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Memorandum

Date: 26 July 2021

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Subject: East Multnomah County TSA Groundwater Remedy (ECSI 1479)
Data Gaps Investigation

Geosyntec Consultants (Geosyntec) and Landau Associates, Inc. (LAI) have prepared this memorandum to provide the Oregon State Department of Environmental Quality (DEQ) results of the Data Gaps Investigation completed in summer 2020 for the East Multnomah County Troutdale Sandstone Aquifer (EMC TSA) remedy being conducted jointly by Cascade Corporation (Cascade) and The Boeing Company (Boeing) under DEQ Consent Order No. WMCSR-NWR-96-08 (DEQ, 1997).

BACKGROUND AND LOCATION

The original study area for the EMC Site was approximately 2,300 acres, and successful groundwater remediation has reduced the active groundwater remedy area to approximately 14 acres among the Cascade, Dermody, and Boeing properties, as shown on Figure 1. The Data Gaps Investigation described herein was conducted on the Cascade property at 2525 NE 201st Avenue in Gresham, Oregon (Figure 1) and focuses on a small portion of the EMC Site referred to as the mound area. The mound area was identified as a portion of the Site located on a historical groundwater mound described during the Remedial Investigation phase of the project (Emcon and Landau, 1995). Due to the complex geological setting in this area of the EMC Site, a localized radial groundwater flow existed under natural conditions, which complicates remedial approaches. The localized radial groundwater flow along with erosional truncation of formations above the TSA in the mound area make understanding the conceptual model, along with fate and transport of volatile organic compounds (VOCs), difficult to evaluate the performance of the remedy. Persistent concentrations of VOCs, predominately trichloroethene (TCE), remain elevated in this area; therefore, a focused investigation in the mound area will support potential modifications to the remedy to increase performance. For reference, a comprehensive historical overview of the EMC Remedy was summarized in the Partial No Further Action Request (Geosyntec and Landau,

2020), and the most recent EMC TSA Remedy data were provided in the 2020 TSA Annual Report (Geosyntec et al., 2021).

PURPOSE/OBJECTIVES

The Data Gaps Investigation Work Plan dated 21 February 2020 was approved by DEQ on 12 March 2020 (Geosyntec, 2020; DEQ 2020a), and field work commenced in June 2020. The objectives of the Data Gaps Investigation for the mound area were to:

- Obtain subsurface soil data to better understand soil types/lithology (e.g., weathering, fractures, grain sizes/pore space, degree of cementation etc.) in areas between existing boreholes/wells. The data were used to evaluate stratigraphy/lithology and identify any low-permeability layers, such as finer-grained layers that may not transmit groundwater and/or contaminant flow, either historical or currently if near extraction wells.
- Install groundwater monitoring wells to obtain groundwater samples at a higher resolution/closer spacing than currently exists in the mound area. These wells may also be utilized in the future, if appropriate, as part of the remediation system, such as soil vapor extraction (SVE), groundwater extraction, and/or other alternatives.
- Provide data to refine the conceptual site model to target remediation more accurately (spatially and with depth).

The collected data have been utilized to update the Conceptual Site Model (CSM) and provide higher resolution of water levels and VOC concentrations that should lead to a better understanding of possible causes for recent (since approximately 2016) increases in TCE concentrations in the mound area. TCE concentrations have increased at mound area monitoring wells D-17(ds), CMW17(ds), and CMW-18(ds) in recent years, in contrast with other areas of the TSA dissolved plume where TCE concentrations have decreased to levels near or below the cleanup level (maximum contaminant limit [MCL] of 5 micrograms per liter [µg/L]). TCE profiles for the three wells are shown in Figures 2 through 4.

FIELD INVESTIGATION

Borehole Locations and Drilling

Six boreholes were completed on two east-to-west-oriented transects: a southern transect along the southern portion of the mound area between extraction wells EW-14 and EW-2; and a northern transect along the erosional truncation of the Troutdale Gravel Aquifer (TGA) and underlying siltstone unit 1 (SU1) where Shepard Springs formerly discharged TCE-impacted groundwater at the ground surface. Borehole/well locations are shown on Figure 1 and are labeled as VMW-I through VMW-N.

The boreholes were advanced using roto-sonic drilling methods, and telescoping drill casing techniques (i.e., a stepdown) were used at the contact between the TGA and silt/clay layer of the SU1, which is referred to as the Confining Unit (CU1) before drilling into the underlying TSA. The boreholes were drilled with 9-inch or 10-inch casing and a 6-inch diameter core barrel through the TGA/CU1, where a 3- to 5 foot (ft)-thick bentonite seal was placed and allowed to hydrate. At this depth, the casing was stepped down to an 8-inch or 9-inch diameter, continuing with the 6-inch diameter core barrel. Once the target depth was reached, a monitoring well was constructed in the borehole. Drilling conditions were difficult with loose, heaving sands locking up the core barrel and casing. In several instances, both the 8-inch and 9-inch casings were used to reduce heaving and free up the sand-locked casing/drill rod.

Soil was cored continuously characterized/logged and field screened for VOCs during drilling using a photoionization detector (PID). Field screening was completed by placing a small portion of the core sample into a sealed plastic bag and measuring the head space vapor with the PID. The core was photographed and described in detail. Borehole/well construction logs are provided in Attachment 1, and a photolog is provided in Attachment 2.

Three soil samples for VOC analysis were collected during drilling where small/thin lenses of perched water were encountered: two soil samples in VMW-L at 65.5 to 69 ft below ground surface (bgs) and 70.5 to 72.5 ft bgs; and one soil sample in VMW-J2 at 82.75 to 83 ft bgs. Perched water was insufficient at these two boreholes to allow for the collection of groundwater samples.

Total depths of the boreholes ranged from 110 to 150 ft bgs. Target depths for the borings were based on first encountered groundwater in the TSA, attempting to get 20 feet of saturated screen to allow for a 30-ft-long screen with 10 feet above groundwater. Saturated thicknesses of the Upper TSA can be limited; therefore, some borings were advanced to the upper portion of the Lower TSA. Groundwater elevation and vertical profiling testing (discussed below) will be utilized to evaluate if the results characterize the Upper TSA or the Lower TSA for wells with screened sections spanning the two subunits of the TSA. Borehole and monitoring well construction details are summarized in Table 1.

Well Installation and Construction

The wells were constructed of 4-inch diameter, Schedule 40 polyvinyl chloride (PVC), with a 0.01-inch (10-slot) screen and 2/12 silica sand filter pack. An approximate 1- to 2-ft thick bentonite chip seal was placed on top of the sand filter pack, followed by bentonite grout placed from the top of the seal to within approximately 2 to 3 ft of the ground surface using a tremie pipe. A concrete surface seal extends from the surface to the top of the bentonite grout. The wells were completed with aboveground steel monuments and three, 2-inch diameter concrete-filled steel protective bollards.

The monitoring wells were surveyed by a Professional Land Surveyor on 7 July 2021 and tied into the existing monitoring well network. Tops of casing and ground surface elevations, along with location coordinates are summarized in Table 1.

Well Development

Wells were developed by pumping and surging until approximately 10 well volumes were removed and/or water parameters stabilized (e.g., turbidity, conductivity, temperature remaining within 10%). Water was slightly turbid during initial development activities, but quickly cleared up in each of the wells developed. VMW-K and VMW-L did not sustain pumping of 10 well volumes, and well development was terminated following removal of three well volumes (wells dried up after three attempts); turbidity conductivity and temperature were stable in these two wells. In general, water clarity was very good (i.e., very low turbidity) in each of the six wells.

Groundwater Elevations and Groundwater Sampling

Groundwater elevations were obtained using a depth to water tape prior to retrieval of passive diffusion bags (PDBs) installed for groundwater sampling purposes, to allow for stabilized measurements throughout the project area. Depths to groundwater and groundwater elevations are summarized in Table 2. In addition to manual measurements, Solinst mini-diver transducers were placed into the six new wells for longer term, continual groundwater elevation monitoring (Figure 5).

Groundwater samples were obtained from the six new wells using PDBs placed at depths along the saturated portion of the well screen for vertical profiling. The PDBs were allowed to equilibrate for a minimum of two weeks prior to sample collection during regularly scheduled quarterly monitoring events. PDB placement depths for the August event were selected at the top, middle, and bottom of the well screens to evaluate potential preferential flow patterns throughout the saturated portion of the aquifer. Based on August groundwater results, which indicated either variability between PDBs in individual wells or between other wells in the vicinity, additional depths were selected for placement of PDBs during the November 2020 event at wells VMW-I, VMW-J2, VMW-M, and VMW-N. The remaining two wells (VMW-K and VMW-L) had three PDBs installed to represent similar sampling depth intervals as the August 2020 sampling event due to low VOC concentration results. PDB depths were adjusted slightly from the August to November sampling event to adjust for changed water levels. Sample depths are shown in Table 3b.

Following the two-week equilibration time frame, PDBs were retrieved from the wells, water samples were transferred into laboratory-provided containers, placed into a cooler with ice, and submitted for analytical testing of VOCs by EPA Method 8260. Analytical results are summarized in Tables 3a and 3b. Groundwater laboratory reports are provided in the 2020 Annual Report (Geosyntec, Landau, SSPA, 2021).

Investigation-Derived Waste

Investigation-derived waste (IDW) consisted of soil cuttings and water generated during drilling, equipment decontamination, well development, and a small amount of excess water from the PDBs. Soil cuttings were stored on site in a total of 71 drums, and the drill core was placed into one 10-yard roll-off box. Prior to disposal, the IDW was dewatered as necessary by pumping water into the on-site treatment system. Multi-part composite soil samples were obtained from the drums and the roll-off box (2 samples) to characterize the soil IDW. Soil IDW characterization samples were analyzed for VOCs and RCRA 8 metals, as required by the landfill. Sample results were provided to the landfill and DEQ, the waste was determined non-hazardous for disposal (DEQ, 2020b), and the soil IDW was hauled off site for permitted disposal at the Hillsboro Landfill (roll-off box) and Roosevelt Landfill (drums). DEQ and landfill determinations and the disposal receipts are provided in Attachment 4.

Water was stored on site in the 8,000-gallon water storage tank and treated through the on-site Central Treatment System.

Work Plan Deviations

No significant deviations from the work plan occurred, except as noted below.

- Wooden core boxes were not used to keep the drill core from the two boreholes. Instead, the core was placed on and covered with plastic for the duration of the project and/or until all parties who wanted to view/describe the core had done so.
- During installation of well VMW-J, the PVC well pulled up during the casing extraction, so the PVC was removed, and the hole was backfilled with bentonite grout. Borehole/well VMW-J2 was drilled at a second location stepped over approximately 15 ft west from VMW-J, and the well was installed.
- Soil samples were collected during drilling from two borings (VMW-J2 and VMW-L) due to observations of perched groundwater conditions during drilling. No perched groundwater or soil sampling had been anticipated in the Work Plan.

INVESTIGATION FINDINGS

Geology and Hydrogeology

Brief descriptions of the four major geologic units present at the EMC Site are provided in following sections and are depicted on cross-sections in Figures 6 through 11. Boreholes VMW-J and VMW-J2 are combined for this discussion, except as noted. Separate logs were prepared for each borehole, since they were 15 ft apart, and although the units are similar, some differences in lithologic unit depths were observed. Borehole logs are provided in Attachment 1. A photolog is provided in Attachment 2.

For reference, site and vicinity geology and hydrogeology were described thoroughly in the Remedial Investigation (RI) report (Emcon and Landau Associates, 1995), including a stratigraphic column copied here in Attachment 1, or regionally, in Swanson, et al., 1993.

Troutdale Gravel Aquifer (TGA)

The TGA consisted of grey to brown, loosely consolidated, rounded coarse gravel with a notable high percentage of quartzite and volcanic-derived gravels and a silty sandy matrix with iron cementation. The TGA is a water bearing unit and was encountered in five of the six boreholes at depths ranging from 1 to 4.5 ft bgs. The TGA was not encountered at VMW-N, suggesting that it was eroded, and the erosional truncation extends and curves slightly southward in this portion of the EMC Site. Groundwater was encountered at 3 to 9 ft bgs in these new wells (except at VMW N).

Siltstone Unit 1

The SU1 consists of four distinct layers (SU1a, SU1b/CU1, SU1c, and SU1d), which are noted on the borehole logs (Attachment 1) and cross-sections. The four subunits consist of siltstone and sandstone layers. The most notable of these is SU1b, also known as Confining Unit 1 (CU1), which is a distinctive hard, dry, grey-green siltstone with clay material. The four subunits were encountered in each of the six borings, and the depths and thicknesses of the units were variable across the mound area. Each unit showed significant weathering, with numerous fractures and degraded rock fabric (i.e., saprolitic) in places, and orange oxidation staining or black manganese nodules were observed.

Upper TSA

The Upper TSA is a partially cemented, coarse-grained sandstone that is mostly unsaturated; the lower portion is saturated. The sandstone is comprised of vitric- and basaltic-derived sand and is dark grey to black in some interbeds. The Upper TSA was encountered at depths ranging from 30 to 89.5 ft bgs, and thickness ranged from 13 to 76 ft.

TSA groundwater was encountered at depths ranging from 87 to 116 ft bgs during drilling in five of the boreholes. Groundwater at VMW-I was encountered deeper at 116 ft bgs, likely due to being in the vicinity of actively operated extraction well EW-2. The Upper TSA was largely unsaturated in the six boreholes (the estimated extent of the “Unsaturated TSA” is shown with an olive-green line on Figure 1).

The Upper TSA Sandstone rock strength is highly variable, with large sections of well cemented, hard sandstone separated by friable, weak sections. Significant weathering and fracturing were observed during this investigation, in particular, in the middle to lower portion of the Upper TSA. Mechanical weathering of the sandstone varied significantly, sections of the sandstone were present as thin discs or pucks (approximately 1 to 3 inches thick), separated by loose, highly friable

sandstone (sand). Some of the sandstone disaggregation may have been the result of roto-sonic drilling methods. In some sections, the sandstone was completely degraded to fine to coarse loose sand, in particular, VMW-J from approximately 93.5 to 106 ft bgs and at VMW-M from approximately 55 to 70 ft bgs). Differential chemical weathering of the base of the Upper TSA was also marked, most significantly in borehole VMW-J where orange oxidation discoloration was observed permeating the dark grey sandstone, which was interpreted to be an oxidation front along fractures. This orange oxidation was not observed at borehole VMW-J2, where the contact with the Lower TSA was deeper by approximately 15 ft. Reprecipitation of silica and iron minerals was apparent in portions of the Upper TSA as secondary cementation. This secondary cementation was visible in the Upper TSA as white to orange, pore-filling mineralization, in particular at VMW-I, VMW-J, and VMW-J2. The differential weathering/oxidation and secondary cementation could explain variable cementation observed in the Upper TSA Sandstone.

