	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	46.9	-----	0.332	-----	20.5	-----
East 2 Sump	C18030669-002	3/20/2018	12.2	10.16	16086	2.31	<0.02	57.2	247.6	304.8	5.1	4000	1520	1790	7.0	724	6.0	5500	4.0	2.0	17	4870	0.013	0.31	0.98	0.050	-----	0.060	0.006	39.6	1.3	0.247	9.1	16.4	<0.01
East 2 Sump	C18050511-001	5/7/2018	15.5	9.93	16587	3.35	<0.02	140.3	243.4	383.7	6.5	4200	1590	1890	9.2	684	6.0	5380	4.0	2.0	15	4280	0.028	0.070	1.44	0.050	-----	0.15	0.007	34.1	<2	0.361	9.0	13.5	<0.01
East 2 Sump	C18070731-006	7/17/2018	16.8	9.93	16410	1.99	<0.02	114.9	241.7	356.6	6.0	4110	1420	2110	4.3	702	6.0	5300	2.0	1.0	17	5080	0.016	0.10	1.23	0.060	<0.05	0.070	0.008	40.7	<2	0.309	9.0	18	<0.02
East 2 Sump	C18070731-001	9/11/2018	22.6	9.81	16415	3.22	<0.02	-75.1	234.1	159.0	2.7	4070	1390	2130	7.8	711	5.0	5280	3.0	2.0	16	4720	<0.04	<0.05	0.82	0.040	<0.05	0.080	0.018	40.0	<2	0.312	10.0	14.6	0.010
East 2 Sump	C18110483-001	11/12/2018	10.4	10.18	15730	2.48	-----	79.6	250.0	329.6	5.6	-----	-----	-----	-----	653	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.6	-----	0.343	-----	14	-----
East 2 Sump	C19010314-004	1/9/2019	11.3	10.23	16359	2.44	-----	68.2	248.8	317.0	5.4	-----	-----	-----	-----	662	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	39.3	-----	0.408	-----	13.7	-----
East 2 Sump	C19030304-002	3/11/2019	10.7	10.26	16038	3.36	-----	76.2	249.6	325.8	5.5	-----	-----	-----	-----	684	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	40.8	-----	0.453	-----	14.1	-----
East 2 Sump	C19050913-002	5/22/2019	11.4	10.41	15466	7.66	-----	80.9	248.7	329.6	5.6	-----	-----	-----	-----	677	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	39.9	-----	0.470	-----	14.3	-----
East 2 Sump	C19070871-006	7/17/2019	23.8	10.31	15224	2.93	-----	35.9	232.6	268.5	4.5	-----	-----	-----	-----	674	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	40.9	-----	0.490	-----	14.3	-----
East 2 Sump	C19120721-006	12/13/2019	13.2	9.94	13594	3.36	-----	5.6	246.3	251.9	4.3	-----	-----	-----	-----	656	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.8	-----	0.480	-----	13.8	-----
East 2 Sump	C20020490-006	2/19/2020	11.1	10.26	12769	4.22	-----	206.9	249.1	456.0	7.7	-----	-----	-----	-----	680	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36.5	-----	0.596	-----	14.1	-----
North 1 Sump	C18030669-003	3/20/2018	11.6	9.95	14163	1.26	<0.02	216.0	248.4	464.4	7.8	2860	828	1810	9.0	673	5.0	5130	4.0	5.0	15	4140	0.34	1.06	0.02	0.030	-----	0.070	0.009	36.9	0.80	0.420	7.1	20.8	0.040
North 1 Sump	C18050310-002	5/2/2018	12.4	9.84	14561	1.17	<0.02	113.9	247.4	361.3	6.1	3070	888	1930	13.4	634	5.0	4970	6.0	5.0	12	4480	<0.04	1.01	0.06	0.070	-----	<0.2	0.009	37.9	<2	0.398	8.0	18.5	0.030
North 1 Sump	C18070731-002	7/16/2018	15.7	9.76	15081	1.95	<0.02	137.0	243.1	380.1	6.4	3180	923	2000	12.4	656	6.0	5180	5.0	5.0	14	4480	0.040	1.06	0.07	0.050	<0.05	0.090	0.009	39.7	<2	0.326	7.0	21.8	0.040
North 1 Sump	C18090462-005	9/10/2018	25.7	9.62	16203	3.54	0.020	-153.6	230.1	76.5	1.3	3420	957	2230	24	711	5.0	5660	4.0	5.0	15	4570	<0.2	0.60	0.34	0.030	<0.05	0.070	0.014	45.2	2.0	0.080	6.0	18.9	0.040
North 1 Sump	C18110483-005	11/12/2018	5.7	9.81	13484	4.81	-----	118.5	256.1	374.6	6.3	-----	-----	-----	-----	593	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	31.8	-----	0.483	-----	17.2	-----
North 1 Sump	C19010314-001	1/8/2019	17.6	10.07	15650	2.52	-----	112.0	240.6	352.6	6.0	-----	-----	-----	-----	654	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	42.7	-----	0.469	-----	16.9	-----
North 1 Sump	C19030186-001	3/6/2019	18.6	9.63	15615	5.61	-----	91.0	239.3	330.3	5.6	-----	-----	-----	-----	597	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	33.2	-----	0.410	-----	16.7	-----
North 1 Sump	C19050867-003	5/20/2019	11.9	10.19	15320	6.05	-----	106.8	248.0	354.8	6.0	-----	-----	-----	-----	675	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	43.8	-----	0.394	-----	16.8	-----
North 1 Sump	C19070871-004	7/17/2019	16.1	10.35	13427	4.46	-----	101.7	242.6	344.3	5.8	-----	-----	-----	-----	597	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.3	-----	0.370	-----	16.5	-----
North 1 Sump	C19120575-004	12/12/2019	10.5	10.72	13035	1.40	-----	-41.1	249.9	208.8	3.5	-----	-----	-----	-----	651	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36.4	-----	0.314	-----	16.5	-----

Attachment 2: Tailings and Alluvial Water Quality Data.

Location	Laboratory ID	Date	Temp	pH	Specific Conductivity	Dissolved Oxygen	Fe^{+2}	ORP	E_{ref}	Eh	pe	Alkalinity	CO_3	HCO_3	DOC	Cl	F	SO_4	Ca	Mg	K	Na	H_2S	NH_3-N	NO_3+NO_2 N	Al	Ba	Fe	Mn	Mo	P	Se	SiO_2	U	V
			°C	s.u.	µS/cm	mg/L	mg/L	mV	mV	mV		mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
North 1 Sump	C2020490-001	2/18/2020	14.7	10.12	11682	3.05	-----	138.2	244.4	382.6	6.5	-----	-----	-----	-----	620	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36.4	-----	0.365	-----	16.2	-----
North 3 Sump	C18030669-004	3/20/2018	6.9	9.94	13713	3.98	<0.02	206.8	254.5	461.3	7.8	2600	704	1740	7.9	676	6.0	5080	5.0	6.0	14	4030	0.029	0.86	0.71	0.030	-----	0.070	0.010	36.8	0.90	0.242	7.2	18.1	0.030
North 3 Sump	C18050310-003	5/3/2018	11.1	9.04	11330	3.17	<0.02	-59.2	249.1	189.9	3.2	1370	142	1380	6.9	693	2.0	4560	11	7.0	11	3260	0.060	4.3	0.08	0.050	-----	<0.2	0.014	18.6	<2	0.038	7.0	7.08	<0.01
North 3 Sump	C18070731-003	7/16/2018	22.0	9.68	15033	4.87	<0.02	108.9	234.9	343.8	5.8	3080	872	1980	13.5	662	6.0	5190	4.0	5.0	14	4480	0.030	1.7	1.02	0.080	<0.05	0.10	0.010	40.8	<2	0.209	7.0	21.3	0.0400
North 3 Sump	C18090462-002	9/11/2018	18.5	9.65	17717	2.20	0.070	-176.0	239.5	63.5	1.1	3760	1020	2520	49	823	7.0	6660	5.0	6.0	13	5280	<0.20	0.10	0.95	0.050	0.030	0.17	0.033	47.1	3.0	0.186	7.0	19.3	0.100
North 3 Sump	C18110483-004	11/12/2018	7.2	9.95	13606	5.41	-----	65.2	254.1	319.3	5.4	-----	-----	-----	-----	620	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	34.1	-----	0.307	-----	15.1	-----
North 3 Sump	C19010314-002	1/8/2019	16.3	9.71	12528	7.76	-----	44.7	242.3	287.0	4.8	-----	-----	-----	-----	623	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	27.8	-----	0.223	-----	11.3	-----
North 3 Sump	C19030186-002	3/6/2019	13.8	9.50	10724	7.97	-----	86.2	245.6	331.8	5.6	-----	-----	-----	-----	577	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	19.3	-----	0.082	-----	6.49	-----
North 3 Sump	C19050867-002	5/20/2019	12.5	9.65	9676	8.30	-----	97.7	247.3	345.0	5.8	-----	-----	-----	-----	586	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	18.4	-----	0.063	-----	6.64	-----
North 3 Sump	C19070871-002	7/17/2019	20.8	9.40	9800	5.53	-----	90.3	236.5	326.8	5.5	-----	-----	-----	-----	568	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	17.9	-----	0.060	-----	6.57	-----
North 3 Sump	C19120575-005	12/12/2019	10.5	10.10	9767	0.14	-----	-293.3	249.9	-43.5	-0.7	-----	-----	-----	-----	595	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20.4	-----	0.045	-----	8.14	-----
North 3 Sump	C20020490-002	2/19/2020	4.5	9.13	8146	9.50	-----	216.4	257.7	474.1	8.0	-----	-----	-----	-----	544	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	18.3	-----	0.058	-----	6.66	-----
South 1 Sump	C18030669-005	3/20/2018	14.1	8.77	6988	0.87	0.10	-180.5	245.2	64.7	1.1	868	69	919	3.7	384	3.0	2620	32	21	13	1800	0.16	5.5	0.07	<0.03	-----	0.31	0.096	12.8	0.10	0.009	13.6	8.87	<0.01
South 1 Sump	C18050310-001	5/3/2018	15.7	8.71	6926	0.99	<0.02	73.6	243.1	316.7	5.3	886	48	982	4.4	370	3.0	2510	31	18	11	1800	0.027	6.0	0.15	0.021	-----	<0.2	0.080	12.7	<0.4	0.059	13.0	7.86	<0.01
South 1 Sump	C18070731-004	7/16/2018	22.4	8.61	6546	1.69	<0.02	104.2	234.4	338.6	5.7	851	55	927	5.0	345	3.0	2300	22	15	10	1680	0.018	6.8	0.29	0.270	0.010	0.41	0.392	12.4	<0.7	0.041	10.0	8.25	<0.02
South 1 Sump	C18090462-003	9/11/2018	21.4	9.02	5574	6.12	<0.02	-151.2	235.7	84.5	1.4	860	63	921	4.4	355	2.0	2450	26	17	12	1670	<0.04	8.6	0.08	0.003	0.010	0.090	0.062	12.1	<0.7	0.032	11.0	7.58	<0.01
South 1 Sump	C18110483-006	11/12/2018	8.9	9.23	6382	2.56	-----	111.0	251.9	362.9	6.1	-----	-----	-----	-----	333	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.7	-----	0.061	-----	6.99	-----
South 1 Sump	C19010314-006	1/9/2019	9.4	9.27	6642	1.74	-----	104.4	251.3	355.7	6.0	-----	-----	-----	-----	333	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	11.4	-----	0.11	-----	7.1	-----
South 1 Sump	C19030186-004	3/6/2019	16.5	9.15	7184	3.75	-----	74.7	242.1	316.8	5.4	-----	-----	-----	-----	360	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	17.1	-----	0.018	-----	8.2	-----
South 1 Sump	C19050915-001	5/21/2019	11.7	9.39	7275	7.07	-----	116.7	248.3	365.0	6.2	-----	-----	-----	-----	375	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.6	-----	0.034	-----	9.12	-----
South 1 Sump	C19070871-001	7/17/2019	20.4	8.96	7291	3.93	-----	-108.2	237.0	128.8	2.2	-----	-----	-----	-----	401	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	15.5	-----	0.016	-----	10.4	-----
South 1 Sump	C19120721-004	12/12/2019	14.6	9.42	6917	0.78	-----	-77.2	244.5	167.3	2.8	-----	-----	-----	-----	394	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.1	-----	0.023	-----	9.32	-----
South 1 Sump	C20020490-004	2/19/2020	9.0	8.91	6044	4.42	-----	179.8	251.8	431.6	7.3	-----	-----	-----	-----	396	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.2	-----	0.023	-----	8.66	-----
West 1 Sump	C18030669-006	3/20/2018	5.6	9.99	14616	6.06	-----	137.1	256.2	393.3	6.6	2870	817	1830	9.2	699	6.0	5350	8.0	9.0	15	4290	0.19	0.60	1.07	1.82	-----	1.26	0.088	35.2	1.0	0.119	14.4	19.9	0.050
West 1 Sump	C18050310-004	5/2/2018	11.8	9.77	15098	7.99	<0.02	133.8	248.2	382.0	6.5	3000	814	2000	13.8	686	5.0	5280	7.0	9.0	14	4540	<0.04	0.08	1.06	0.130	-----	0.12	0.010	39.3	<2	0.244	6.0	18	0.040
West 1 Sump	C18070731-001	7/16/2018	21.9	9.48	11626	5.39	0.070	119.2	235.0	354.2	6.0	2220	513	1660	17	511	4.0	3890	11	8.0	13	3300	0.040	0.020	0.36	0.320	0.090	0.50	0.026	30.5	<2	0.191	10.0	14.8	0.030
West 1 Sump	C18090462-006	9/11/2018	18.1	9.59	17765	6.97	<0.02	-167.3	240.0	72.7	1.2	3880	1150	2390	45	828	8.0	6730	4.0	6.0	15	5250	<0.2	<0.05	1.15	0.040	0.030	0.090	0.020	50.1	3.0	0.198	6.0	19.7	0.070
West 1 Sump	C18110483-003	11/12/2018	2.6	9.77	13858	11.40	-----	104.9	260.1	365.0	6.2	-----	-----	-----	-----	635	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.6	-----	0.317	-----	17	-----
West 1 Sump	C19010314-005	1/8/2019	16.1	9.68	15171	9.92	-----	90.8	242.6	333.4	5.6	-----	-----	-----	-----	757	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	38.1	-----	0.367	-----	16.6	-----
West 1 Sump	C19030186-003	3/6/2019	11.3	9.84	14525	7.14	-----	45.6	248.8	294.4	5.0	-----	-----	-----	-----	598	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	39.4	-----	0.313	-----	16.5	-----
West 1 Sump	C19050867-001	5/20/2019	10.3	10.20	11133	9.02	-----	92.5	250.1	342.6	5.8	-----	-----	-----	-----	503	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	32.0	-----	0.266	-----	12.8	-----
West 1 Sump	C19070871-003	7/17/2019	23.4	10.18	13761	4.05	-----	66.8	233.1	299.9	5.1	-----	-----	-----	-----	611	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.6	-----	0.360	-----	16	-----
West 1 Sump	C19120721-003	12/12/2019	14.4	10.76	10873	3.77	-----	-1.3	244.8	243.5	4.1	-----	-----	-----	-----	485	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	28.0	-----	0.173	-----	12.2	-----
West 1 Sump	C20020490-003	2/19/2020	2.3	10.33	10405	6.75	-----	227.9	260.5	488.4	8.3	-----	-----	-----	-----	528	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	32.0	-----	0.275	-----	14.3	-----
DD	C18030669-009	3/21/2018	15.9	7.15	3788	2.09	<0.02	219.9	242.8	462.7	7.8	244	<5	297	2.4	77	0.50	2230	485	112	7.0	399	0.006	<0.05	12.5	0.002		0.003	0.415	0.005	<0.4	0.082	15.8	0.11	<0.01
DD	C18030608-004	6/21/2018	14.3	7.30	3824	1.85	<0.02	-183.7	244.9	61.2	1.0	270	<5	329	3.0	73	0.40	2120	514	105	6.0	370	<0.04	0.020	10.8	0.003	0.008	0.006	0.520	0.001	<0.4	0.089	17.5	0.11	<0.01
DD	C18090668-003	9/17/2018	19.4	7.22	3805	1.87	<0.02	-144.8	238.3	93.5	1.6	274	<5	334	2.6	74	0.40	2040	462	103	6.0	363	<0.04	0.020	12.1	<0.03	0.007	0.008	0.344	0.003	<0.4	0.069	17.5	0.12	<0.01
DD	C18120219-004	12/5/2018	12.8	7.41	3914	2.10	<0.02	140.4	246.9	387.3	6.5	268	<5	327	2.7	71	0.40	2090	456	112	6.0	364	<0.91	<0.05	10.8	<0.03	0.009	0.008	0.504	0.013	<0.1	0.080	17.2	0.11	<0.01
Q	C18030669-012	3/20/2018	16.5	7.24	3008	0.35	0.03	-97.5	242.1	144.6	2.4	178	<5	217	6.8	67	0.40	1540	392	76	8.0	304	0.11	0.89	13.7	0.007	-----	0.014	0.150	0.001	<0.4	0.388	17.2	0.06	<0.01
Q	C18060844-002	6/20/2018	15.0	7.37	3059	5.80	<0.02	-158.9	244.0	85.1	1.4	186	<5	227	2.2	68	0.40	1580	420	72	7.0	271	<0.04	0.020	15.1	<0.03	0.010	0.030	0.109	0.0008	<0.4	0.415	18.3	0.05	<0.01
Q	C18090528-001	9/13/2018	14.4	7.42	2971	1.98	<0.02	-181.3	244.8	63.5	1.1	189	<5	231	1.8	65	0.50	1520	400	67	6.0	261	<0.04	<0.05	14.7	0.0029	0.010	0.005	0.107	0.0009	<0.4	0.387	17.5	0.05	<0.01
Q	C18120219-001	12/3/2018	12.5	7.53	2996	2.73	<0.02	180.5	247.3	427.8	7.2	189	<5	231	1.8	66	0.40	1510	364	71	7.0	271	<0.91	0.03	14.1	<0.03	0.011	0.007	0.104	0.002	<0.1	0.445	18.0	0.05	<0.01
R	C18030669-011	3/21/2018	17.5	7.65	2732	2.45	<0.02	210.1	240.8	450.9	7.6	124	<5	152	1.6	58	0.60	1440	329	58	5.0	305	<0.04	<0.05	17.6	<0.03	-----	0.005	<0.001	0.002	<0.4	0.657	18.9	0.02	<0.01
R	C18060838-002	6/20/2018	16.3	7.71	2808	2.55	0.11	-174.0	242.3	68.3	1.2	134	<5	163	2.6	56	0.60	1440	351	54	4.0	275	0.012	0.02	16.7	0.050	0.010	0.030	0.004	0.019	<0.4	0.664	19.8	0.02	<0.01
R	C18090528-002	9/12/2018	16.3	7.70	2790	2.33	<0.02	-192.2	242.3	50.1	0.8	133	<5	162	1.7	57	0.70	1430	343	53	4.0	276	<0.04	<0.05	19.1	0.0018	0.009	0.003	0.0003	0.002	<0.4	0.641	19.0	0.02	<0.01
R	C18120219-002	12/3/2018	13.0	7.61	2797	7.46	<0.02	190.2	246.6	436.8	7.4	134	<5	164	1.6	53	0.50	1400	307	54	4.0	271	<0.91	0.030	17.1	<0.03	0.010	0.007	0.0002	0.002	0.02	0.710	19.1	0.02	<0.01
M19	C18040250-002	4/4/2018	17.3	7.16	2472	2.31	<0.02	141.0	241.0	382.0	6.5	400	<5	488	1.1	196	0.40	753	233	59	5.0	262	<0.04	<0.05	1.65	0.015	-----	0.100	0.039	0.416	<0.4	0.047	21.7	0.65	<0.01
M19	C18060838-001	6/21/2018	16.7	7.17	2498	2.44	<0.02	-98.1	241.8	143.7	2.4	404	<5	493	1.1	197	0.30	754	251	61	6.0	251	<0.04	0.020	1.46	<0.03	0.018	0.020	0.047	0.380	<0.4	0.043	23.3	0.51	<0.01
M19	C18100128-001	10/1/2018	16.2	7.28	2542	2.47	<0.02	144.4	242.4	386.8	6.5	403	<5	492	0.90	196	0.40	761	252	65	7.0	279	0.006	<0.05	1.68	0.003	0.019	0.015	0.008	0.443	<0.4	0.047	22.1	0.52	<0.01
M19	C18120419-001	12/12/2018	14.5	7.25	2567	2.55	<0.02	137.5	244.7	382.2	6.5	409	<5	500	1.0	185	0.30	765	250	65	6.0	264	<2	<0.05	1.47	<0.03	0.020	0.030	0.008	0.391	0.020	0.055	23.7	0.51	0.0001
MR	C18030762-005	3/22/2018	23.8	6.74	2818	1.98	<0.02	71.6	232.6	304.2	5.1	368	<5	449	1.5	212	0.40	1050	279	74	8.0	322	<0.04	<0.05	3.68	<0.03	-----	0.030	0.035	0.060	<0.4	0.058	24.8	0.43	<0.01
MR	C18060619-002	6/13/2018	20.2	7.18	2863	1.93	<0.02	60.2	237.2	297.4	5.0	385	<5	470	0.60	193	0.30	996	289	71	7.0	290	<0.04	<0.05	3.20	<0.03	0.014	0.030	0.071	0.057	<0.4	0.056	24.0	0.45	<0.01
MR	C18090668-004	9/17/2018	14.6	7.17	2819	1.92	<0.02	-90.5	244.5	154.0	2.6	385	<5	469	1.2	195	0.40	970	262	69	8.0	286	<0.04	0.020	3.68	<0.03	0.014	0.020	0.052	0.058	<0.4	0.055	26.2	0.43	0.0020
MR	-----	12/4/2018	14.0	7.37	2831	1.74	-----	76.1	245.3	321.4	5.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
S4	C18030669-010	3/22/2018	14.9	6.69	2553	3.68	<0.02	101.4	244.1	345.5	5.8	412	<5	503	0.60	206	0.30	787	249	63	5.0	290	<0.04	<0.05	0.77	<0.03	-----	0.020	<0.001	0.291	<0.4	0.021	26.4	0.14	<0.01
S4	C18060619-001	6/13/2018	18.2	7.13	2517	3.41	<0.02	104.2	239.8	344.0	5.8	435	<5	530	0.46	180	0.30	716	236	60	4.0	278	<0.04	<0.05	0.90	<0.03	0.013	0.020	0.0005	0.321	<0.4	0.028	25.5	0.13	<0.01
S4	C18090668-005	9/18/2018	14.5	7.22	2417	4.27	<0.02	-144.7	244.7	100.0	1.7	416	<5	507	1.0	169	0.30	716	209	53	4.0	259	<0.04	0.020	1.08	<0.03	0.012	<0.02	0.0003	0.339	<0.4	0.031	26.4	0.12	<0.01
S4	C18120219-005	12/5/2018	14.1	7.31	2401	3.94	<0.02	56.6	245.2	301.8	5.1	401	<5	489	1.0	159	0.30	716	201	54	4.0	250	<0.91	<0.05	0.99	<0.03	0.014	0.006	0.0003	0.365	<0.1	0.032	24.9	0.12	<0.01
D1	C18030669-007	3/22/2018	12.0	6.88	2332	3.75	<0.02	226.2	247.9	474.1	8.0	356	<5	434	1.3	165	0.40	769	183	43	4.0	335	0.006	<0.05	1.48	0.0012	-----	0.007	0.003	2.66	<0.1	0.061	23.9	1.97	0.0030
D1	C18060619-003	6/12/2018	14.1	6.98	2414	5.78	<0.02	80.0	245.2	325.2	5.5	304	<5	370	1.0	141	0.50	867	216	42	3.0	300	<0.04	<0.05	1.12	<0.03	0.012	0.007	0.002	1.46	<0.4	0.065	22.5	1.11	<0.01
D1	C18090668-001	9/17/2018	12.9	7.21	2340	4.46	<0.02	-64.0	246.7	182.7	3.1	361	<5	440	1.2	153	0.40	746	189	40	3.0	291	<0.04	0.040	1.50	0.0009	0.012	0.005	0.001	2.31	<0.4	0.058	26.9	1.65	0.0030
D1	C18120219-003	12/5/2018	12.7	7.50	2184	5.39	<0.02	-20.7	247.0	226.3	3.8	314	<5	383	1.3	130	0.40	723	174	37	3.0	257	<0.91	0.040	1.18	<0.03	0.012	0.006	0.002	1.31	<0.1	0.052	23.5	0.95	0.0009

Attachment 2: Tailings and Alluvial Water Quality Data.

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Location	Laboratory ID	Date	Temp	pH	Specific Conductivity	Dissolved Oxygen	Fe^{+2}	ORP	E_{ref}	Eh	pe	Alkalinity	CO_3	HCO_3	DOC	Cl	F	SO_4	Ca	Mg	K	Na	H_2S	NH_3-N	NO_3+NO_2 N	Al	Ba	Fe	Mn	Mo	P	Se	SiO_2	U	V
			°C	s.u.	µS/cm	mg/L	mg/L	mV	mV	mV		mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
X	C18030669-008	3/22/2018	13.8	6.96	1840	5.59	<0.02	65.8	245.6	311.4	5.3	231	<5	282	0.60	136	0.30	631	182	43	6.0	205	0.008	<0.05	1.48	0.0012	-----	0.070	0.003	0.072	<0.1	0.013	12.2	0.04	0.0080
X	C18060619-004	6/13/2018	15.4	7.28	1659	6.37	<0.02	193.6	243.5	437.1	7.4	267	<5	325	0.31	121	0.30	460	153	34	5.0	172	<0.04	<0.05	1.27	0.0058	0.024	0.006	0.0007	0.093	<0.4	0.012	13.7	0.04	0.0080
X	C18090668-002	9/17/2018	15.9	7.53	1788	6.26	<0.02	-140.3	242.8	102.5	1.7	217	<5	265	0.70	113	0.30	566	168	36	5.0	156	<0.04	0.020	1.75	0.0028	0.024	0.010	0.0003	0.129	<0.1	0.020	15.7	0.05	0.0100
X	C18120219-006	12/5/2018	15.1	7.55	1599	6.54	<0.02	117.6	243.9	361.5	6.1	235	<5	287	0.60	89	0.30	495	146	34	4.0	136	<0.91	0.030	1.24	<0.03	0.022	0.004	0.0005	0.129	<0.1	0.018	15.5	0.05	0.0100
F	C18030762-002	3/24/2018	12.2	7.00	2504	4.71	<0.02	304.6	247.6	552.2	9.3	404	<5	493	0.50	208	0.30	740	238	60	4.0	281	<0.04	<0.05	2.12	0.002	-----	0.003	<0.001	0.001	0.40	0.019	40.1	0.05	0.0040
F	C18060619-005	6/11/2018	14.3	7.16	2498	5.65	<0.02	187.6	244.9	432.5	7.3	396	<5	483	0.48	191	0.30	727	228	62	5.0	279	<0.04	<0.05	2.54	0.004	0.015	0.018	0.001	0.011	<0.4	0.027	40.9	0.05	<0.01
F	C18090891-003	9/26/2018	13.0	7.22	2595	6.40	<0.02	181.8	246.6	428.4	7.2	374	<5	456	1.1	190	0.40	828	260	60	5.0	261	<0.04	<0.05	3.52	0.011	0.025	0.008	0.0009	0.002	<0.4	0.020	39.9	0.06	0.0020
F	C18120419-006	12/11/2018	12.4	7.21	2561	6.54	<0.02	141.8	247.4	389.2	6.6	381	<5	465	1.1	179	0.30	778	245	63	4.0	274	<2	<0.05	3.24	<0.03	0.015	0.006	0.0005	0.0004	<0.1	0.040	42.1	0.05	0.0021
I	C18040250-003	4/4/2018	13.7	7.20	1770	5.45	<0.02	154.9	245.7	400.6	6.8	348	<5	425	0.60	131	0.50	434	141	37	3.0	198	0.006	<0.05	1.52	0.0015	-----	<0.03	<0.001	<0.001	<0.1	0.008	35.9	0.07	0.0040
I	C18060844-001	6/19/2018	15.4	7.21	1762	5.64	<0.02	185.0	243.5	428.5	7.2	353	<5	431	0.60	129	0.40	428	151	36	3.0	192	<0.04	0.020	1.33	<0.03	0.015	0.002	<0.001	0.0008	<0.1	0.007	36.3	0.11	0.0040
I	C18100087-001	9/27/2018	13.4	7.42	1746	5.99	<0.02	-181.8	246.1	64.3	1.1	345	<5	421	-----	126	0.50	423	155	39	4.0	221	<0.04	<0.05	1.37	0.002	0.018	0.003	0.0003	0.0007	<0.1	0.009	37.3	0.06	0.0040
I	C18120419-002	12/12/2018	12.8	7.40	1758	5.78	<0.02	155.7	246.9	402.6	6.8	346	<5	422	0.70	120	0.50	420	147	38	3.0	200	<2	<0.05	1.38	<0.03	0.017	0.007	0.0006	0.0006	<0.1	0.012	37.7	0.07	0.0030
T2	C18040387-001	4/9/2018	14.6	7.85	13523	1.15	<0.02	-46.3	244.5	198.2	3.3	1860	32	2210	12.3	682	1.7	5830	138	104	8.0	3400	<0.04	<0.05	2.57	<0.03	-----	0.080	0.135	41.1	0.20	1.010	19.7	21.4	<0.01
T2	C18060844-003	6/21/2018	14.5	7.96	13273	0.21	<0.02	-80.2	244.7	164.5	2.8	1980	<5	2410	12.7	654	1.6	5780	152	103	8.0	3340	0.006	0.030	1.77	<0.03	<0.05	0.030	0.070	40.1	<2	0.642	22.0	20.4	<0.01
T2	C18090747-001	9/18/2018	15.7	8.14	13272	0.96	<0.02	-73.4	243.1	169.7	2.9	1930	<5	2350	16	641	1.7	5600	121	92	8.0	3670	<0.04	0.020	1.31	0.018	<0.05	0.140	0.049	35.5	<2	0.470	17.0	20.0	<0.01
T2	C18120419-005	12/11/2018	13.0	8.27	13136	0.40	<0.02	35.9	246.6	282.5	4.8	2020	<5	2460	13	633	1.8	5080	100	80	7.0	3440	<2	<0.05	0.92	<0.07	0.017	0.040	0.041	43.9	0.30	0.331	18.1	19.0	0.0096
T20	C18030762-004	3/23/2018	14.8	6.86	8283	0.90	5.7	-55.3	244.3	189.0	3.2	897	<5	1090	4.5	427	0.30	3800	321	87	8.0	1930	<0.04	0.31	2.38	0.005	-----	6.80	0.424	19.8	<0.4	0.392	22.3	14.8	<0.01
T20	C18061026-001	6/27/2018	15.0	6.94	8760	2.21	5.6	-64.8	244.0	179.2	3.0	987	<5	1200	6.7	429	0.40	3730	327	87	8.0	2010	<0.04	0.22	2.58	0.006	0.060	9.08	0.498	21.8	<0.4	0.519	24.0	16.5	<0.01
T20	C18090891-001	9/24/2018	14.2	7.29	9323	2.61	2.0	-32.0	245.0	213.0	3.6	1070	<5	1310	6.8	479	0.30	4000	371	92	8.0	1960	<0.04	0.14	3.80	0.013	0.040	4.61	0.428	20.8	<0.4	0.694	23.0	19.4	<0.01
T20	C18120419-004	12/11/2018	13.5	7.32	9221	2.20	3.0	-50.5	246.0	195.5	3.3	1040	<5	1270	10	485	0.30	3990	360	98	8.0	2060	<2	0.16	3.66	<0.03	0.050	5.03	0.473	18.9	0.10	0.720	24.5	19.2	0.0010
T22	C18040250-001	4/3/2018	16.9	7.90	7077	0.11	<0.02	-12.8	241.5	228.7	3.9	1240	62	1390	5.9	293	2.0	2420	56	26	7.0	660	<0.04	5.8	0.99	0.007	-----	0.050	0.076	18.5	0.30	0.079	12.0	6.29	0.0400
T22	C18061026-002	6/27/2018	16.4	7.48	10773	1.47	0.06	37.2	242.2	279.4	4.7	1200	<5	1460	7.3	492	1.1	4570	200	117	13	2810	<0.04	33	33.0	0.017	0.080	0.060	0.283	31.0	<2	0.486	21.0	17.5	0.0400
T22	C18090891-002	9/24/2018	14.7	7.94	9433	0.38	<0.02	76.9	244.4	321.3	5.4	1200	<5	1470	6.3	406	1.2	3770	220	124	12	2320	<0.04	22	26.30	0.004	0.080	0.030	0.241	25.5	0.40	0.520	19.0	14.7	0.0400
T22	C18120419-003	12/11/2018	14.6	7.91	9592	1.18	<0.02	90.3	244.5	334.8	5.7	1180	<5	1430	6.5	475	1.0	4790	223	129	11	2680	<2	34	39.80	<0.07	0.080	0.050	0.243	26.3	0.30	0.554	21.7	15.2	0.0400
WME-9	C18080853-005	8/20/2018	17.6	7.55	1930	3.70	0.050	-31.6	240.6	209.0	3.5	341	<5	416	5.3	127	1.0	507	82	23	6.0	345	0.016	<0.05	0.26	0.050	0.030	0.080	0.184	1.72	<0.1	0.023	34.2	0.42	0.0100
WME-9	C18110483-008	11/14/2018	18.3	7.89	1963	0.94	0.190	-193.7	239.7	46.0	0.8	351	<5	429	7.7	117	1.0	489	75	22	5.0	315	1.6	<0.05	0.01	0.008	0.032	0.25	0.391	1.46	0.07	0.003	30.8	0.32	0.0004
WME-9	C19020706-007	2/27/2019	18.1	7.94	1699	1.57	----	-22.5	240.0	217.5	3.7	246	<5	300	-----	117	0.90	465	119	31	7.3	216	-----	<0.05	0.74	0.0017	0.039	0.13	0.089	0.344	<0.1	0.028	12.0	0.15	0.0099
WME-9	C19050911-001	5/22/2019	24.1	7.76	1649	1.58	-----	-13.0	232.2	219.2	3.7	254	<5	310	-----	117	0.90	470	126	30	5.0	205	-----	0.040	0.57	<0.03	0.031	0.040	0.012	0.224	0.03	0.036	24.9	0.09	0.010
WME-9	C19120721-007	12/13/2019	16.8	8.08	773	4.47	-----	27.6	241.7	269.3	4.5	189	<5	230	-----	59	1.2	223	63	15	4.0	121	-----	-----	-----	0.004	0.024	0.040	0.010	0.264	<0.1	0.014	20.6	0.04	0.020
WME-10	C18080853-005	8/20/2018	19.6	7.25	1604	1.02	<0.02	-118.0	238.0	120.0	2.0	284	<5	347	3.0	113	0.80	441	133	28	4.0	209	<0.04	<0.05	1.20	0.0031	0.036	0.004	0.070	0.280	<0.1	0.078	34.0	0.17	0.090
WME-10	C18110483-007	11/14/2018	19.0	7.60	1627	5.17	0.17	56.4	238.8	295.2	5.0	284	<5	347	1.1	110	0.80	427	129	27	3.0	183	<0.91	<0.05	1.29	0.030	0.037	0.040	0.013	0.263	0.02	0.136	33.6	0.15	0.080
WME-10	C19020706-008	2/27/2019	19.1	7.68	1639	5.01	----	-69.8	238.7	168.9	2.9	281	<5	342	-----	111	0.80	430	134	28	4.0	200	-----	<0.05	1.16	0.210	0.090	0.21	0.027	0.251	0.01	0.116	35.8	0.14	0.060
WME-10	C19050911-002	5/22/2019	21.0	7.84	1688	4.70	-----	-45.2	236.2	191.0	3.2	280	>5	342	-----	112	0.70	489	142	30	3.0	187	-----	0.030	1.16	<0.03	0.033	0.50	0.018	0.240	0.01	0.115	31.5	0.12	0.080
WME-10	C19120721-008	12/13/2019	15.8	7.67	1397	5.02	-----	-67.0	243.0	176.0	3.0	282	<5	345	-----	114	0.70	440	133	29	4.0	201	-----	-----	-----	0.004	0.041	0.16	0.009	0.319	0.01	0.129	29.6	0.18	0.110

Attachment 3
DCM Science XRD and SEM Mineralogy Reports

DCM SCIENCE LABORATORY, INC
12421 W. 49th Avenue, Unit #6
Wheat Ridge, CO 80033 (303) 463-8270

Semi-Quantitative X-Ray Diffraction Analysis

Client:
ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

Analysis Date:	8-30-18
Reporting Date:	9-6-18
Receipt Date:	7-24-18
Client Job No.:	None Given
Project Title:	None Given
DCMSL Project:	ACZ60

Client Sample No.:	**WME-1**	**WME-2**	**WME-3**	**WME-4**
Bulk Sample				
Quartz	47	55	59	46
K-Feldspar	15	14	11	13
Plagioclase	15	14	12	14
Calcite	10	8	8	8
Pyrite	1	1	1	1
Total Clay	12	8	9	18
Smectite	5	3	2	6
Illite	<1	<1	1	1
Kaolinite	6	4	4	9
Chlorite	1	1	1	2

Client Sample No.:	**WME-5**	**WME-6**	**WME-9**	**WME-10**
Bulk Sample				
Quartz	45	37	69	53
K-Feldspar	12	9	11	14
Plagioclase	12	12	10	14
Calcite	8	13	2	9
Pyrite	1	-	-	-
Total Clay	23	29	8	10
Smectite	9	13	3	4
Illite	2	2	2	1
Kaolinite	10	11	3	3
Chlorite	2	3	<1	2

12421 W. 49th Avenue, Unit #6
Wheat Ridge, CO 80033 (303) 463-8270

Semi-Quantitative X-Ray Diffraction Analysis

Client:
ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

Analysis Date: 8-30-18
Reporting Date: 9-6-18
Receipt Date: 7-24-18
Client Job No.: None Given
Project Title: None Given
DCMSL Project: ACZ60

Client Sample No.:	**WME-8@110**	**WME-8@121**	**WME-11**	**WME-14**
Bulk Sample				
Quartz	72	74	73	40
K-Feldspar	10	8	7	5
Plagioclase	7	7	7	6
Calcite	4	6	9	21
Pyrite	-	-	1	-
Amorphous	-	-	-	13
Total Clay	7	5	3	15
Smectite	4	3	1	4
Illite	1	1	1	6
Kaolinite	2	1	1	5
Chlorite	<1	<1	-	-

12421 W. 49th Avenue, Unit #6
Wheat Ridge, CO 80033 (303) 463-8270

Semi-Quantitative X-Ray Diffraction Analysis

Client:
ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

Analysis Date: 8-30-18
Reporting Date: 9-6-18
Receipt Date: 7-24-18
Client Job No.: None Given
Project Title: None Given
DCMSL Project: ACZ60

Client Sample No.:	**WME-15**	**WME-16**	**WME-17**
Bulk Sample			
Quartz	72	77	77
K-Feldspar	7	8	8
Plagioclase	5	7	9
Calcite	11	6	4
Pyrite	-	-	-
Amorphous	-	-	-
Total Clay	5	2	2
Smectite	3	1	1
Illite	1	<1	<1
Kaolinite	1	1	1
Chlorite	-	<1	<1

The bulk samples were prepared for x-ray diffraction analysis and scanned over a range of 3º to 45º 2θ Cu Kα radiation, 40kV, 25mA. Mineral phases were identified with the aid of computer-assisted programs accessing a powder diffraction database. Estimates of mineral concentrations are based on relative peak heights and reference intensity ratios (RIR) measured in-house.