Lower TSA

The Lower TSA was observed to be a saturated, dense, grey, coarse-rounded sandy gravel (or conglomerate) with variable sand content as a matrix. The Lower TSA was encountered at depths ranging from 93.5 to 118 ft bgs, and the base of the Lower TSA was not explored in this investigation.

No significant weathering, either mechanical or chemical, was noted in the Lower TSA. Some fine sand and iron cementation was observed. In VMW-N, a 1-ft thick coarse sand interbed was encountered at the base of the borehole (109.5 to 110.5 ft bgs).

Groundwater Elevations

Depths to water and groundwater elevations are summarized in Table 2. Water levels from manual readings and transducers are shown in Figure 5. Once water levels stabilized after well installation and development, water levels in monitoring wells have remained fairly consistent and do not appear to show variations due to pumping of extraction wells EW-2 or EW-14.

Groundwater elevation contours are shown on Figure 12 and indicate the cones of depression for actively operated extraction wells EW-2 and EW-14 are mainly separated, possibly indicating a groundwater divide or zone of stagnation between the two extraction wells.

Analytical Results

Three soil samples were obtained during drilling. Soil analytical results are summarized in Table 3a, and laboratory results are provided in Attachment 3. Soil analytical results were as follows.

- VOCs were not detected at concentrations above the laboratory reporting limits in the two soil samples collected from the perched groundwater bearing units in VMW-L, except a

low concentration (0.120 milligrams/kilogram (mg/kg)) of 2-butanone (MEK) in sample VMW-L at 67 ft bgs. The method detection limit for 2-butanone was 0.116 mg/kg, and this VOC is not EMC Site related.

- TCE only was detected in the soil sample from borehole VMW-J2 at 82.75 ft at a concentration of 0.005 mg/kg. Groundwater was encountered at approximately 91 ft bgs during drilling and 112 ft bgs in the well following development.

Groundwater samples were obtained from PDBs placed into the six new wells during the August and November 2020 quarterly groundwater monitoring events. Vertical profiling was conducted during the two sampling events to evaluate the potential preferred pathways. Groundwater sample depths and results are summarized in Table 3b. Results are described below.

- TCE and daughter product cis-1,2-DCE were detected in groundwater samples from wells VMW-I, VMW-J2, VMW-M, and VMW-N from both the August and November events. Detected TCE and cis-1-2-DCE concentrations were as follows:
  - VMW-I: TCE ranged from 28.1 to 53.9 and cis-1,2-DCE from 1.82 to 5.3 ug/L
  - VMW-J2: TCE ranged from 12.5 to 85.4 and cis-1,2-DCE from 2.0 to 10.0 ug/L
  - VMW-M: TCE ranged from 3.68 to 14.2 and cis-1,2-DCE from <0.5 to 2.4 ug/L
  - VMW-N: TCE ranged from 18.4 to 22.9 and cis-1,2-DCE from 2.9 to 3.9 ug/L
- VOCs were not detected in wells VMW-K and VMW-L at concentrations above the laboratory reporting limit from both the August and November events.
- Vertical profiling results from August indicate that higher TCE concentrations were present in the top of the screens at VMW-1, VMW-M, and VMW-N. Vertical profiling results at VMW-J2 indicate higher TCE concentrations in the bottom of the screen.
- Vertical profiling results from the November sampling event indicate less variability vertically with TCE concentrations. VMW-I results showed significant variation with higher TCE at 124.25 ft (top) depth during the August event, but less variability in November. TCE vertical profile concentrations in November were similar to August at VMW-J2, VMW-M, and VMW-N.
- TCE concentrations were higher along southern transect (VMW-I and -J2) rather than the northern transect beneath the TGA/CU1 truncation (VMW-M and -N) (Figure 13).
- VOCs were not detected or were detected very low (<1 ug/L) at VMW-K, VMW-L, and existing well VMW-H during the August and November events. Elevated TCE concentrations in the western part of the mound area (near D-17ds) appear to not be contiguous with the plume in the eastern part of the mound area (CMW-17ds, CMW-18ds, and existing VMW wells). (Figure 13).

- VOCs detected at VMW-J2 and existing wells VMW-A and VMW-B define a central area where TCE concentrations are higher than adjacent wells (Figure 13), defining a third zone between the western and eastern TCE portions of the plume (as defined by D-17ds and CMW-18ds, respectively). This central area appears to correlate with the possible groundwater divide depicted by the groundwater elevation contours.

HYDROGEOLOGY AND CONCEPTUAL SITE MODEL DISCUSSION

SU1 Truncation/Shepard Spring/Overland Migration Pathway: Historically, Shepard Spring was a free-flowing spring where contaminated TGA groundwater discharged at the ground surface. TGA groundwater was successfully remediated and closed in 2015 (DEQ, 2015), and Shepard Spring water was contained and piped to the TSA treated-water conveyance system. One theory for historic TCE migration to the Upper TSA is from TCE-impacted groundwater infiltrating from the spring (and possibly a seepage face along the truncation) to the underlying SU1 and TSA. The northern transect of borings for this investigation, VMW-L, VMW-M, and VMW-N, was placed along the truncation to collect data to evaluate the contaminant migration pathway from Shepard Spring to the underlying SU1 and TSA. VMW-M was placed close to and west of Shepard Spring to specifically evaluate this pathway beneath/in the vicinity of the historic spring. The location of these borings/wells and Shepard Spring are shown on Figure 1.

The underlying SU1 was not subject to active TGA remediation, since it is largely unsaturated. Two SU1 investigations in 2012 and 2015 evaluated the potential for VOC mass retention in SU1 and the Upper TSA (SSPA, 2012/LAI, 2012, Geosyntec, 2015). In particular, the finer grained siltstones are thought to possibly retain VOCs in pore water, and VOCs possibly release slowly via chemical diffusion (i.e., matrix diffusion) and/or become entrained in infiltrating precipitation that migrates into the underlying Upper TSA. Both pore water and siltstone (rock core) samples were evaluated for VOCs in the 2012 and 2015 studies, and TCE concentrations ranged from 3 to 50 µg/L in bulk rock samples and 15 to 160 µg/L in calculated porewater concentrations (when detected). TCE concentrations decreased with depth in SU1, and in the 2015 study, TCE pore water samples were collected beneath the unit where rock core TCE concentrations were highest (and maximum pore water was estimated to be 160 ug/L). Concentrations in the pore water samples beneath this unit were 48 and 15 ug/L (Geosyntec, 2015). As a result, the VOC concentrations do not appear to be present or migrating in sufficient quantity to be the source of three pounds per year removed from TSA groundwater via the three groundwater extraction wells, although it may account for a small portion of the mass removed by the SVE and/or the groundwater treatment system.

During this data gap investigation, perched groundwater was observed in the Upper TSA at borings VMW-J2 and VMW-L. As mentioned above, VOCs were not detected in the water and saturated soil samples collected from this perched groundwater. While these perched water samples were insufficient to fully evaluate the downward transport pathway from Shepard Springs/truncation, they do provide additional data for this portion of the CSM. VOC concentrations in the three wells

along the truncation (northern transect) were significantly less than detected in the wells along the southern transect, suggesting this migration pathway may be less significant than others. However, based on VOCs detected in SU1 rock and pore water samples during prior studies and VOCs detected in VMW-M and VMW-N above the MCL, this pathway is still regarded as a possible pathway for the CSM.

Upper TSA Hydrogeology: The Upper TSA was observed to be considerably more weathered due to either or both mechanical and chemical weathering than in other areas and depths of the EMC Site. In addition, a high degree of cementation is present in the central portion of the Mound Area within the Upper TSA, in particular at VMW-I and VMW-J/J2 (see the Upper TSA Section above). These heterogeneities could be significantly variable throughout the mound area, likely resulting in differential contaminant transport and groundwater flow (including infiltration, downward groundwater movement, and horizontal flow). These observations, along with low hydraulic conductivity measurements obtained in mound area monitoring wells CMW-17ds and CMW-18ds (Prowell/SSPA 2012), indicate that groundwater flow in the Upper TSA is more complex than initially realized. A copy of the hydraulic conductivity summary table is included in Attachment 5.

Groundwater levels in the Upper TSA indicate the saturated thickness is thin, up to approximately 16 ft. The thin saturated thickness, variable cementation, low hydraulic conductivity, and radial flow of original source zone contribute to difficult remediation conditions in the Upper TSA.

Groundwater Divide: Groundwater and TCE concentration contours (Figures 12 and 13) indicated a possible groundwater divide between the two active mound-area extraction wells. This area could also be interpreted as a potential area of stagnation where pumping influence from either or both of the two extraction wells (EW-2 and EW-14) is limited or are competing against each other. This likely caused less flushing in the mound area than throughout the rest of the downgradient treatment area.

To further evaluate these conditions, vertical profiling is being conducted along the well screens to look at VOC variability, and transducers have been placed in the six new wells to further evaluate shorter- and longer-term temporal changes in water levels at these wells. The VOC results and sample depths obtained in 2020 are provided in Table 3, and additional vertical profiling samples are being collected at some wells in 2021. These results are being used to evaluate the potential next steps.

SUMMARY OF FINDINGS

The results of the Data Gap Investigation provided a higher resolution on the CSM in the mound area. Two transects of three boreholes were advanced through the Upper TSA to evaluate conditions along the erosional truncation (northern transect) and the central area of the mound area (southern transect). Geologic information obtained from boreholes in both transects indicate significant mechanical and/or chemical weathering in the Upper TSA as compared to other

borehole observations made outside of the mound area. Cementation of the Upper TSA matrix was observed at boreholes VMW-I and VMW-J2 (southern transect).

Three soil samples were collected for analytical testing purposes from perched groundwater intervals at wells VMW-L (65.5 to 69 ft bgs and 70.5 to 72.5 ft bgs) and VMW-J2 (82.75 to 83 ft bgs). The results indicate TCE concentrations ranged from non-detect at the laboratory reporting limit to 0.005 mg/kg. Groundwater samples were collected in August and November from several intervals in the Data Gap Investigation wells using PDBs to evaluate vertical variability. Groundwater results indicate TCE concentrations range from non-detect at the laboratory reporting limit to 85.4 µg/L (VMW-J2). The results of the groundwater sampling events indicate variability vertically within wells VMW-I and VMW-J2, and higher TCE concentrations were observed within wells in the southern transect. Vertical variability is still being evaluated as more sampling results are becoming available.

These data, along with data obtained from a 2015 investigation in the SU1, indicate that VOC concentrations in the northern transect near the erosional truncation were significantly less than detected in the boreholes/wells along the southern transect, suggesting that this migration pathway may be less significant than others. However, based on VOCs detected in SU1 rock and pore water samples during prior studies and VOCs detected in wells VMW-M and VMW-N at concentrations above the MCL, VOC migration over the erosional truncation or through SU1 is still regarded as a possible pathway for the CSM.

Groundwater and TCE concentration contours indicated a possible groundwater divide between the two active mound-area extraction wells (EW-2 and EW-14). This area may be interpreted as a potential area of stagnation where pumping influence from either or both of the two extraction wells has limited available groundwater, likely resulting in low flushing rates through the mound area.

NEXT STEPS

The updated CSM suggests that groundwater extraction and treatment (GET) in the mound area may not be effective in highly cemented areas where little to no flushing may be occurring. The mound area GET wells have been operated since 1997 (24 years) and although have achieved the goal of hydraulic containment, may now need to be adjusted to create pathways for increased contaminant flushing through areas with low-hydraulic conductivity and residual VOC mass. The EMC team is planning to conduct hydraulic testing at mound area wells to evaluate potential changes to the existing (or expanded) GET system. Hydraulic testing at the wells will provide data to further characterize the large amount of matrix cementation observed at VMW-I and VMW-J2 and assist with the evaluation of potential additional groundwater extraction or other aquifer remedies.

The new VMW wells were installed with screens spanning approximately 10 ft of unsaturated aquifer, which provide an opportunity to expand the SVE system if warranted. The SVE system currently removes more VOC mass from the mound area than the GET system and is a cost-efficient way of removing VOC mass directly above the water table in the zone that will eventually become re-saturated when the GET wells are shut down. The EMC team is planning for a possible expansion of the SVE system using some or all of the six new VMW wells. Baseline vapor sampling of the VMW wells is being conducted to evaluate if VOC mass is present in the unsaturated interval to sustain expansion of the SVE system.

Once the next steps are determined, they will be proposed to DEQ in a work plan. Until then, the six new VMWs are being used for groundwater level monitoring and sample collection during quarterly groundwater monitoring events.

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Attachments:

Table 1: Monitoring Well Construction
Table 2: Water Levels
Table 3a: Soil VOC Results
Table 3b: Groundwater VOC Results

Figure 1: TSA Data Gaps Well Locations
Figure 2: TCE Concentration Profile D-17(ds)
Figure 3: TCE Concentration Profile CMW-17(ds)
Figure 4: TCE Concentration Profile CMW-18(ds)
Figure 5: Manual and Transducers Depths to Water EMC TSA Remedy
Figure 6: Cross Section Locations
Figure 7: Cross Section A-A′
Figure 8: Cross Section B-B′
Figure 9: Cross Section C-C′
Figure 10: Cross Section D-D′
Figure 11: Cross Section E-E′
Figure 12: TSA Data Gaps Groundwater Elevation Contours, August 2020
Figure 13: TSA Data Gaps TCE Concentration Contours, August 2020

Attachment 1: Borehole/Well Construction Logs, Stratigraphic Column
Attachment 2: Photolog
Attachment 3: Soil Analytical Laboratory Reports
Attachment 4: DEQ Approval Letter, Landfill IDW Acceptance; Disposal Receipts
Attachment 5: Copy of SSPA 2011, Table 1, Summary of Slug Test Results (hydraulic conductivity values)

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TABLES

Table 1
Monitoring Well Construction
EMC TSA Data Gaps Investigation

Well Name	Well Tag ID	Aquifer	Survey Data Easting (X)	Survey Data Northing (Y)	Grnd Surface (ft NGVD29)	Top of Casing (ft NGVD29)	Screen Top	Screen Bottom (ft bgs)	Screen Top Elev (ft	Screen Bottom Elev	Screen Lengt	Well Diameter (in)	Well Material	Well Depth (ft bgs)	Boring Depth (ft bgs)	Boring Diameter	Casing Material	Completed Date
VMW-I	L135623	Upper TSA	7,700,614.93	689,242.68	125.77	128.73	110	150	15.77	-24.24	40	4	S40 PVC	150	160	10" (0-30ft), 9" (30-160ft)	S40 PVC	06/16/2020
VMW-J2	L135624	Upper TSA	7,700,421.03	689,306.88	123.78	126.87	90.5	120.5	33.28	3.28	30.25	4	S40 PVC	120.5	121	10" (0-26.5ft), 8" (26.5-121ft)	S40 PVC	06/30/2020
VMW-K	L135622	Upper TSA	7,700,281.14	689,359.16	123.52	126.55	90.75	120.75	32.77	2.77	29.75	4	S40 PVC	121	121	10" (0-32ft), 8" (31-121ft)	S40 PVC	07/02/2020
VMW-L	L135625	Upper TSA	7,700,260.40	689,588.33	110.14	111.98	82	112	28.14	-1.86	30	4	S40 PVC	112	115	9" (0-15ft), 6" (15-115ft)	S40 PVC	06/25/2020
VMW-M	L133600	Upper TSA	7,700,507.57	689,556.76	108.62	111.47	80	110	28.62	-1.38	29.75	4	S40 PVC	110	110	9" (0-15ft), 6" (15-110ft)	S40 PVC	06/30/2020
VMW-N	L135621	Upper TSA	7,700,730.27	689,494.50	109.54	112.52	80.5	110.5	29.04	-0.96	20	4	S40 PVC	110.5	110.5	9" (0-15ft), 6" (15-110.5ft)	S40 PVC	07/09/2020

Notes:
ID = identification
in or " = inches
ft = feet
bgs = below ground surface
NA = not applicable
NL = not listed
HSAs = hollow stem auger
PVC = polyvinyl chloride
Easting (X) and Northing (Y) Recorded in NAD 1927 StatePlane Oregon North FIPS 3601 Feet (US Foot)
Elevations are relative to NGVD29

Table 2
Water Levels
EMC TSA Data Gaps Investigation

Location	TSA Zone	SampleDate	TOC Elevation	Depth to Water (ft below TOC)	Groundwater Elevation (ft MSL)
VMW-I	Upper	8/3/2020	131.976	124.17	7.81
VMW-I	Upper	11/2/2020	131.976	125.09	6.89
VMW-J2	Upper	8/3/2020	130.115	113.12	17
VMW-J2	Upper	11/2/2020	130.115	113.08	17.04
VMW-K	Upper	8/3/2020	129.803	108.57	21.23
VMW-K	Upper	11/2/2020	129.803	108.52	21.28
VMW-L	Upper	8/3/2020	115.225	93.35	21.88
VMW-L	Upper	11/2/2020	115.225	94.38	20.85
VMW-M	Upper	8/3/2020	114.722	92.28	22.44
VMW-M	Upper	11/2/2020	114.722	93.06	21.66
VMW-N	Upper	8/3/2020	115.772	93.17	22.6
VMW-N	Upper	11/2/2020	115.772	93.7	22.07

Notes:
ft MSL = feet above mean sea level
TOC = top of casing

Table 3a
Soil VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	Trichloroethene (TCE)	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene	Vinyl Chloride	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-dichloro-1-Propene	1,1-Dichloroethane	1,1-Dichloroethene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,3-Trimethylbenzene	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene	1,2-Dibromo-3-Chloropropane	1,2-Dibromoethane	1,2-Dichlorobenzene
VMW-J2	82.75	2020-06-29	VMWJ2-82.75-20200629	0.00535	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.020	< 0.020	< 0.0079	< 0.020	< 0.0079	< 0.039	< 0.0039	< 0.0079
VMW-L	67.00	2020-06-24	VMW-L 67	< 0.0012	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.014	< 0.014	< 0.0058	< 0.014	< 0.0058	< 0.029	< 0.0029	< 0.0058
VMW-L	72.00	2020-06-24	VMW-L 72	< 0.0012	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.015	< 0.015	< 0.0060	< 0.015	< 0.0060	< 0.030	< 0.0030	< 0.0060

Notes

Depth is with respect to the north side, top of the PVC casing.

Concentrations are given in µg/L

< Less than the reported detection limit.

J+ The identification of the analyte is acceptable; the reported value is an estimate and has a potential positive bias.

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

Table 3a
Soil VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	1,2-Dichloroethane	1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene	2,2-Dichloropropane	Acetone	acrylonitrile	Benzene	bromobenzene	Bromoform	Butylbenzene	Carbon Tetrachloride	Chlorobenzene	Chlorodibromomethane	Chloroform	Chloromethane
VMW-J2	82.75	2020-06-29	VMWJ2-82.75-20200629	< 0.0039	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0039	< 0.079	< 0.020	< 0.0016	< 0.020	< 0.039	< 0.020	< 0.0079	< 0.0039	< 0.0039	< 0.0039	< 0.020
VMW-L	67.00	2020-06-24	VMW-L 67	< 0.0029	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0029	< 0.058	< 0.014	< 0.0012	< 0.014	< 0.029	< 0.014	< 0.0058	< 0.0029	< 0.0029	< 0.0029	< 0.014
VMW-L	72.00	2020-06-24	VMW-L 72	< 0.0030	< 0.0060	< 0.0060	< 0.0060	< 0.0060	< 0.0060	< 0.0030	< 0.060	< 0.015	< 0.0012	< 0.015	< 0.030	< 0.015	< 0.0060	< 0.0030	< 0.0030	< 0.0030	< 0.015

Notes

Depth is with respect to the north side, top of the PVC casing.

Concentrations are given in µg/L

< Less than the reported detection limit.

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Table 3a
Soil VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	cis-1,3-Dichloropropene	Dibromomethane	Dichlorobromomethane	Diisopropyl Ether	Ethyl Chloride	Ethylbenzene	Freon 11	Freon 113	Freon 12	Hexachlorobutadiene (HCBD)	Isopropylbenzene	Methyl Bromide	Methyl ethyl ketone	Methyl Isobutyl Ketone (MIBK)	Methyl tert-Butyl Ether (MTBE)	Methylene Chloride (DCM)	Naphthalene	n-Propylbenzene
VMW-J2	82.75	2020-06-29	VMWJ2-82.75-20200629	< 0.0039	< 0.0079	< 0.0039	< 0.0016	< 0.0079	< 0.0039	< 0.0039	< 0.0039	< 0.0039	< 0.039	< 0.0039	< 0.020	< 0.16	< 0.039	< 0.0016	< 0.039	< 0.020	< 0.0079
VMW-L	67.00	2020-06-24	VMW-L 67	< 0.0029	< 0.0058	< 0.0029	< 0.0012	< 0.0058	< 0.0029	< 0.0029	< 0.0029	< 0.0029	< 0.029	< 0.0029	< 0.014	0.12	< 0.029	< 0.0012	< 0.029	< 0.014	< 0.0058
VMW-L	72.00	2020-06-24	VMW-L 72	< 0.0030	< 0.0060	< 0.0030	< 0.0012	< 0.0060	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.030	< 0.0030	< 0.015	0.12	< 0.030	< 0.0012	< 0.030	< 0.015	< 0.0060

Notes

Depth is with respect to the north side, top of the PVC casing.

Concentrations are given in µg/L

< Less than the reported detection limit.

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

Table 3a
Soil VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	o-Chlorotoluene	p-Chlorotoluene	p-Cymene	sec-Butylbenzene	Styrene	tert-Butylbenzene	Toluene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	Xylenes, Total
VMW-J2	82.75	2020-06-29	VMWJ2-82.75-20200629	< 0.0039	< 0.0079	< 0.0079	< 0.020	< 0.020	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.010
VMW-L	67.00	2020-06-24	VMW-L 67	< 0.0029	< 0.0058	< 0.0058	< 0.014	< 0.014	< 0.0058	< 0.0058	< 0.0058	< 0.0058	< 0.0075
VMW-L	72.00	2020-06-24	VMW-L 72	< 0.0030	< 0.0060	< 0.0060	< 0.015	< 0.015	< 0.0060	< 0.0060	< 0.0060	< 0.0060	< 0.0077

Notes

Depth is with respect to the north side, top of the PVC casing.

Concentrations are given in µg/L

< Less than the reported detection limit.

J+ The identification of the analyte is acceptable; the reported value is an estimate and has a potential positive bias.

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

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	Trichloroethene (TCE)	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene	Vinyl Chloride	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-dichloro-1-Propene	1,1-Dichloroethane	1,1-Dichloroethene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,3-Trimethylbenzene	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene	1,2-Dibromo-3-Chloropropane	1,2-Dibromoethane	1,2-Dichlorobenzene
VMW-I	148.25	2020-08-10	VMWI-081020-B	37.8	1.59	3.05	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	137.25	2020-08-10	VMWI-081020-M	38.7	1.58	3.08	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	124.25	2020-08-10	VMWI-081020-T	53.9	2.18	5.30	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	126.40	2020-11-05	VMWI-110520-126.4	28.1	< 0.500	1.82	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	131.60	2020-11-05	VMWI-110520-131.6	35.6	< 0.500	2.74	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	137.30	2020-11-05	VMWI-110520-137.3	30.9	1.25 J+	2.16	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	140.50	2020-11-05	VMWI-110520-140.5	34.5	< 0.500	2.57	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	143.70	2020-11-05	VMWI-110520-143.7	36.5	1.48 J+	2.75	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-I	148.10	2020-11-05	VMWI-110520-148.1	35.5	1.41 J+	2.58	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-J2	122.75	2020-08-10	VMWJ2-081020-B	58.9	0.732	10.0	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-J2	117.75	2020-08-10	VMWJ2-081020-M	41.7	0.725	5.52	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-J2	114.00	2020-11-05	VMWJ2-110520-114.0	12.5	< 0.500	2.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-J2	115.80	2020-11-05	VMWJ2-110520-115.8	13.4	< 0.500	2.20	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-J2	117.80	2020-11-05	VMWJ2-110520-117.8	23.5	< 0.500	3.44	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-J2	120.20	2020-11-05	VMWJ2-110520-120.2	85.4	1.92 J+	9.95	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-J2	122.70	2020-11-05	VMWJ2-110520-122.7	76.3	1.95 J+	8.94	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-K	119.25	2020-08-10	VMWK-081020-B	1.26	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-K	114.25	2020-08-10	VMWK-081020-M	1.02	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-K	110.00	2020-11-05	VMWK-110520-110.0	2.19	< 0.500	0.782	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-K	114.30	2020-11-05	VMWK-110520-114.3	2.26	< 0.500	0.741	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-K	119.00	2020-11-05	YMWK-110520-119.0	2.10	< 0.500	0.794	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-L	113.75	2020-08-10	VMWL-081020-B	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-L	103.25	2020-08-10	VMWL-081020-M	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-L	93.25	2020-08-10	VMWL-081020-T	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-L	96.00	2020-11-05	VMWL-110520-96.0	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-L	103.30	2020-11-05	VMWL-110520-103.3	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-L	113.40	2020-11-05	VMWL-110520-113.4	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	110.75	2020-08-10	VMWM-081020-B	6.21	< 0.50	0.993	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	101.75	2020-08-10	VMWM-081020-M	7.20	< 0.50	1.06	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	92.25	2020-08-10	VMWM-081020-T	14.2	< 0.50	2.44	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	94.00	2020-11-05	VMWM-110520-94.0	12.7	< 0.500	1.87	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	97.70	2020-11-05	VMWM-110520-97.7	5.00	< 0.500 J	0.616	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	101.80	2020-11-05	VMWM-110520-101.8	3.96	< 0.500	0.524	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	106.20	2020-11-05	VMWM-110520-106.2	3.68	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-M	110.70	2020-11-05	VMWM-110520-110.7	3.84	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500 J	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-N	111.25	2020-08-10	VMWN-081020-B	18.4	0.703	2.94	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	Trichloroethene (TCE)	Tetrachloroethene (PCE)	cis-1,2-Dichloroethene	Vinyl Chloride	1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,1-dichloro-1-Propene	1,1-Dichloroethane	1,1-Dichloroethene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane	1,2,3-Trimethylbenzene	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene	1,2-Dibromo-3-Chloropropane	1,2-Dibromoethane	1,2-Dichlorobenzene
VMW-N	102.25	2020-08-10	VMWN-081020-M	18.5	0.696	3.19	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-N	93.25	2020-08-10	VMWN-081020-T	19.3	0.959	3.41	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-N	95.00	2020-11-05	VMWN-110520-95.0	22.4	< 0.500	3.70	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-N	98.30	2020-11-05	VMWN-110520-98.3	22.2	< 0.500	3.66	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-N	102.30	2020-11-05	VMWN-110520-102.3	21.9	1.23 J+	3.61	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-N	106.50	2020-11-05	VMWN-110520-106.5	22.0	1.32 J+	3.63	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500
VMW-N	110.80	2020-11-05	VMWN-110520-110.8	22.9	1.50 J	3.92	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 1.00	< 0.500	< 2.50	< 0.500	< 0.500

Notes
Depth is with respect to the north side, top of the PVC casing.
Concentrations are given in µg/L

< Less than the reported detection limit.

J+ The identification of the analyte is acceptable; the reported value is an estimate and has a potential positive bias.