DCM SCIENCE LABORATORY, INC.
12421 W. 49th Avenue, Unit #6
Wheat Ridge, CO 80033 (303) 463-8270

Semi-Quantitative X-Ray Diffraction Analysis

Client:
ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

Analysis Date: 8-30-18
Reporting Date: 9-6-18
Receipt Date: 7-24-18
Client Job No.: None Given
Project Title: None Given
DCMSL Project: ACZ60

Client Sample No.:	**WME-1**	**WME-2**	**WME-3**	**WME-4**
Clay Fraction <2µm				
Smectite	39	34	27	35
Illite	5	4	11	5
Kaolinite	49	56	48	49
Chlorite	7	6	14	11

Client Sample No.:	**WME-5**	**WME-6**	**WME-9**	**WME-10**
Clay Fraction <2µm				
Smectite	37	45	32	40
Illite	8	7	19	12
Kaolinite	44	39	42	33
Chlorite	11	9	7	15

Client Sample No.:	**WME-8@110**	**WME-8@121**	**WME-11**	**WME-14**
Clay Fraction <2µm				
Smectite	55	56	47	25
Illite	13	14	20	41
Kaolinite	29	27	33	34
Chlorite	3	3	-	-

12421 W. 49th Avenue, Unit #6
Wheat Ridge, CO 80033 (303) 463-8270

Semi-Quantitative X-Ray Diffraction Analysis

Client:
ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

Analysis Date:	8-30-18
Reporting Date:	9-6-18
Receipt Date:	7-24-18
Client Job No.:	None Given
Project Title:	None Given
DCMSL Project:	ACZ60

Client Sample No.:	**WME-15**	**WME-16**	**WME-17**
Clay Fraction <2µm			
Smectite	64	44	32
Illite	15	18	18
Kaolinite	21	36	47
Chlorite	-	2	3

An oriented clay mount (<2µm) was prepared for x-ray diffraction analysis and scanned over a range of 3° to 40° 2Θ Cu Ka radiation, 40kV, 25mA. The mount was analyzed air-dried (RH ~25%) and glycolated. Clay concentrations are based on peak areas and intensity factors measured in-house on known standards or computer calculated.

Ron Schott

Ron Schott, Analyst

DCM SCIENCE LABORATORY, INC.

September 6, 2018

Mr. Scott Habermehl
ACZ Laboratories, Inc.
2773 Downhill Drive
Steamboat Springs, CO 80487

Dear Mr. Habermehl:

We have performed scanning electron microscopy analysis on your six soil/tailing samples (client sample number **WME-2, WME-3, WME-5, WME-10, WME-14** and **WME-16)**. The results are outlined in the following report.

Thank you for the opportunity to provide this service. If you have any questions, please call.

Sincerely,

Ron Schott

Ron Schott
Analyst

12421 W. 49th Ave. ● Unit 6 ● Wheat Ridge, Colorado 80033
303-463-8270 ● Fax 303-463-8267 ● 800-852-7340
www.dcmsciencelab.com

12421 W. 49th Avenue, Unit #6
Wheat Ridge, CO 80033 - (303) 463-8270

Scanning Electron Microscopy Analysis

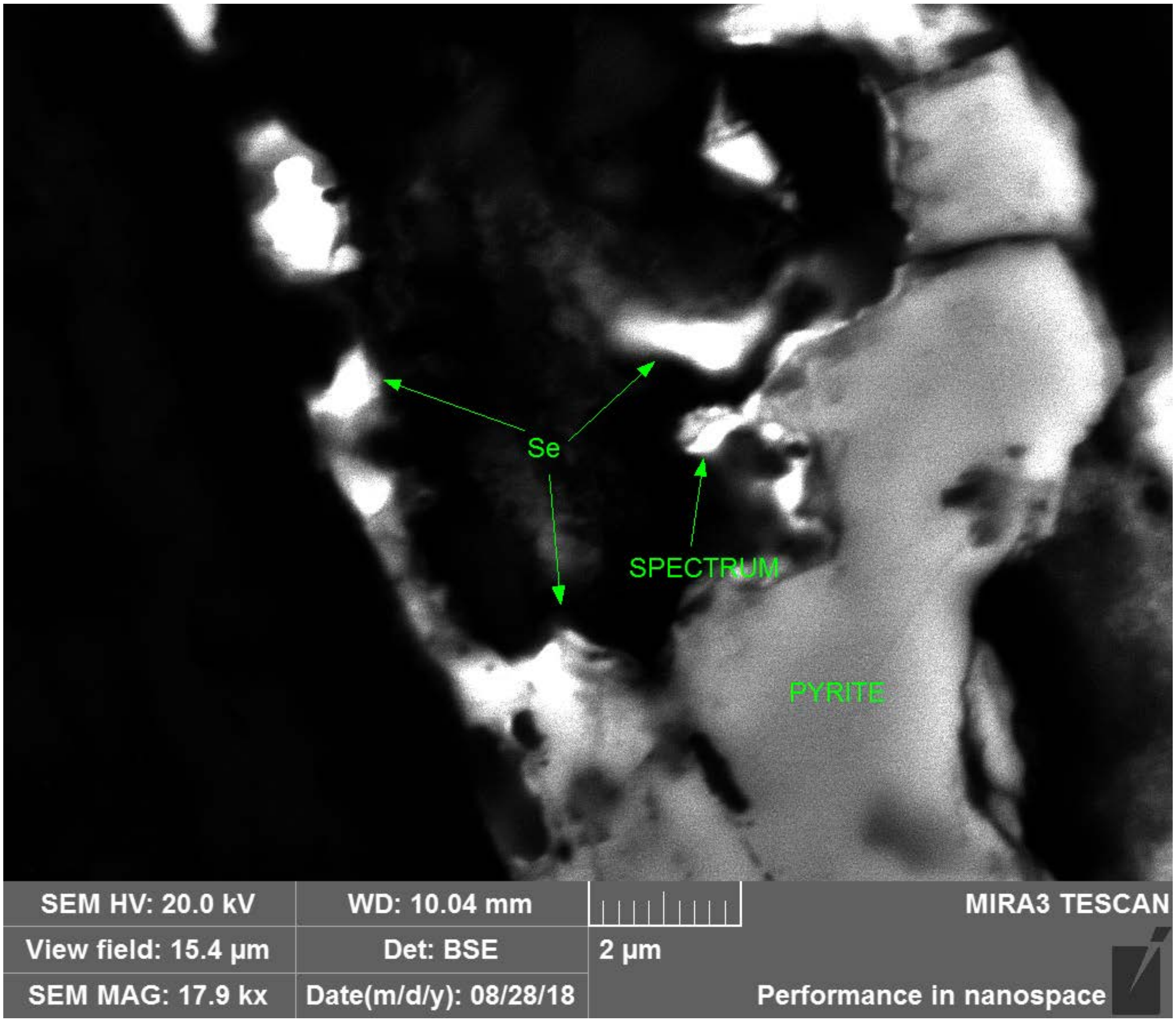
Client:		Analysis Date:	9-5-18
	ACZ Laboratories Inc.	Reporting Date:	9-6-18
	2773 Downhill Dr.	Receipt Date:	7-24-18
	Steamboat Springs, CO 80487	Client Job No.:	None Given
		Project Title:	None Given
		DCMSL Project:	ACZ61

The objective of this project is to determine U associations with other mineral phases contained in six soil/tailing samples (client samples no. **WME-2, WME-3, WME-5, WME-10, WME-14** and **WME-16**). Each sample was prepared as a polished thin section for study by field emission scanning electron microscopy (FE-SEM) equipped with an energy dispersive system (EDS). Particles of interest were identified using backscatter imaging at magnifications ranging from 500X to 50,000X, 20keV. FE-SEM images, spectra and some quant tables of relevant features are included for documentation.

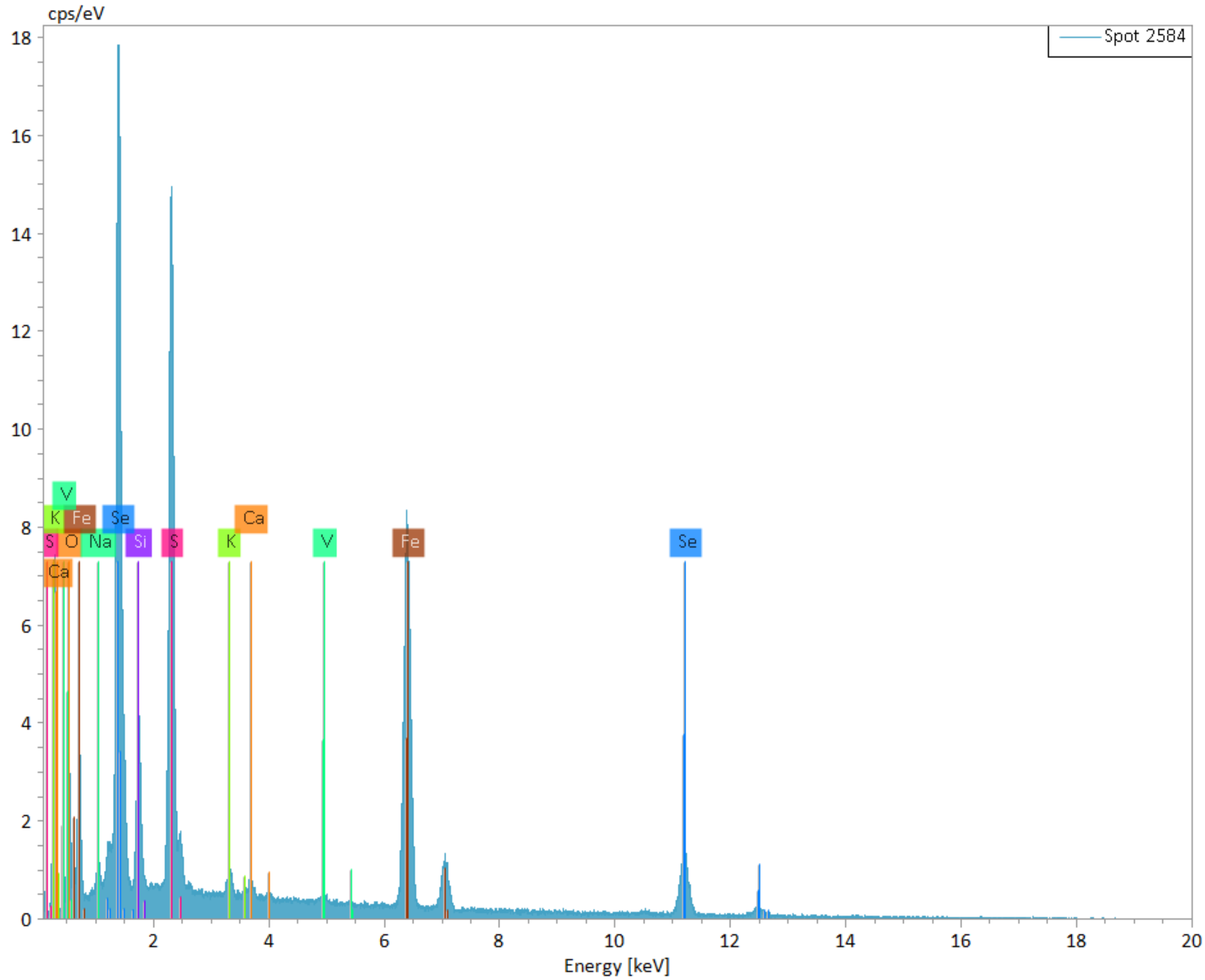
Client Sample No.: **WME-2**

This sample is a brown colored very fine to medium grained, silty sand with some clay content. Quartz (~55%) is the primary hard silicate and occurs as angular to rounded grains that vary greatly in size from 10µm up to 500µm. Plagioclase and potassium feldspar are present in like amounts. Plagioclase (~14%) occurs as angular fragments in the 5µm to 200µm size range. The plagioclase is commonly pitted and has corroded grain boundaries. K-spar (~14%) is angular to sub-rounded with a similar size range as the plagioclase. The feldspars commonly carry minute grains of zircon, xenotime and other rare earth phosphates of the monazite mineral group. Calcite (~8%) occurs as liberated grains in a size range of 10µm up to 250µm. A few fine-grained aggregates are also present. Clay is present in low amounts (~8%) and is seen coating quartz/feldspar and as small masses. XRD identifies the clay as mainly kaolinite (~4%), swelling smectite (~3%) and low amounts of illite (<1%) and chlorite (~1%). EDS x-ray microanalysis of several clay masses failed to detect U. Sulfides are present with pyrite as the primary type (~1%). Pyrite occurs as liberated fragments and as small inclusions in quartz. One fairly large pyrite mass is seen wearing a thin rind of Se with detectable V. Native Se and FeSe (ferroselite?) are also seen as minute liberated fragments. Although chalcopyrite is rare, it is present as minute inclusions in quartz/feldspar and pyrite. Barite is the only sulfate identified

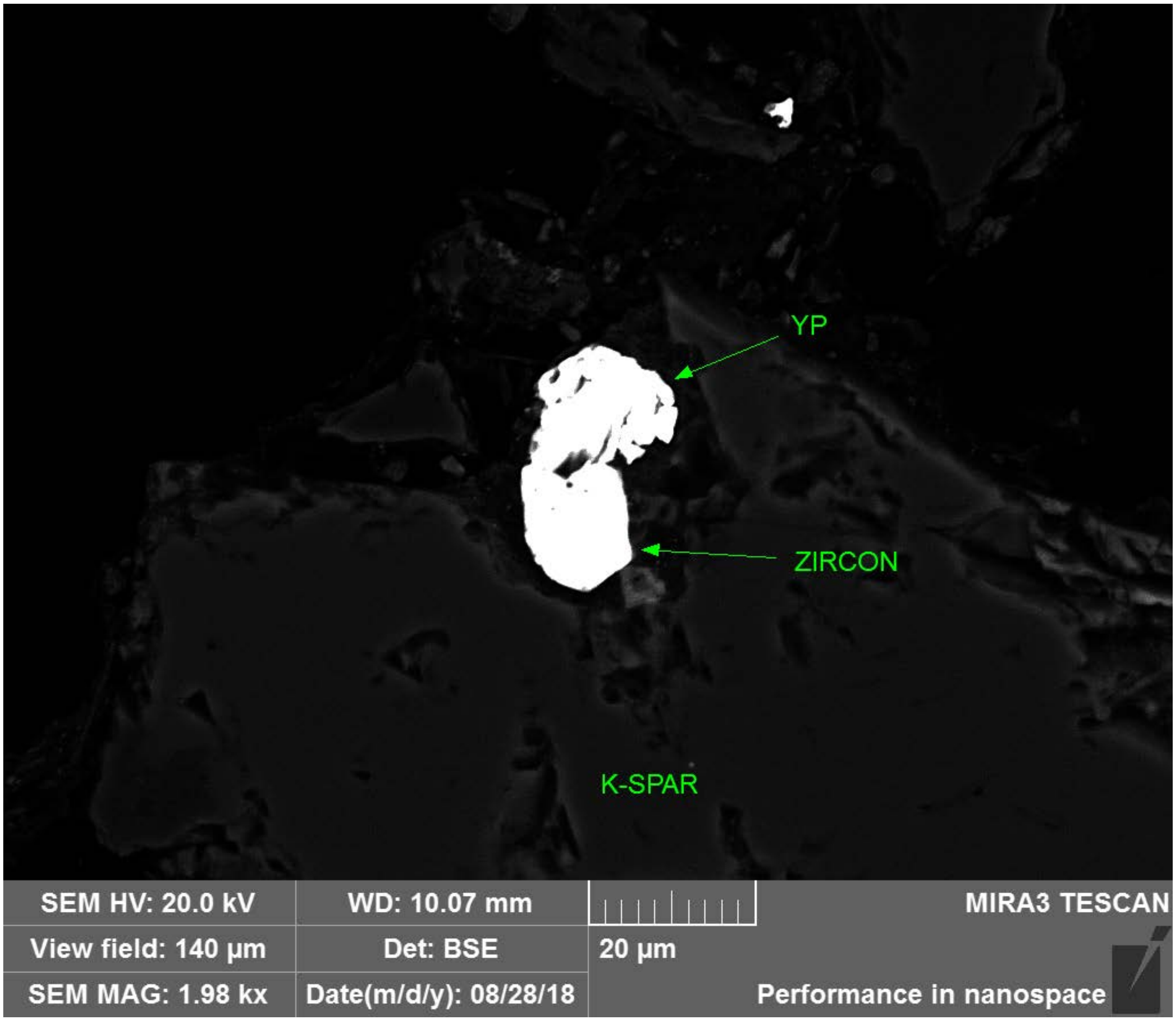
and occurs as liberated fragments and minute inclusions in quartz/feldspar. Oxides are present as a trace and include hematite, rutile, magnetite and Cu oxide with some Zn content. Two small grains of a U phase were identified attached to K-spar. The largest grain measures ~10µm and is composed primarily of U with lesser amounts of Ca and V.



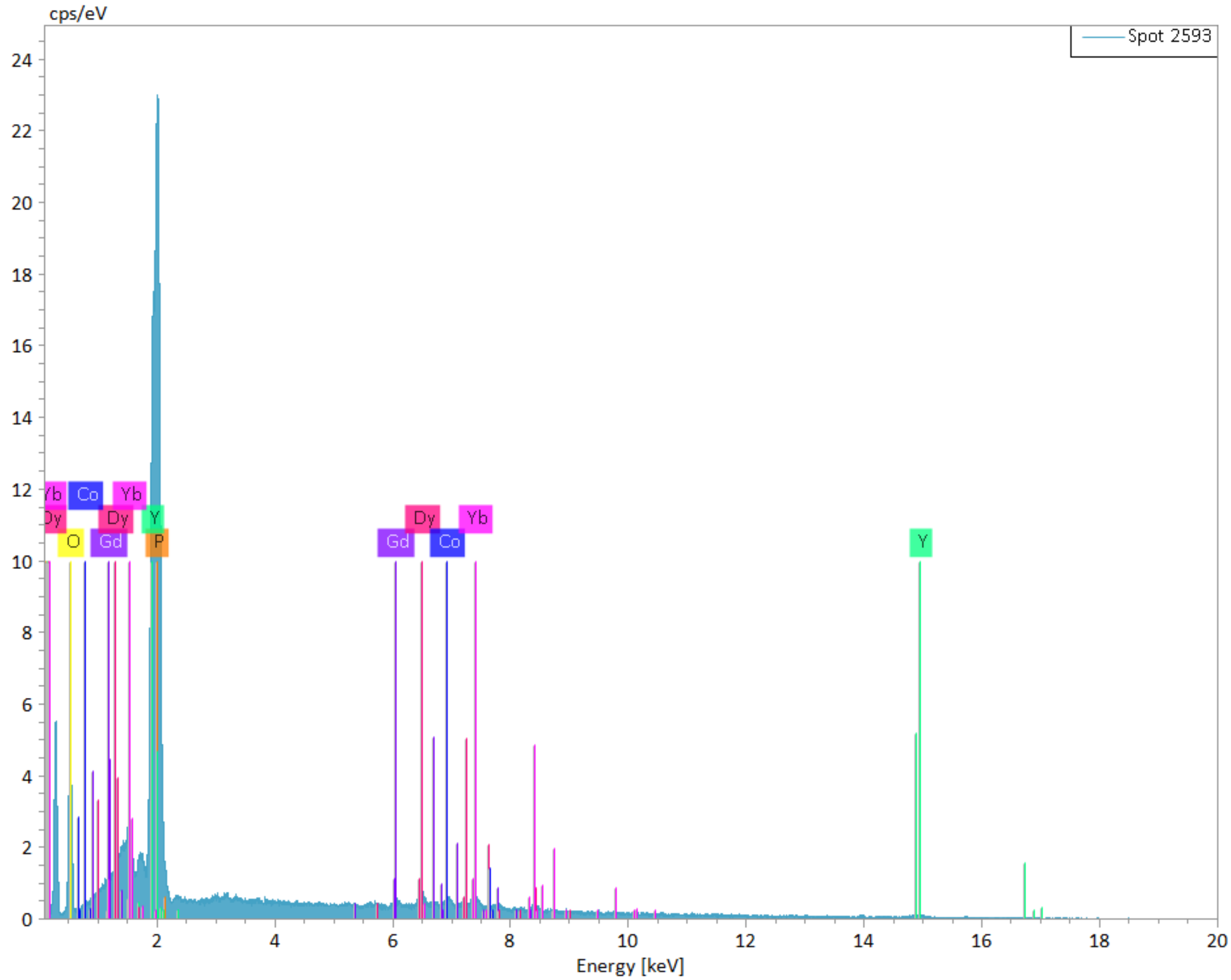
Client Sample No.: **WME-2**
Backscatter image of pyrite rimmed with Se – 17,900X

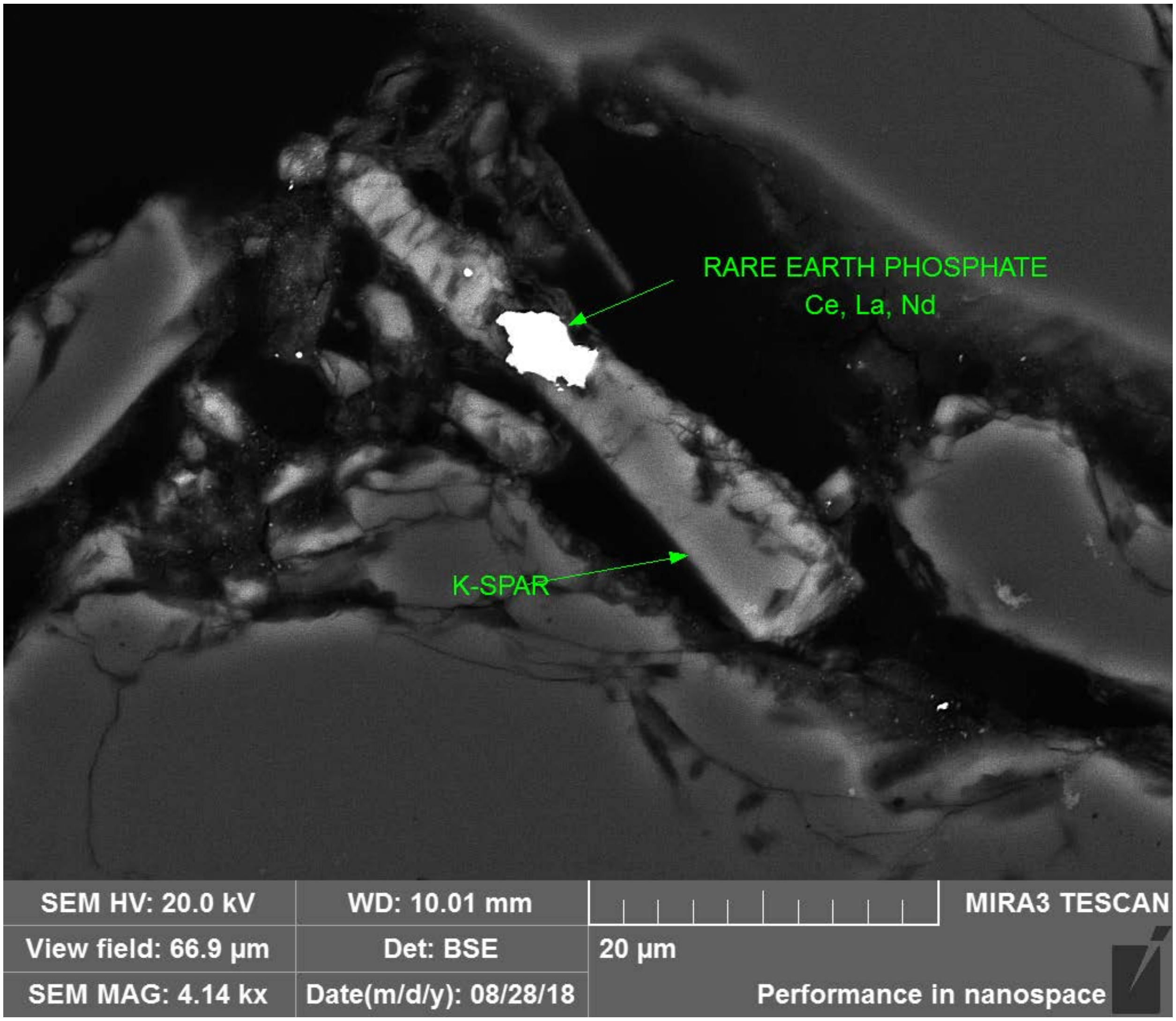


Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	667	0.49	0.85	3.36	0.15	30.54
Silicon	14	170	0.04	0.07	0.17	0.00	10.17
Sulfur	16	5061	1.10	1.90	3.74	0.07	6.28
Iron	26	58263	26.33	45.27	51.21	0.73	2.78
Selenium	34	25658	30.19	51.91	41.53	0.94	3.10
		Sum	**58.16**	**100.00**	**100.00**		

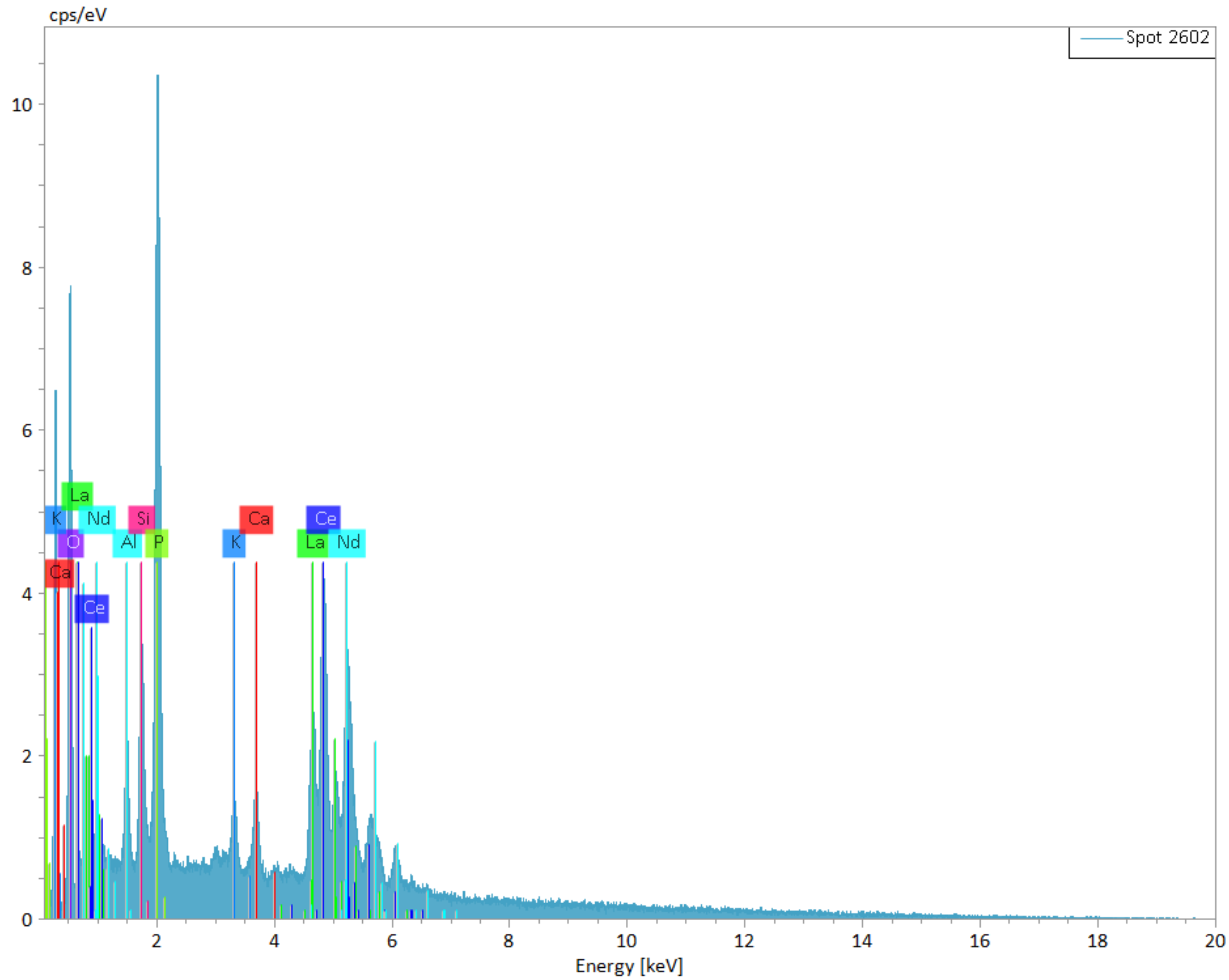


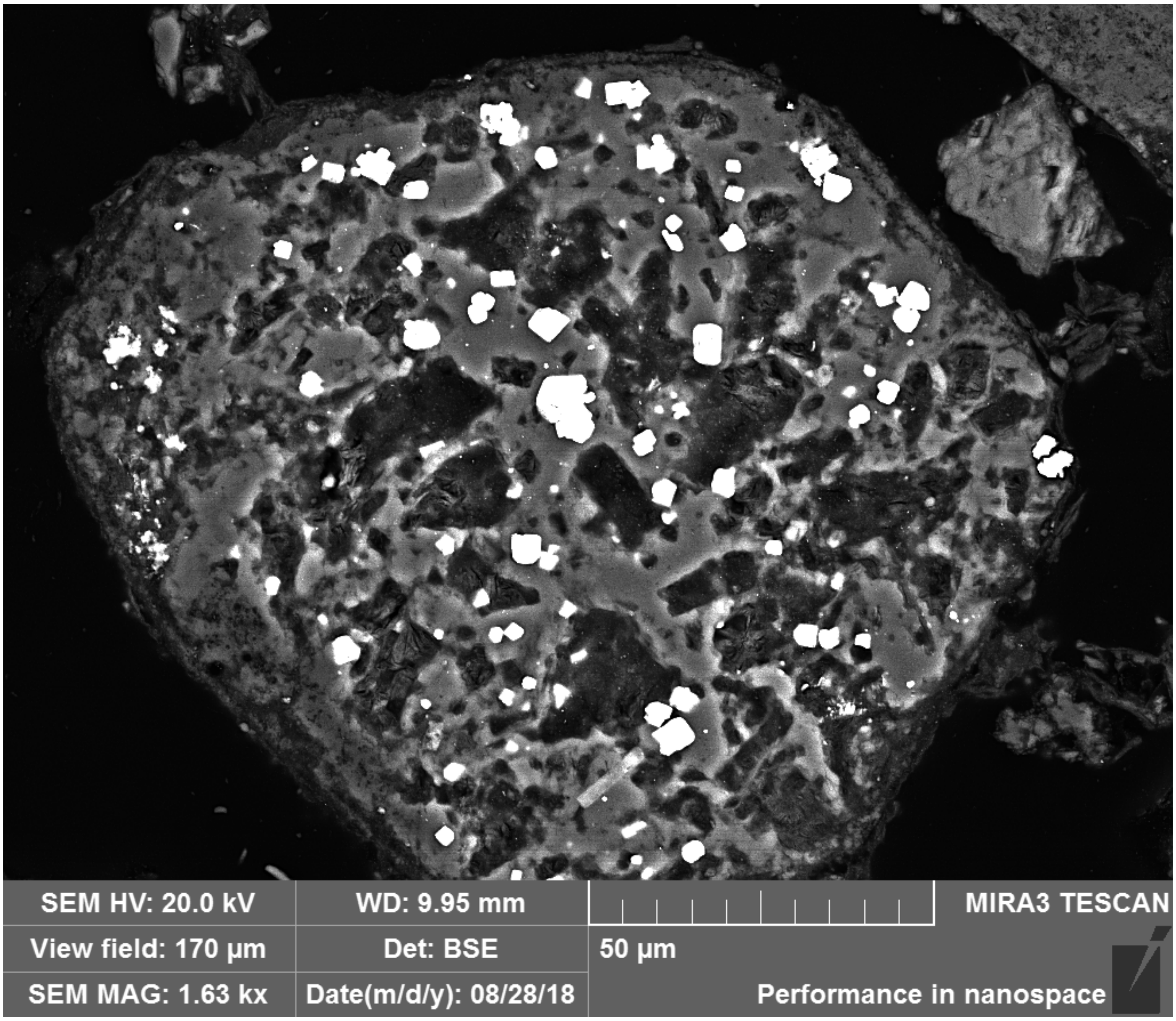
Client Sample No.: **WME-2**
Backscatter image of zircon and xenotime included in K-spar – 1,980X


cps/eV
Spot 2593
24
22
20
18
16
14
12
10
8
6
4
2
0
Yb
Co
Yb
Dy
Dy
Y
O
Gd
P
Dy
Yb
Gd
Co
Y
2
4
6
8
10
12
14
16
18
20
Energy [keV]

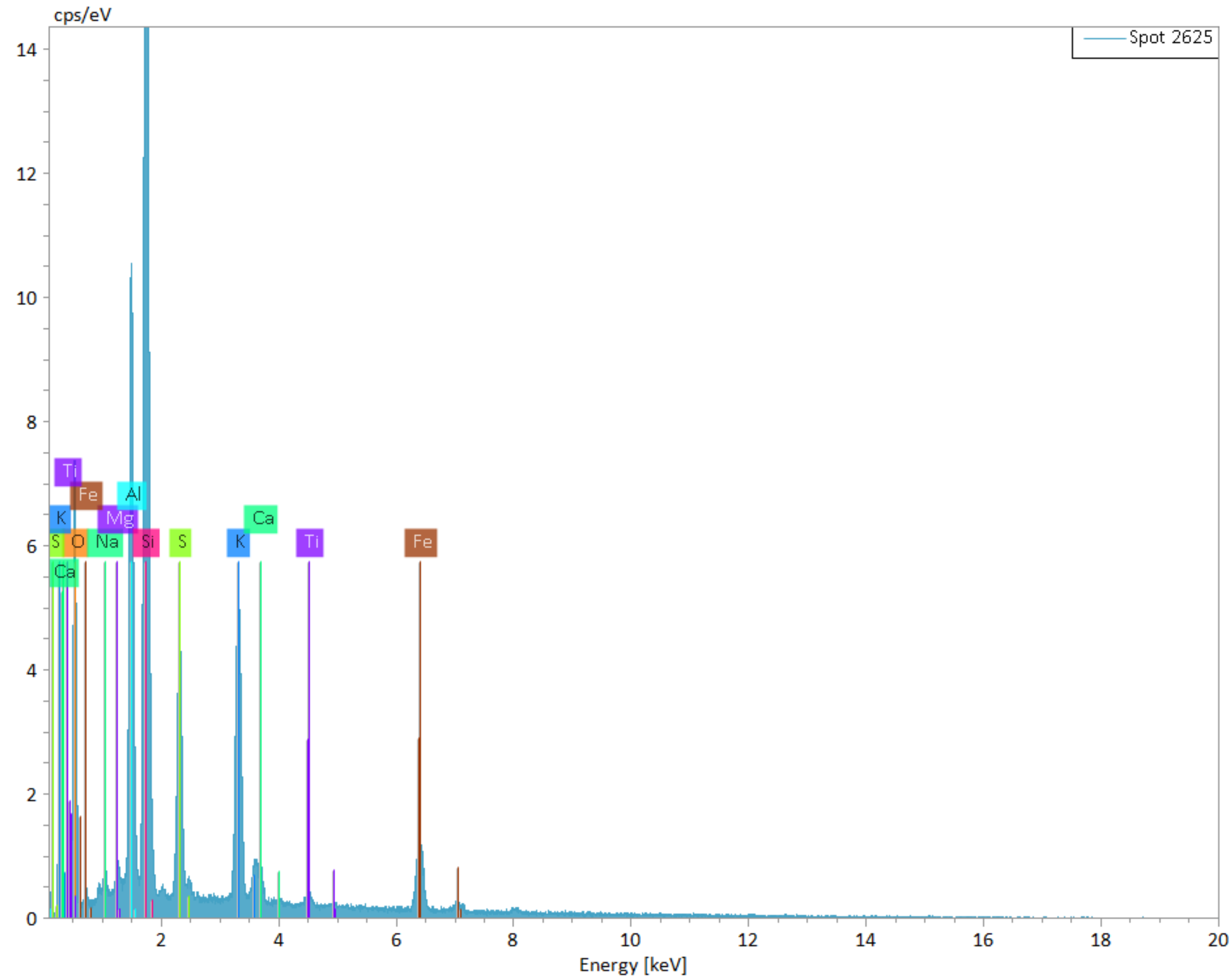


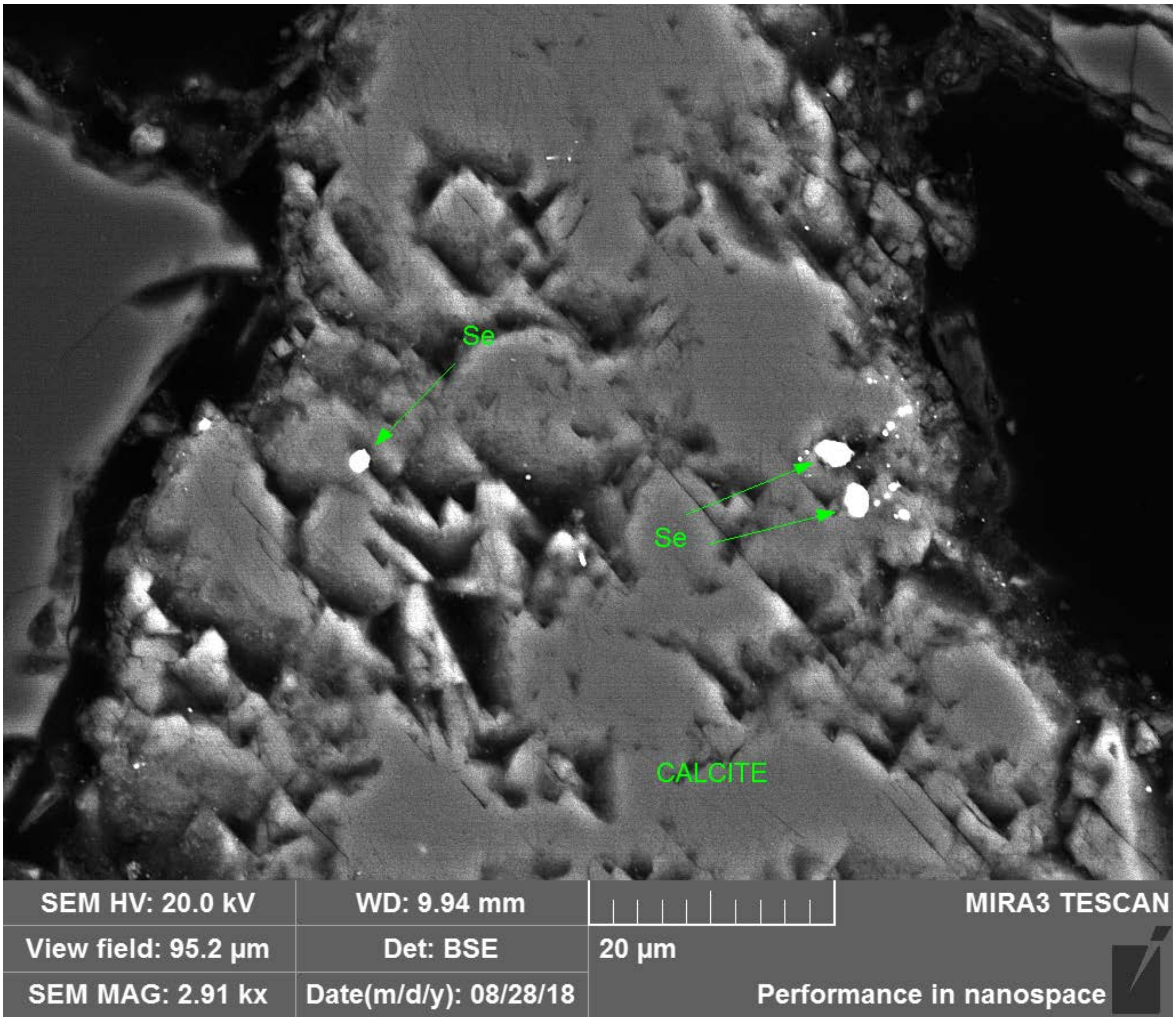
Client Sample No.: **WME-2**
Backscatter image of a monazite grain included in K-spar – 4,150X


cps/eV
Spot 2602
10
8
6
4
2
0
La
K
Nd
Si
Ca
Ce
O
Al
P
K
La
Nd
Ca
Ce
2
4
6
8
10
12
14
16
18
20
Energy [keV]

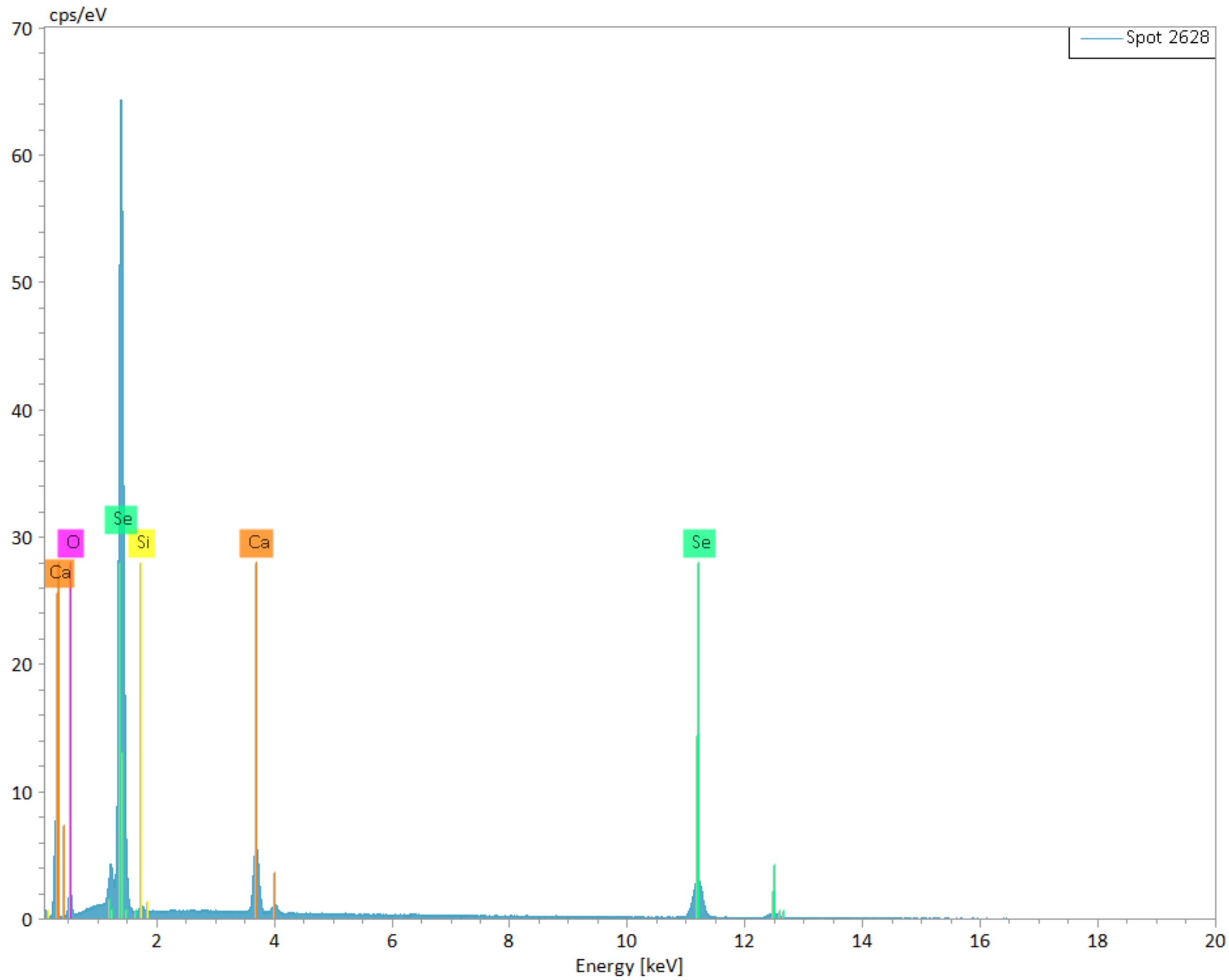


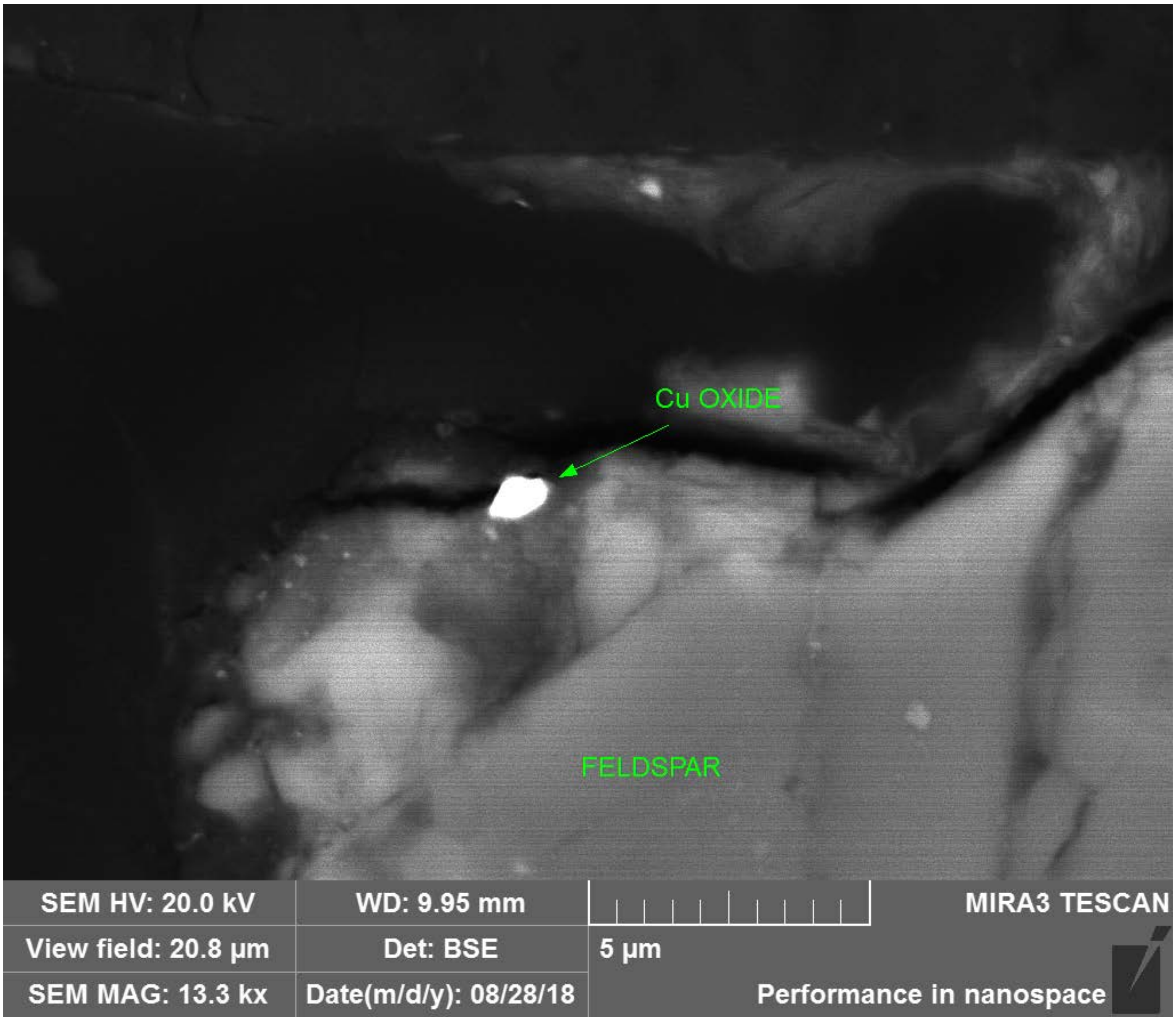
Client Sample No.: **WME-2**
Backscatter image showing numerous cubes of bright pyrite in a multi-mineral rock fragment
1,630X


cps/eV
Spot 2625
14
12
10
8
6
4
2
0
Ti
Fe
Al
K
Mg
Ca
S
O
Na
Si
S
K
Ti
Fe
Ca
2
4
6
8
10
12
14
16
18
20
Energy [keV]



Client Sample No.: **WME-2**
Backscatter image showing bright grains of native Se in calcite – 2,910X


cps/eV
Spot 2628
70
60
50
40
30
20
10
0
Se
O
Si
Ca
Ca
Se
2
4
6
8
10
12
14
16
18
20
Energy [keV]



Client Sample No.: **WME-2**
Backscatter image of bright copper oxide in feldspar – 13,300X

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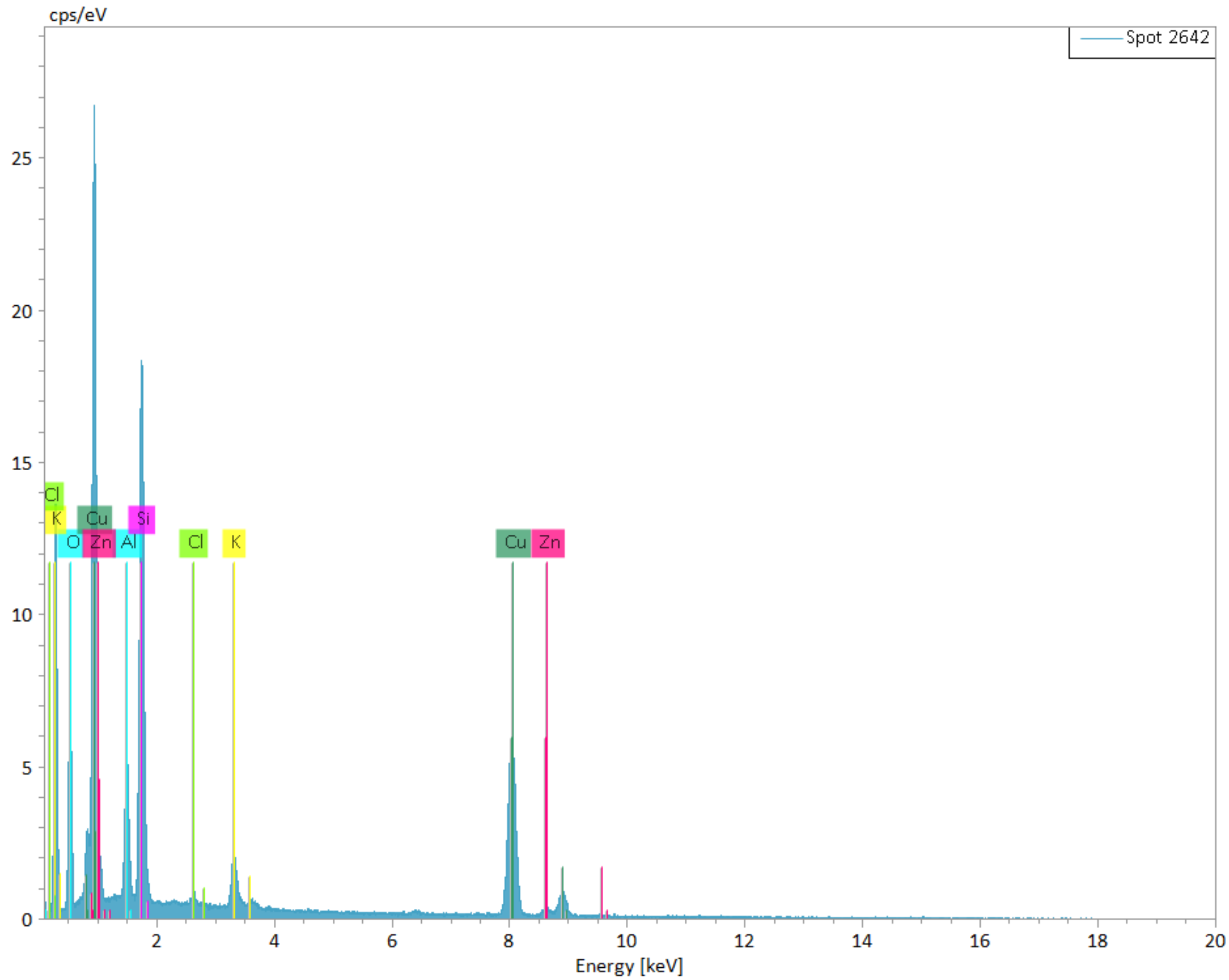
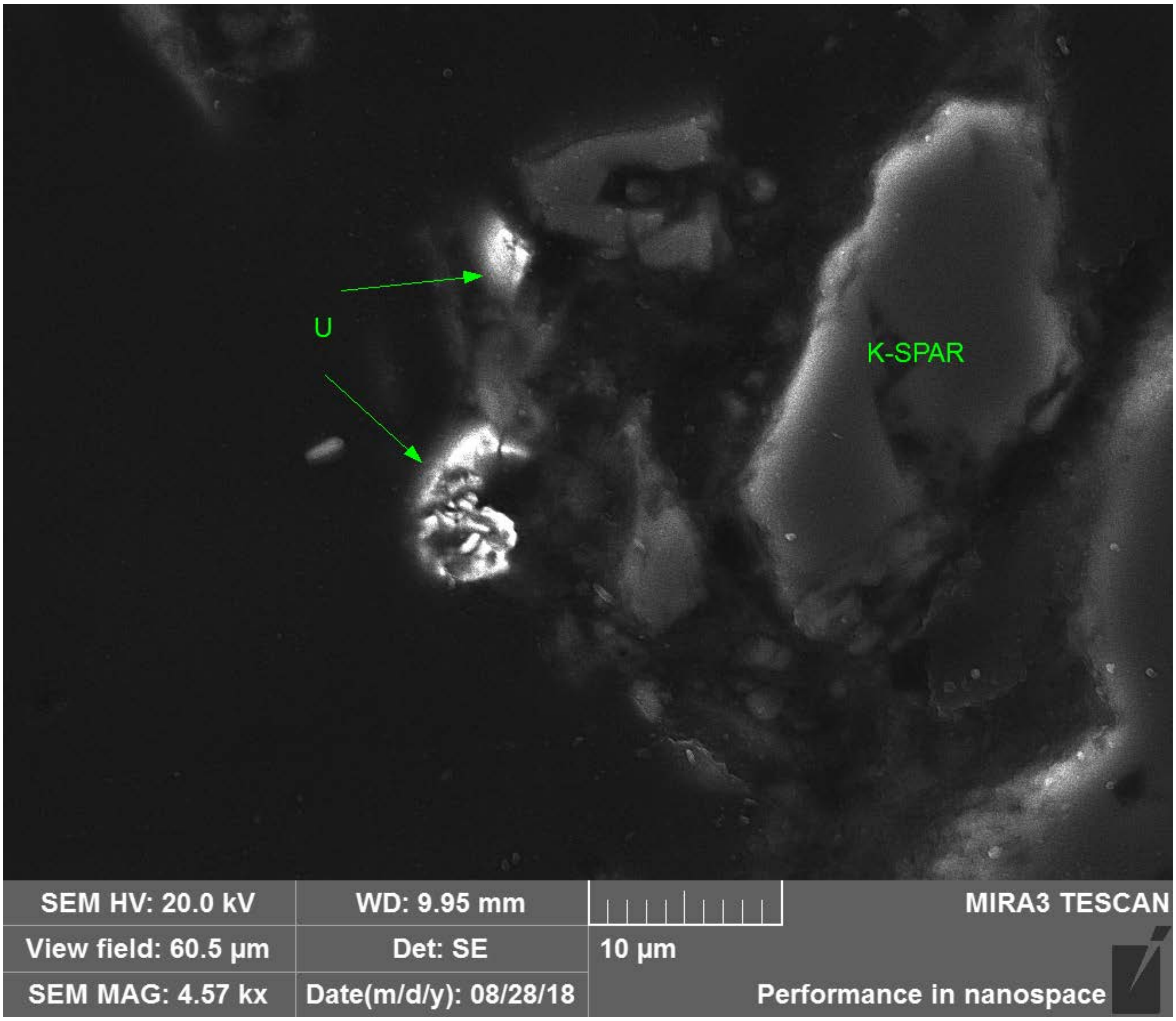
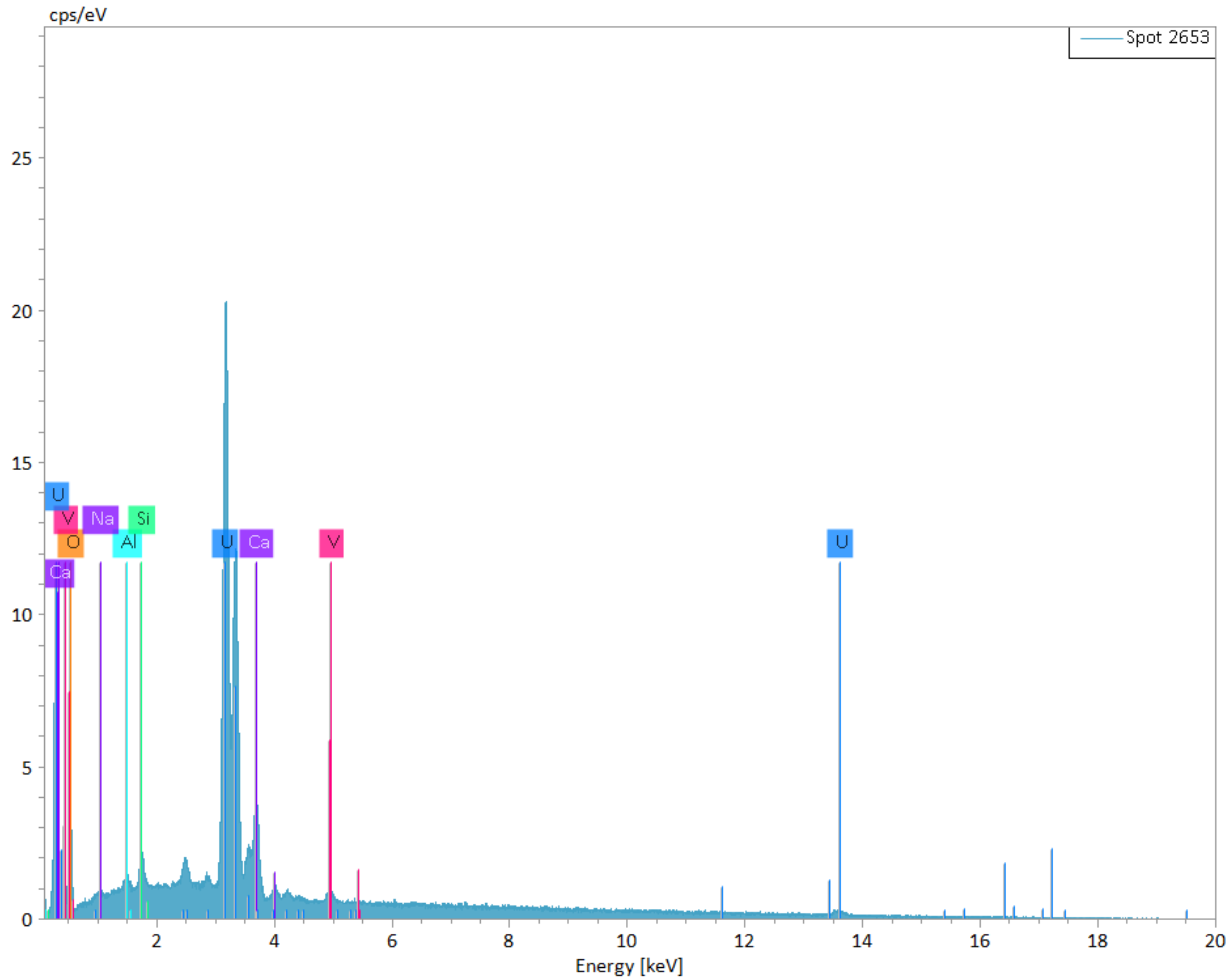
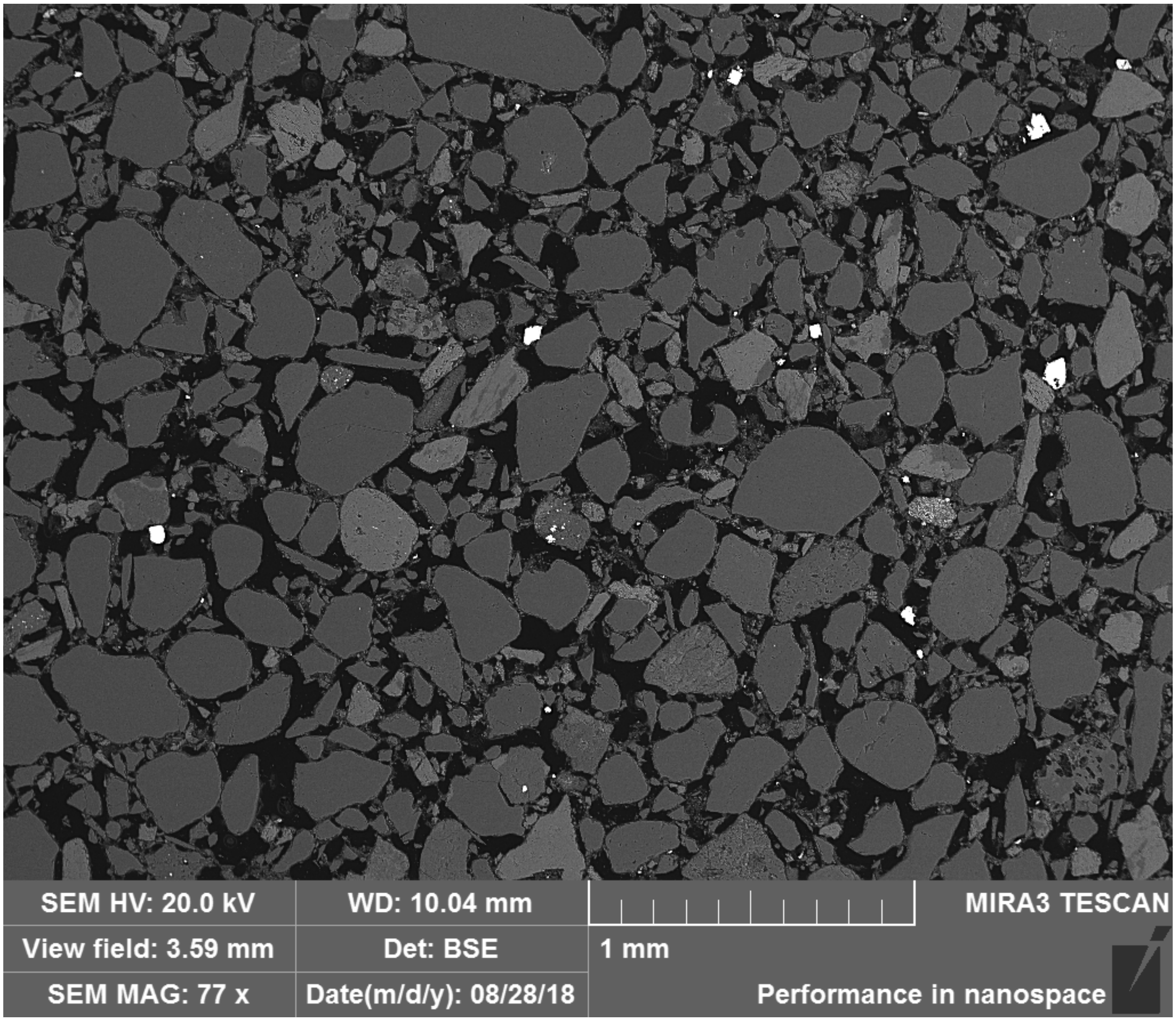

cps/eV
Spot 2642
25
20
15
10
5
0
Cl
K
O
Cu
Zn
Al
Si
Cl
K
Cu
Zn
2
4
6
8
10
12
14
16
18
20
Energy [keV]



Client Sample No.: **WME-2**
Backscatter image shows a U phase attached to K-spar – 4,570X



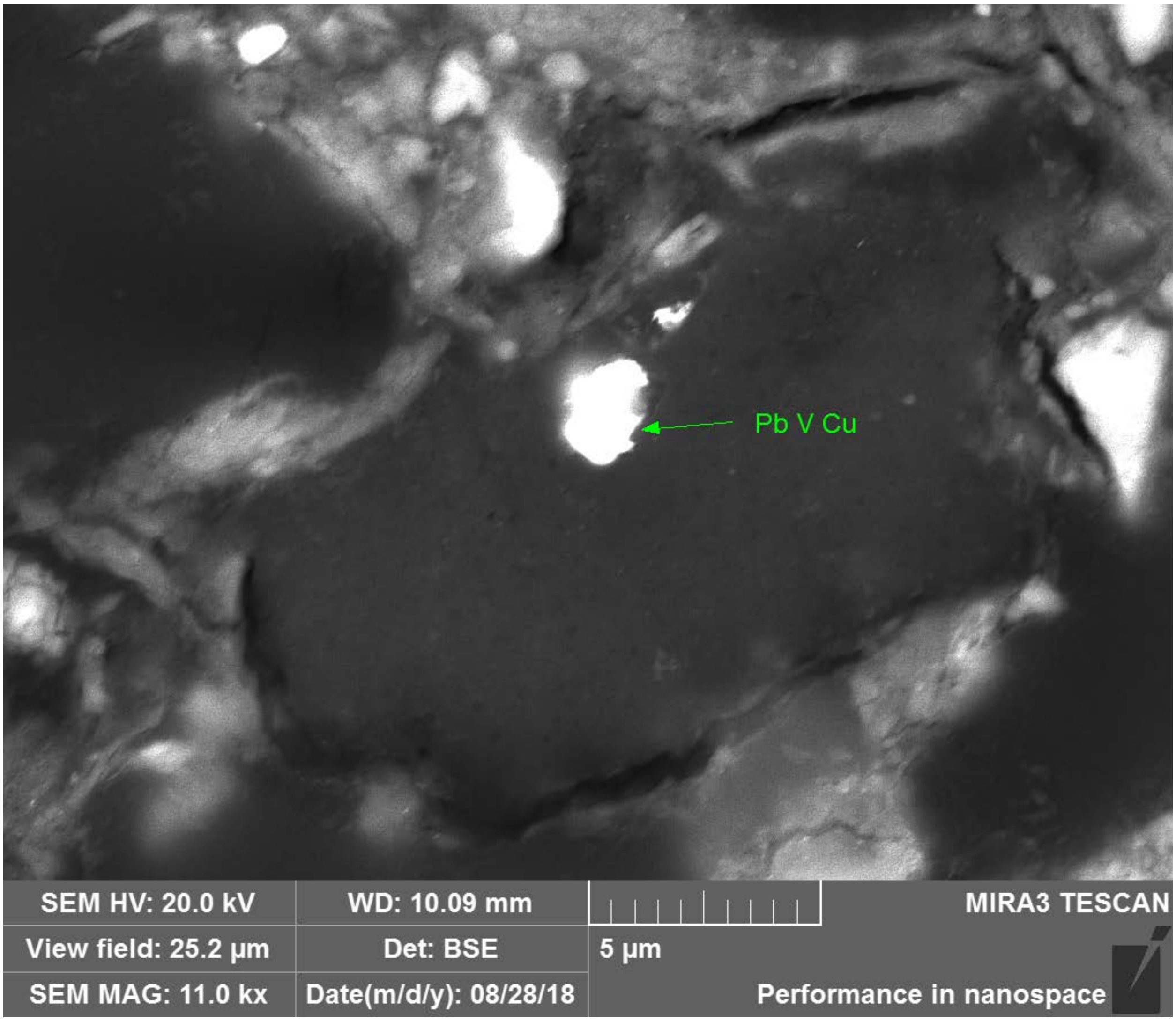
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	9088	5.77	10.27	47.87	0.84	14.63
Aluminium	13	2676	1.14	2.03	5.61	0.09	7.74
Silicon	14	5653	1.61	2.87	7.61	0.10	6.21
Calcium	20	17281	3.32	5.91	11.00	0.13	3.80
Vanadium	23	4315	1.54	2.74	4.02	0.07	4.85
Uranium	92	164409	42.81	76.19	23.88	1.33	3.11
		Sum	**56.20**	**100.00**	**100.00**		



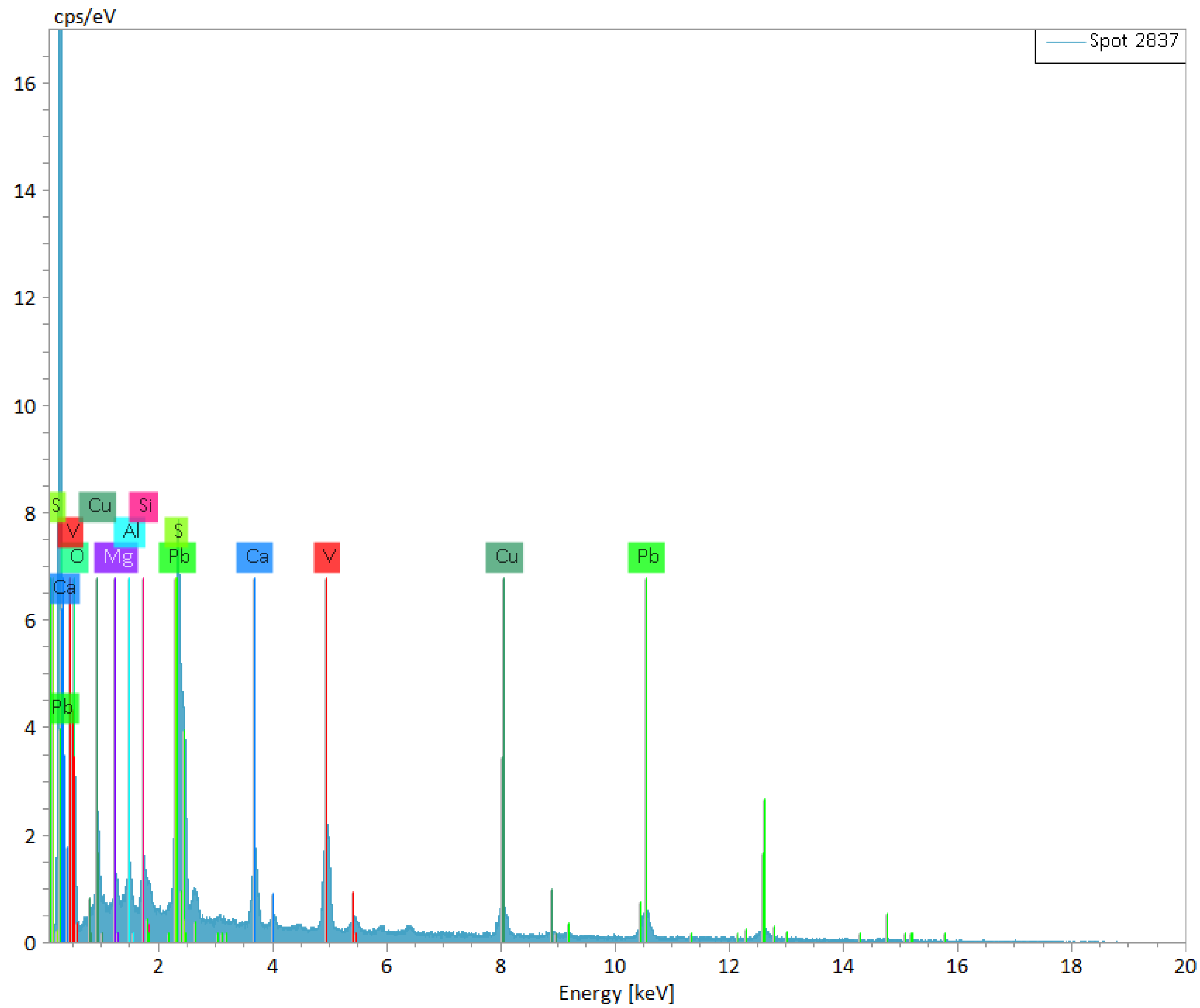
Client Sample No.: **WME-2**
Low magnification backscatter image showing grain size distribution – 77X