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

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	1,2-Dichloroethane	1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene	2,2-Dichloropropane	Acetone	Acrolein	acrylonitrile	Benzene	bromobenzene	Bromoform	Butylbenzene	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chlorodibromomethane	Chloroform	Chloromethane
VMW-I	148.25	2020-08-10	VMWI-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	37.2 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-I	137.25	2020-08-10	VMWI-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	96.7 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-I	124.25	2020-08-10	VMWI-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	39.8 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-I	126.40	2020-11-05	VMWI-110520-126.4	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	< 25.0	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-I	131.60	2020-11-05	VMWI-110520-131.6	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	< 25.0	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-I	137.30	2020-11-05	VMWI-110520-137.3	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	< 25.0	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-I	140.50	2020-11-05	VMWI-110520-140.5	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	35.5	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-I	143.70	2020-11-05	VMWI-110520-143.7	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	25.9	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-I	148.10	2020-11-05	VMWI-110520-148.1	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	< 25.0	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-J2	122.75	2020-08-10	VMWJ2-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	62.2 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	1.36	< 1.25
VMW-J2	117.75	2020-08-10	VMWJ2-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	77.2 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	7.53	< 1.25
VMW-J2	114.00	2020-11-05	VMWJ2-110520-114.0	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	27.7	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	1.62	< 1.25
VMW-J2	115.80	2020-11-05	VMWJ2-110520-115.8	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	29.6	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	1.54	< 1.25
VMW-J2	117.80	2020-11-05	VMWJ2-110520-117.8	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	28.4	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	1.64	< 1.25
VMW-J2	120.20	2020-11-05	VMWJ2-110520-120.2	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	29.7	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	0.507	< 1.25
VMW-J2	122.70	2020-11-05	VMWJ2-110520-122.7	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	< 25.0	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	0.537	< 1.25
VMW-K	119.25	2020-08-10	VMWK-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	72.2 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-K	114.25	2020-08-10	VMWK-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	98.9 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-K	110.00	2020-11-05	VMWK-110520-110.0	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	32.9	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-K	114.30	2020-11-05	VMWK-110520-114.3	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	32.6	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-K	119.00	2020-11-05	YMWK-110520-119.0	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	40.2 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.25
VMW-L	113.75	2020-08-10	VMWL-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	113 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-L	103.25	2020-08-10	VMWL-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	56.5 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-L	93.25	2020-08-10	VMWL-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	92.7 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 1.25
VMW-L	96.00	2020-11-05	VMWL-110520-96.0	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	< 25.0	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-L	103.30	2020-11-05	VMWL-110520-103.3	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	27.4	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-L	113.40	2020-11-05	VMWL-110520-113.4	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	33.6	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500	< 1.25
VMW-M	110.75	2020-08-10	VMWM-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	87.6 J	< 50.0	< 5.00	10.7	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	5.13	< 1.25
VMW-M	101.75	2020-08-10	VMWM-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	74.2 J	< 50.0	< 5.00	18.1	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	5.20	< 1.25
VMW-M	92.25	2020-08-10	VMWM-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	52.6 J	< 50.0	< 5.00	29.7	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	6.89	< 1.25
VMW-M	94.00	2020-11-05	VMWM-110520-94.0	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	45.3	< 50.0	< 5.00	0.918	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	2.12	< 1.25
VMW-M	97.70	2020-11-05	VMWM-110520-97.7	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	54.8 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1.04	< 1.25
VMW-M	101.80	2020-11-05	VMWM-110520-101.8	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	27.8	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	0.808	< 1.25
VMW-M	106.20	2020-11-05	VMWM-110520-106.2	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	35.7	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	0.822	< 1.25
VMW-M	110.70	2020-11-05	VMWM-110520-110.7	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	37.6	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	< 0.500 J	< 0.500	< 0.500	0.748	< 1.25
VMW-N	111.25	2020-08-10	VMWN-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	51.2 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	1.21	< 1.25

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	1,2-Dichloroethane	1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene	2,2-Dichloropropane	Acetone	Acrolein	acrylonitrile	Benzene	bromobenzene	Bromoform	Butylbenzene	Carbon Disulfide	Carbon Tetrachloride	Chlorobenzene	Chlorodibromomethane	Chloroform	Chloromethane
VMW-N	102.25	2020-08-10	VMWN-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	149 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	1.23	< 1.25
VMW-N	93.25	2020-08-10	VMWN-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.50	< 0.500	84.5 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.50	1.15	< 1.25
VMW-N	95.00	2020-11-05	VMWN-110520-95.0	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	43.3 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	0.941	< 1.25
VMW-N	98.30	2020-11-05	VMWN-110520-98.3	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	53.1 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1.06	< 1.25
VMW-N	102.30	2020-11-05	VMWN-110520-102.3	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	36.7 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1.06	< 1.25
VMW-N	106.50	2020-11-05	VMWN-110520-106.5	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	< 25.0	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1.05	< 1.25
VMW-N	110.80	2020-11-05	VMWN-110520-110.8	< 0.500	< 0.500	< 0.500	< 0.500	< 1.00	< 0.500	< 0.500	56.9 J	< 50.0	< 5.00	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	1.07	< 1.25

Notes
Depth is with respect to the north side, top of the PVC casing.
Concentrations are given in µg/L

< Less than the reported detection limit.

J+ The identification of the analyte is acceptable; the reported value is an estimate and has a potential positive bias.

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

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	cis-1,3-Dichloropropene	Dibromomethane	Dichlorobromomethane	Diisopropyl Ether	Ethyl Chloride	Ethylbenzene	Freon 11	Freon 113
VMW-I	148.25	2020-08-10	VMWI-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-I	137.25	2020-08-10	VMWI-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-I	124.25	2020-08-10	VMWI-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-I	126.40	2020-11-05	VMWI-110520-126.4	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-I	131.60	2020-11-05	VMWI-110520-131.6	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-I	137.30	2020-11-05	VMWI-110520-137.3	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-I	140.50	2020-11-05	VMWI-110520-140.5	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-I	143.70	2020-11-05	VMWI-110520-143.7	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-I	148.10	2020-11-05	VMWI-110520-148.1	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-J2	122.75	2020-08-10	VMWJ2-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-J2	117.75	2020-08-10	VMWJ2-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-J2	114.00	2020-11-05	VMWJ2-110520-114.0	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-J2	115.80	2020-11-05	VMWJ2-110520-115.8	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-J2	117.80	2020-11-05	VMWJ2-110520-117.8	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-J2	120.20	2020-11-05	VMWJ2-110520-120.2	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-J2	122.70	2020-11-05	VMWJ2-110520-122.7	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-K	119.25	2020-08-10	VMWK-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-K	114.25	2020-08-10	VMWK-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-K	110.00	2020-11-05	VMWK-110520-110.0	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-K	114.30	2020-11-05	VMWK-110520-114.3	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-K	119.00	2020-11-05	YMWK-110520-119.0	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-L	113.75	2020-08-10	VMWL-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-L	103.25	2020-08-10	VMWL-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-L	93.25	2020-08-10	VMWL-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-L	96.00	2020-11-05	VMWL-110520-96.0	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-L	103.30	2020-11-05	VMWL-110520-103.3	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-L	113.40	2020-11-05	VMWL-110520-113.4	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-M	110.75	2020-08-10	VMWM-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-M	101.75	2020-08-10	VMWM-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-M	92.25	2020-08-10	VMWM-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-M	94.00	2020-11-05	VMWM-110520-94.0	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-M	97.70	2020-11-05	VMWM-110520-97.7	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-M	101.80	2020-11-05	VMWM-110520-101.8	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-M	106.20	2020-11-05	VMWM-110520-106.2	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-M	110.70	2020-11-05	VMWM-110520-110.7	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-N	111.25	2020-08-10	VMWN-081020-B	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	cis-1,3-Dichloropropene	Dibromomethane	Dichlorobromomethane	Diisopropyl Ether	Ethyl Chloride	Ethylbenzene	Freon 11	Freon 113
VMW-N	102.25	2020-08-10	VMWN-081020-M	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-N	93.25	2020-08-10	VMWN-081020-T	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.5	< 0.500
VMW-N	95.00	2020-11-05	VMWN-110520-95.0	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-N	98.30	2020-11-05	VMWN-110520-98.3	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-N	102.30	2020-11-05	VMWN-110520-102.3	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-N	106.50	2020-11-05	VMWN-110520-106.5	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500
VMW-N	110.80	2020-11-05	VMWN-110520-110.8	< 0.500	< 0.500	< 0.500	< 0.500	< 2.50	< 0.500	< 2.50	< 0.500

Notes
Depth is with respect to the north side, top of the PVC casing.
Concentrations are given in µg/L

< Less than the reported detection limit.

J+ The identification of the analyte is acceptable; the reported value is an estimate and has a potential positive bias.

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

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	Freon 12	Hexachlorobutadiene (HCBD)	Isopropylbenzene	Methyl Bromide	Methyl ethyl ketone	Methyl Isobutyl Ketone (MIBK)	Methyl tert-Butyl Ether (MTBE)	Methylene Chloride (DCM)	Naphthalene	n-Propylbenzene	o-Chlorotoluene	p-Chlorotoluene	p-Cymene	sec-Butylbenzene	Styrene	tert-Butylbenzene	Toluene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	Xylenes, Total
VMW-I	148.25	2020-08-10	VMWI-081020-B	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	137.25	2020-08-10	VMWI-081020-M	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	124.25	2020-08-10	VMWI-081020-T	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	126.40	2020-11-05	VMWI-110520-126.4	< 2.50	< 1.00	< 0.500	< 2.50 J	6.81 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	131.60	2020-11-05	VMWI-110520-131.6	< 2.50	< 1.00	< 0.500	< 2.50 J	8.90 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	137.30	2020-11-05	VMWI-110520-137.3	< 2.50	< 1.00	< 0.500	< 2.50 J	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	140.50	2020-11-05	VMWI-110520-140.5	< 2.50	< 1.00	< 0.500	< 2.50 J	9.34 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	143.70	2020-11-05	VMWI-110520-143.7	< 2.50	< 1.00	< 0.500	< 2.50 J	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-I	148.10	2020-11-05	VMWI-110520-148.1	< 2.50	< 1.00	< 0.500	< 2.50 J	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-J2	122.75	2020-08-10	VMWJ2-081020-B	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	1.74	< 0.500	< 0.500	< 1.50
VMW-J2	117.75	2020-08-10	VMWJ2-081020-M	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	2.48	< 0.500	< 0.500	< 1.50
VMW-J2	114.00	2020-11-05	VMWJ2-110520-114.0	< 2.50	< 1.00	< 0.500	< 2.50 J	9.63 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-J2	115.80	2020-11-05	VMWJ2-110520-115.8	< 2.50	< 1.00	< 0.500	< 2.50 J	9.41 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-J2	117.80	2020-11-05	VMWJ2-110520-117.8	< 2.50	< 1.00	< 0.500	< 2.50 J	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-J2	120.20	2020-11-05	VMWJ2-110520-120.2	< 2.50	< 1.00	< 0.500	< 2.50 J	9.62 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-J2	122.70	2020-11-05	VMWJ2-110520-122.7	< 2.50	< 1.00	< 0.500	< 2.50 J	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-K	119.25	2020-08-10	VMWK-081020-B	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-K	114.25	2020-08-10	VMWK-081020-M	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-K	110.00	2020-11-05	VMWK-110520-110.0	< 2.50	< 1.00	< 0.500	< 2.50 J	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-K	114.30	2020-11-05	VMWK-110520-114.3	< 2.50	< 1.00	< 0.500	< 2.50 J	6.04 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-K	119.00	2020-11-05	YMWK-110520-119.0	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-L	113.75	2020-08-10	VMWL-081020-B	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-L	103.25	2020-08-10	VMWL-081020-M	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-L	93.25	2020-08-10	VMWL-081020-T	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-L	96.00	2020-11-05	VMWL-110520-96.0	< 2.50	< 1.00	< 0.500	< 2.50 J	10.1 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-L	103.30	2020-11-05	VMWL-110520-103.3	< 2.50	< 1.00	< 0.500	< 2.50 J	9.22 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-L	113.40	2020-11-05	VMWL-110520-113.4	< 2.50	< 1.00	< 0.500	< 2.50 J	10.9 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-M	110.75	2020-08-10	VMWM-081020-B	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	1.17	< 0.500	< 0.500	< 1.50
VMW-M	101.75	2020-08-10	VMWM-081020-M	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	1.76	< 0.500	< 0.500	< 1.50
VMW-M	92.25	2020-08-10	VMWM-081020-T	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	2.45	< 0.500	< 0.500	< 1.50
VMW-M	94.00	2020-11-05	VMWM-110520-94.0	< 2.50	< 1.00	< 0.500	< 2.50 J	10.4 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-M	97.70	2020-11-05	VMWM-110520-97.7	< 2.50	< 1.00	< 0.500	< 2.50	9.02	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-M	101.80	2020-11-05	VMWM-110520-101.8	< 2.50	< 1.00	< 0.500	< 2.50 J	9.42 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-M	106.20	2020-11-05	VMWM-110520-106.2	< 2.50	< 1.00	< 0.500	< 2.50 J	9.58 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-M	110.70	2020-11-05	VMWM-110520-110.7	< 2.50	< 1.00	< 0.500	< 2.50 J	10.6 J	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-N	111.25	2020-08-10	VMWN-081020-B	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50

Table 3b
Groundwater VOC Results
EMC TSA Data Gaps Investigation

Location	Depth	Date Sampled	Sample ID	Freon 12	Hexachlorobutadiene (HCBD)	Isopropylbenzene	Methyl Bromide	Methyl ethyl ketone	Methyl Isobutyl Ketone (MIBK)	Methyl tert-Butyl Ether (MTBE)	Methylene Chloride (DCM)	Naphthalene	n-Propylbenzene	o-Chlorotoluene	p-Chlorotoluene	p-Cymene	sec-Butylbenzene	Styrene	tert-Butylbenzene	Toluene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	Xylenes, Total
VMW-N	102.25	2020-08-10	VMWN-081020-M	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-N	93.25	2020-08-10	VMWN-081020-T	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.5	< 2.50	< 0.500	< 0.500	< 0.500	< 0.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-N	95.00	2020-11-05	VMWN-110520-95.0	< 2.50	< 1.00	< 0.500	< 2.50	7.69	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-N	98.30	2020-11-05	VMWN-110520-98.3	< 2.50	< 1.00	< 0.500	< 2.50	8.43	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-N	102.30	2020-11-05	VMWN-110520-102.3	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-N	106.50	2020-11-05	VMWN-110520-106.5	< 2.50	< 1.00	< 0.500	< 2.50	< 5.00	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50
VMW-N	110.80	2020-11-05	VMWN-110520-110.8	< 2.50	< 1.00	< 0.500	< 2.50	10.1	< 5.00	< 0.500	< 2.50	< 2.50	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 1.50

Notes

Depth is with respect to the north side, top of the PVC casing.