Client Sample No.: **WME-3**

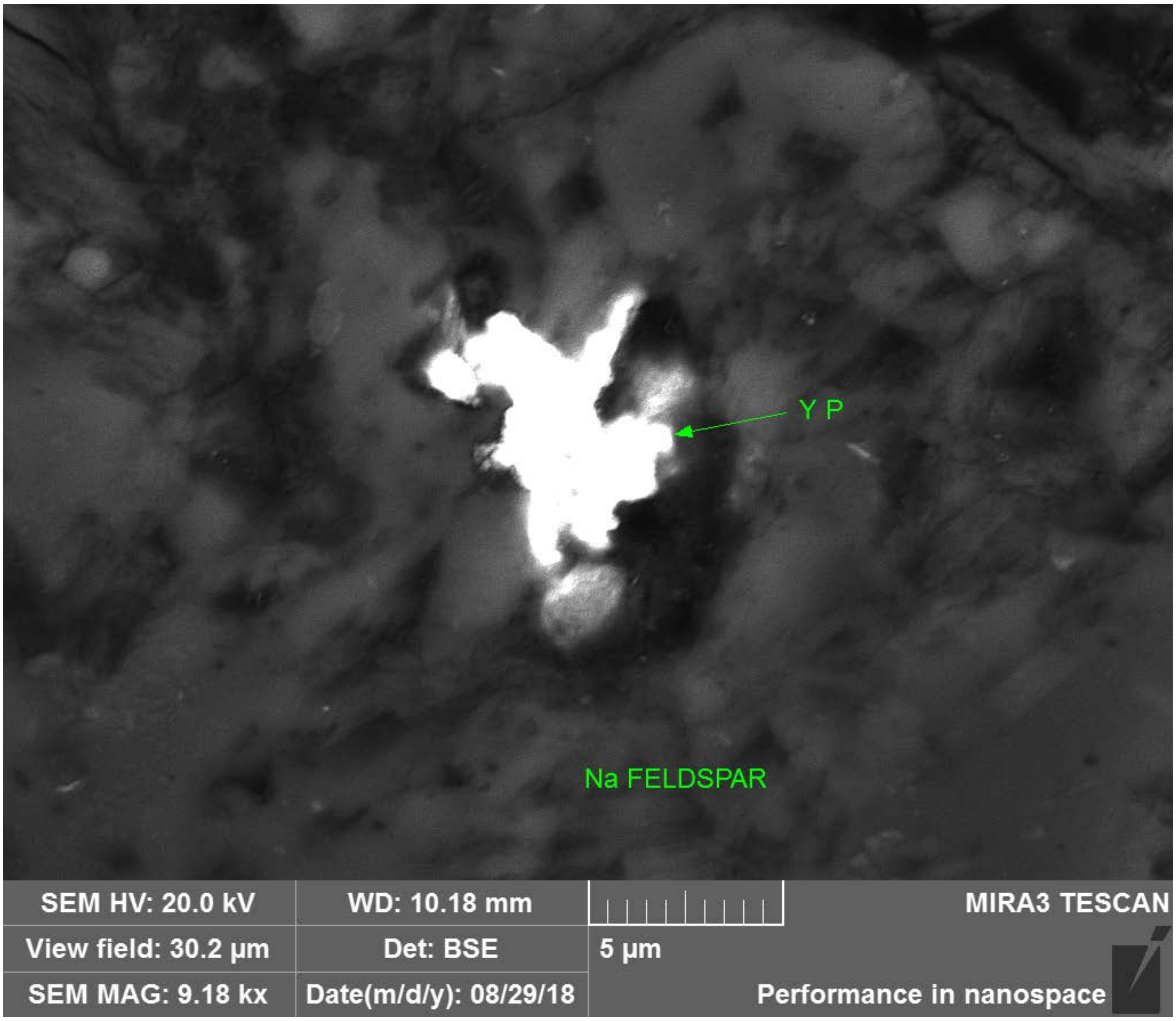
This sample is very similar to the previous sample **WME-2**. Texturally, the sample is a very fine to medium grained silty sand with some clay content. The bulk of the sediment is composed of hard silicates with quartz (~59%) as the primary type. Quartz occurs as angular to well rounded grains that vary from 5µm to 500µm in size. Collectively plagioclase and K-spar account for ~23% of the sample's mass. Plagioclase (~12%) occurs as angular to sub-angular fragments that measure from 5µm up to 250µm. Many of the grains exhibit corroded grain boundaries and intragrain pitting. K-spar (~11%) is angular to sub-rounded and has a similar grain size. The feldspars carry minute inclusions of barite, zircon and rare earth phosphates. Calcite (~8%) occurs as fine-grained aggregates and liberated grains up to 200µm. Clay minerals account for ~9% of the sample. XRD indicates kaolinite (~4%) is the primary type followed by swelling smectite (~2%), illite and chlorite at ~1% each. The clay minerals occur as grain coatings on silicates and small mixed masses with silt. Pyrite is the main sulfide and occurs as small liberated grains and euhedral cubes included in some of the quartz/feldspar. Chalcopyrite is present as a trace and occurs as minute inclusions in a small population of the hard silicates. Oxide mineralogy includes hematite, rutile, magnetite, and a rare Cu-Sn oxide. Selenides are present as a trace and include native Se, Fe selenide and a rare Pb-Cu selenide with low to moderate V content. Two examples of U bearing phases were identified. A grain of yttrium phosphate assumed to be xenotime, occurs as a small 6µm amoeba shaped inclusion in a pitted grain of plagioclase. EDS x-ray microanalysis of the grain in several areas confirms the presence of U, V, and significant As. Intermixed with clay/silt, a small liberated, 2.5µm grain composed primarily of U-Ti was identified.



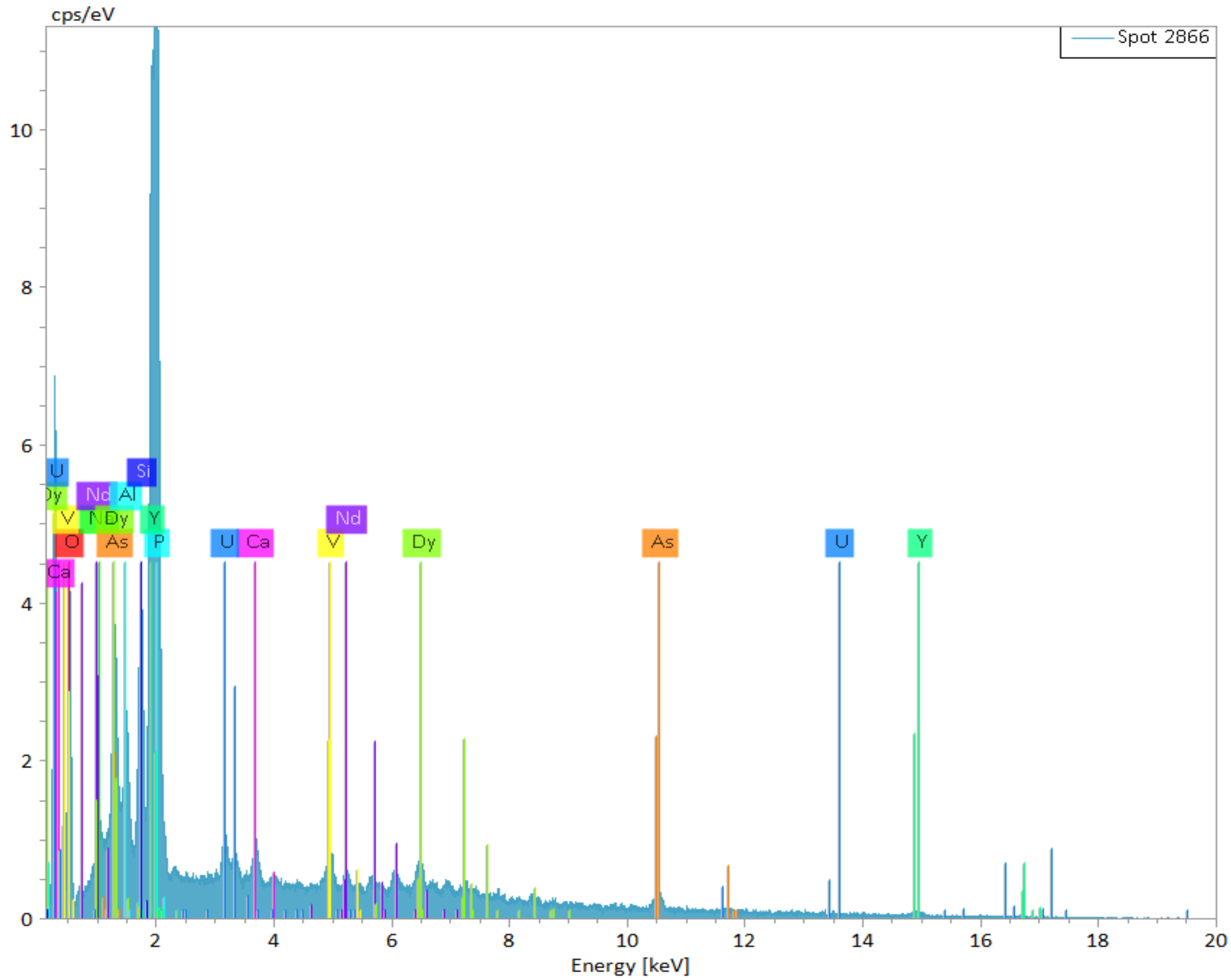
Client Sample No.: **WME-3**
Backscatter image of a bright Pb-V-Cu phase – 11,000X



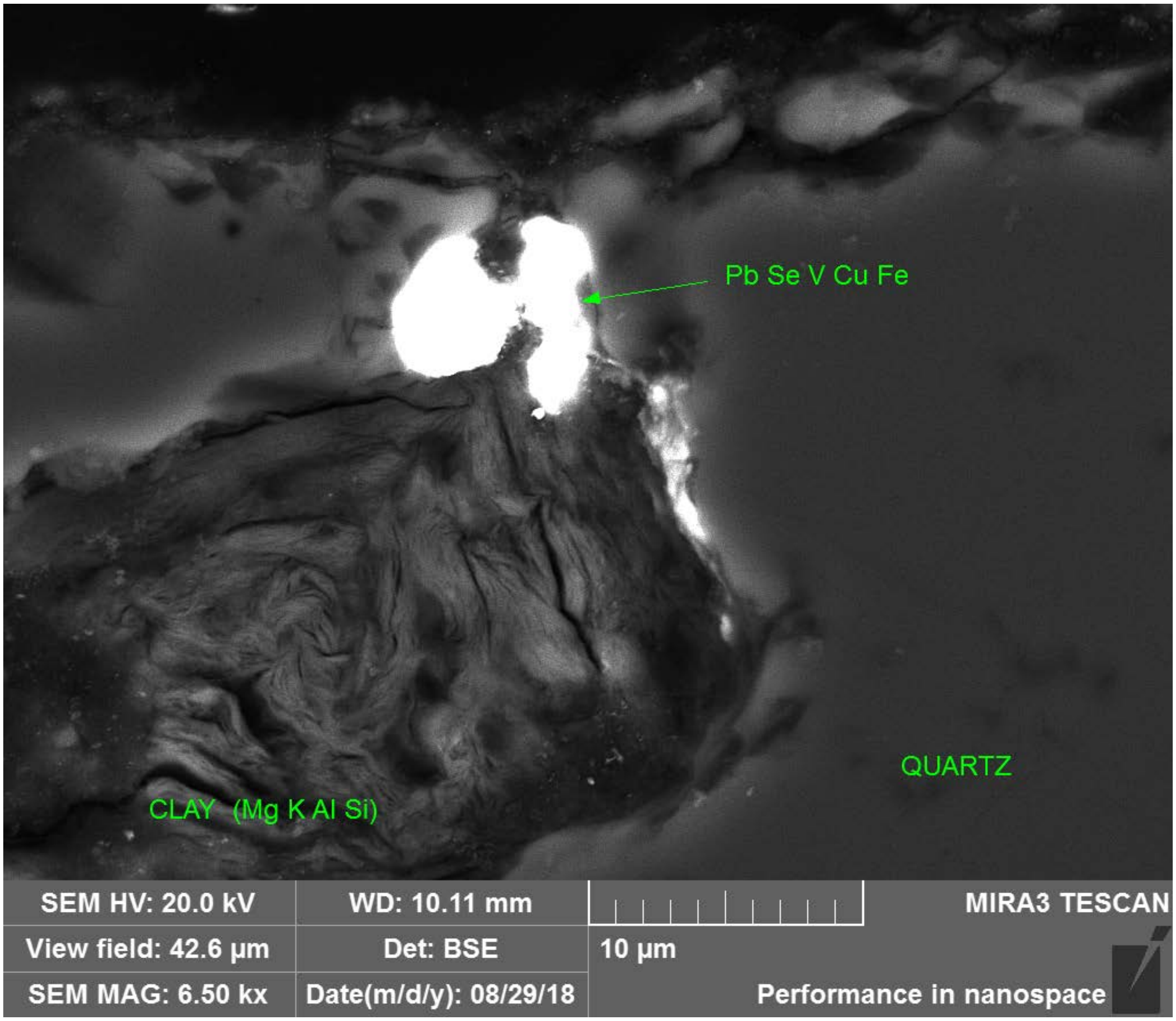
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	9111	16.81	26.86	70.26	2.41	14.34
Magnesium	12	0	0.00	0.00	0.00	0.00	3.46
Aluminium	13	0	0.00	0.00	0.00	0.00	2.77
Silicon	14	90	0.01	0.01	0.02	0.00	13.00
Calcium	20	8517	2.67	4.26	4.45	0.11	4.12
Vanadium	23	13264	7.20	11.51	9.46	0.23	3.24
Copper	29	4779	5.36	8.57	5.64	0.19	3.60
Lead	82	6538	30.34	48.48	9.79	1.03	3.41
Sulfur	16	2140	0.19	0.30	0.39	0.03	17.95
		Sum	**62.57**	**100.00**	**100.00**		



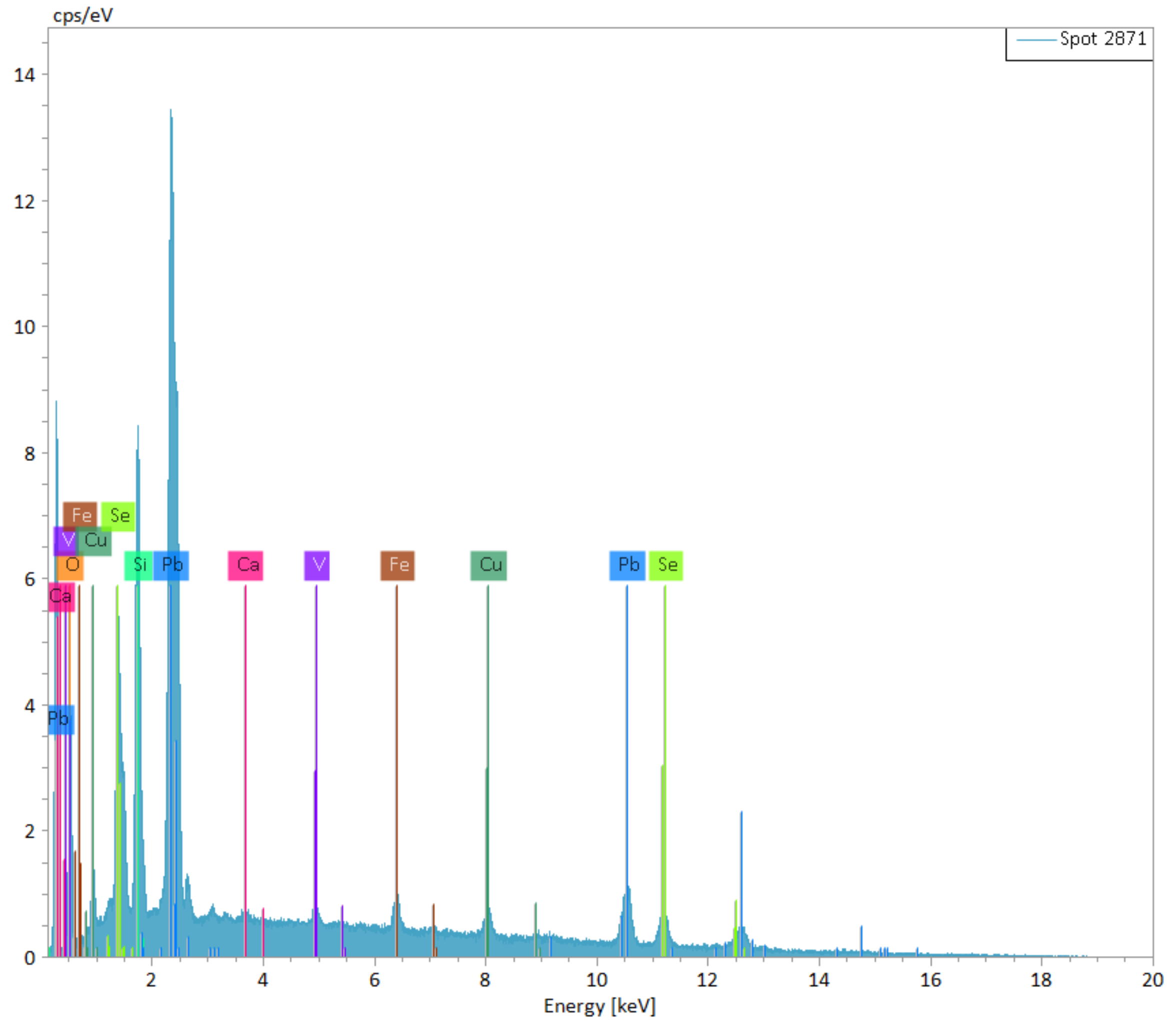
Client Sample No.: **WME-3**
Backscatter image of xenotime (?) associated with U and V in plagioclase feldspar – 9,180X



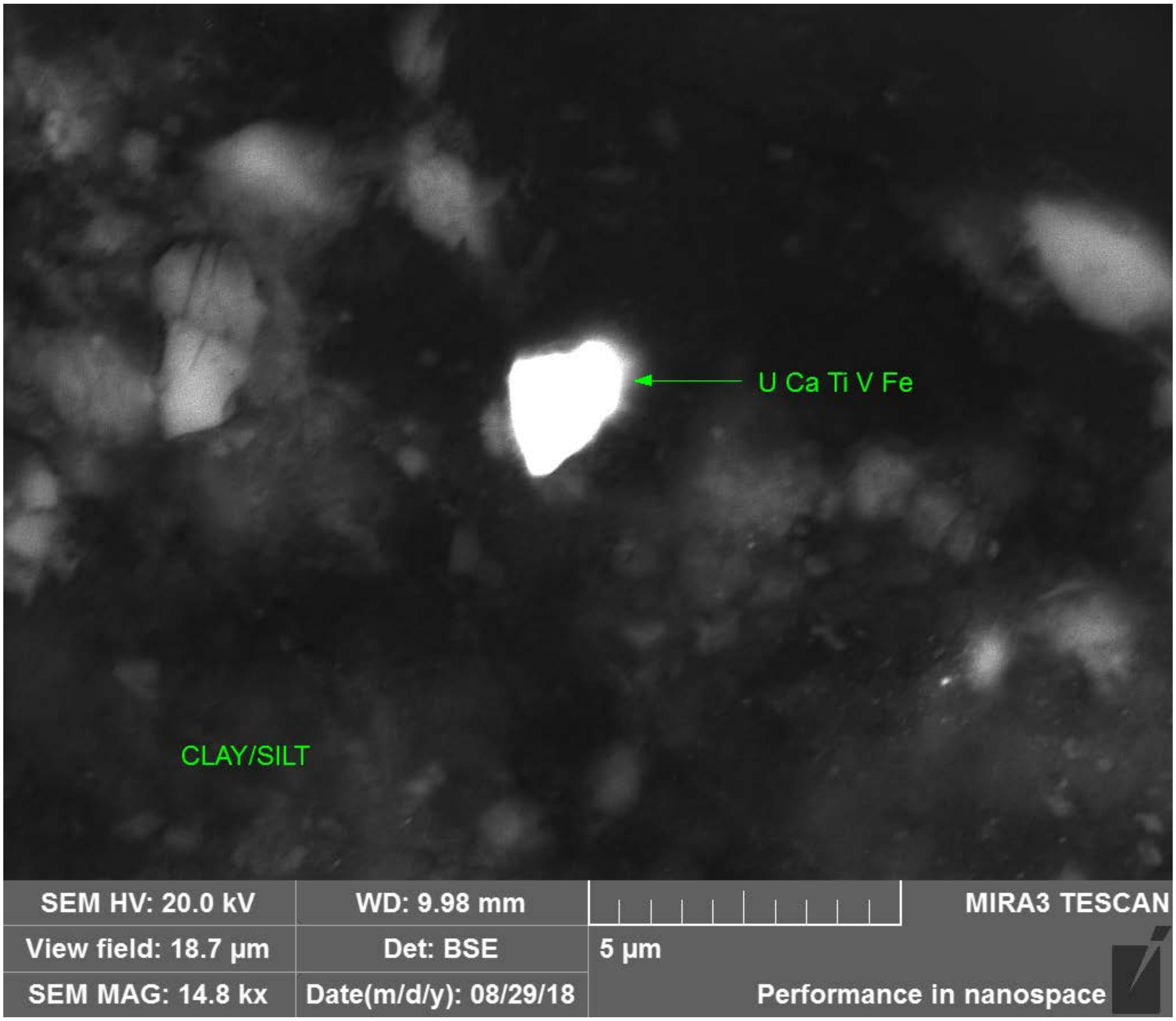
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	15581	15.51	25.44	55.93	2.07	13.37
Sodium	11	1961	0.54	0.88	1.35	0.07	12.09
Phosphorus	15	46569	7.03	11.53	13.10	0.30	4.27
Calcium	20	4308	0.97	1.60	1.40	0.06	5.99
Vanadium	23	4186	1.07	1.75	1.21	0.06	5.59
Arsenic	33	2537	3.55	5.82	2.73	0.15	4.37
Yttrium	39	878	21.16	34.70	13.73	1.33	6.31
Neodymium	60	3312	1.22	2.00	0.49	0.07	5.36
Dysprosium	66	6280	2.78	4.56	0.99	0.11	3.91
Uranium	92	6922	3.18	5.21	0.77	0.13	4.16
Aluminium	13	9914	1.75	2.87	3.74	0.11	6.44
Silicon	14	16986	2.22	3.64	4.56	0.12	5.52
		Sum	60.99	100.00	100.00		



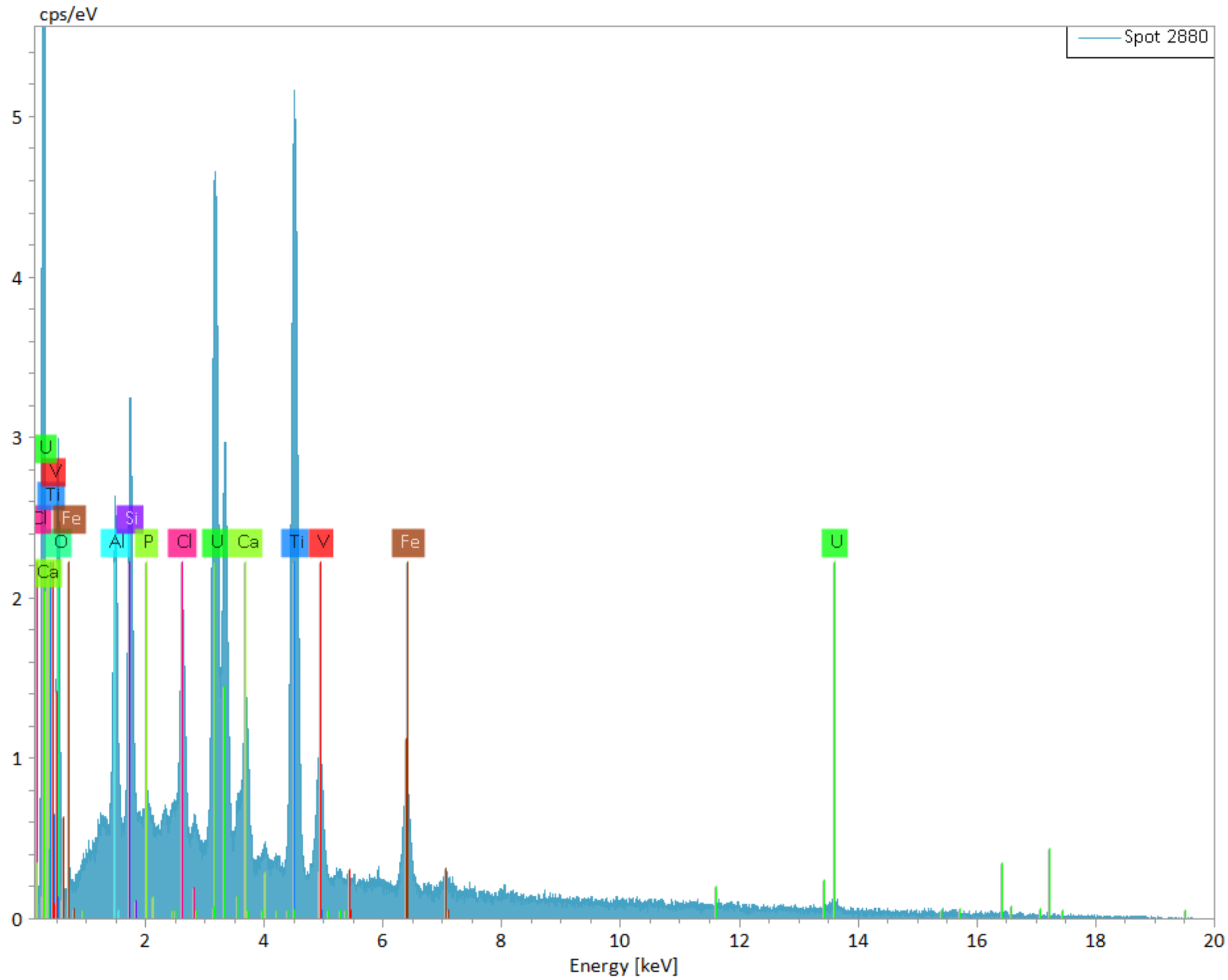
Client Sample No.: **WME-3**
Backscatter image showing a bright grain composed primarily of Pb with lesser amounts of Se, V, Cu and Fe next to a small vug filled with clay in quartz – 6,500X



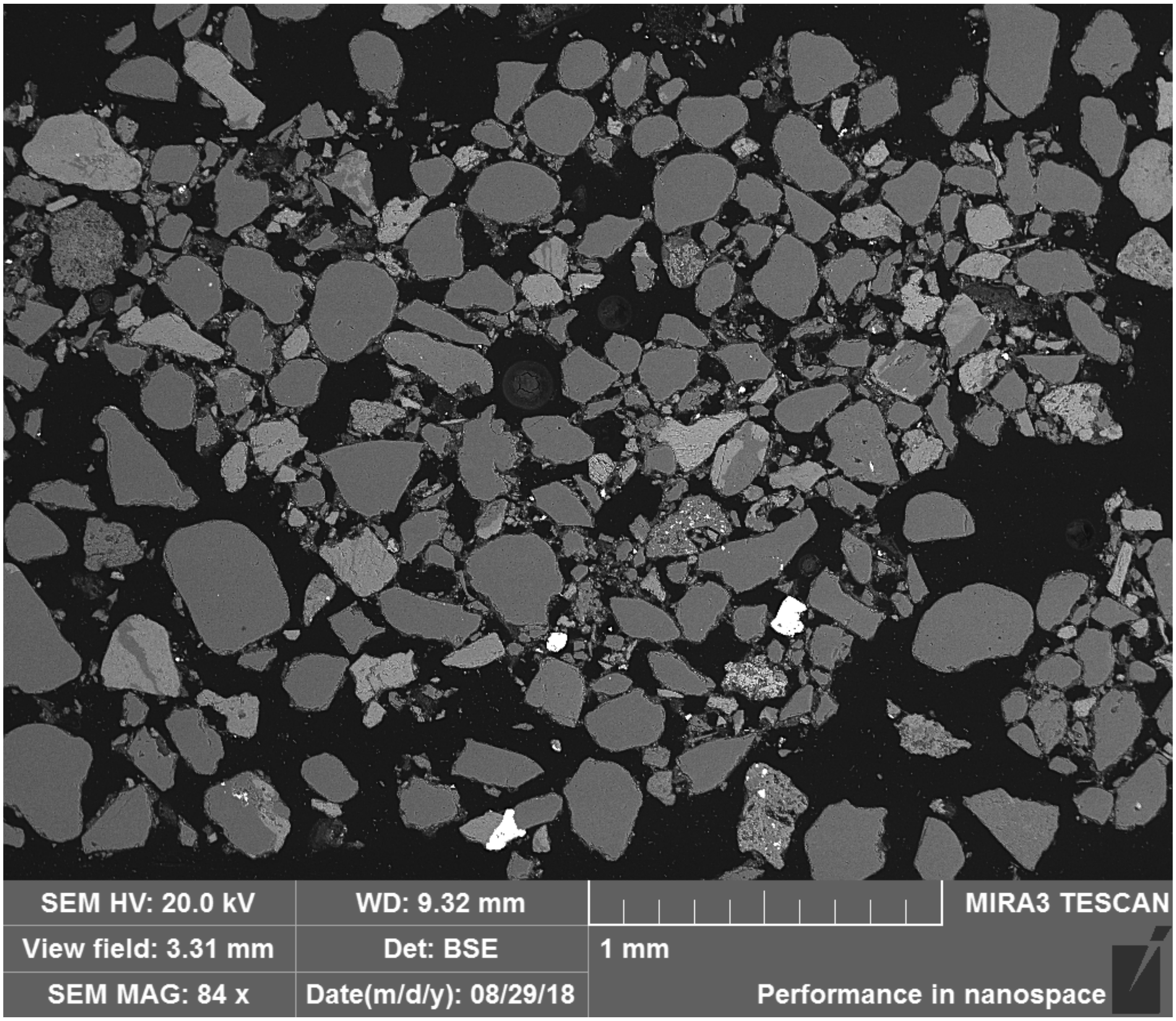
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	15085	13.25	17.02	55.37	1.78	13.45
Silicon	14	40352	6.25	8.03	14.88	0.29	4.72
Vanadium	23	2240	0.59	0.75	0.77	0.05	7.88
Iron	26	5240	1.72	2.21	2.06	0.08	4.53
Copper	29	5260	2.67	3.43	2.81	0.11	4.03
Selenium	34	7399	12.47	16.01	10.56	0.43	3.44
Lead	82	16944	40.68	52.23	13.12	1.29	3.18
Calcium	20	1056	0.26	0.33	0.43	0.04	14.19
		Sum	**77.90**	**100.00**	**100.00**		



Client Sample No.: **WME-3**
Backscatter image showing a bright liberated grain composed primarily of U and Ti – 14,800X



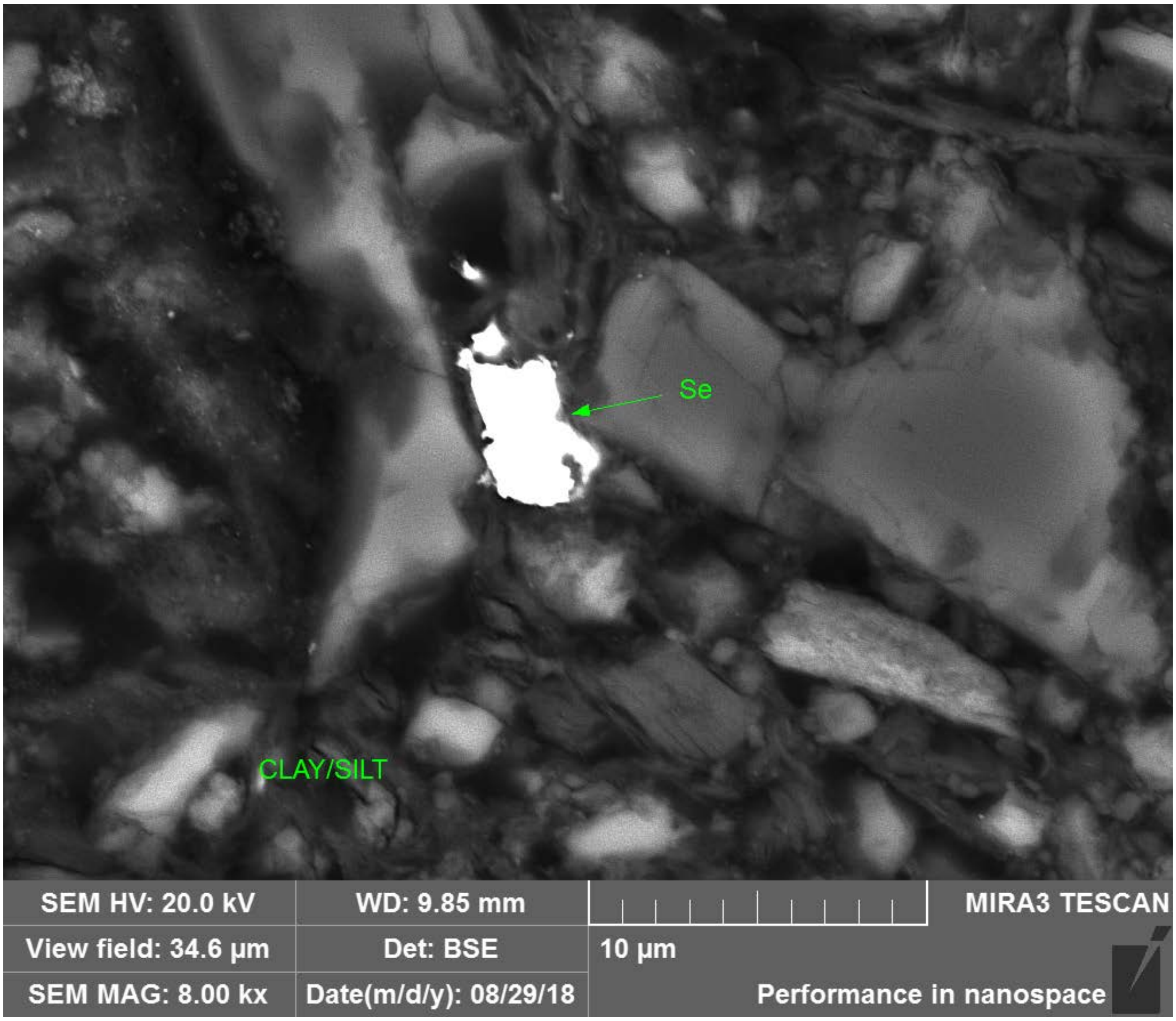
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	10311	13.03	21.87	52.39	1.84	14.13
Aluminium	13	10031	2.29	3.85	5.47	0.14	6.09
Silicon	14	13663	2.20	3.70	5.05	0.12	5.56
Chlorine	17	7926	1.32	2.21	2.39	0.07	5.54
Calcium	20	7576	1.90	3.19	3.05	0.09	4.53
Titanium	22	41171	15.69	26.33	21.08	0.47	2.98
Vanadium	23	1462	0.57	0.96	0.72	0.05	8.36
Iron	26	6631	4.05	6.79	4.66	0.15	3.61
Uranium	92	46238	18.44	30.94	4.98	0.60	3.23
Phosphorus	15	540	0.10	0.16	0.20	0.03	32.58
		Sum	**59.60**	**100.00**	**100.00**		



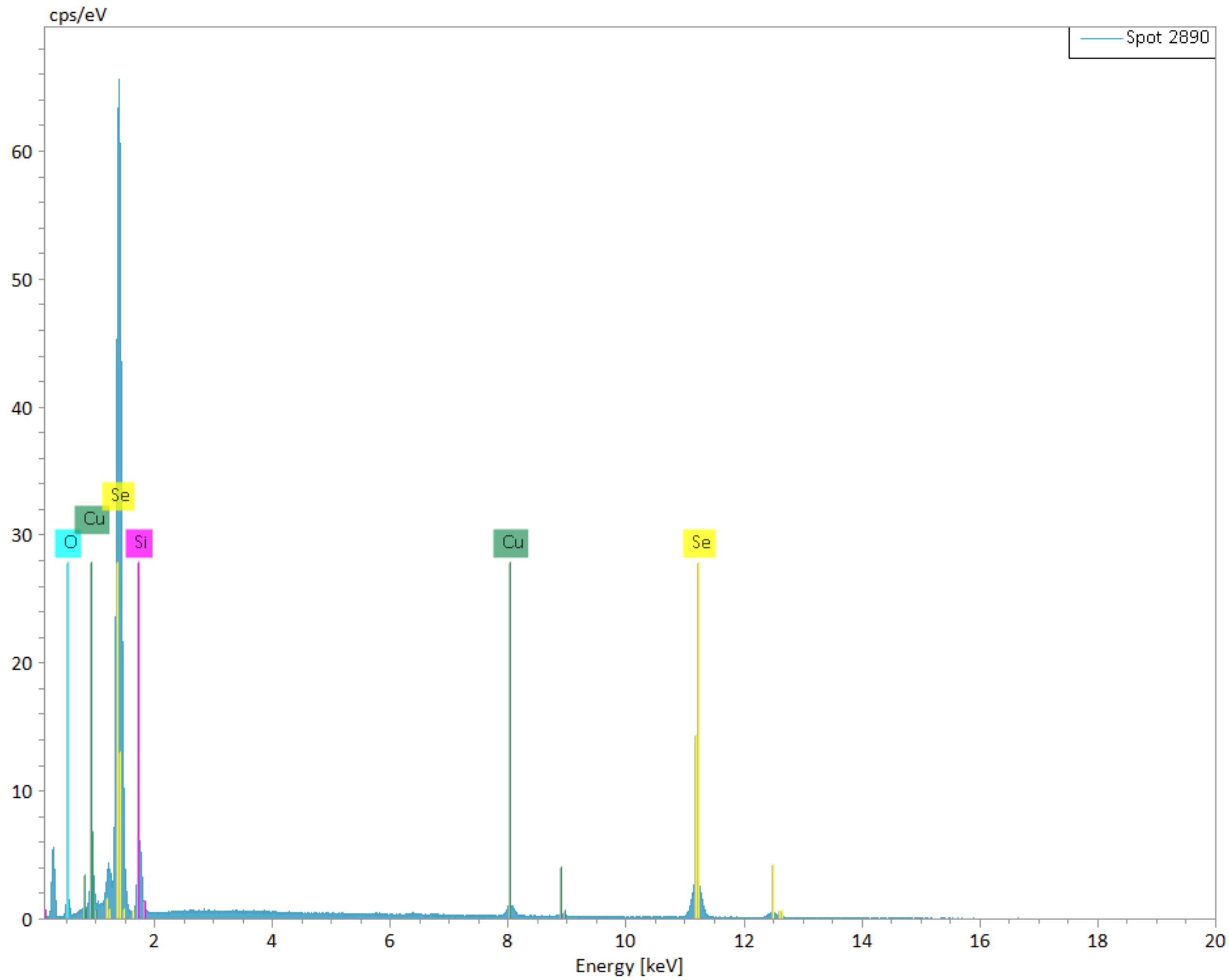
Client Sample No.: **WME-3**
Low magnification backscatter image showing grain size distribution – 84X

Client Sample No.: **WME-5**

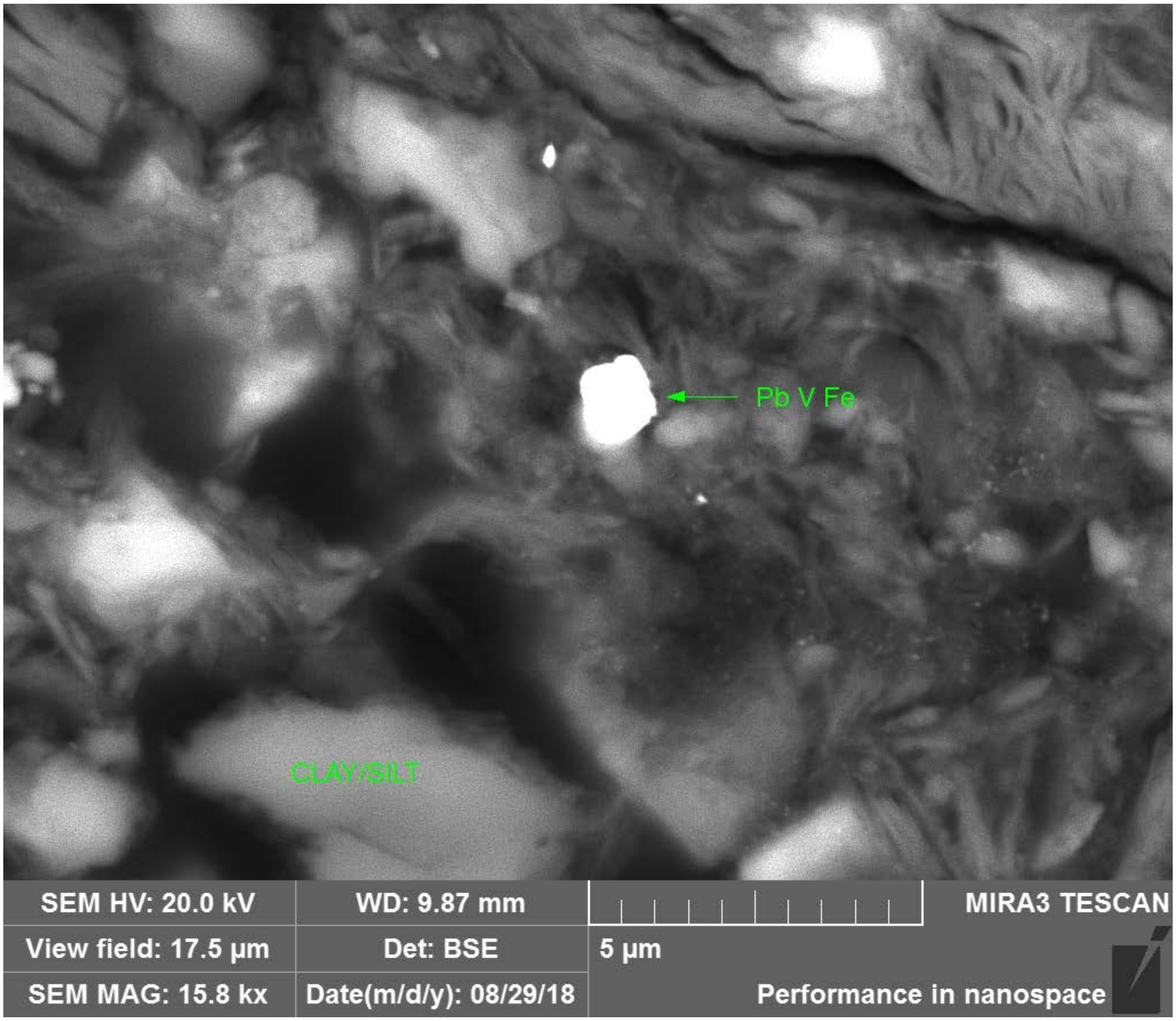
This sample is a grey colored sediment with a clayey silt texture. Clay accounts for >20% of the sample's mass and is identified by XRD as primarily kaolinite (~10%), swelling smectite (~9%) and lesser amounts of chlorite (~2%) and illite (~2%). Quartz (~45%) is the primary hard silicate and occurs as angular to rounded grains that vary significantly in size from 2µm to 300µm. Plagioclase and K-spar are present in like amounts (~12%) and occur as angular fragments in the 2µm to 75µm size range. Calcite accounts for ~8% of the sample and occurs as very fine dispersed grains in the 2µm to 100µm size range. Pyrite up to 20µm in size is the only sulfide identified and accounts for ~1% of the sample. Other mineral phases include zircon, monazite, rutile, iron oxide and barite in trace amounts. One grain of monazite carries elevated Th in addition to its typical REE of Ce, La and Nd. Of the sediments studied, this sample carries the highest concentration of selenides represented by several types. Native Se is the most prominent and occurs as irregularly shaped, liberated grains that vary from <1µm up to 50µm in size. Cu-Se is the next most abundant and occurs as small liberated grains in the <1µm to 10µm size range. A few small liberated grains of Pb-Se were also detected. A small 1µm grain of Pb-V was identified in a mass of clay. Two round grains of U were identified and occur as minute 0.1µm to 0.2µm inclusions in a large grain of native Se.



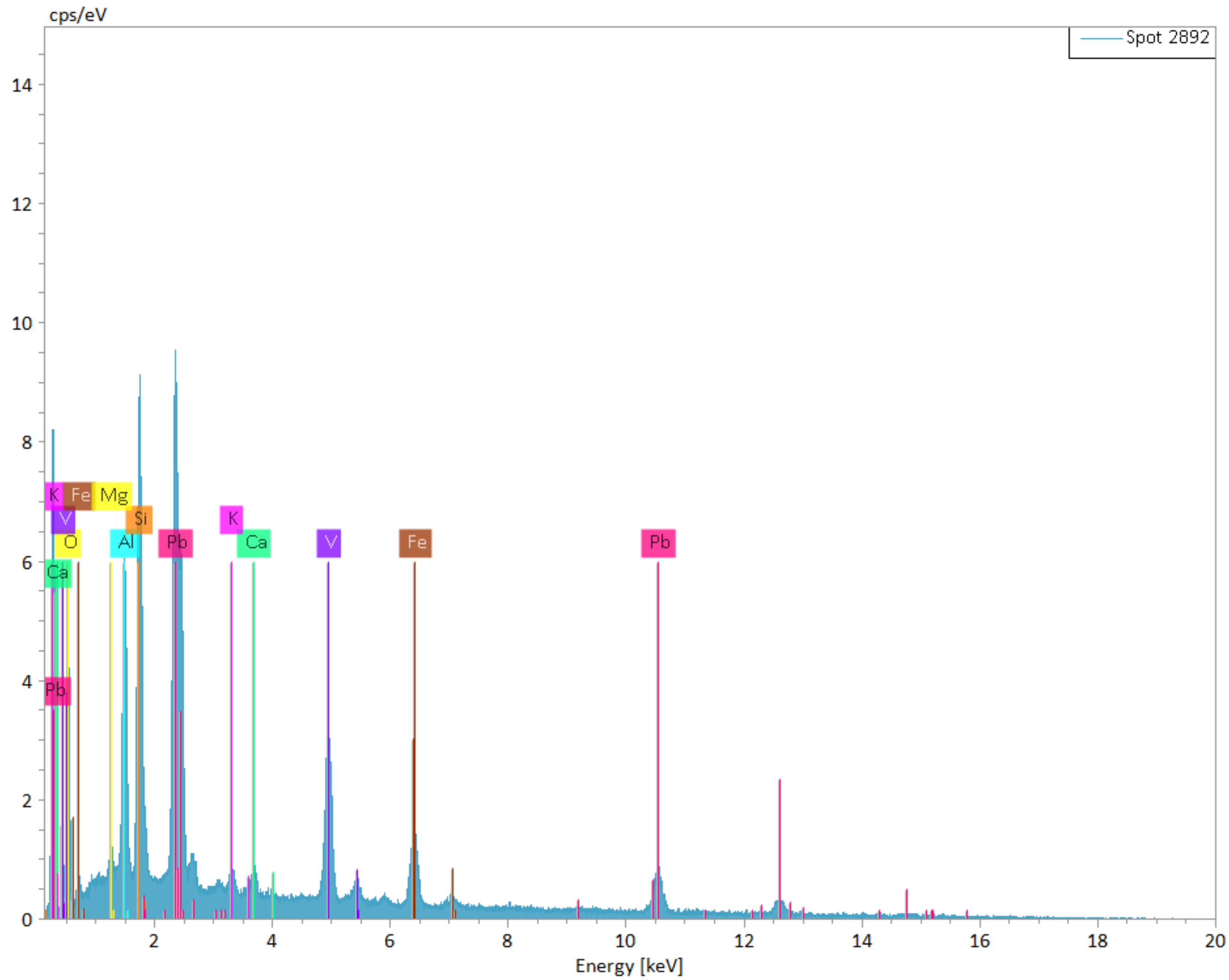
Client Sample No.: **WME-5**
Backscatter image showing a bright grain on native Se in a clay/silt matrix – 8,000X



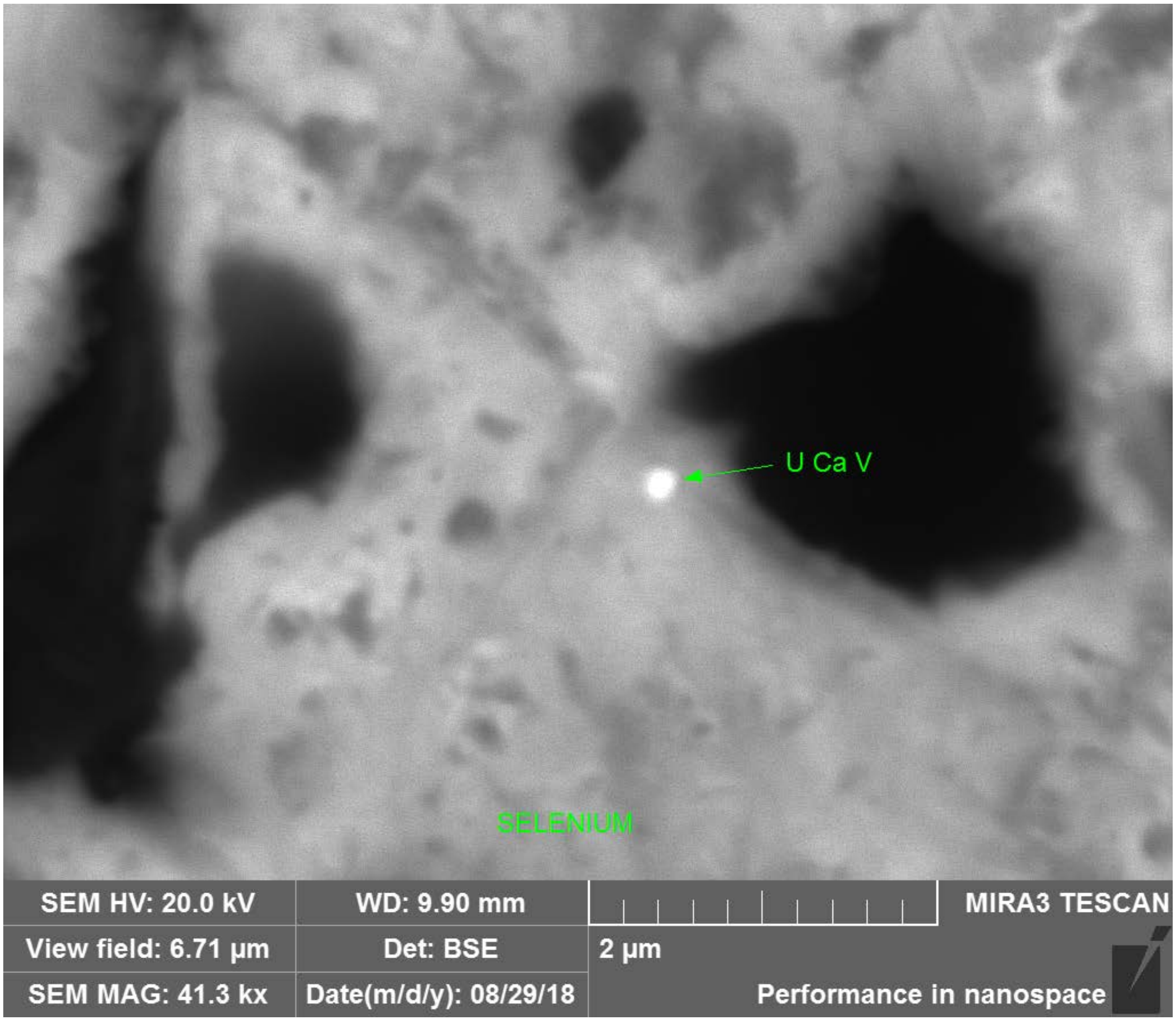
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	3367	6.11	6.77	23.25	1.06	17.30
Silicon	14	15215	7.91	8.77	17.15	0.37	4.73
Copper	29	4493	4.37	4.85	4.19	0.16	3.73
Selenium	34	18896	71.82	79.62	55.41	2.22	3.09
		Sum	**90.20**	**100.00**	**100.00**		



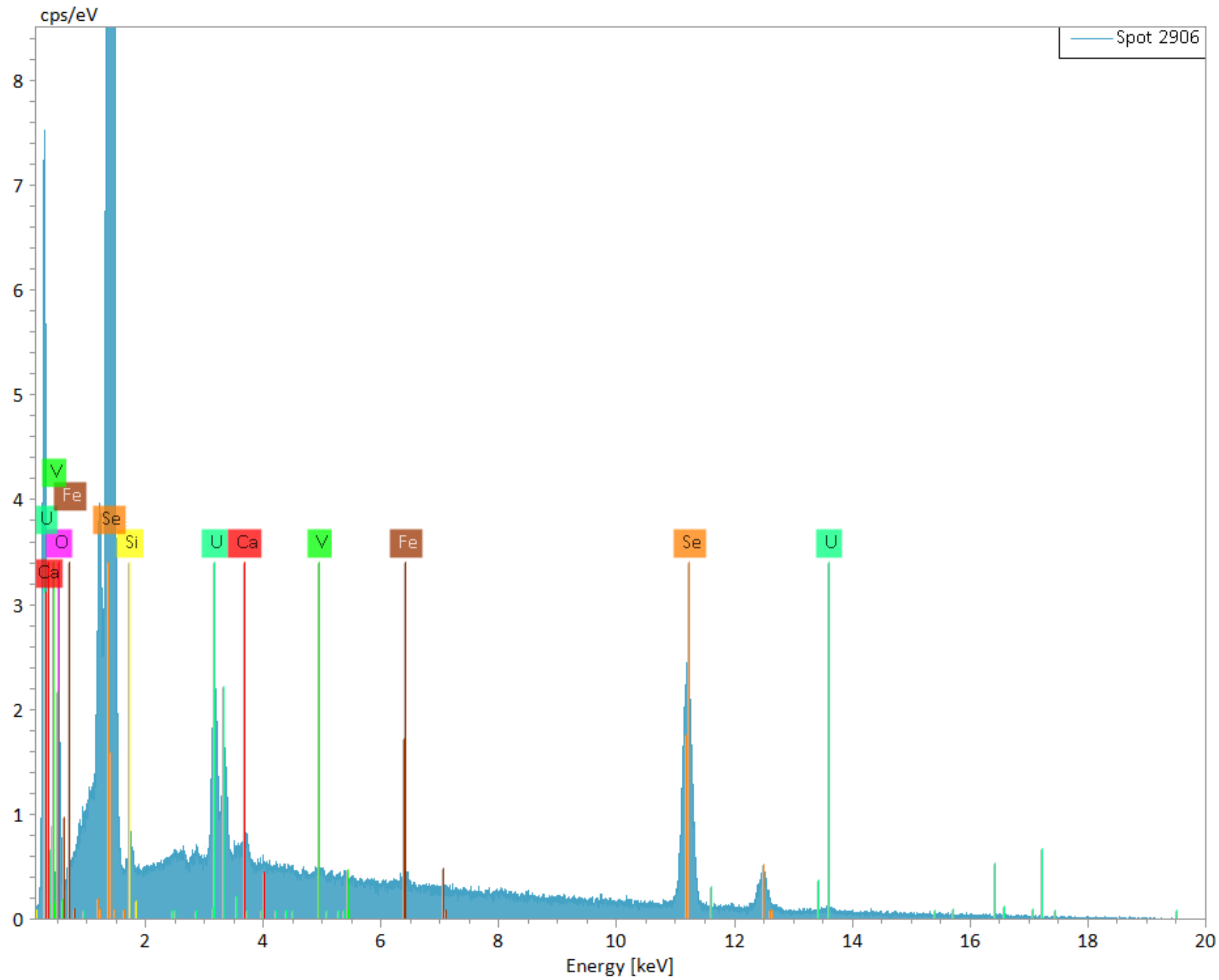
Client Sample No.: **WME-5**
Backscatter image of a bright Pb-V-Fe phase in a body of clay – 15,800X



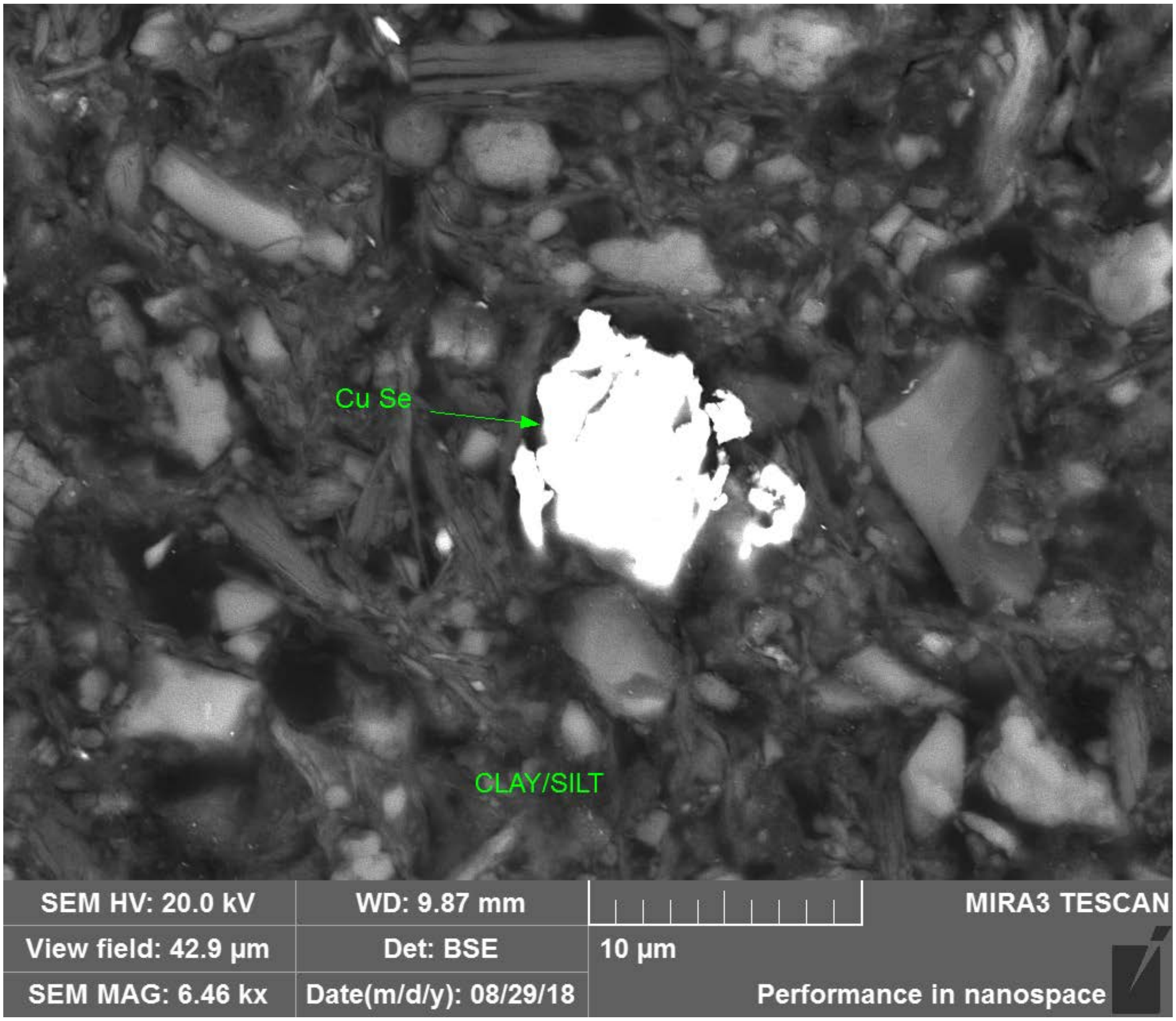
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	14029	23.78	24.36	57.25	3.21	13.48
Aluminium	13	19617	6.81	6.97	9.72	0.36	5.26
Silicon	14	32937	8.46	8.67	11.61	0.39	4.62
Calcium	20	2223	0.99	1.01	0.95	0.06	6.35
Vanadium	23	18147	8.35	8.55	6.31	0.26	3.14
Iron	26	9501	6.64	6.80	4.58	0.22	3.27
Lead	82	8952	41.11	42.10	7.64	1.36	3.30
Potassium	19	1840	0.73	0.75	0.72	0.05	7.53
Magnesium	12	1675	0.77	0.79	1.22	0.08	9.88
		Sum	**97.63**	**100.00**	**100.00**		



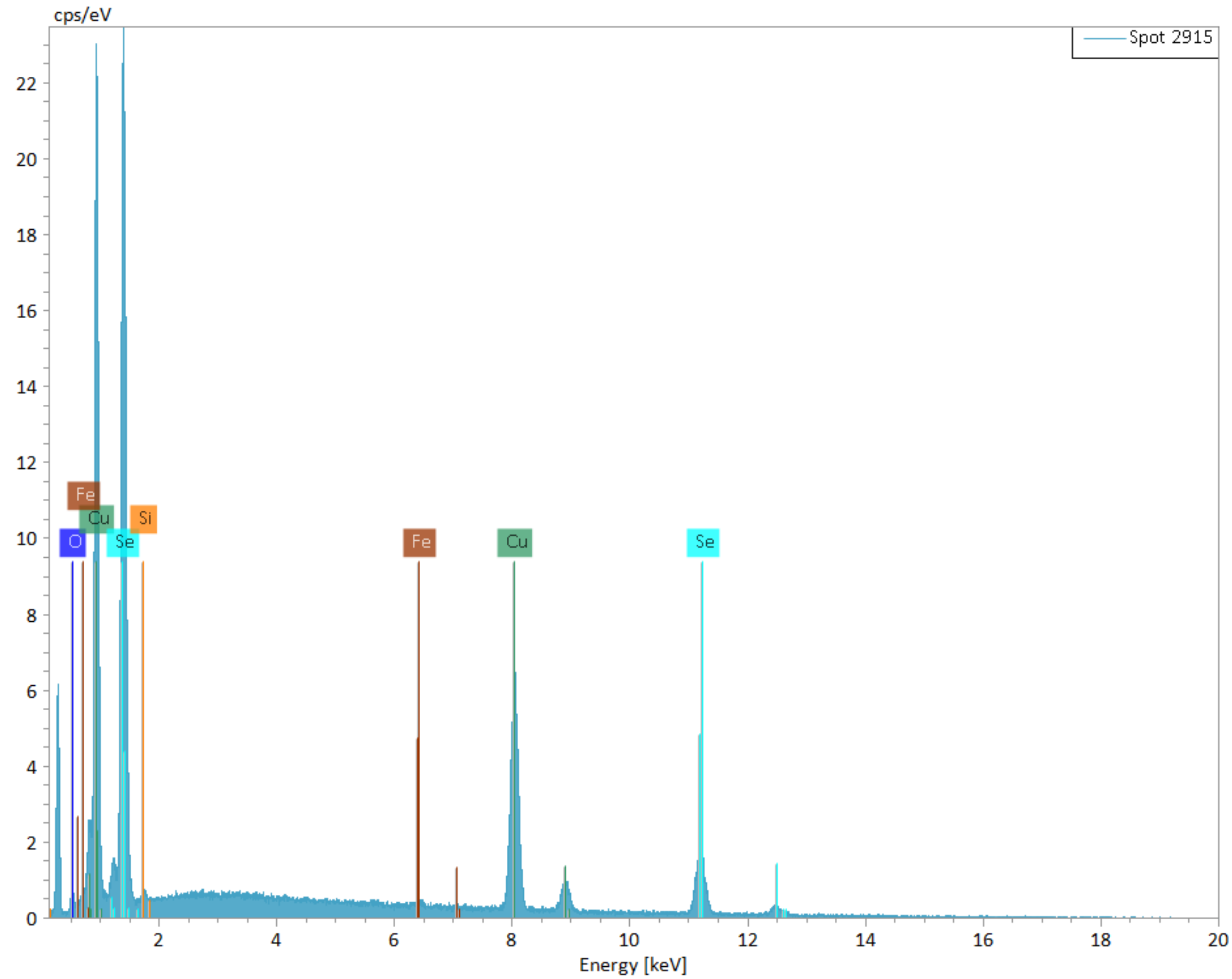
Client Sample No.: **WME-5**
Backscatter image showing a bright, minute grain of U in a matrix of native Se – 41,300X



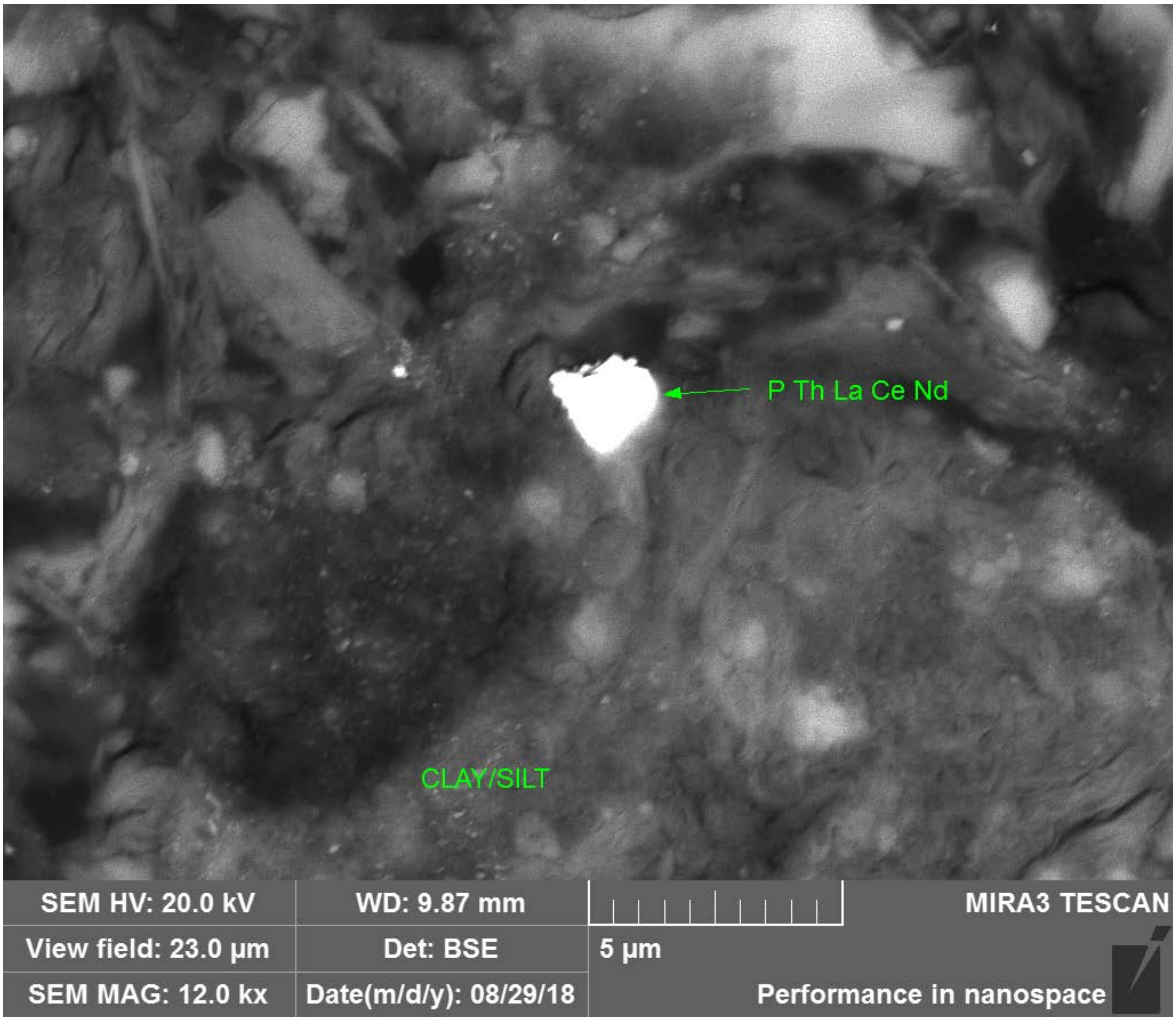
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	6628	6.83	7.98	31.14	1.04	15.28
Silicon	14	1839	0.54	0.63	1.39	0.05	9.98
Selenium	34	31844	68.44	79.89	63.21	2.08	3.04
Uranium	92	20407	8.88	10.36	2.72	0.31	3.44
Calcium	20	2083	0.45	0.53	0.83	0.04	9.38
Iron	26	1003	0.38	0.44	0.49	0.04	11.01
Vanadium	23	555	0.15	0.18	0.22	0.03	22.01
		Sum	**85.67**	**100.00**	**100.00**		



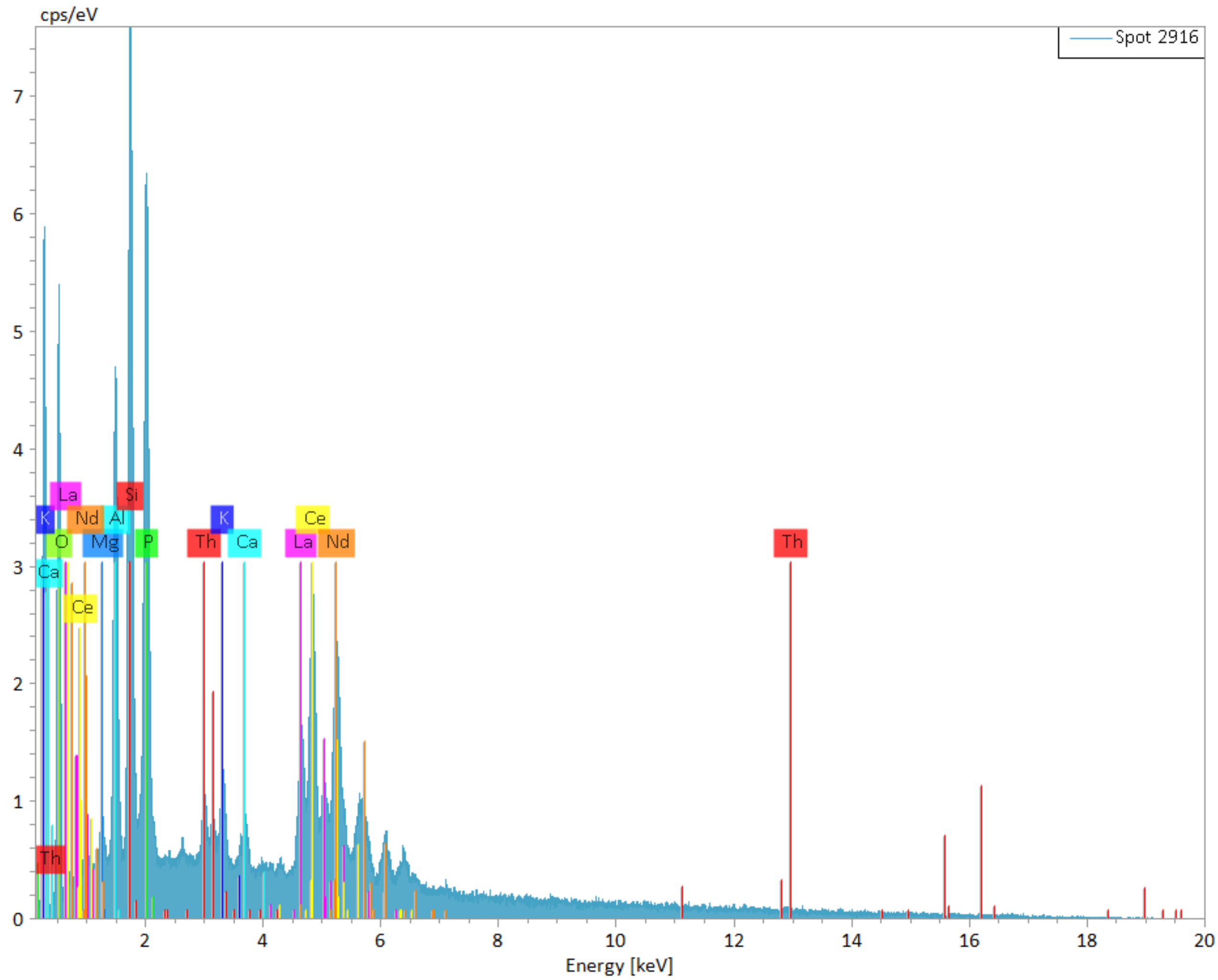
Client Sample No.: **WME-5**
Backscatter image of bright Cu selenide in a clay/silt matrix – 6,640X