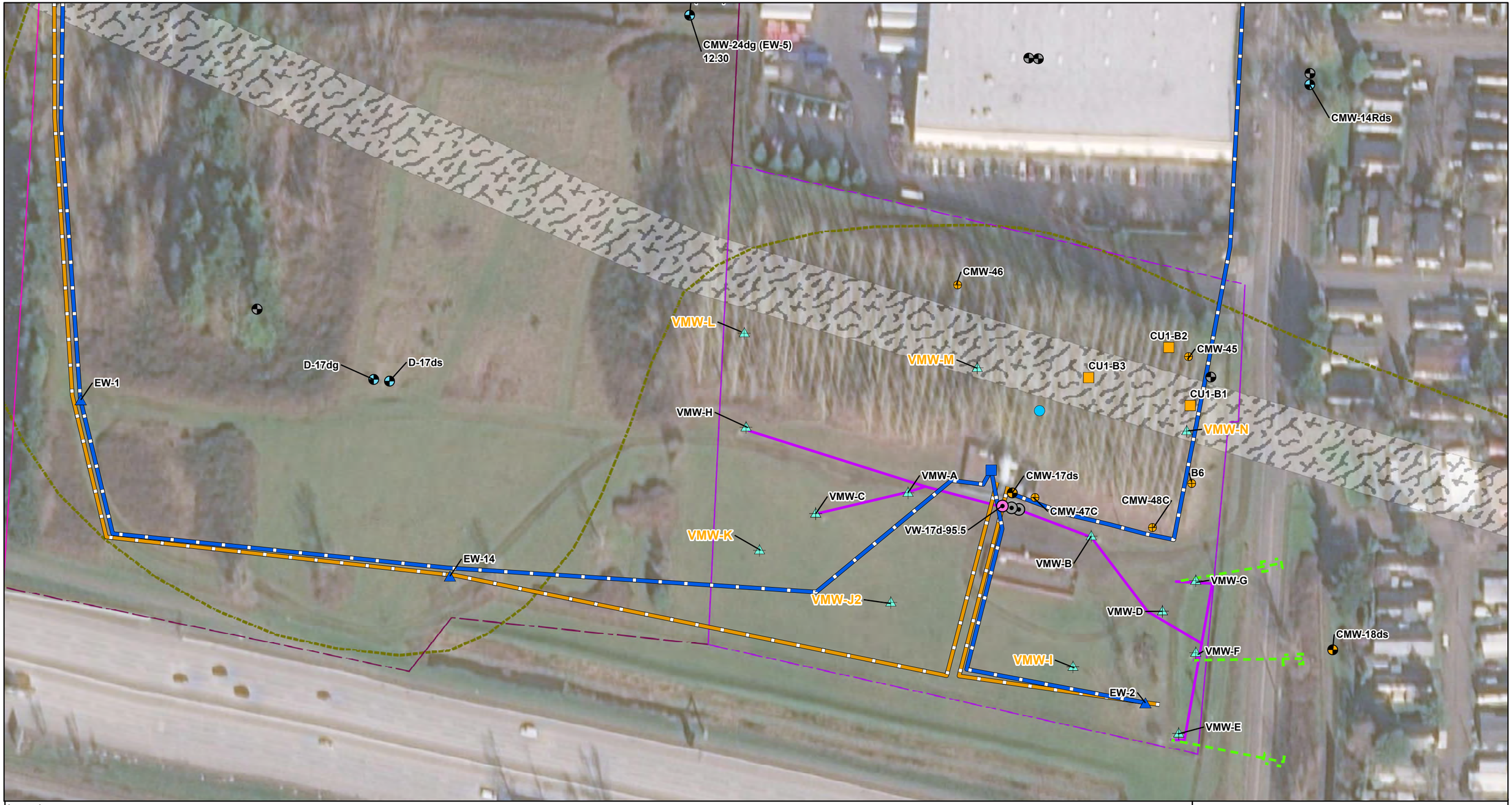
Concentrations are given in µg/L

< Less than the reported detection limit.

J+ The identification of the analyte is acceptable; the reported value is an estimate and has a potential positive bias.

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

FIGURES



Legend

- CU1 Soil Sample Boring
- CU1 Monitoring Well
- Soil Vapor Extraction and Groundwater Monitoring Well
- Decommissioned TSA Monitoring Well
- Decommissioned Soil Vapor Monitoring Well
- Soil Vapor Extraction Well
- Upper & Lower TSA Monitoring Well
- Upper TSA Monitoring Well
- Lower TSA Monitoring Well
- Lower TSA Extraction Well
- Decommissioned Extraction Well
- Groundwater Treatment System
- Spring
- Extracted Groundwater Conveyance
- Extraction Well Power Line
- Angled VMW Screen Direction and Location
- Soil Vapor Extraction Piping
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary
- Former Boyd's Property Boundary
- Approximate Area of Unsaturated Upper TSA
- Approximate Area of TGA/CU1 Truncation