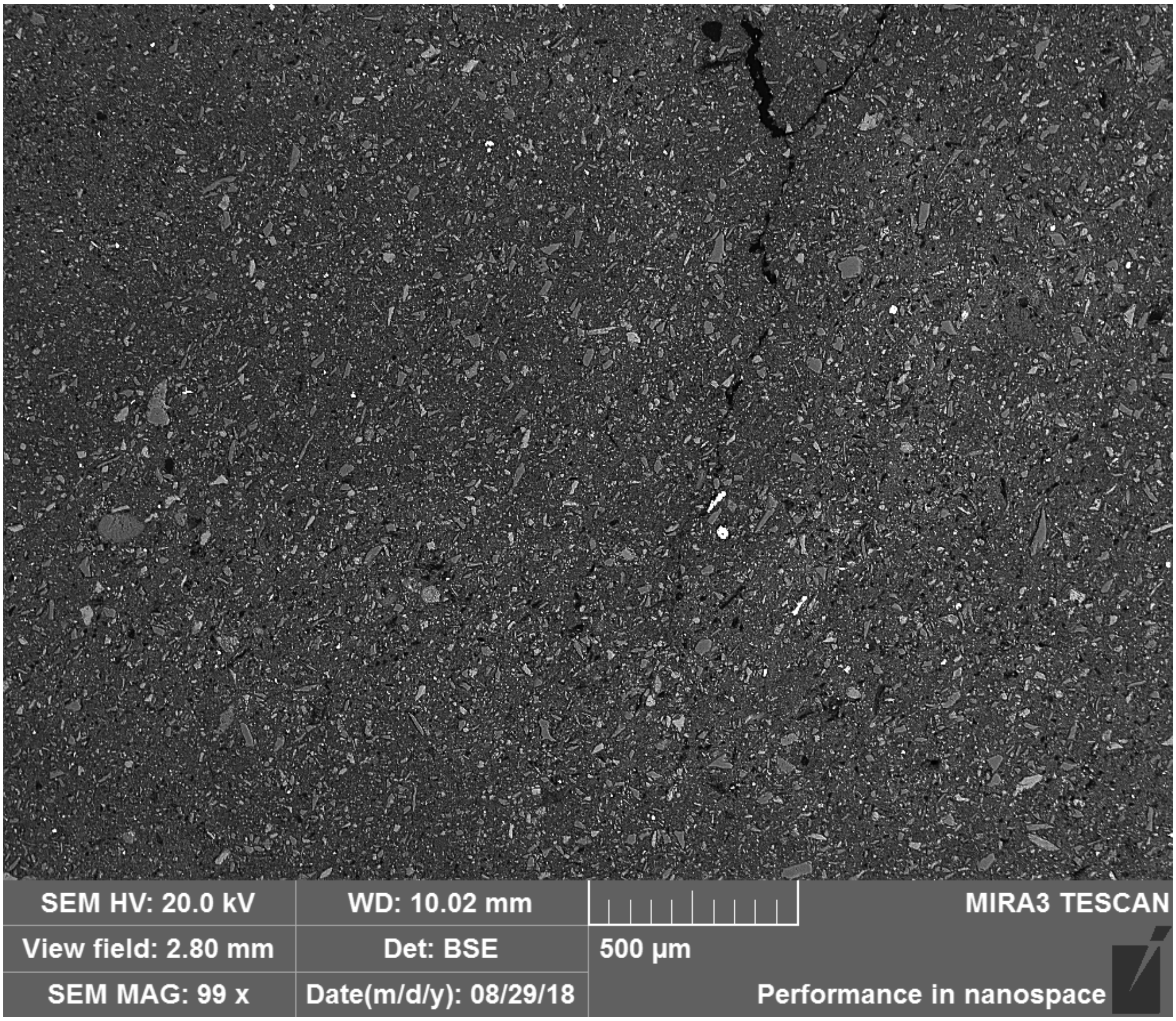
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	827	1.35	1.60	6.73	0.35	25.76
Copper	29	35820	37.31	44.25	46.84	1.05	2.80
Selenium	34	11721	45.17	53.56	45.63	1.44	3.19
Iron	26	724	0.42	0.50	0.61	0.05	10.76
Silicon	14	136	0.07	0.08	0.19	0.03	47.74
		Sum	84.32	100.00	100.00		



Client Sample No.: **WME-5**
Backscatter image of monazite with Th in clay – 12,000X



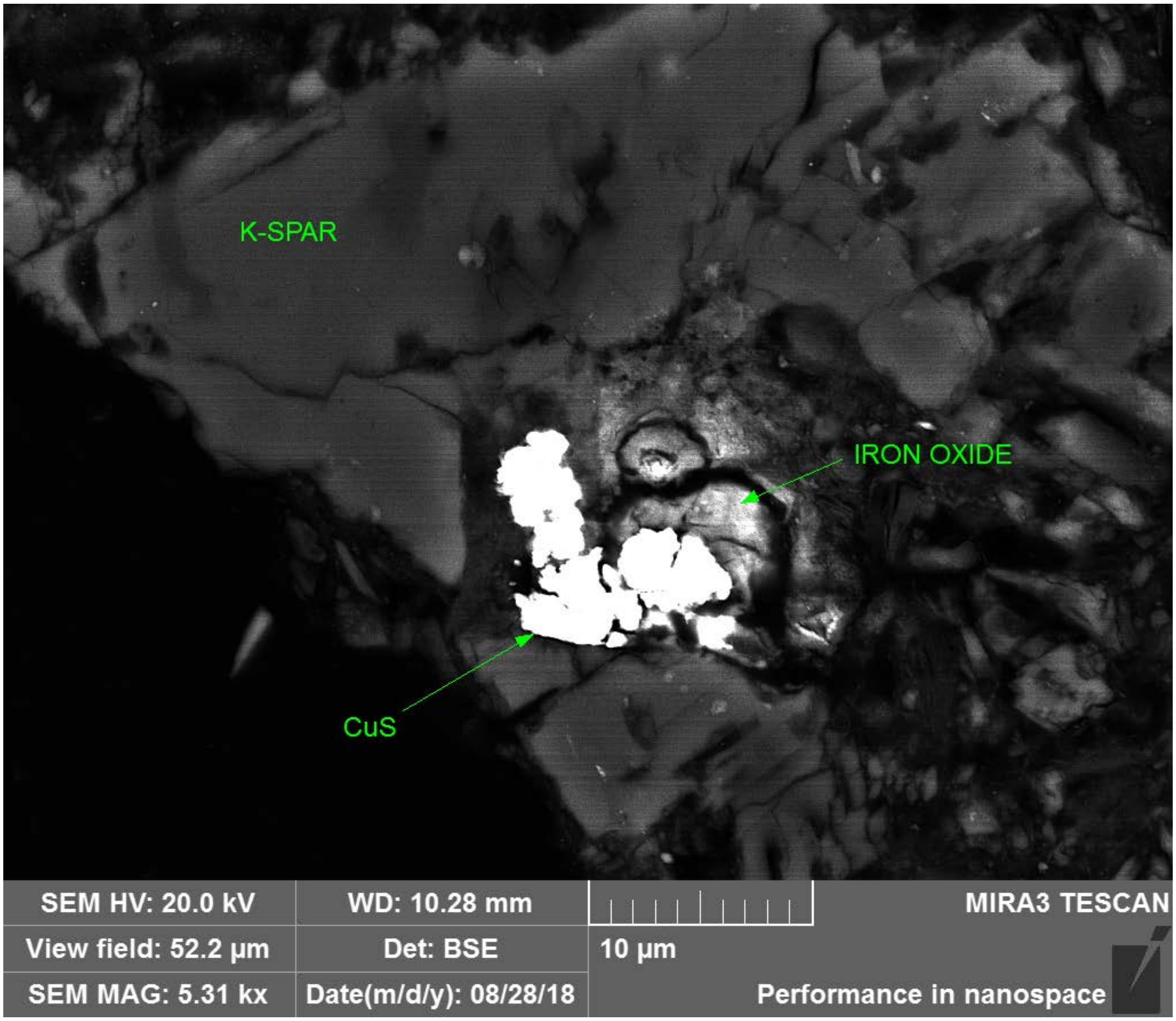
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Thorium	90	4626	1.87	2.93	0.47	0.09	4.93
Oxygen	8	18445	12.46	19.50	45.35	1.64	13.15
Magnesium	12	1876	0.60	0.94	1.43	0.06	10.70
Aluminium	13	20386	5.19	8.12	11.20	0.28	5.37
Silicon	14	38502	7.06	11.04	14.64	0.33	4.67
Phosphorus	15	33542	7.01	10.97	13.19	0.30	4.30
Potassium	19	4612	0.85	1.33	1.27	0.05	6.44
Calcium	20	2315	0.49	0.77	0.71	0.04	8.89
Lanthanum	57	19072	7.24	11.32	3.03	0.23	3.18
Cerium	58	36846	14.61	22.86	6.07	0.43	2.93
Neodymium	60	14970	6.54	10.22	2.64	0.21	3.21
		Sum	**63.93**	**100.00**	**100.00**		



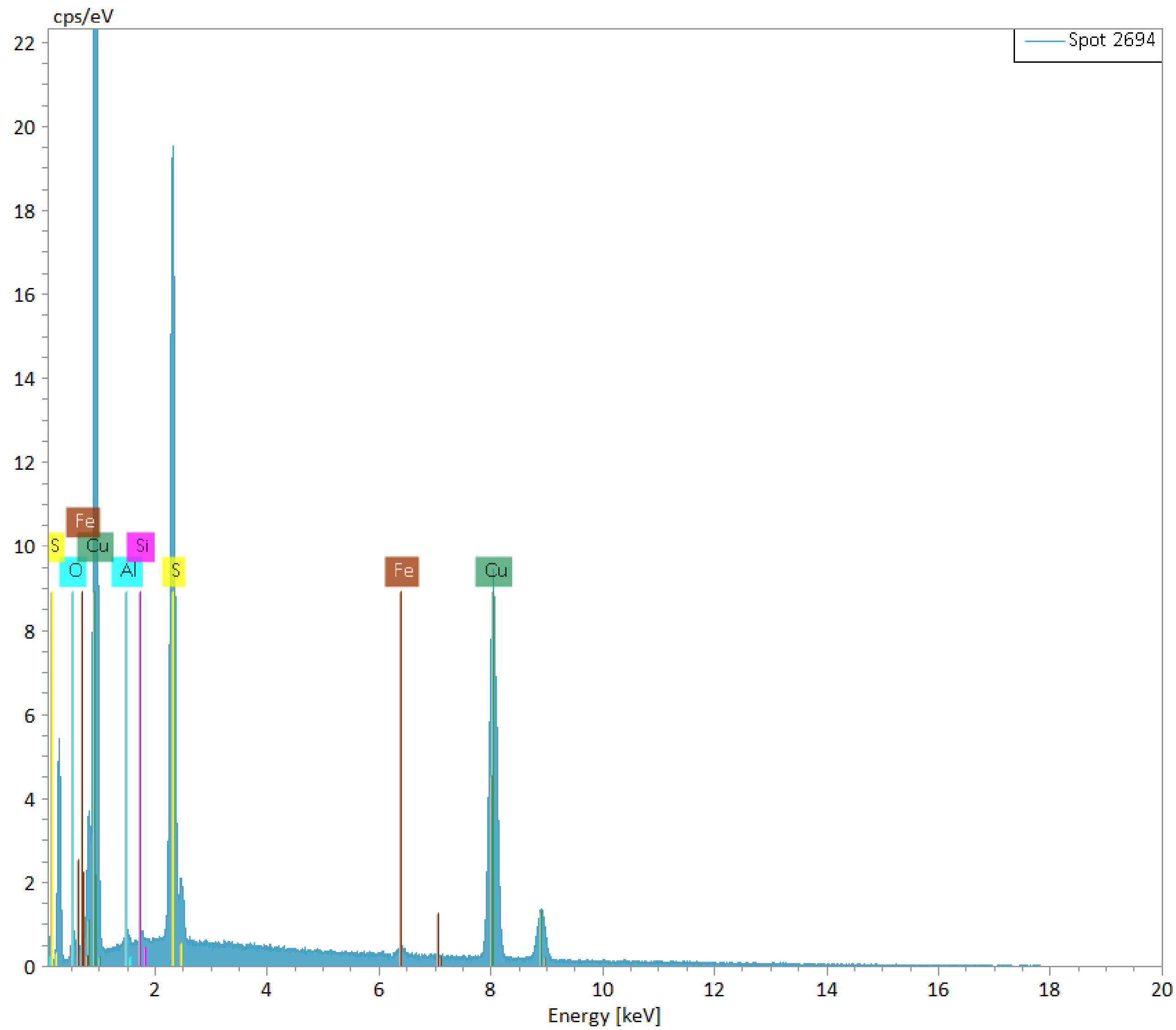
Client Sample No.: **WME-5**
Low magnification backscatter image showing the sample's fine-grained texture – 99X

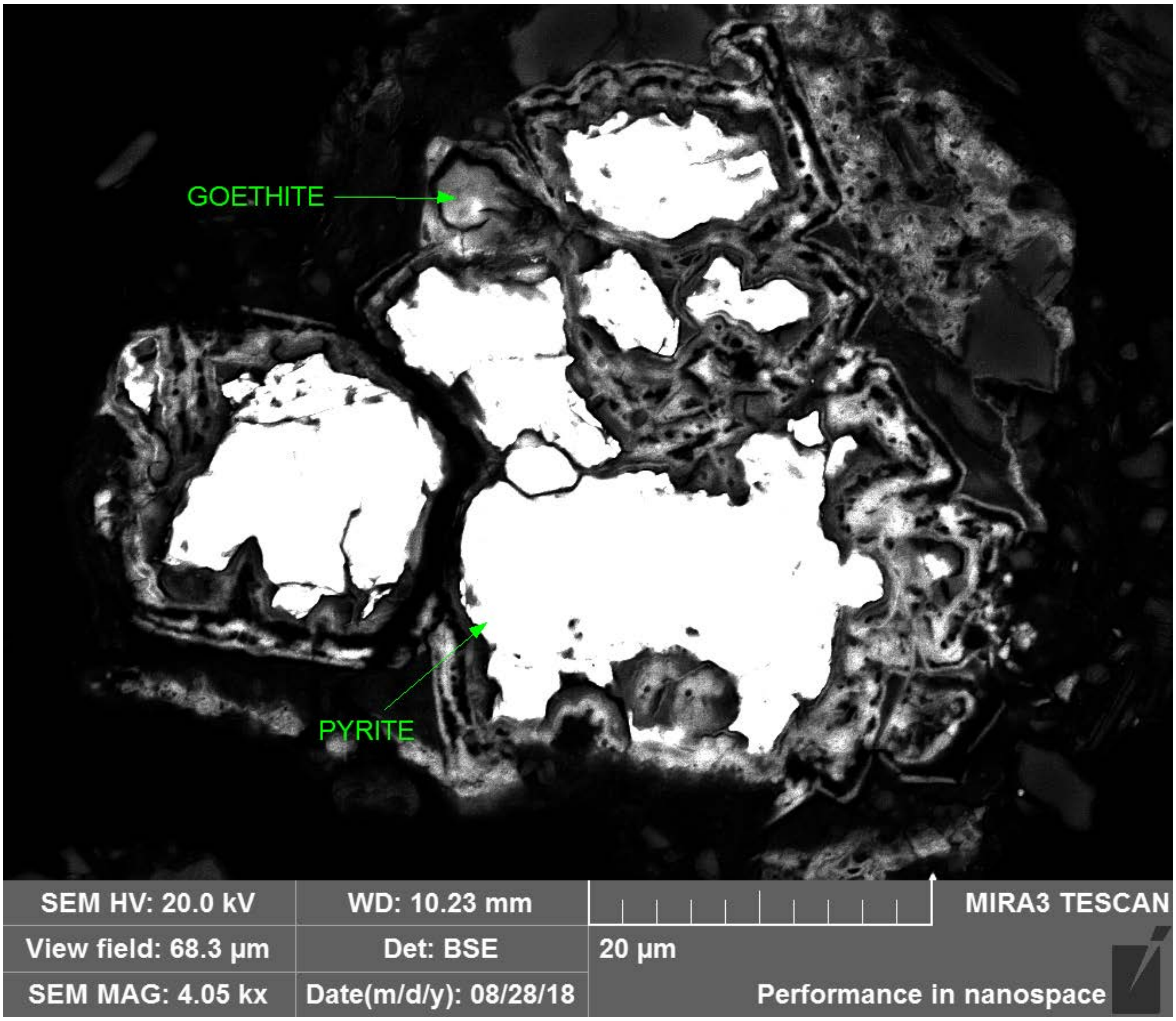
Client Sample No.: **WME-10**

This sample is a brown colored fine to medium sand with moderate amounts of clay. XRD identifies the clay as primarily swelling smectite (~4%), kaolinite (~3%), chlorite (~2%) and illite (~1%). Numerous concentrated clay masses were analyzed by EDS but failed to detect any U content. Quartz (~53%) is the dominant hard silicate and occurs as angular to well rounded grains that vary greatly in size from 5µm to 350µm. K-spar and plagioclase are present in like concentrations of ~14% each and occur as angular to sub-angular fragments in the 5µm to 200µm size range. Plagioclase grains show mild grain boundary corrosion and intragrain pitting. The feldspars tend to carry small inclusions of barite, zircon, rare earth phosphates and sulfides. Pyrite and chalcopyrite are present as a trace with a grain size up to 20µm. Much of the pyrite shows replacement by goethite and chalcopyrite shows some replacement by Cu oxide, CuS (covellite?) and iron oxide. Calcite (~9%) occurs as small angular grains that vary significantly in size from 2µm up to 200µm. One large carbonate grain carries a small 4µm grain of Au. Selenides are present as a trace and represented by native Se, Pb-Se and Cu-Se. The grains are liberated with grain size measurements of 2µm to 3.5µm. Three grains composed of U, Ti and Fe were identified. They occur as irregularly shaped grains that vary in size from 0.4µm up to approximately 3µm and are attached to spongy looking iron oxide.

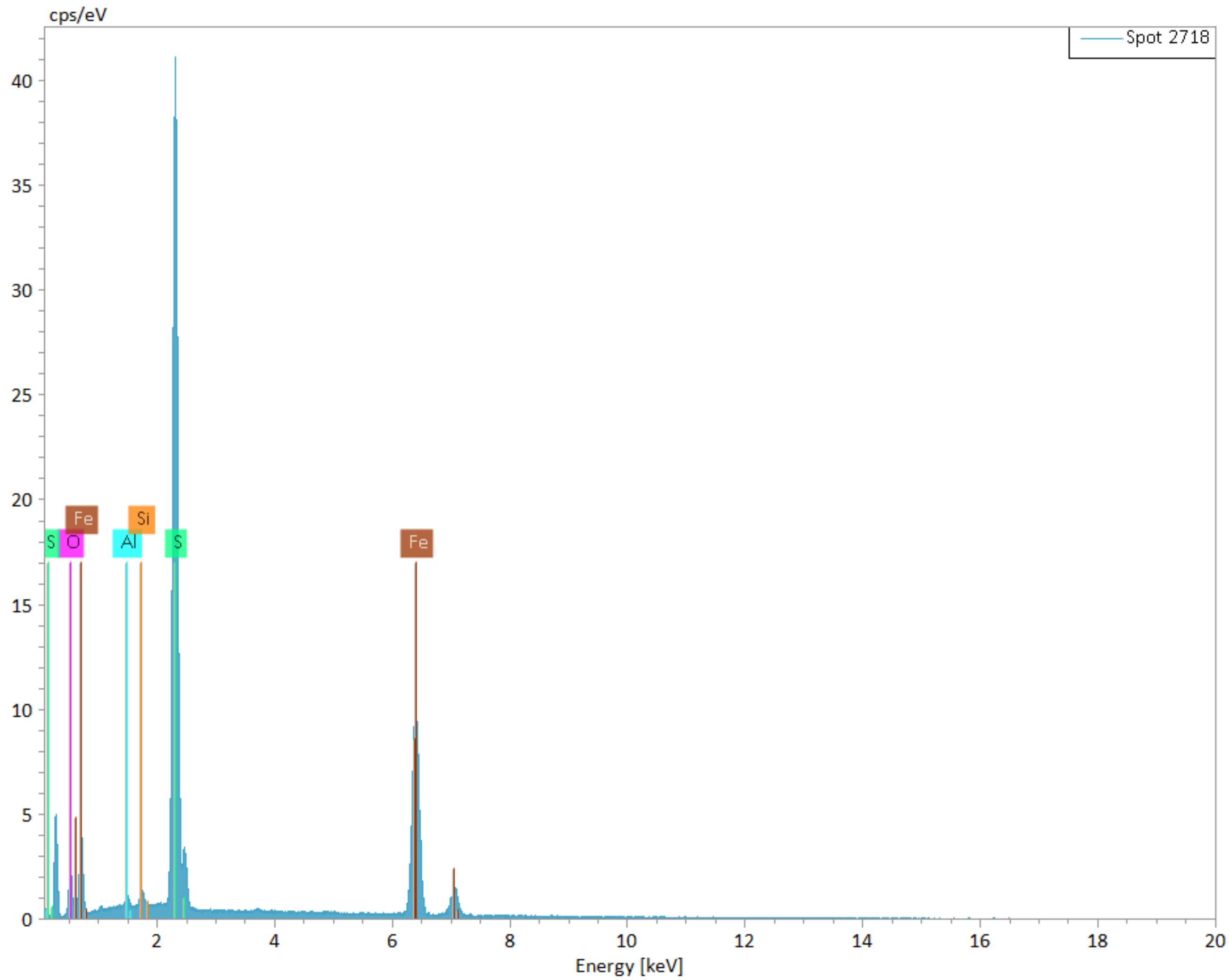


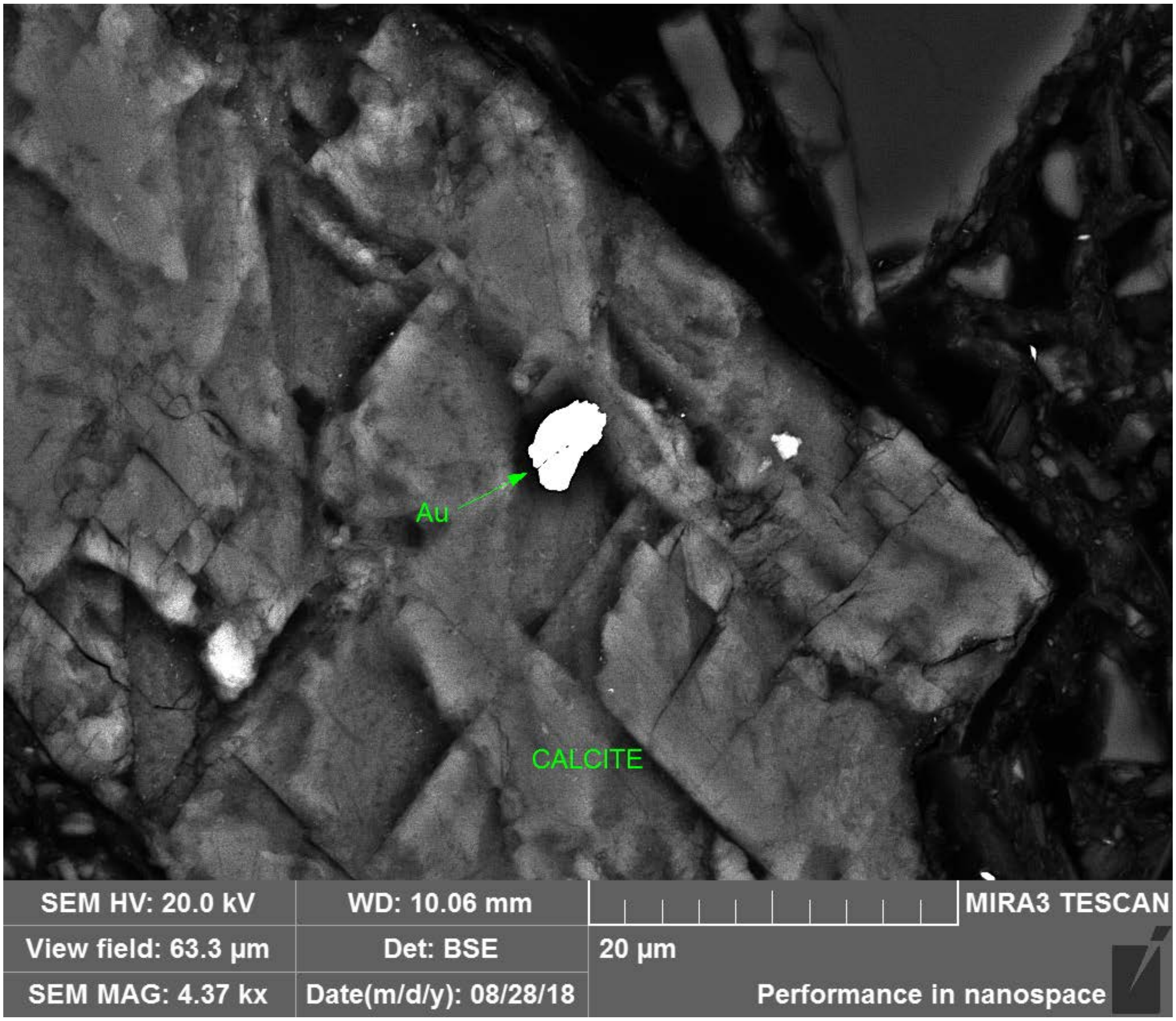
Client Sample No.: **WME-10**
Backscatter image of covellite replacing chalcopyrite in a grain of K-spar – 5,310X


cps/eV
Spot 2694
22
20
18
16
14
12
10
8
6
4
2
0
Fe
S
Cu
Si
O
Al
S
Fe
Cu
2
4
6
8
10
12
14
16
18
20
Energy [keV]

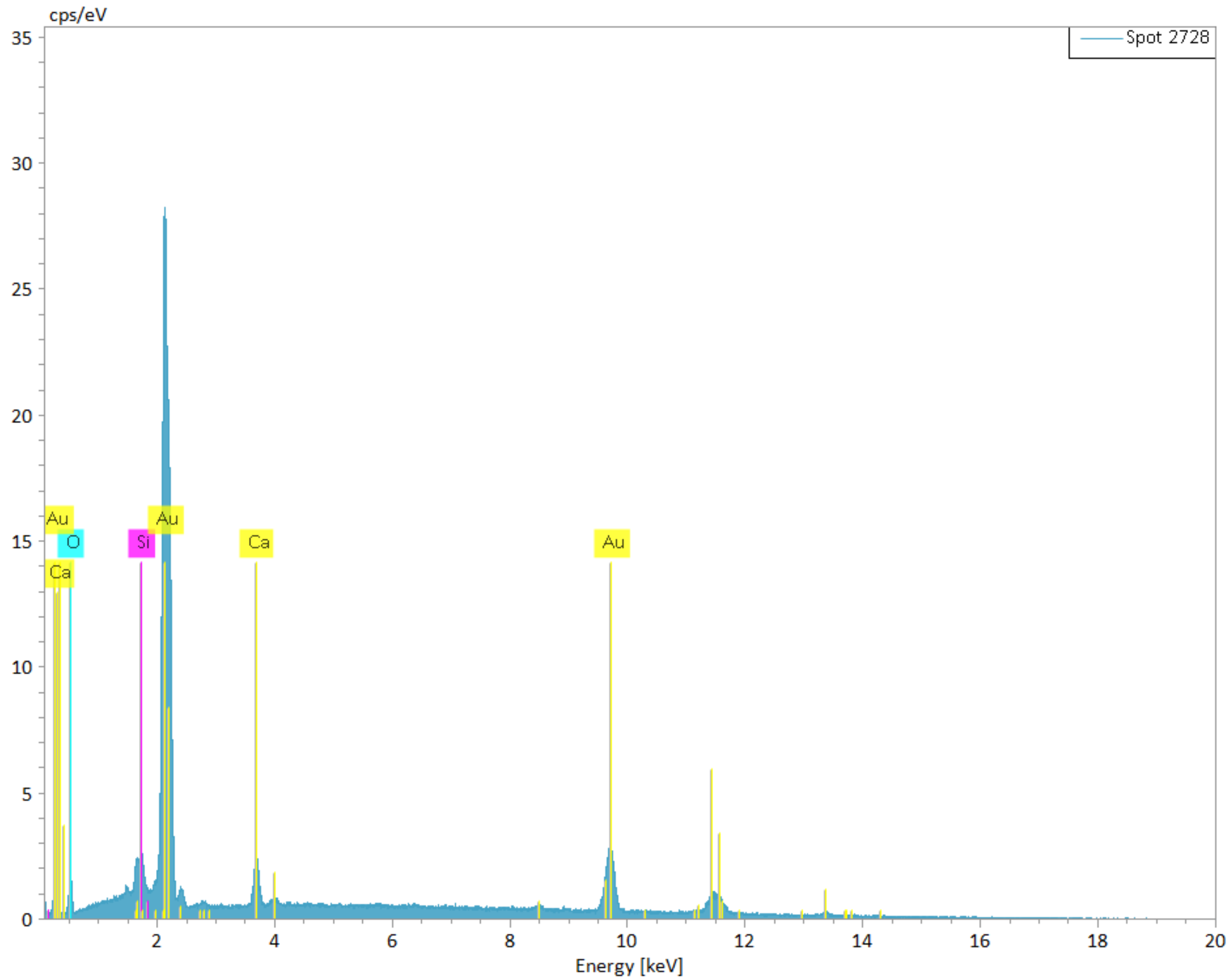


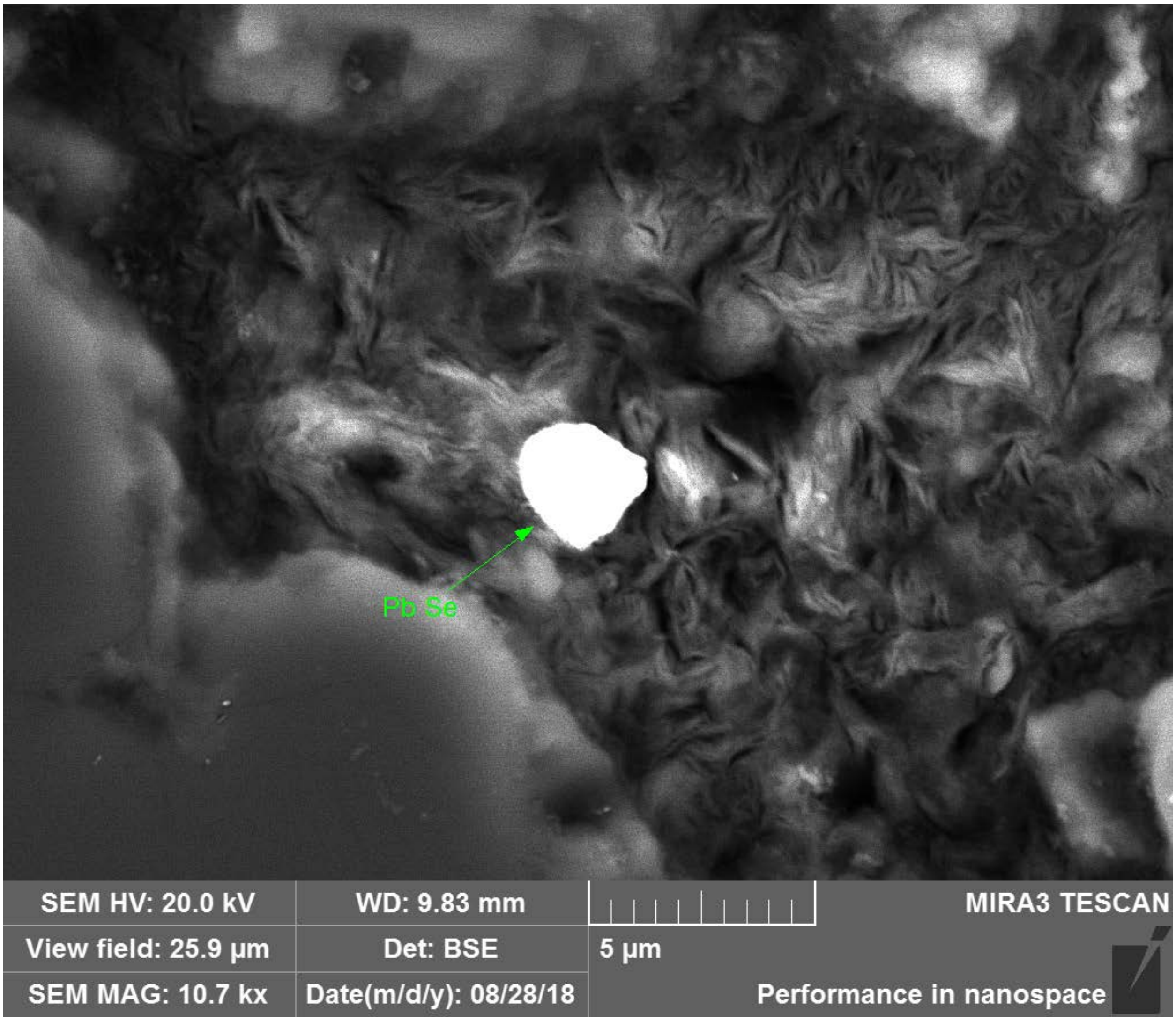
Client Sample No.: **WME-10**
Backscatter image of goethite replacing pyrite – 4,050X


cps/eV
Spot 2718
40
35
30
25
20
15
10
5
0
Fe
Si
S
O
Al
S
Fe
2
4
6
8
10
12
14
16
18
20
Energy [keV]

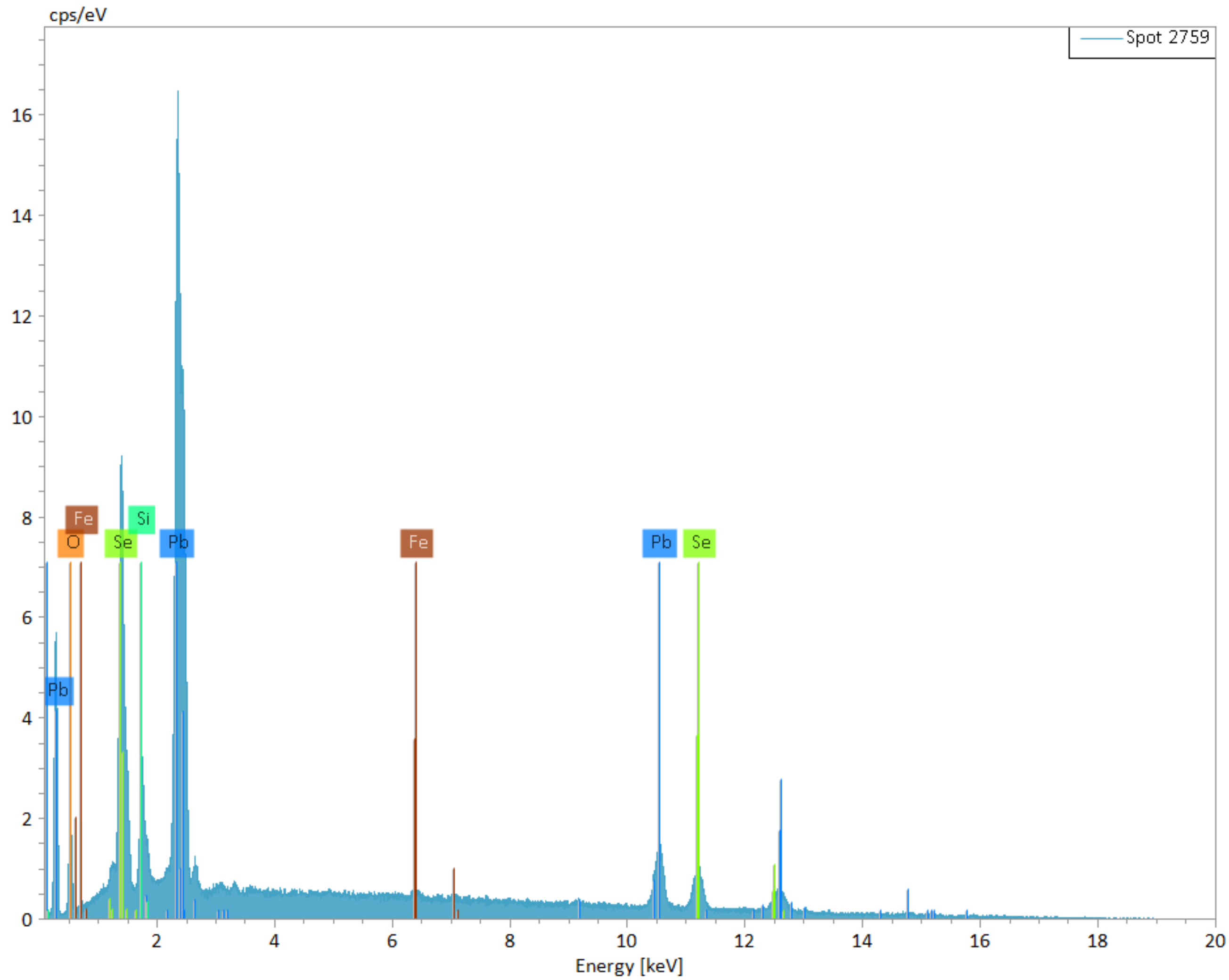


Client Sample No.: **WME-10**
Backscatter image of calcite with a bright grain of Au – 4,370X