N

0 100 Feet

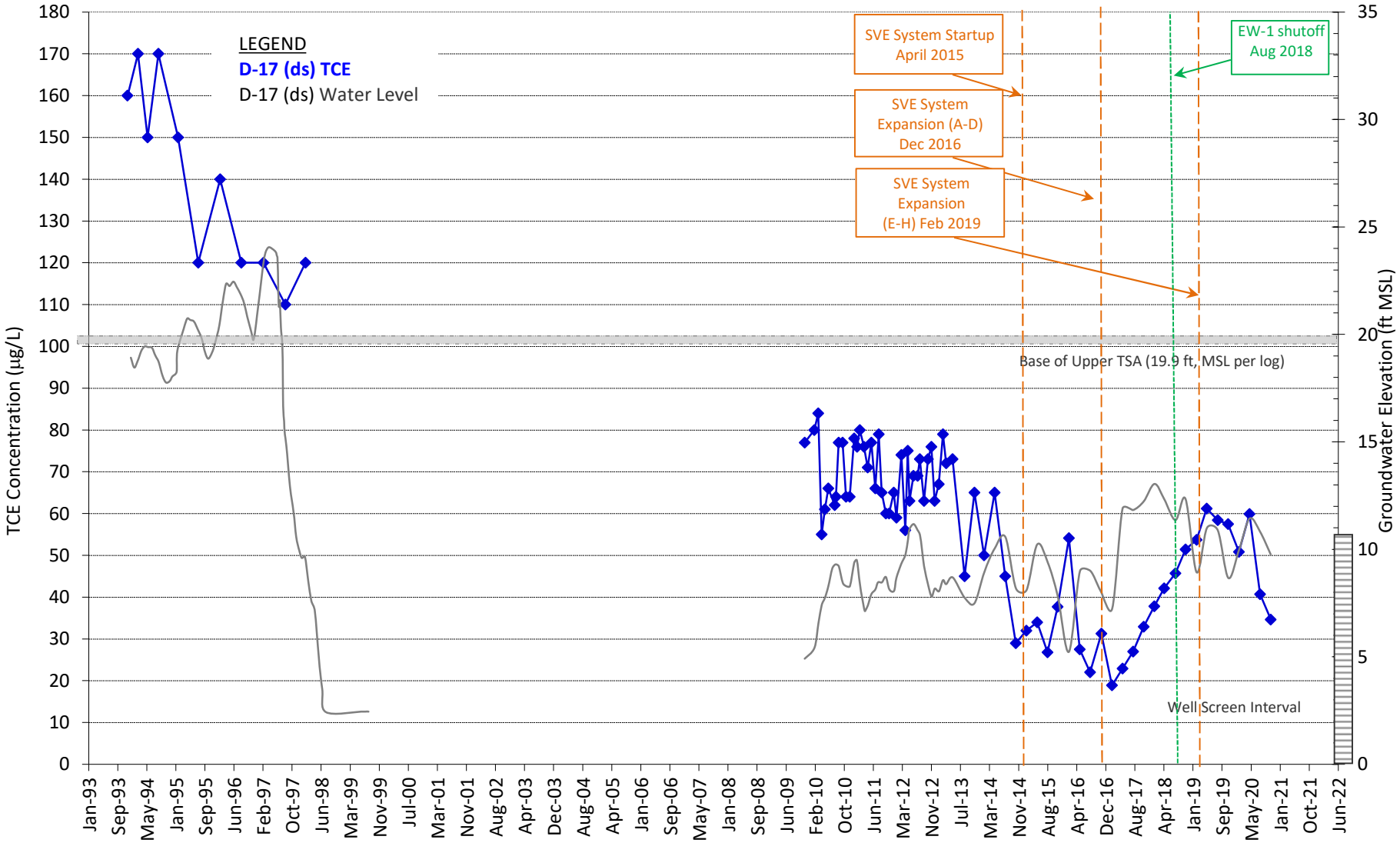
TSA Data Gaps Well Locations

East Multnomah County

Geosyntec consultants

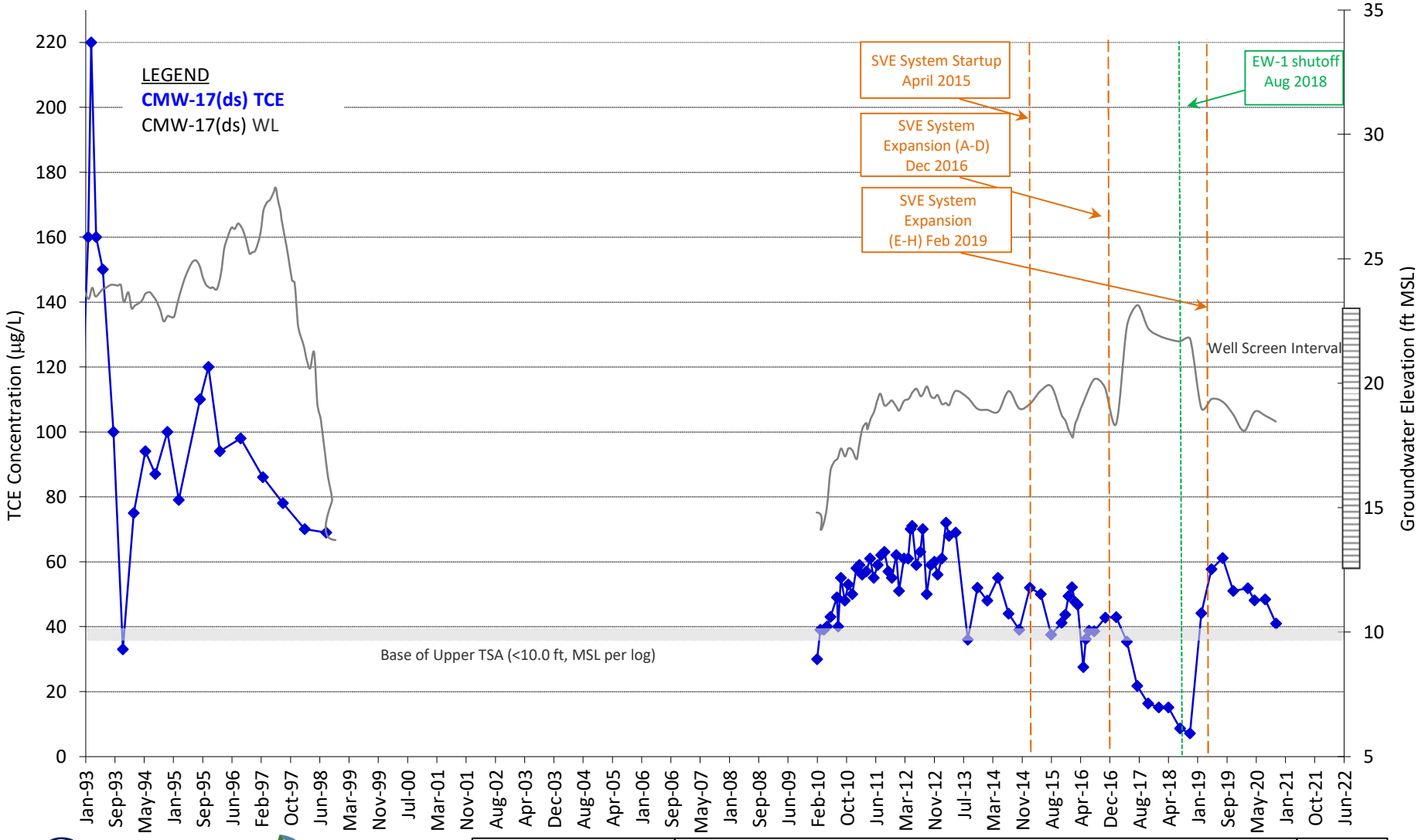
Santa Barbara | February 2021

Figure 1



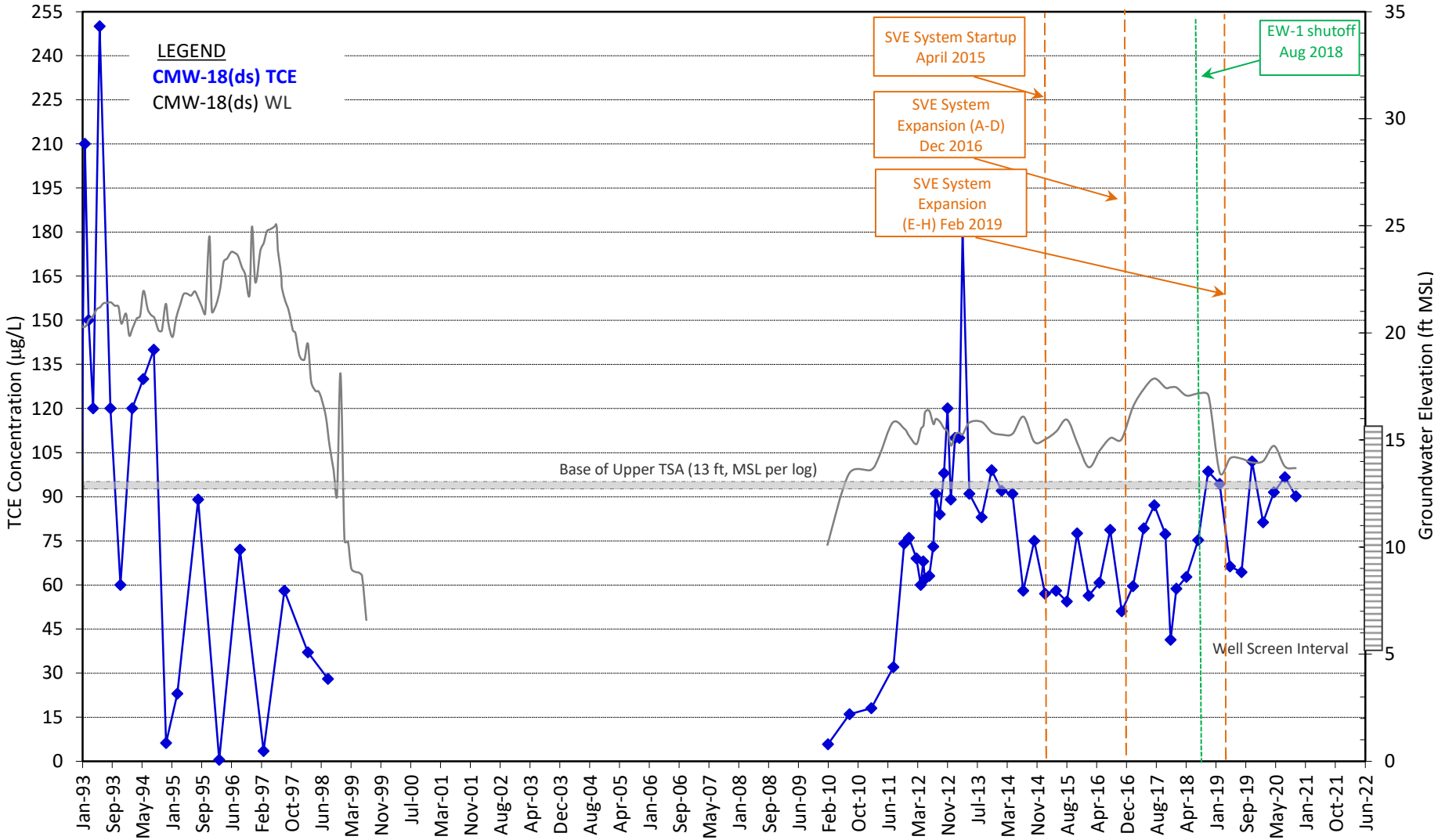
Geosyntec consultants

Cascade Corporation Gresham, Oregon	**TCE Concentration Profile D-17(ds) TSA Remedy**	Figure 2



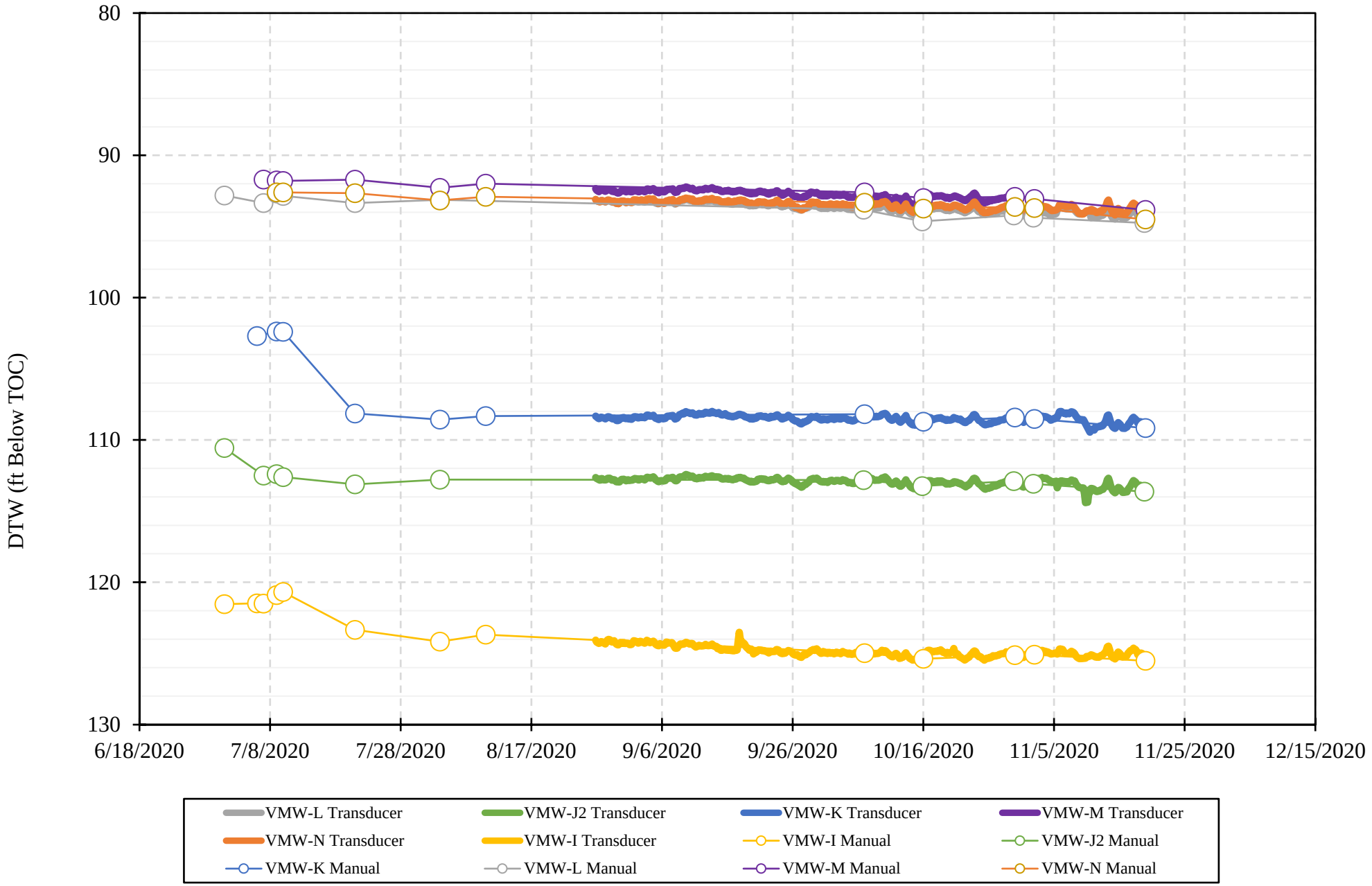
Geosyntec consultants

Cascade Corporation Gresham, Oregon	**TCE Concentration Profile CMW-17(ds) TSA Remedy**	Figure 3



Geosyntec consultants

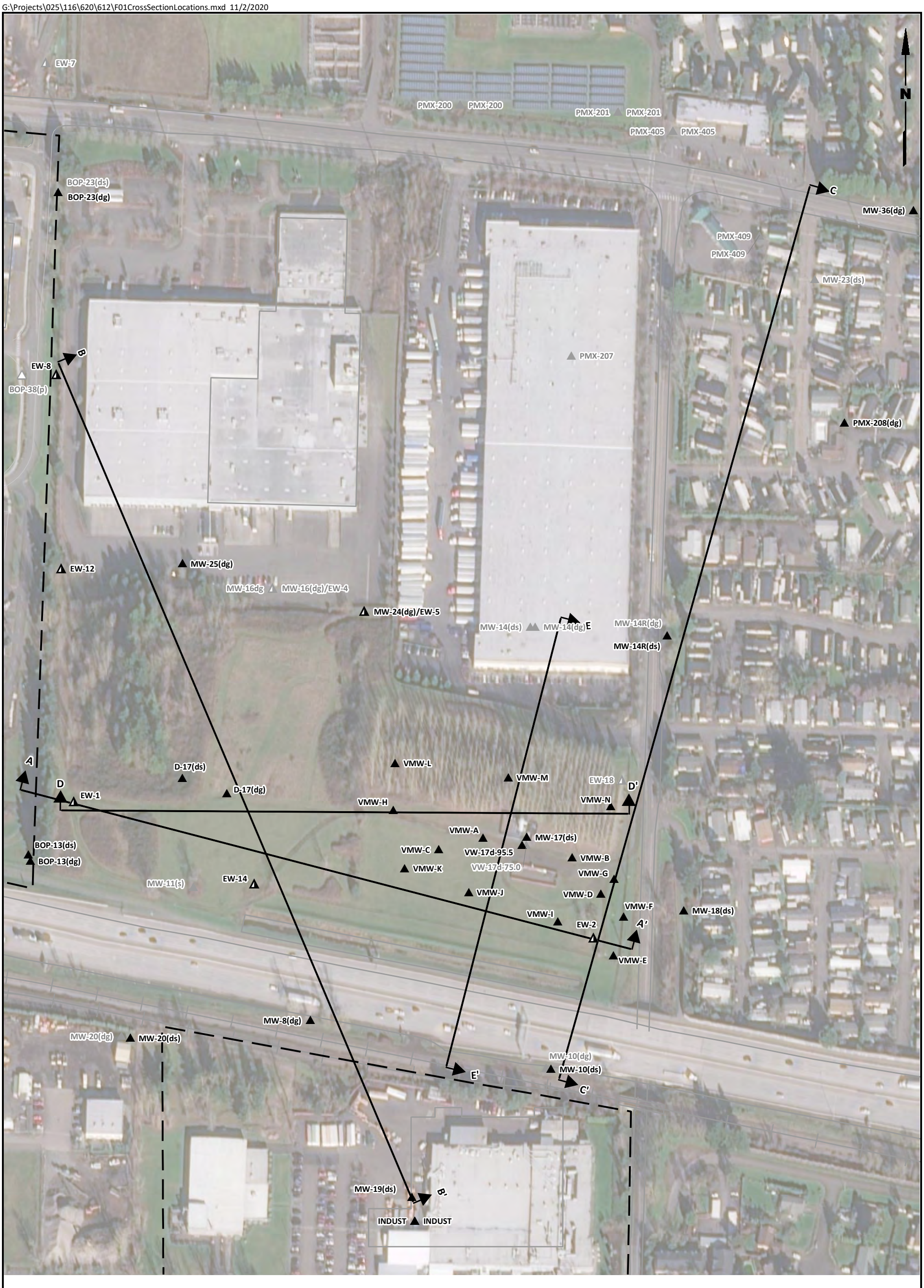
Cascade Corporation Gresham, Oregon	**TCE Concentration Profile CMW-18(ds)** **TSA Remedy**	Figure 4



Geosyntec consultants

Cascade Corporation Gresham, Oregon	**Manual and Transducer Depths to Water** **EMC TSA Remedy**	Figure 5

G:\Projects\025\116\620\612\F01CrossSectionLocations.mxd 11/2/2020



Legend

- TSA Extraction Wells - Active
- TSA Extraction Wells - Decommissioned
- TSA Monitoring Wells - Active
- TSA Monitoring Wells - Decommissioned
- TSA Perched Wel - Decommissioned
- Cross Section Location

Note

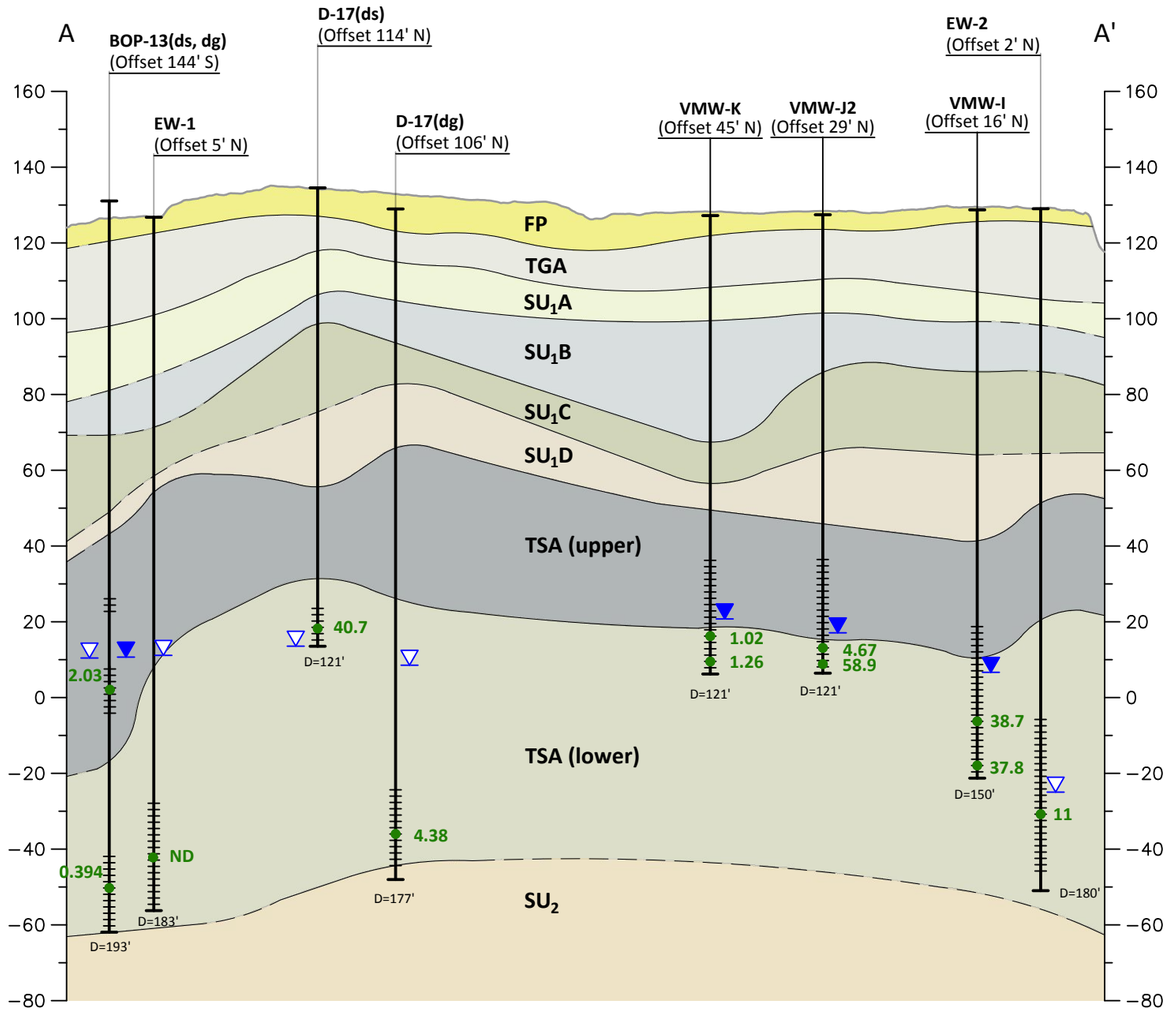
1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 200 400

Scale in Feet

LANDAU ASSOCIATES

Boeing Portland Gresham, Oregon	**Cross Section Locations**	Figure 6



Geologic Profile Alignment A-A'

Horizontal Scale in Feet: 1"=200'
Vertical Scale in Feet: 1"=40'
5x Vertical Exaggeration

Legend

- **MW-1** — Project Exploration Designation
- (Offset 160' W) — Offset Distance in Feet and Direction
- Top of Exploration
- Groundwater Elevation - TSA (Upper) - August 2020
- Groundwater Elevation - TSA (Lower) - August 2020
- Soil Type Contact
- Trichloroethene Concentration (µg/L in August 2020)
- Inferred Groundwater Table
- Inferred Geologic Contact
- Well Screen Interval
- Bottom of Exploration
- D=14' — Depth of Exploration

FP: Flood Plain Deposits: Silty, sandy GRAVEL

TGA: Troutdale Gravel: Sandy, silty GRAVEL

SUA | SUB | SUC | SUD — SU_1: Siltstone Unit 1 consisting of four distinct low permeable layers (SUA, SUB/CU_1, SUC, & SUD) with the second layer being a blueish/gray Clayey Siltstone

TSA (Upper): Upper portion of the Troutdale Sandstone Unit: Sandstone

TSA (Lower): Lower portion of the Troutdale Sandstone Unit: Conglomerate

SU_2: Siltsone Unit 2

SGA: Sand and Gravel Aquifer

Notes

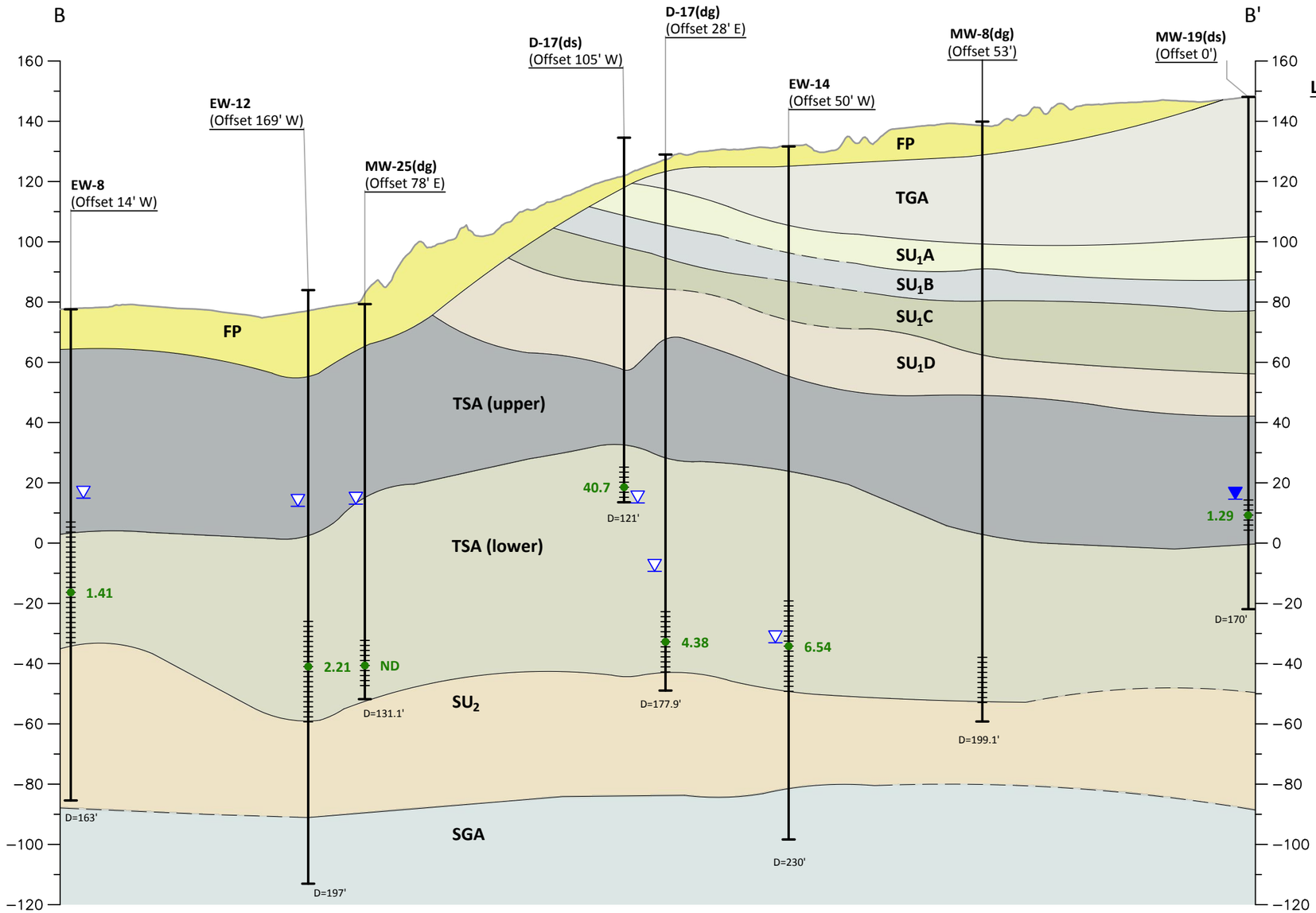
1. Soil descriptions are generalized, based on interpretation of exploration logs. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For Cross Section location, see the Site and Exploration Plan, Figure 1.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: <source name>, <date>

Boeing Portland Gresham, Oregon	**Cross Section A-A'**	Figure 7

LANDAU ASSOCIATES

Landau Associates | G:\Projects\025\116\620\612\FxCrossSection.dwg | 6/29/2021 7:12 AM | jvalluzzi



Legend

- **MW-1** — Project Exploration Designation
- (Offset 160' W) — Offset Distance in Feet and Direction
- Top of Exploration
- Groundwater Elevation - TSA (Upper) - August 2020
- Groundwater Elevation - TSA (Lower) - August 2020
- Soil Type Contact
- Trichloroethene Concentration (µg/L in August 2020)
- Inferred Groundwater Table
- Inferred Geologic Contact
- Well Screen Interval
- Bottom of Exploration
- D=14' — Depth of Exploration

FP: Flood Plain Deposits: Silty, sandy GRAVEL

TGA: Troutdale Gravel: Sandy, silty GRAVEL

SU_1: Siltstone Unit 1 consisting of four distinct low permeable layers (SUA, SUB/CU_1, SUC, & SUD) with the second layer being a blueish/gray Clayey Siltstone

TSA (Upper): Upper portion of the Troutdale Sandstone Unit: Sandstone

TSA (Lower): Lower portion of the Troutdale Sandstone Unit: Conglomerate

SU_2: Siltsone Unit 2

SGA: Sand and Gravel Aqufer

Notes

1. Soil descriptions are generalized, based on interpretation of exploration logs. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For Cross Section location, see the Site and Exploration Plan, Figure 1.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Geologic Profile Alignment B-B'

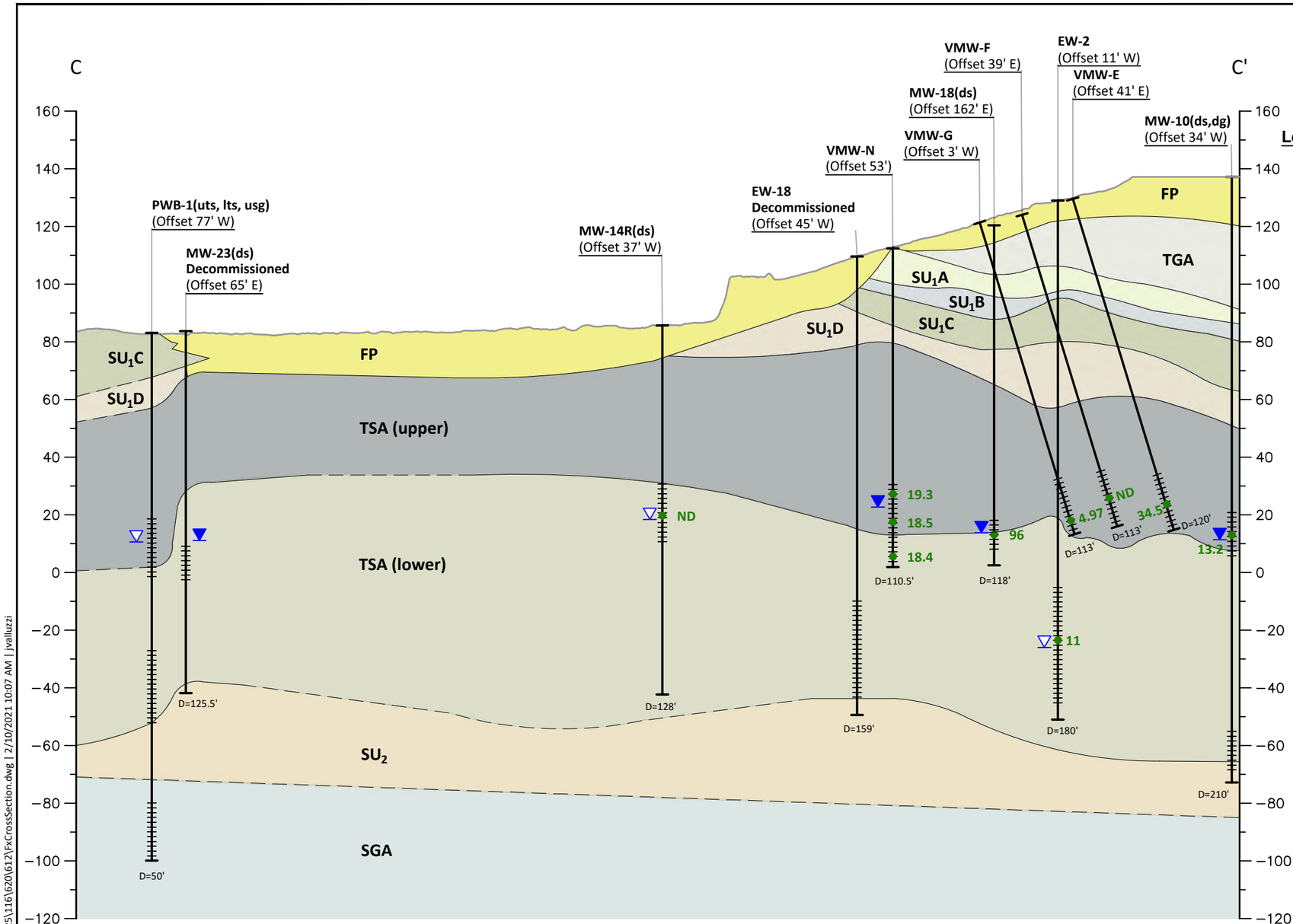
Horizontal Scale in Feet: 1"=200'
Vertical Scale in Feet: 1"=40'
5x Vertical Exaggeration

Source: <source name>, <date>

Landau Associates | G:\Projects\025\116\620\612\FxCrossSection.dwg | 6/29/2021 7:11 AM | jvalluzzi

LANDAU ASSOCIATES

Boeing Portland Gresham, Oregon	**Cross Section B-B'**	Figure 8



Legend

- **MW-1** (Offset 160' W) — Project Exploration Designation; Offset Distance in Feet and Direction
- Top of Exploration
- Groundwater Elevation - TSA (Upper) - August 2020
- Groundwater Elevation - TSA (Lower) - August 2020
- Soil Type Contact
- Trichloroethene Concentration (µg/L in August 2020)
- Inferred Groundwater Table
- Inferred Geologic Contact
- Well Screen Interval
- Bottom of Exploration
- D=14' — Depth of Exploration

FP: Flood Plain Deposits: Silty, sandy GRAVEL

TGA: Troutdale Gravel: Sandy, silty GRAVEL

SUA | SUB | SUC | SUD — SU_1: Siltstone Unit 1 consisting of four distinct low permeable layers (SUA, SUB/CU_1, SUC, & SUD) with the second layer being a blueish/gray Clayey Siltstone

TSA (Upper): Upper portion of the Troutdale Sandstone Unit: Sandstone

TSA (Lower): Lower portion of the Troutdale Sandstone Unit: Conglomerate

SU_2: Siltsone Unit 2

SGA: Sand and Gravel Aqufer

Notes

1. Soil descriptions are generalized, based on interpretation of exploration logs. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For Cross Section location, see the Site and Exploration Plan, Figure 1.
3. For 45° angled borings (VMW-E, VMW-F, and VMW-G), depths have been converted to vertical depths for contacts and screened intervals.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Geologic Profile Alignment C-C'