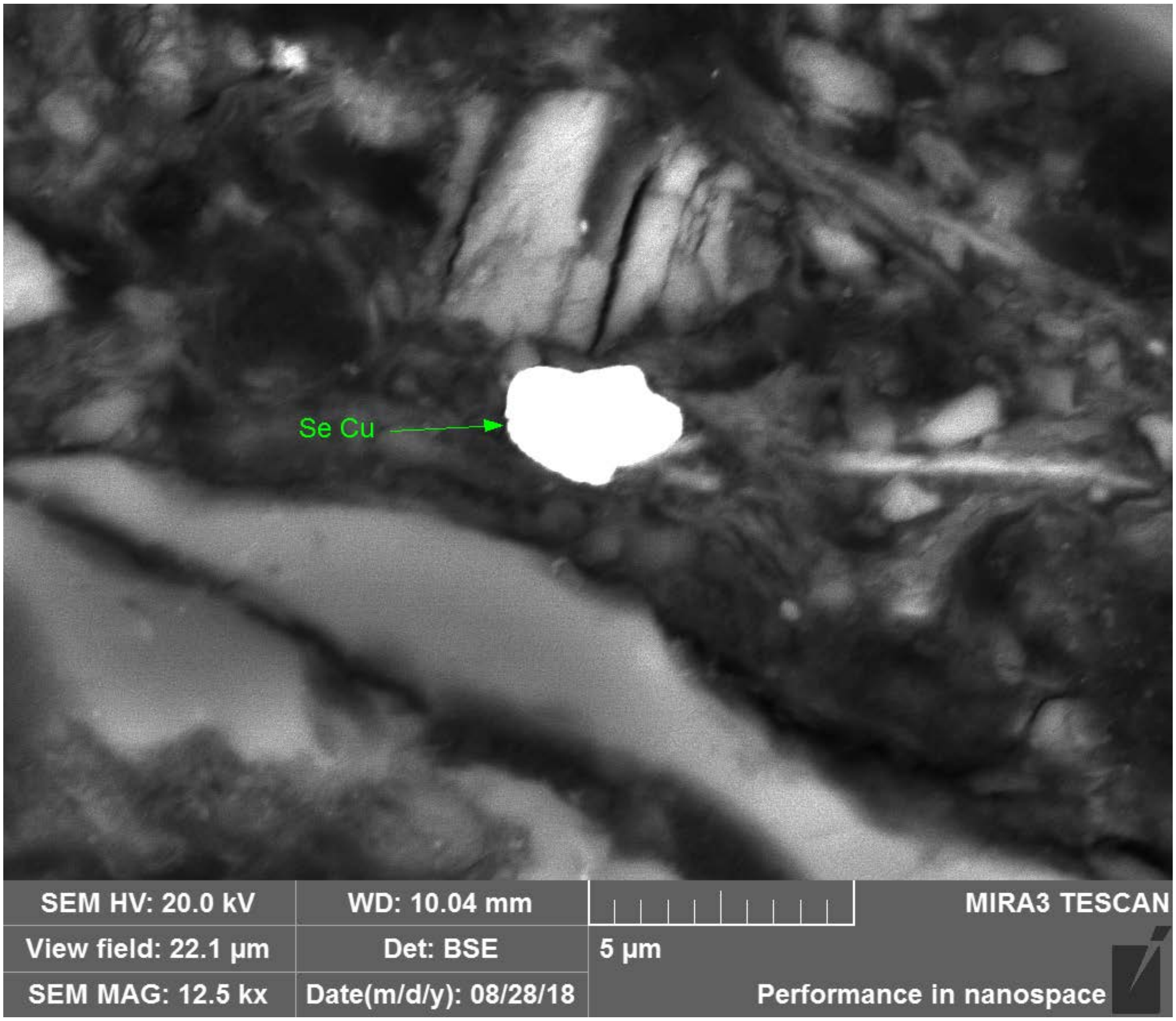

cps/eV
Spot 2728
35
30
25
20
15
10
5
0
Au
O
Ca
Si
Au
Ca
Au
2
4
6
8
10
12
14
16
18
20
Energy [keV]



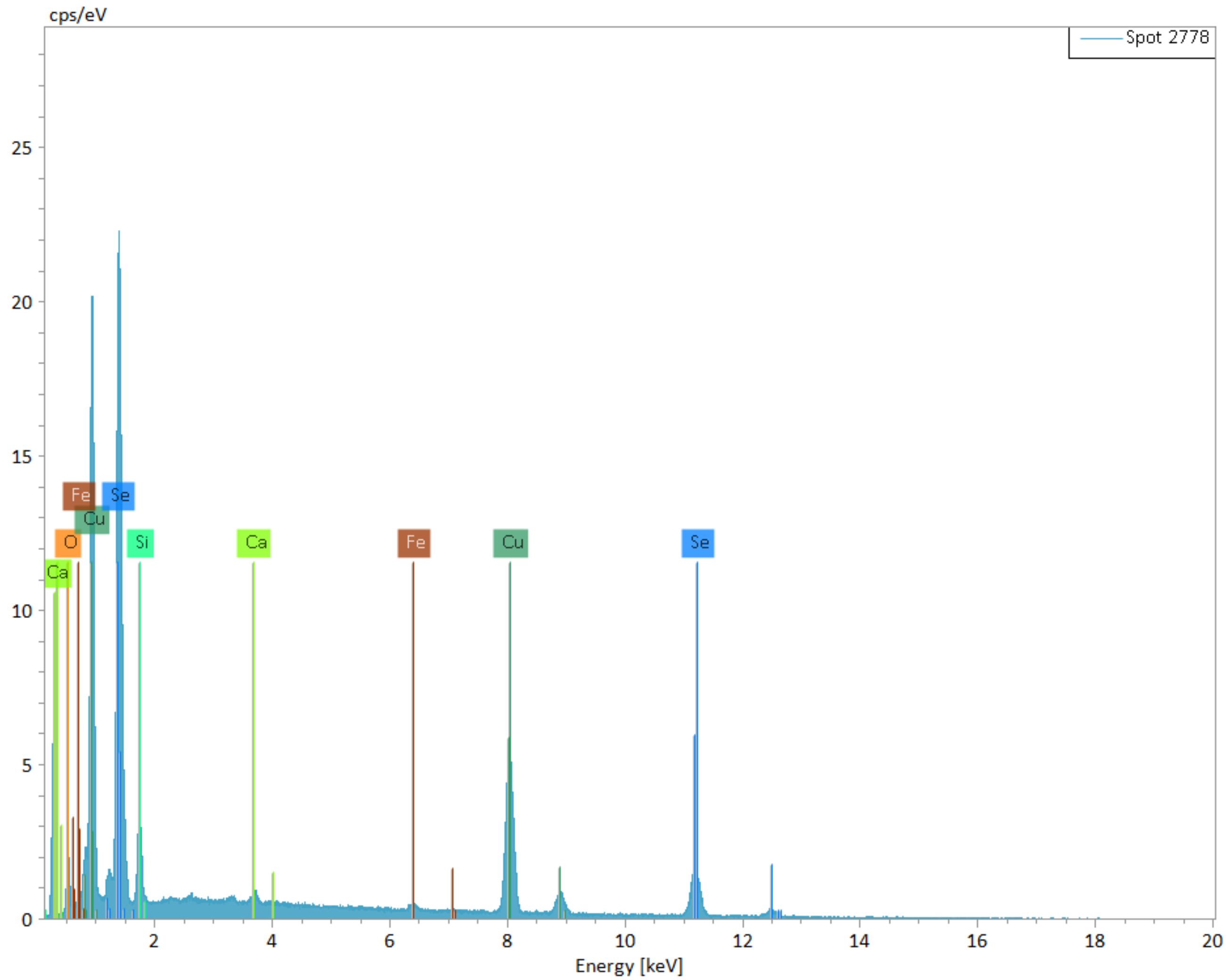
Client Sample No.: **WME-10**
Backscatter image showing a bright grain of Pb selenide in clay -10,700X



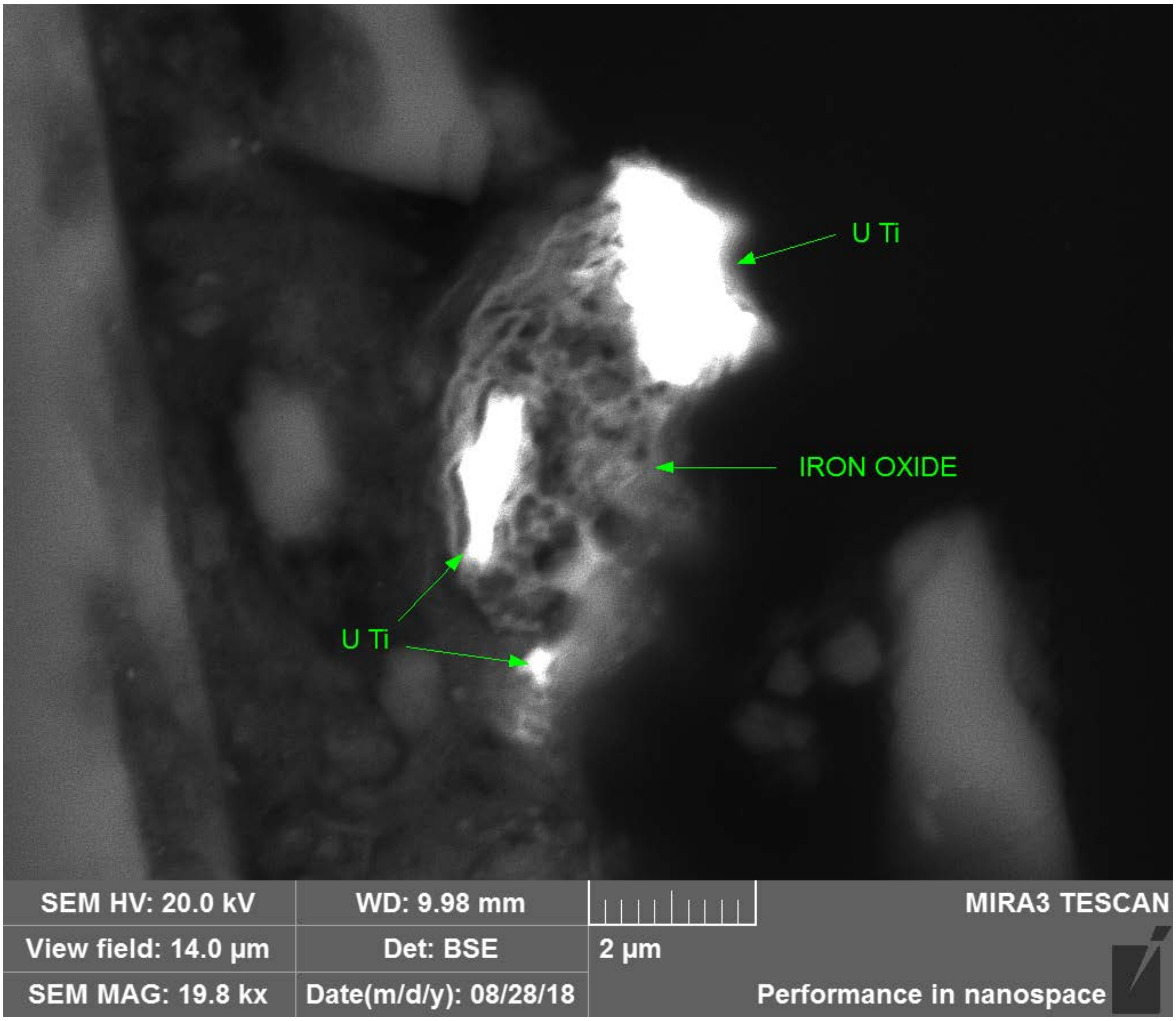
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	1541	1.68	3.14	22.80	0.36	21.68
Silicon	14	0	0.00	0.00	0.00	0.00	2.25
Iron	26	776	0.44	0.82	1.71	0.05	10.45
Selenium	34	7829	12.70	23.70	34.90	0.43	3.42
Lead	82	15845	38.77	72.34	40.59	1.24	3.19
		Sum	**53.59**	**100.00**	**100.00**		



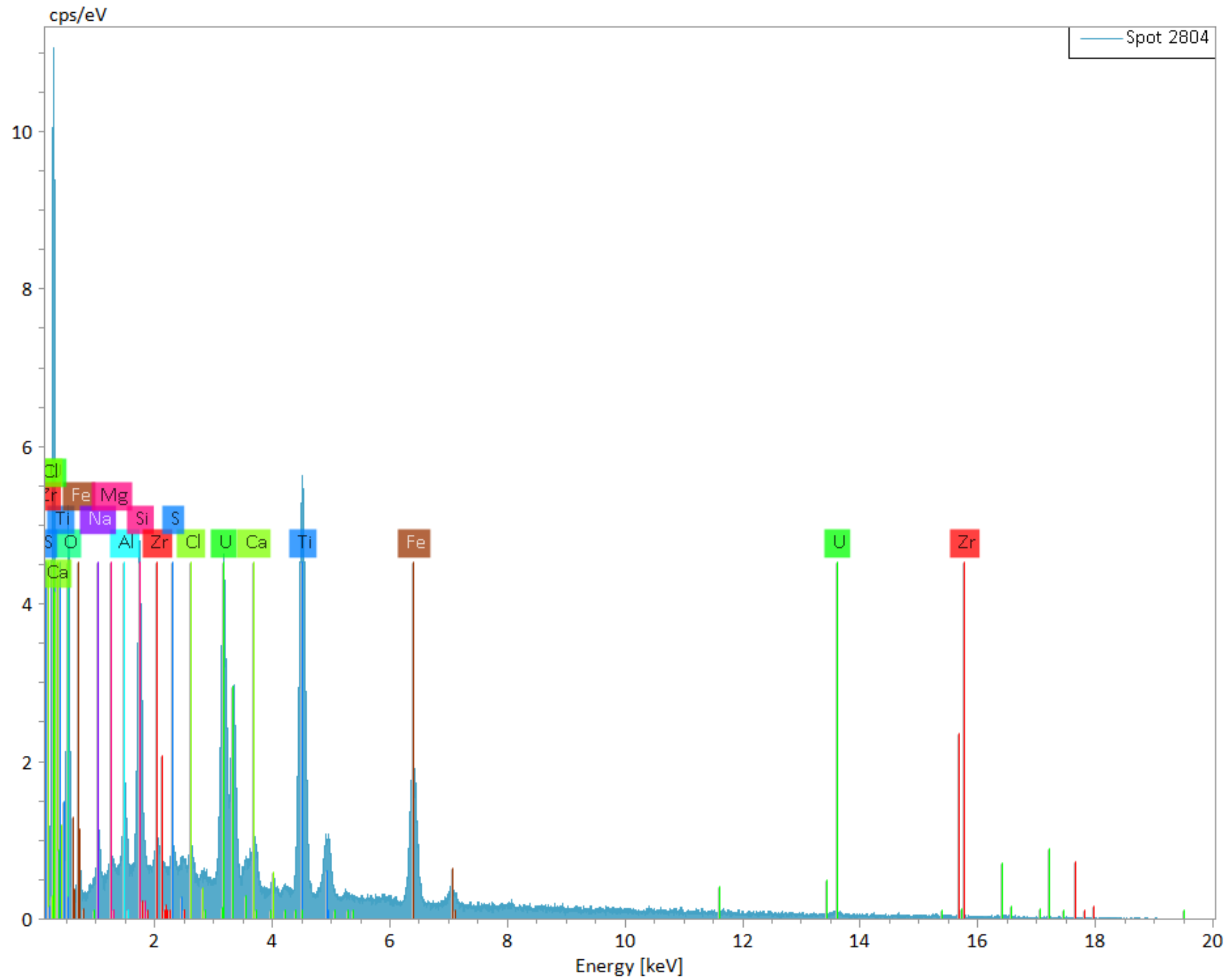
Client Sample No.: **WME-10**
Backscatter image of a Cu selenide in clay – 15,500X



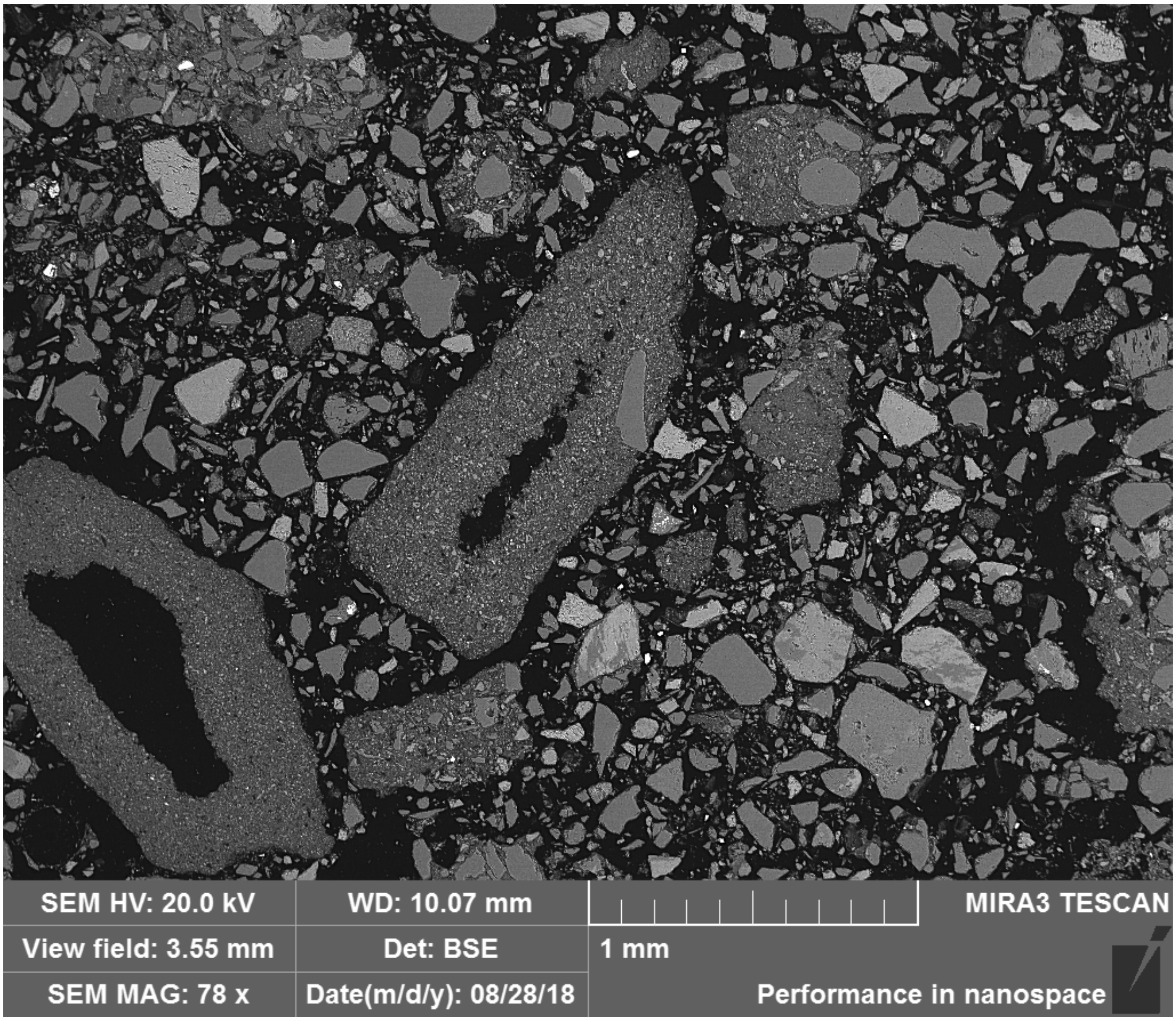
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	5256	2.73	7.00	22.70	0.45	16.43
Silicon	14	12022	3.44	8.82	16.30	0.18	5.18
Calcium	20	2088	0.56	1.42	1.84	0.05	8.37
Copper	29	42933	9.87	25.30	20.66	0.29	2.98
Selenium	34	14435	21.36	54.72	35.96	0.69	3.21
Iron	26	3748	1.07	2.74	2.54	0.06	5.57
		Sum	**39.03**	**100.00**	**100.00**		



Client Sample No.: **WME-10**
Backscatter image of spongy looking iron oxide with attachments of a U-Ti phase – 19,800X



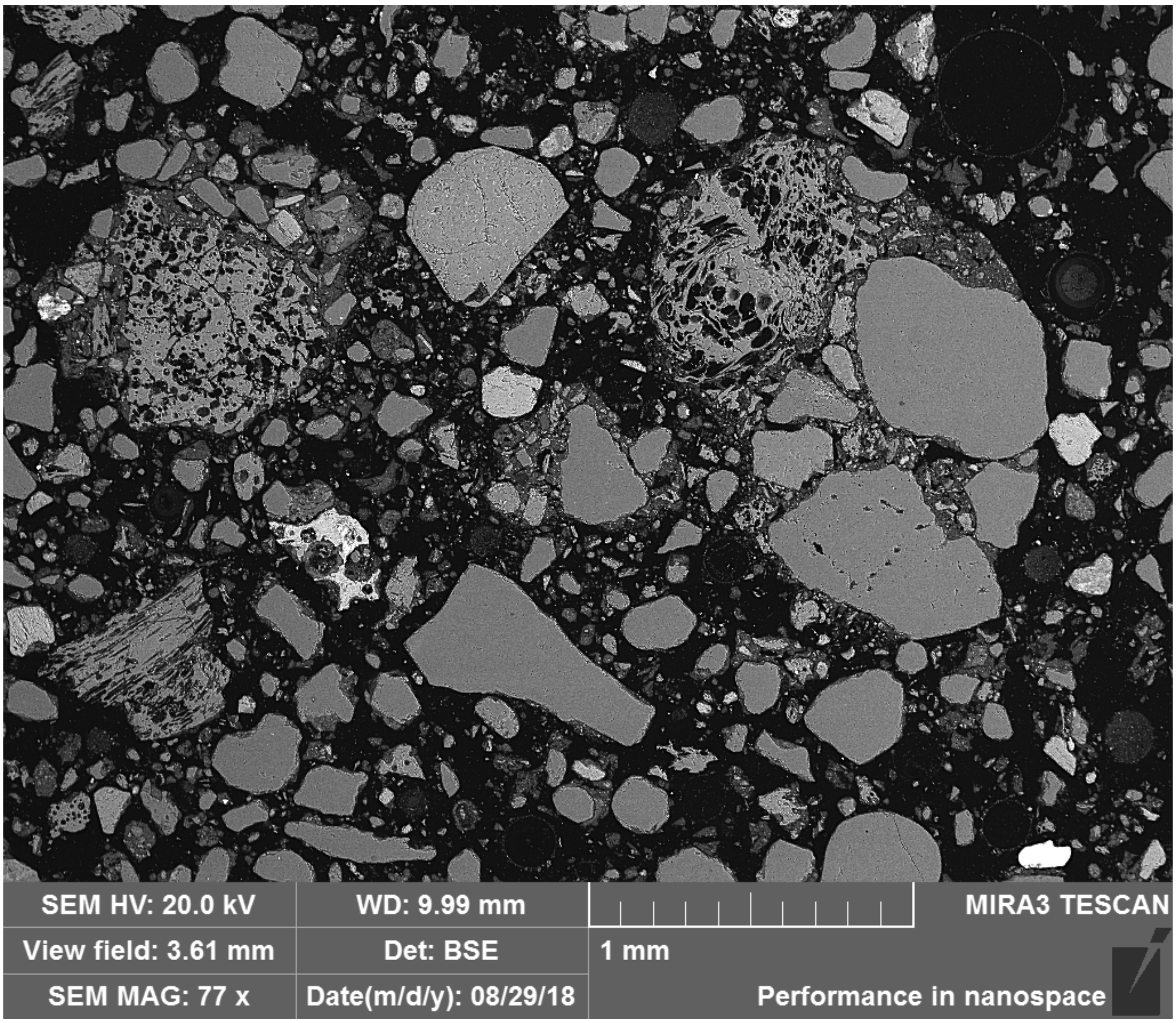
Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	13910	19.77	28.48	60.34	2.67	13.52
Aluminium	13	3798	1.05	1.52	1.91	0.08	7.72
Silicon	14	16097	3.02	4.35	5.25	0.16	5.23
Calcium	20	3847	1.20	1.73	1.46	0.07	5.56
Titanium	22	33869	15.02	21.64	15.32	0.45	3.00
Iron	26	12831	8.84	12.74	7.73	0.28	3.11
Uranium	92	34485	18.02	25.96	3.70	0.59	3.25
Zirconium	40	1335	0.45	0.65	0.24	0.05	10.72
Sodium	11	2339	1.39	2.00	2.94	0.13	9.11
Magnesium	12	812	0.31	0.44	0.62	0.05	15.66
Chlorine	17	1070	0.22	0.32	0.31	0.04	16.25
Sulfur	16	628	0.12	0.18	0.19	0.03	26.51
		Sum	**69.43**	**100.00**	**100.00**		



Client Sample No.: **WME-10**
Low magnification backscatter image showing the sample's variable texture – 78X

Client Sample No.: **WME-14**

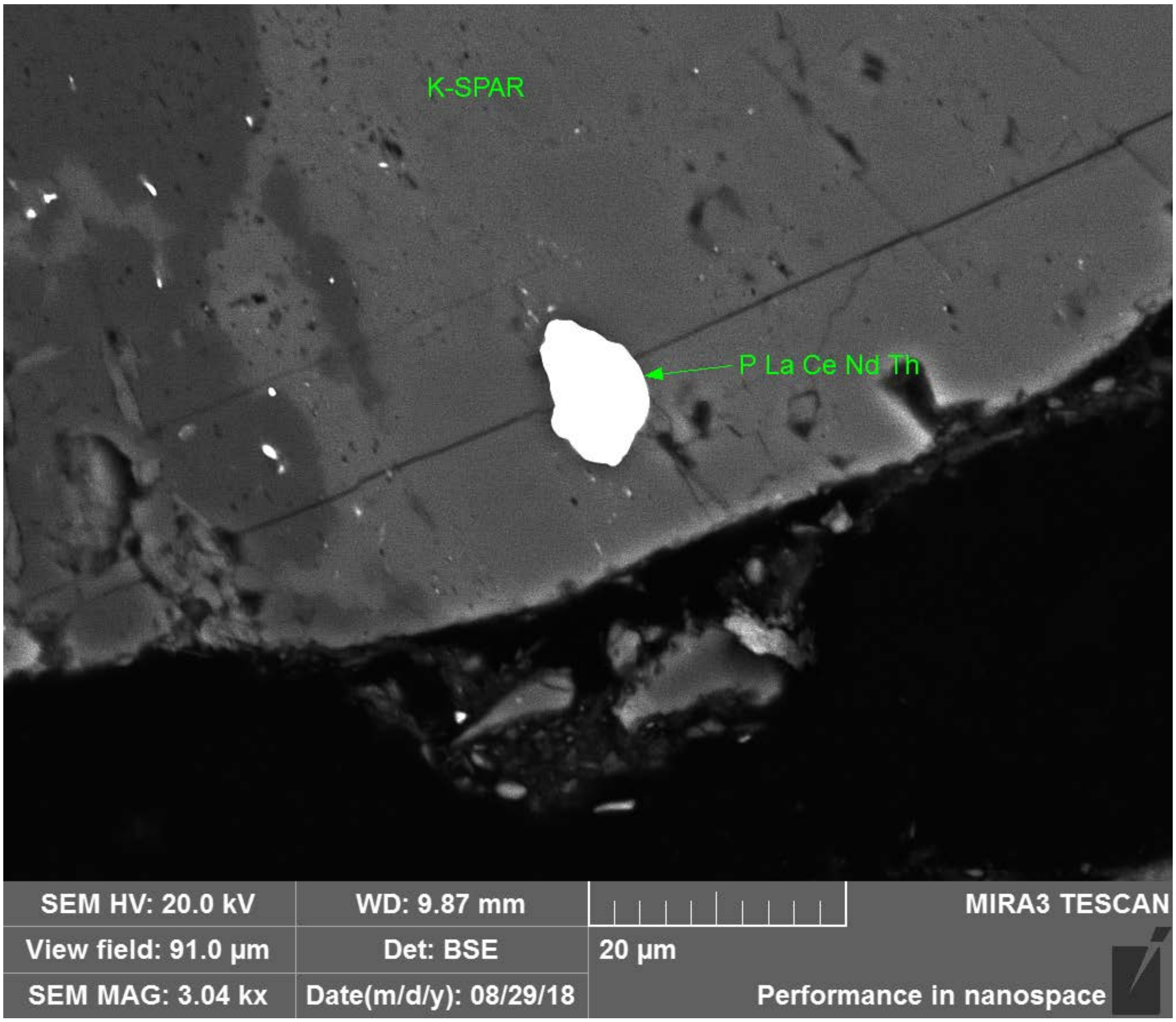
This material is a brown colored, coarse, gravelly sand with appreciable clay content. Collectively clay mineralogy accounts for ~15% of the sample's mass and is primarily mica/illite (~6%), kaolinite (~5%) and swelling smectite (~4%). Quartz (~40%) is the dominant silicate and occurs as angular to well-rounded grains that vary in size from 2µm up to 1mm. Plagioclase and K-spar collectively account for ~11% of the sample and occur as liberated angular fragments up to 1mm in size. Several basaltic rock fragments carry thin, euhedral, lath shaped grains of plagioclase. This sample also contains a significant amount of volcanic glass (~13%) that occurs as large vesicular fragments >1mm in size. These fragments commonly carry small euhedral grains of magnetite, titaniferous magnetite and ilmenite. Of the samples studied, this sediment has the highest concentration of calcite. Although the carbonate is generally very fine grained with measurements that vary from 2µm to 150µm, a few large fine-grained aggregates measure several millimeters in size. Accessory minerals include a trace of pyrite, chalcopyrite, barite, xenotime, rutile and zircon. An extensive search fail to identify U containing phases.



Client Sample No.: **WME-14**
Low magnification backscatter image showing grain texture – 77X

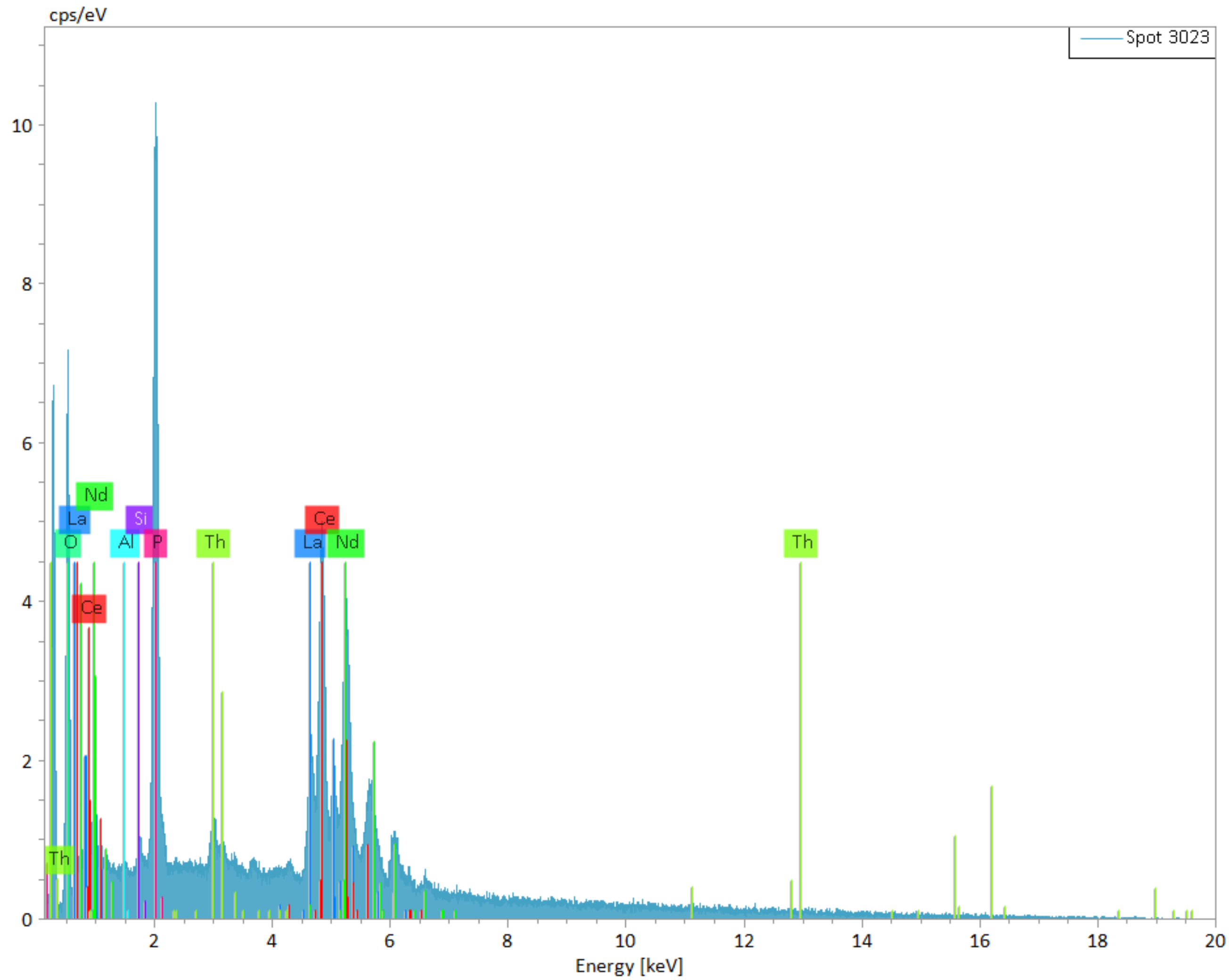
Client Sample No.: **WME-16**

In thin section, this sample contains simple mineralogy. The sediment is a fine to medium grained sand with low clay content. Total clay content is ~2% with kaolinite (~1%) and swelling smectite (~1%) as the primary types and trace amounts of illite/chlorite. Like previous samples, quartz (~77%) is the main hard silicate and occurs as angular to well rounded grains with measurements that vary from 5µm up to 350µm. Plagioclase (~7%) and K-spar (~8%) occur as angular to sub-rounded grains that vary from 5µm up to 250µm. The feldspar commonly carries small inclusions of barite, rutile, zircon, rare earth phosphates and pyrite. Calcite (~6%) is the sole carbonate and occurs as angular fragments with a size variation of 5µm to 150µm. Although an extensive search failed to detect U bearing phases, a monazite grain included in K-spar contains some Th content.

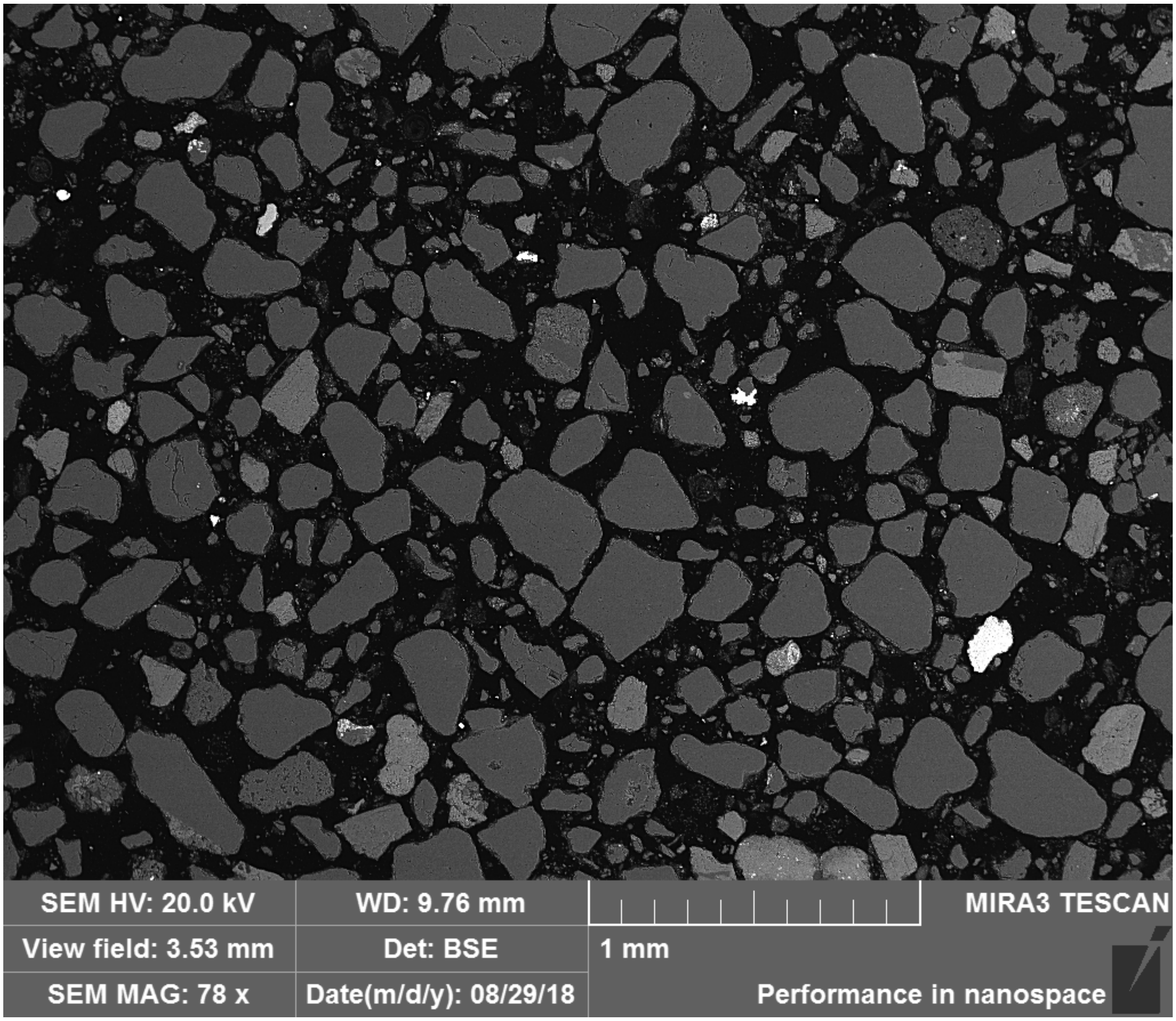


Client Sample No.: **WME-16**

Backscatter image of K-spar with numerous bright grains of monazite with Th – 3,040X



Element	At. No.	Netto	Mass [%]	Mass Norm. [%]	Atom [%]	abs. error [%] (1 sigma)	rel. error [%] (1 sigma)
Oxygen	8	12372	14.39	19.13	55.05	1.98	13.77
Aluminium	13	393	0.24	0.32	0.54	0.04	18.66
Silicon	14	788	0.31	0.42	0.68	0.04	14.34
Phosphorus	15	28554	11.61	15.44	22.94	0.48	4.17
Lanthanum	57	13988	10.29	13.68	4.53	0.32	3.12
Cerium	58	33471	25.57	34.00	11.17	0.73	2.86
Neodymium	60	12974	10.67	14.19	4.53	0.33	3.09
Thorium	90	2626	2.12	2.82	0.56	0.11	5.09
		Sum	**75.22**	**100.00**	**100.00**		



Client Sample No.: **WME-16**
Low magnification backscatter image showing grain texture – 78X

Attachment 4

Humidity Cell Testing Results

Attachment 4: Humidity Cell Testing Results.

ACZ Lab ID	Week	Location	Date	Interstitial Weight	Leachate Volume	Conductivity	pH	Alkalinity	Al	Ca	Fe	Mg	Mn	Mo	Se	Na	SO_4	U	V
				g	L	umhos/cm	units	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
L45307-02	0	WME-2	7/24/2018	484	0.839	563	9.6	130	0.06	0.90	0.03	<0.2	<0.005	0.25	2.29	114	95	0.924	0.427
L45307-03	1	WME-2	7/31/2018	328	0.781	550	9.6	118	0.20	1.60	0.13	<0.2	<0.005	0.21	2.29	113	101	1.120	0.317
L45307-04	2	WME-2	8/7/2018	136	0.867	417	9.5	77	0.06	1.60	0.11	<0.2	<0.005	0.16	2.35	88	106	1.030	0.199
L45307-05	3	WME-2	8/14/2018	218	0.673	908	9.3	172	-----	-----	0.28	-----	-----	-----	-----	-----	372	-----	-----
L45307-06	4	WME-2	8/21/2018	192	0.771	741	9.4	198	0.11	1.50	0.25	<0.2	<0.005	0.14	6.14	179	180	2.430	0.758
L45307-07	5	WME-2	8/28/2018	199	0.766	584	9.3	184	-----	-----	0.17	-----	-----	-----	-----	-----	111	-----	-----
L45307-08	6	WME-2	9/4/2018	191	0.737	551	9.4	156	0.10	1.00	0.22	<0.2	<0.005	0.04	3.20	106	17.1	1.220	0.596
L45307-09	7	WME-2	9/11/2018	171	0.774	418	9.1	140	-----	-----	0.12	-----	-----	-----	-----	-----	20.1	-----	-----
L45307-10	8	WME-2	9/18/2018	183	0.740	371	9.2	120	0.07	1.8	0.18	<0.2	0.038	0.026	1.99	70.4	14.1	0.794	0.457
L45307-11	9	WME-2	9/25/2018	185	0.746	323	9.2	124	-----	-----	0.14	-----	-----	-----	-----	-----	<1	-----	-----
L45307-12	10	WME-2	10/2/2018	243	0.680	248	9.0	95.6	0.08	1.7	0.20	<0.2	<0.005	0.018	1.32	50.7	<1	0.548	0.302
L45307-13	11	WME-2	10/9/2018	203	0.812	243	8.7	94.3	-----	-----	0.10	-----	-----	-----	-----	-----	1.3	-----	-----
L45307-14	12	WME-2	10/16/2018	177	0.767	198	8.3	74	0.18	3.1	0.17	<0.2	<0.005	0.014	0.817	34.3	<1	0.410	0.179
L45307-15	13	WME-2	10/23/2018	182	0.722	162	8.7	69.2	-----	-----	0.18	-----	-----	-----	-----	-----	12.8	-----	-----
L45307-16	14	WME-2	10/30/2018	173	0.751	131	8.6	57.5	-----	-----	0.06	-----	-----	-----	-----	-----	8.6	-----	-----
L45307-17	15	WME-2	11/6/2018	172	0.729	114	8.2	47.7	-----	-----	0.12	-----	-----	-----	-----	-----	6.9	-----	-----
L45307-18	16	WME-2	11/13/2018	159	0.701	112	7.9	47.1	0.07	7.4	0.11	0.3	0.006	0.007	0.354	13.4	6.2	0.228	0.074
L45307-19	17	WME-2	11/20/2018	205	0.759	149	7.9	46.3	-----	-----	0.04	-----	-----	-----	-----	-----	12.8	-----	-----
L45307-20	18	WME-2	11/27/2018	223	0.873	126	8.1	44.9	-----	-----	0.04	-----	-----	-----	-----	-----	9.4	-----	-----
L45307-21	19	WME-2	12/4/2018	241	0.941	94	8.1	37.8	-----	-----	0.02	-----	-----	-----	-----	-----	7.3	-----	-----
L45307-22	20	WME-2	12/11/2018	229	0.878	88	7.6	38.2	<0.03	9.6	0.03	0.4	<0.005	0.007	0.254	5.9	5.2	0.197	0.062
L45693-02	0	WME-3	7/24/2018	430	0.854	740	9.7	172	0.2	0.4	0.37	<0.2	<0.005	0.301	3.1	150	128	0.161	1.010
L45693-03	1	WME-3	7/31/2018	329	0.717	569	9.8	141	0.23	0.5	0.37	<0.2	<0.005	0.211	2.26	121	101	0.126	0.760
L45693-04	2	WME-3	8/7/2018	344	0.651	585	9.9	153	0.19	0.4	0.32	<0.2	<0.005	0.171	2.28	119	90.2	0.110	0.854
L45693-05	3	WME-3	8/14/2018	307	0.739	494	9.9	131	-----	-----	0.17	-----	-----	-----	-----	-----	74	-----	-----
L45693-06	4	WME-3	8/21/2018	252	0.750	515	9.9	132	0.1	0.7	0.21	<0.2	<0.005	0.127	1.47	111	103	0.085	0.514
L45693-07	5	WME-3	8/28/2018	171	0.781	264	9.7	70.1	-----	-----	0.04	-----	-----	-----	-----	-----	43.7	-----	-----
L45693-08	6	WME-3	9/4/2018	187	0.698	263	9.9	57.7	0.14	1.2	0.25	<0.2	<0.005	0.033	0.511	54	34.7	0.014	0.235
L45693-09	7	WME-3	9/11/2018	179	0.690	233	9.6	61	-----	-----	0.14	-----	-----	-----	-----	-----	34.9	-----	-----
L45693-10	8	WME-3	9/18/2018	190	0.676	173	9.5	55.2	0.11	1.9	0.22	<0.2	0.007	0.017	0.441	36	31.1	0.016	0.195
L45693-11	9	WME-3	9/25/2018	191	0.669	169	9.5	59.3	-----	-----	0.18	-----	-----	-----	-----	-----	18.5	-----	-----
L45693-12	10	WME-3	10/2/2018	175	0.735	161	9.3	52.3	0.14	3.4	0.22	<0.2	<0.005	0.018	0.351	30.4	22.8	0.014	0.129
L45693-13	11	WME-3	10/9/2018	150	0.737	163	9.2	49.3	-----	-----	0.11	-----	-----	-----	-----	-----	30.3	-----	-----
L45693-14	12	WME-3	10/16/2018	178	0.649	132	8.9	44.9	0.18	4.7	0.31	<0.2	<0.005	0.018	0.22	22.2	23.1	0.011	0.086
L45693-15	13	WME-3	10/23/2018	180	0.643	153	9.2	48.4	-----	-----	0.48	-----	-----	-----	-----	-----	28	-----	-----
L45693-16	14	WME-3	10/30/2018	172	0.662	139	9.4	48.7	-----	-----	0.25	-----	-----	-----	-----	-----	20.3	-----	-----
L45693-17	15	WME-3	11/6/2018	182	0.643	108	9.1	45.1	-----	-----	0.21	-----	-----	-----	-----	-----	13.3	-----	-----
L45693-18	16	WME-3	11/13/2018	178	0.650	95	9.0	36.3	0.09	4.6	0.14	<0.2	<0.005	0.007	0.154	15	9	0.011	0.088
L45693-19	17	WME-3	11/20/2018	218	0.707	161	8.6	45.4	-----	-----	0.08	-----	-----	-----	-----	-----	18.6	-----	-----
L45693-20	18	WME-3	11/27/2018	271	0.834	110	8.6	37.8	-----	-----	0.04	-----	-----	-----	-----	-----	12.9	-----	-----
L45693-21	19	WME-3	12/4/2018	305	0.880	103	8.7	50.8	-----	-----	0.04	-----	-----	-----	-----	-----	9.2	-----	-----
L45693-22	20	WME-3	12/11/2018	357	0.822	96	8.7	43	<0.03	6	0.04	<0.2	<0.005	0.008	0.149	14.9	7.6	0.013	0.065

Attachment 4: Humidity Cell Testing Results.

ACZ Lab ID	Week	Location	Date	Interstitial Weight	Leachate Volume	Conductivity	pH	Alkalinity	Al	Ca	Fe	Mg	Mn	Mo	Se	Na	SO_4	U	V
				g	L	umhos/cm	units	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
L45309-02	0	WME-9	7/24/2018	434	0.843	593	9.2	50.6	0.38	4.7	0.26	1.1	<0.005	3.81	0.105	110	165	0.304	0.009
L45309-03	1	WME-9	7/31/2018	236	0.844	599	9.0	74.6	0.19	5.5	0.16	1.2	<0.005	4.26	0.148	129	173	0.588	0.020
L45309-04	2	WME-9	8/7/2018	285	0.650	759	9.1	150	0.21	2.5	0.14	0.5	<0.005	3.51	0.262	142	143	1.060	0.101
L45309-05	3	WME-9	8/14/2018	206	0.779	251	9.5	73.6	-----	-----	0.10	-----	-----	-----	-----	-----	35.6	-----	-----
L45309-06	4	WME-9	8/21/2018	199	0.724	237	9.6	114	0.28	1.1	0.17	0.2	<0.005	0.509	0.077	56.7	23	0.464	0.064
L45309-07	5	WME-9	8/28/2018	195	0.741	175	9.5	72.4	-----	-----	0.06	-----	-----	-----	-----	-----	29.3	-----	-----
L45309-08	6	WME-9	9/4/2018	176	0.732	135	9.7	71.9	0.29	1.1	0.48	<0.2	<0.005	0.267	0.048	44.6	1.3	0.275	0.041
L45309-09	7	WME-9	9/11/2018	162	0.735	150	9.4	70.6	-----	-----	0.04	-----	-----	-----	-----	-----	<1	-----	-----
L45309-10	8	WME-9	9/18/2018	165	0.711	158	9.5	74.9	0.31	1.3	0.18	0.3	0.01	0.153	0.056	36.4	1.4	0.276	0.047
L45309-11	9	WME-9	9/25/2018	177	0.704	187	9.4	89.2	-----	-----	0.12	-----	-----	-----	-----	-----	1.1	-----	-----
L45309-12	10	WME-9	10/2/2018	164	0.736	173	9.4	80.9	0.54	1	0.30	<0.2	<0.005	0.105	0.045	38.6	<1	0.195	0.057
L45309-13	11	WME-9	10/9/2018	149	0.769	157	9.3	70.1	-----	-----	0.08	-----	-----	-----	-----	-----	1.2	-----	-----
L45309-14	12	WME-9	10/16/2018	140	0.739	158	9.2	70.1	0.28	1.3	0.14	0.3	<0.005	0.094	0.031	32.6	1.3	0.167	0.045
L45309-15	13	WME-9	10/23/2018	151	0.709	142	9.3	64.7	-----	-----	0.16	-----	-----	-----	-----	-----	<1	-----	-----
L45309-16	14	WME-9	10/30/2018	157	0.720	126	9.2	75.4	-----	-----	0.07	-----	-----	-----	-----	-----	<1	-----	-----
L45309-17	15	WME-9	11/6/2018	155	0.715	112	9.0	54.3	-----	-----	0.08	-----	-----	-----	-----	-----	<1	-----	-----
L45309-18	16	WME-9	11/13/2018	137	0.720	126	8.9	57.9	0.1	2.8	0.03	0.5	<0.005	0.052	0.019	23.4	<1	0.111	0.036
L45309-19	17	WME-9	11/20/2018	207	0.714	155	8.8	50.3	-----	-----	0.07	-----	-----	-----	-----	-----	11.7	-----	-----
L45309-20	18	WME-9	11/27/2018	313	0.792	124	8.8	54.4	-----	-----	0.03	-----	-----	-----	-----	-----	1.2	-----	-----
L45309-21	19	WME-9	12/4/2018	338	0.924	117	8.8	53.5	-----	-----	0.03	-----	-----	-----	-----	-----	5.3	-----	-----
L45309-22	20	WME-9	12/11/2018	303	0.888	97	8.8	49	0.04	4.3	0.02	0.7	<0.005	0.08	0.013	17.8	2.2	0.113	0.018
L45310-02	0	WME-10	7/24/2018	503	0.737	1380	9.5	113	0.28	2.3	0.30	0.3	<0.005	2.52	1.13	267	292	7.220	0.352
L45310-03	1	WME-10	7/31/2018	395	0.720	1670	9.4	177	0.27	3.5	0.29	0.5	<0.005	3.9	1.45	365	354	15.600	0.522
L45310-04	2	WME-10	8/7/2018	446	0.556	1580	9.2	190	0.19	4.7	0.26	0.6	0.005	3.2	1.36	317	288	15.100	0.624
L45310-05	3	WME-10	8/14/2018	398	0.695	789	9.5	153	-----	-----	0.27	-----	-----	-----	-----	-----	213	-----	-----
L45310-06	4	WME-10	8/21/2018	416	0.683	317	9.6	146	0.17	0.4	0.27	0.4	<0.005	1.13	0.865	152	136	8.000	0.462
L45310-07	5	WME-10	8/28/2018	378	0.724	379	9.6	112	-----	-----	0.22	-----	-----	-----	-----	-----	91.4	-----	-----
L45310-08	6	WME-10	9/4/2018	423	0.603	316	9.8	122	0.21	1.8	0.31	<0.2	<0.005	0.708	0.743	117	29.6	5.070	0.348
L45310-09	7	WME-10	9/11/2018	327	0.715	403	9.7	111	-----	-----	0.14	-----	-----	-----	-----	-----	2.2	-----	-----
L45310-10	8	WME-10	9/18/2018	361	0.602	394	9.6	123	0.4	1.6	0.45	0.3	0.026	0.48	0.869	96.5	4.2	3.170	0.369
L45310-11	9	WME-10	9/25/2018	341	0.658	402	9.6	127	-----	-----	0.40	-----	-----	-----	-----	-----	<1	-----	-----
L45310-12	10	WME-10	10/2/2018	312	0.656	351	9.6	120	0.5	1.2	0.63	0.2	0.01	0.337	0.85	81.2	1.4	2.860	0.354
L45310-13	11	WME-10	10/9/2018	291	0.714	276	9.7	93.4	-----	-----	0.19	-----	-----	-----	-----	-----	1.1	-----	-----
L45310-14	12	WME-10	10/16/2018	271	0.669	253	9.5	115	0.39	1.1	0.41	0.2	<0.005	0.192	0.624	58.8	1.6	1.620	0.302
L45310-15	13	WME-10	10/23/2018	280	0.631	279	9.6	111	-----	-----	0.52	-----	-----	-----	-----	-----	28.4	-----	-----
L45310-16	14	WME-10	10/30/2018	272	0.659	234	9.6	98.8	-----	-----	0.26	-----	-----	-----	-----	-----	21.4	-----	-----
L45310-17	15	WME-10	11/6/2018	283	0.622	263	9.5	125	-----	-----	0.25	-----	-----	-----	-----	-----	23.6	-----	-----
L45310-18	16	WME-10	11/13/2018	251	0.655	241	9.4	115	0.17	1.3	0.24	<0.2	0.007	0.144	0.541	59.2	19.2	1.160	0.259
L45310-19	17	WME-10	11/20/2018	290	0.711	299	9.2	118	-----	-----	0.22	-----	-----	-----	-----	-----	23.6	-----	-----
L45310-20	18	WME-10	11/27/2018	331	0.847	188	9.3	88.2	-----	-----	0.05	-----	-----	-----	-----	-----	14	-----	-----
L45310-21	19	WME-10	12/4/2018	340	0.941	146	8.9	63.3	-----	-----	0.03	-----	-----	-----	-----	-----	10.1	-----	-----
L45310-22	20	WME-10	12/11/2018	301	0.914	105	9.2	52.8	0.05	2.6	0.02	<0.2	<0.005	0.059	0.149	23.7	7.1	0.293	0.108

Attachment 4: Humidity Cell Testing Results.

Week	Location	Alk	Cum. Alkalinity	Fe	Cum. Fe	SO_4	Cum. SO_4	Mo	Cum. Mo	Se	Cum. Se	Na	Cum. Na	U	Cum. U	V	Cum. V	Ca	Cum. Ca
		g	g	mg	mg	g	g	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
0	WME-2	0.11	0.11	0.025	0.03	0.079	0.079	0.211	0.211	1.92	1.92	95.6	95.6	0.775	0.775	0.358	0.358	0.76	0.76
1	WME-2	0.09	0.20	0.102	0.13	0.079	0.158	0.166	0.378	1.79	3.71	88.3	183.9	0.875	1.650	0.248	0.606	1.25	2.00
2	WME-2	0.07	0.27	0.095	0.22	0.092	0.250	0.136	0.514	2.04	5.75	76.6	260.5	0.893	2.543	0.173	0.778	1.39	3.39
3	WME-2	0.12	0.38	0.188	0.41	0.250	0.500	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
4	WME-2	0.15	0.54	0.193	0.60	0.139	0.639	0.106	0.620	4.73	10.48	138.0	398.6	1.874	4.416	0.584	1.363	1.16	4.55
5	WME-2	0.14	0.68	0.130	0.73	0.085	0.724	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
6	WME-2	0.11	0.79	0.162	0.90	0.013	0.737	0.027	0.647	2.36	12.84	78.1	476.7	0.899	5.316	0.439	1.802	0.74	5.29
7	WME-2	0.11	0.90	0.093	0.99	0.016	0.752	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
8	WME-2	0.09	0.99	0.133	1.12	0.010	0.763	0.019	0.666	1.47	14.31	52.1	528.8	0.588	5.903	0.338	2.140	1.33	6.62
9	WME-2	0.09	1.08	0.104	1.23	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
10	WME-2	0.07	1.15	0.136	1.36	-----	-----	0.012	0.678	0.90	15.21	34.5	563.2	0.373	6.276	0.205	2.346	1.16	7.77
11	WME-2	0.08	1.22	0.081	1.44	0.001	0.764	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
12	WME-2	0.06	1.28	0.130	1.57	-----	-----	0.011	0.689	0.63	15.84	26.3	589.6	0.314	6.590	0.137	2.483	2.38	10.15
13	WME-2	0.05	1.33	0.130	1.70	0.009	0.773	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
14	WME-2	0.04	1.37	0.045	1.75	0.006	0.780	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
15	WME-2	0.03	1.41	0.087	1.84	0.005	0.785	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
16	WME-2	0.03	1.44	0.077	1.91	0.004	0.789	0.005	0.694	0.25	16.08	9.4	598.9	0.160	6.750	0.052	2.535	5.19	15.34
17	WME-2	0.04	1.48	0.030	1.94	0.010	0.799	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
18	WME-2	0.04	1.52	0.035	1.98	0.008	0.807	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
19	WME-2	0.04	1.55	0.019	2.00	0.007	0.814	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
20	WME-2	0.03	1.59	0.026	2.02	-----	-----	0.006	0.700	0.22	16.31	5.2	604.1	0.173	6.923	0.054	2.589	8.43	23.77
0	WME-3	0.15	0.15	0.316	0.32	0.109	0.109	0.257	0.257	2.65	2.65	128.1	128.1	0.137	0.137	0.863	0.863	0.34	0.34
1	WME-3	0.10	0.25	0.265	0.58	0.072	0.182	0.151	0.408	1.62	4.27	86.8	214.9	0.090	0.228	0.545	1.407	0.36	0.70
2	WME-3	0.10	0.35	0.208	0.79	0.059	0.240	0.111	0.520	1.48	5.75	77.5	292.3	0.072	0.299	0.556	1.963	0.26	0.96
3	WME-3	0.10	0.44	0.126	0.92	0.055	0.295	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
4	WME-3	0.10	0.54	0.158	1.07	0.077	0.372	0.095	0.615	1.10	6.85	83.3	375.6	0.064	0.363	0.386	2.349	0.53	1.49
5	WME-3	0.05	0.60	0.031	1.10	0.034	0.407	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
6	WME-3	0.04	0.64	0.175	1.28	0.024	0.431	0.023	0.638	0.36	7.21	37.7	413.3	0.010	0.373	0.164	2.513	0.84	2.32
7	WME-3	0.04	0.68	0.097	1.38	0.024	0.455	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
8	WME-3	0.04	0.72	0.149	1.52	0.021	0.476	0.012	0.650	0.30	7.51	24.3	437.6	0.011	0.384	0.132	2.645	1.28	3.61
9	WME-3	0.04	0.76	0.120	1.64	0.012	0.488	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
10	WME-3	0.04	0.80	0.162	1.81	0.017	0.505	0.013	0.663	0.26	7.77	22.3	459.9	0.010	0.394	0.095	2.740	2.50	6.11
11	WME-3	0.04	0.83	0.081	1.89	0.022	0.527	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
12	WME-3	0.03	0.86	0.201	2.09	0.015	0.542	0.011	0.674	0.14	7.91	14.4	474.4	0.007	0.401	0.056	2.795	3.05	9.16
13	WME-3	0.03	0.89	0.309	2.40	0.018	0.560	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
14	WME-3	0.03	0.92	0.166	2.56	0.013	0.574	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
15	WME-3	0.03	0.95	0.135	2.70	0.009	0.582	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
16	WME-3	0.02	0.98	0.091	2.79	0.006	0.588	0.005	0.679	0.10	8.01	9.8	484.1	0.007	0.408	0.057	2.853	2.99	12.15
17	WME-3	0.03	1.01	0.057	2.84	0.013	0.601	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
18	WME-3	0.03	1.04	0.033	2.88	0.011	0.612	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
19	WME-3	0.04	1.09	0.035	2.91	0.008	0.620	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
20	WME-3	0.04	1.12	0.033	2.95	0.006	0.626	0.006	0.685	0.12	8.13	12.2	496.4	0.010	0.419	0.053	2.906	4.93	17.08
0	WME-9	0.04	0.04	0.219	0.22	0.139	0.139	3.212	3.212	0.09	0.09	92.7	92.7	0.256	0.256	0.008	0.008	3.96	3.96

Attachment 4: Humidity Cell Testing Results.

Week	Location	Alk	Cum. Alkalinity	Fe	Cum. Fe	SO_4	Cum. SO_4	Mo	Cum. Mo	Se	Cum. Se	Na	Cum. Na	U	Cum. U	V	Cum. V	Ca	Cum. Ca
		g	g	mg	mg	g	g	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
1	WME-9	0.06	0.11	0.135	0.35	0.146	0.285	3.595	6.807	0.12	0.21	108.9	201.6	0.496	0.753	0.017	0.024	4.64	8.60
2	WME-9	0.10	0.20	0.091	0.45	0.093	0.378	2.282	9.089	0.17	0.38	92.3	293.9	0.689	1.442	0.066	0.090	1.63	10.23
3	WME-9	0.06	0.26	0.078	0.52	0.028	0.406	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
4	WME-9	0.08	0.34	0.123	0.65	0.017	0.422	0.369	9.457	0.06	0.44	41.1	335.0	0.336	1.777	0.046	0.136	0.80	11.03
5	WME-9	0.05	0.40	0.044	0.69	0.022	0.444	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
6	WME-9	0.05	0.45	0.351	1.04	0.001	0.445	0.195	9.653	0.03	0.47	32.6	367.6	0.201	1.979	0.030	0.166	0.81	11.83
7	WME-9	0.05	0.50	0.029	1.07	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
8	WME-9	0.05	0.55	0.128	1.20	0.001	0.446	0.109	9.762	0.04	0.51	25.9	393.5	0.196	2.175	0.033	0.200	0.92	12.76
9	WME-9	0.06	0.62	0.084	1.28	0.001	0.447	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
10	WME-9	0.06	0.68	0.221	1.50	-----	-----	0.077	9.839	0.03	0.55	28.4	421.9	0.144	2.319	0.042	0.242	0.74	13.49
11	WME-9	0.05	0.73	0.062	1.57	0.001	0.448	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
12	WME-9	0.05	0.78	0.103	1.67	0.001	0.449	0.070	9.908	0.02	0.57	24.1	446.0	0.123	2.442	0.033	0.275	0.96	14.45
13	WME-9	0.05	0.83	0.113	1.78	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
14	WME-9	0.05	0.88	0.050	1.83	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
15	WME-9	0.04	0.92	0.057	1.89	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
16	WME-9	0.04	0.96	0.022	1.91	-----	-----	0.037	9.946	0.01	0.58	16.8	462.8	0.080	2.522	0.026	0.301	2.02	16.47
17	WME-9	0.04	1.00	0.050	1.96	0.008	0.457	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
18	WME-9	0.04	1.04	0.024	1.99	0.001	0.458	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
19	WME-9	0.05	1.09	0.028	2.01	0.005	0.463	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
20	WME-9	0.04	1.14	0.018	2.03	0.002	0.465	0.071	10.016	0.01	0.59	15.8	478.6	0.100	2.622	0.016	0.317	3.82	20.29
0	WME-10	0.08	0.08	0.221	0.22	0.215	0.215	1.857	1.857	0.83	0.83	196.8	196.8	5.321	5.321	0.259	0.259	1.70	1.70
1	WME-10	0.13	0.21	0.209	0.43	0.255	0.470	2.808	4.665	1.04	1.88	262.8	459.6	11.232	16.553	0.376	0.635	2.52	4.22
2	WME-10	0.11	0.32	0.145	0.57	0.160	0.630	1.779	6.444	0.76	2.63	176.3	635.8	8.396	24.949	0.347	0.982	2.61	6.83
3	WME-10	0.11	0.42	0.188	0.76	0.148	0.778	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
4	WME-10	0.10	0.52	0.184	0.95	0.093	0.871	0.772	7.216	0.59	3.22	103.8	739.6	5.464	30.413	0.316	1.298	0.27	7.10
5	WME-10	0.08	0.60	0.159	1.11	0.066	0.937	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
6	WME-10	0.07	0.68	0.187	1.29	0.018	0.955	0.427	7.643	0.45	3.67	70.6	810.2	3.057	33.470	0.210	1.508	1.09	8.19
7	WME-10	0.08	0.76	0.100	1.39	0.002	0.957	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
8	WME-10	0.07	0.83	0.271	1.66	0.003	0.959	0.289	7.932	0.52	4.19	58.1	868.3	1.908	35.378	0.222	1.730	0.96	9.15
9	WME-10	0.08	0.91	0.263	1.93	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
10	WME-10	0.08	0.99	0.413	2.34	0.001	0.960	0.221	8.153	0.56	4.75	53.3	921.6	1.876	37.254	0.232	1.962	0.79	9.94
11	WME-10	0.07	1.06	0.136	2.48	0.001	0.961	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
12	WME-10	0.08	1.14	0.274	2.75	0.001	0.962	0.128	8.282	0.42	5.17	39.3	960.9	1.084	38.338	0.202	2.164	0.74	10.67
13	WME-10	0.07	1.21	0.328	3.08	0.018	0.980	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
14	WME-10	0.07	1.27	0.171	3.25	0.014	0.994	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
15	WME-10	0.08	1.35	0.156	3.41	0.015	1.009	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
16	WME-10	0.08	1.42	0.157	3.56	0.013	1.021	0.094	8.376	0.35	5.52	38.8	999.7	0.760	39.098	0.170	2.334	0.85	11.52
17	WME-10	0.08	1.51	0.156	3.72	0.017	1.038	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
18	WME-10	0.07	1.58	0.042	3.76	0.012	1.050	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
19	WME-10	0.06	1.64	0.028	3.79	0.010	1.059	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
20	WME-10	0.05	1.69	0.018	3.81	0.006	1.066	0.054	8.430	0.14	5.66	21.7	1021.3	0.268	39.366	0.099	2.432	2.38	13.90

Attachment 5
LTP Static Column Testing Results

Attachment 5: LTP Static Column Testing Results.

Column	Lab ID	Date	pH	Alkalinity	CO_3	HCO_3	Cl	F	SO_4	Ca	Mg	K	Na	Al	Fe	Mn	Mo	P	Se	SiO_2	U	V
Column 1 (sand)	C18060844-005	6/18/2018	9.9	3620	1330	1700	1720	3	7980	3	<1	18	5760	0.07	0.03	0.010	39.2	3	0.719	19	13.2	0.49
1	C18080121-001	8/1/2018	9.6	3090	855	2040	1610	4	7650	3	0.7	16	5610	0.09	0.04	0.013	36.8	4.5	0.072	128	15.9	<0.02
1	C18090458-001	9/12/2018	9.6	3240	1010	1910	1650	3	7780	4	1	18	5880	0.08	0.06	0.013	36.3	3	0.02	134	14.2	0.03
1	C18120421-001	12/12/2018	9.6	3580	965	2410	1640	3	7590	2	<1	12	6210	<0.07	0.55	0.009	26.1	5.4	0.049	130	10.6	<0.01
1	C19030161-001	3/5/2019	9.4	3480	938	2340	1480	3	6990	2	0.2	14	5950	0.42	0.07	0.007	35.8	4.6	0.011	125	11.6	<0.01
1	C19060814-001	6/20/2019	9.6	3710	1050	2380	1690	3	7840	12	0.14	14	5580	0.04	<0.04	0.009	37.2	4.6	0.012	108	11.6	0.003
Column 2 (sand)	C18060844-006	6/19/2018	9.6	843	225	571	251	1	1340	5	0.8	7	1060	1.1	2.33	0.075	3.6	0.5	0.099	21.9	1.08	0.37
2	C18080121-002	8/1/2018	9.7	895	255	573	253	1	1370	2	0.3	7	1140	0.05	0.09	0.016	3.57	1.3	0.171	67.4	3.16	0.54
2	C18090458-002	9/12/2018	9.7	913	258	590	245	1	1310	4	0.7	8	1170	0.22	0.5	0.027	3.7	<0.7	0.087	87	3.09	0.74
2	C18120421-002	12/12/2018	9.6	1440	396	950	241	1.2	877	4	<1	8	1190	0.08	1.9	0.015	2.32	0.7	0.806	182	2.35	0.13
2	C19030161-002	3/5/2019	9.4	2210	499	1680	242	0.2	27	2	0.18	7	1070	0.06	0.2	0.022	1.38	0.9	0.01	225	0.4	0.02
2	C19060814-002	6/20/2019	9.4	2210	390	1900	259	0.2	40	4	0.29	6	1100	0.09	0.11	0.026	1.07	0.9	0.121	202	0.125	0.02
Column 3 (sand)	C18060969-001	6/22/2018	9.7	1110	15	1320	209	2	1720	17	4	10	1210	0.94	1.2	0.023	3.63	<0.7	0.572	25	1.39	0.39
3	C18080121-003	8/1/2018	8.3	1470	55	1680	197	1	1710	29	4	9	1440	0.48	0.32	0.040	2.39	0.2	0.085	118	1.38	0.04
3	C18090458-003	9/12/2018	8.3	1520	34	1790	187	1.1	1610	21	4	8	1590	0.15	0.9	0.094	2.5	<0.7	0.019	129	1.23	0.02
3	C18120421-003	12/12/2018	8.3	1610	31	1910	175	1	1630	17	3	7	1490	0.06	0.32	0.036	1.08	0.7	0.139	107	1.18	0.0092
3	C19030161-003	3/5/2019	8.1	1600	13	1920	176	1	1710	17	4	7	1370	1.7	1.92	0.075	2.96	0.4	0.007	103	0.995	0.1
3	C19060814-003	6/20/2019	8.2	1580	40	1850	183	1	1790	19	4	7	1500	0.026	0.48	0.079	3.23	0.3	0.007	77.1	0.788	0.0075
Column 4 (slime)	C18060969-002	6/23/2018	10.0	9340	3970	3320	537	5	7920	8	2	26	7410	0.26	0.16	0.010	110	8	0.411	31	38	0.42
4	C18080121-004	8/1/2018	9.9	10200	4330	3660	545	4	8610	3	0.7	24	9280	0.09	0.09	0.020	139	10.3	0.102	48.1	47.1	<0.02
4	C18090458-004	9/12/2018	9.9	10200	4300	3750	550	4	9110	2	0.5	21	8540	0.07	0.07	0.029	116	7.8	0.328	56.2	42.9	<0.01
4	C18120421-004	12/12/2018	9.9	10400	4260	3970	511	5	8360	12	0.4	22	8320	0.08	0.07	0.015	121	9.2	0.193	103	39.6	0.04
4	C19030161-004	3/5/2019	9.9	10200	4150	4000	536	4.6	8560	4	1	25	8310	0.1	0.06	0.006	101	8.2	0.068	85	39.3	<1
4	C19060814-004	6/20/2019	9.9	10200	4070	4140	563	5	9180	3	<1	23	9120	0.04	<0.04	0.010	112	7.5	0.068	80	39	<0.01
Column 5 (slime)	C18060969-003	6/26/2018	10.3	3430	1510	1120	248	6	3020	5	1	33	2710	0.62	0.5	0.012	41.4	4	6.07	24	28.2	6.69
5	C18080121-005	8/1/2018	10.0	4500	2000	1430	263	8	3650	3	0.4	29	3800	0.14	0.13	0.007	68.8	5	1.03	57	47.8	4.73
5	C18090458-005	9/12/2018	10.0	4570	1950	1610	268	8	3770	3	0.8	31	3900	0.14	0.17	0.049	58.6	4	0.237	91	45.5	2.24
5	C18120421-005	12/12/2018	9.8	4940	1950	2060	252	8	3450	6	0.5	29	3850	0.64	0.52	0.020	53.9	4.4	0.266	193	32.8	0.2
5	C19030161-005	3/5/2019	9.7	5480	1980	2660	259	7	3090	2	0.51	30	3830	0.22	1.75	0.010	53.2	4.3	0.176	185	27.2	0.11
5	C19060814-005	6/20/2019	9.5	-----	-----	-----	272	11	2270	7	0.24	24	3560	0.08	0.4	0.020	51.4	5.8	0.155	203	23	0.22
Column 6 (slime)	C18060969-004	6/24/2018	10.2	5470	2590	1400	406	11	4590	4	<1	55	4550	0.22	0.11	0.008	62.7	5	2.15	20	23.6	1.12
6	C18080121-006	8/1/2018	10.0	7330	3260	2310	455	15	6510	2	<1	36	6370	0.11	0.04	0.009	110	6	0.067	41	42.8	0.04
6	C18090458-006	9/12/2018	10.0	7500	3270	2500	475	17	6890	3	0.6	35	6470	0.1	0.1	0.015	103	6	0.039	67	37.3	0.02
6	C18120421-006	12/12/2018	10.0	7570	3130	2880	426	17	6240	11	0.3	32	6280	0.08	0.07	0.009	102	8.2	0.059	107	31.4	0.3
6	C19030161-006	3/5/2019	9.8	7700	3040	3220	450	22	6280	5	1	33	6210	0.09	4.08	0.006	98	8.8	0.05	116	28.2	<0.02
6	C19060814-006	6/20/2019	9.9	7800	3040	3320	470	19	6250	14	<1	32	5920	0.06	0.09	0.007	96.3	8	0.045	95	24	<0.01