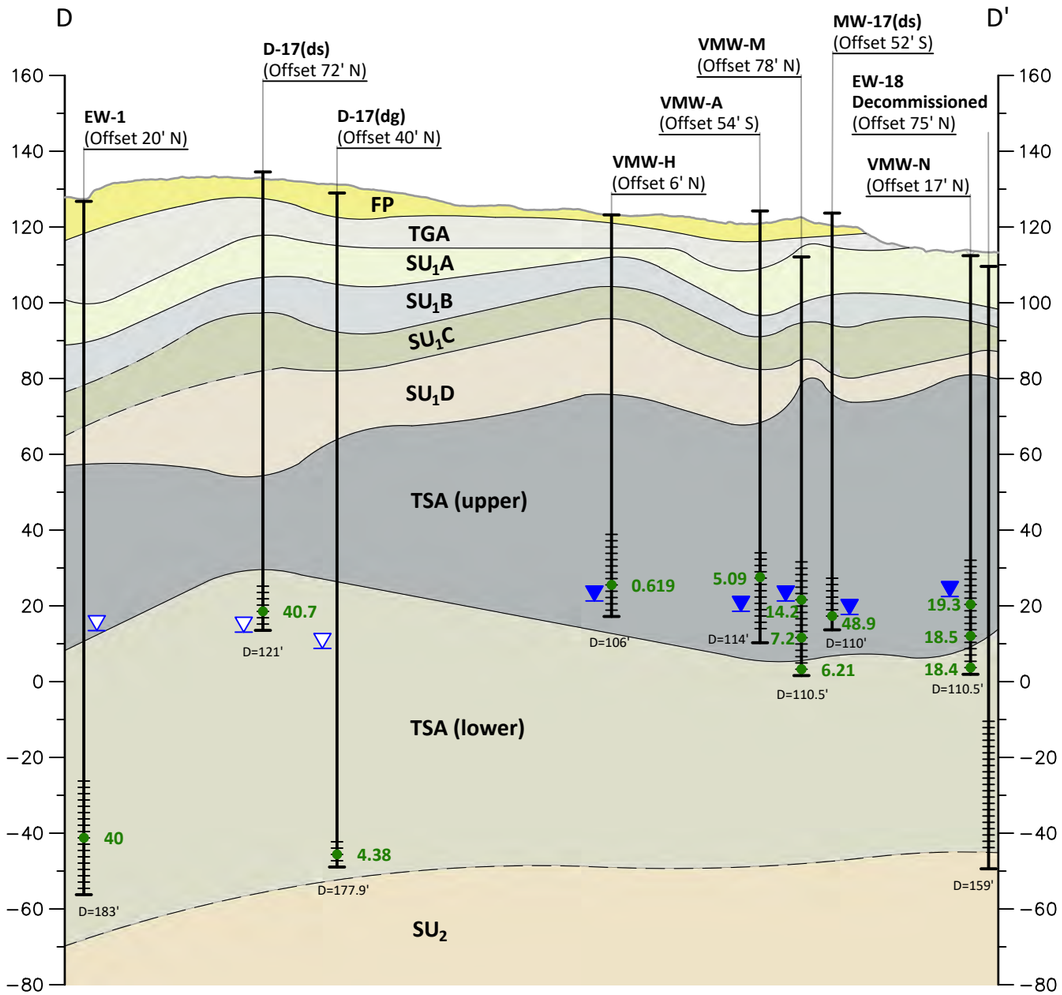
Horizontal Scale in Feet: 1"=200'
Vertical Scale in Feet: 1"=40'
5x Vertical Exaggeration

Source: <source name>, <date>

Landau Associates | G:\Projects\025\116\620\612\FxCrossSection.dwg | 2/10/2021 10:07 AM | jvalluzzi

LANDAU ASSOCIATES

Boeing Portland Gresham, Oregon	**Cross Section C-C'**	Figure 9



Geologic Profile Alignment D-D'

Horizontal Scale in Feet: 1"=200'
Vertical Scale in Feet: 1"=40'
5x Vertical Exaggeration

Legend

- **MW-1** — Project Exploration Designation
- (Offset 160' W) — Offset Distance in Feet and Direction
- Top of Exploration
- Groundwater Elevation - TSA (Upper) - August 2020
- Groundwater Elevation - TSA (Lower) - August 2020
- Soil Type Contact
- Trichloroethene Concentration (µg/L in August 2020)
- Inferred Groundwater Table
- ? Inferred Geologic Contact
- Well Screen Interval
- Bottom of Exploration
- D=14' Depth of Exploration

- FP: Flood Plain Deposits: Silty, sandy GRAVEL
- TGA: Troutdale Gravel: Sandy, silty GRAVEL
- SUA, SUB, SUC, SUD — SU_1: Siltstone Unit 1 consisting of four distinct low permeable layers (SUA, SUB/CU_1, SUC, & SUD) with the second layer being a blueish/gray Clayey Siltstone
- TSA (Upper): Upper portion of the Troutdale Sandstone Unit: Sandstone
- TSA (Lower): Lower portion of the Troutdale Sandstone Unit: Conglomerate
- SU_2: Siltsone Unit 2
- SGA: Sand and Gravel Aqufer

Notes

1. Soil descriptions are generalized, based on interpretation of exploration logs. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For Cross Section location, see the Site and Exploration Plan, Figure 1.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: <source name>, <date>

Boeing Portland Gresham, Oregon	**Cross Section D-D'**	Figure 10

LANDAU ASSOCIATES

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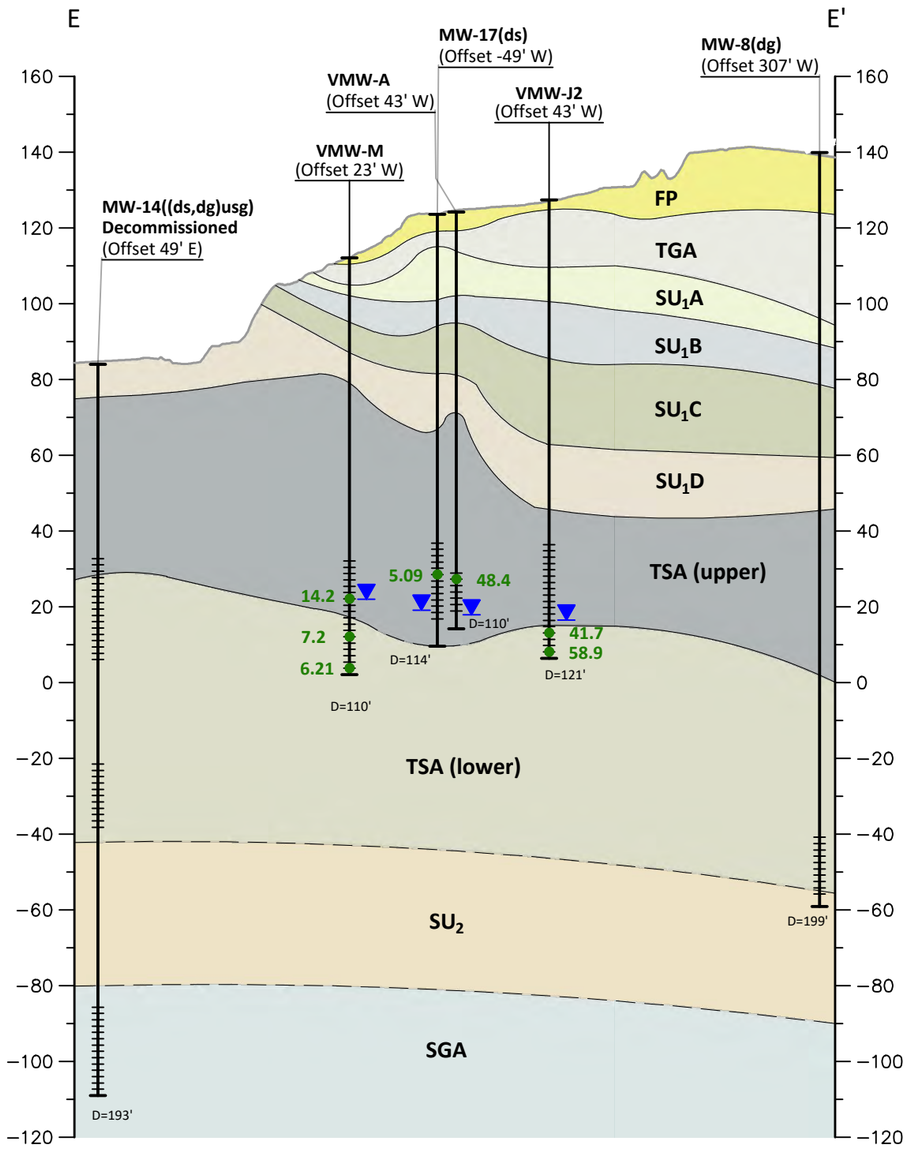


Legend

MW-1 — Project Exploration Designation
(Offset 160' W) — Offset Distance in Feet and Direction
Top of Exploration
Groundwater Elevation - TSA (Upper) - August 2020
Groundwater Elevation - TSA (Lower) - August 2020
Soil Type Contact
Trichloroethene Concentration (µg/L in August 2020)
Inferred Groundwater Table
Inferred Geologic Contact
Well Screen Interval
Bottom of Exploration
D=14' — Depth of Exploration

FP: Flood Plain Deposits: Silty, sandy GRAVEL

TGA: Troutdale Gravel: Sandy, silty GRAVEL

SUA SUB SUC SUD — SU_1: Siltstone Unit 1 consisting of four distinct low permeable layers (SUA, SUB/CU_1, SUC, & SUD) with the second layer being a blueish/gray Clayey Siltstone

TSA (Upper): Upper portion of the Troutdale Sandstone Unit: Sandstone

TSA (Lower): Lower portion of the Troutdale Sandstone Unit: Conglomerate

SU_2: Siltsone Unit 2

SGA: Sand and Gravel Aqufer

Notes

1. Soil descriptions are generalized, based on interpretation of exploration logs. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. For Cross Section location, see the Site and Exploration Plan, Figure 1.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Geologic Profile Alignment E-E'

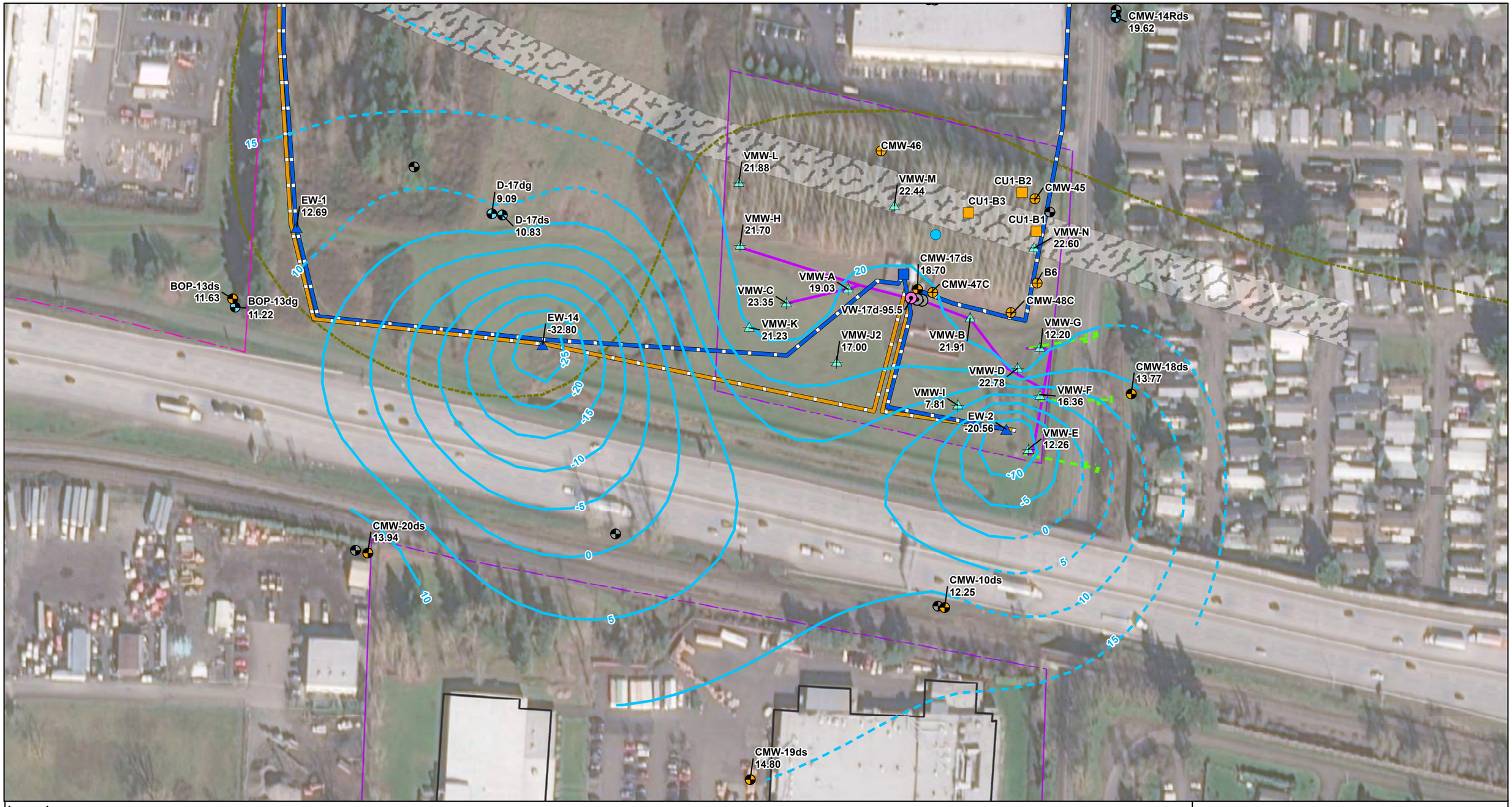
Horizontal Scale in Feet: 1"=200'
Vertical Scale in Feet: 1"=40'
5x Vertical Exaggeration

Source: <source name>, <date>

Boeing Portland Gresham, Oregon	**Cross Section E-E'**	Figure 11

LANDAU ASSOCIATES

Landau Associates | G:\Projects\025\116\620\612\FxCrossSection.dwg | 2/9/2021 3:04 PM | jvalluzzi



Legend

- CU1 Soil Sample Boring
- CU1 Monitoring Well
- Soil Vapor Extraction and Groundwater Monitoring Well
- Decommissioned TSA Monitoring Well
- Decommissioned Soil Vapor Monitoring Well
- Soil Vapor Extraction Well
- Upper & Lower TSA Monitoring Well
- Upper TSA Monitoring Well
- Lower TSA Monitoring Well
- Lower TSA Extraction Well
- Decommissioned Extraction Well
- Groundwater Treatment System
- Spring
- Inferred Upper TSA Groundwater Elevation (ft. AMSL)
- Known Upper TSA Groundwater Elevation (ft. AMSL)
- Extracted Groundwater Conveyance
- Extraction Well Power Line
- Angled VMW Screen Direction and Location
- Soil Vapor Extraction Piping
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary
- Approximate Area of Unsaturated Upper TSA
- Approximate Area of TGA/CU1

Notes:
VMW-E, VMW-F, VMW-G, and D-17dg were excluded from contour generation.

N

0 150 Feet

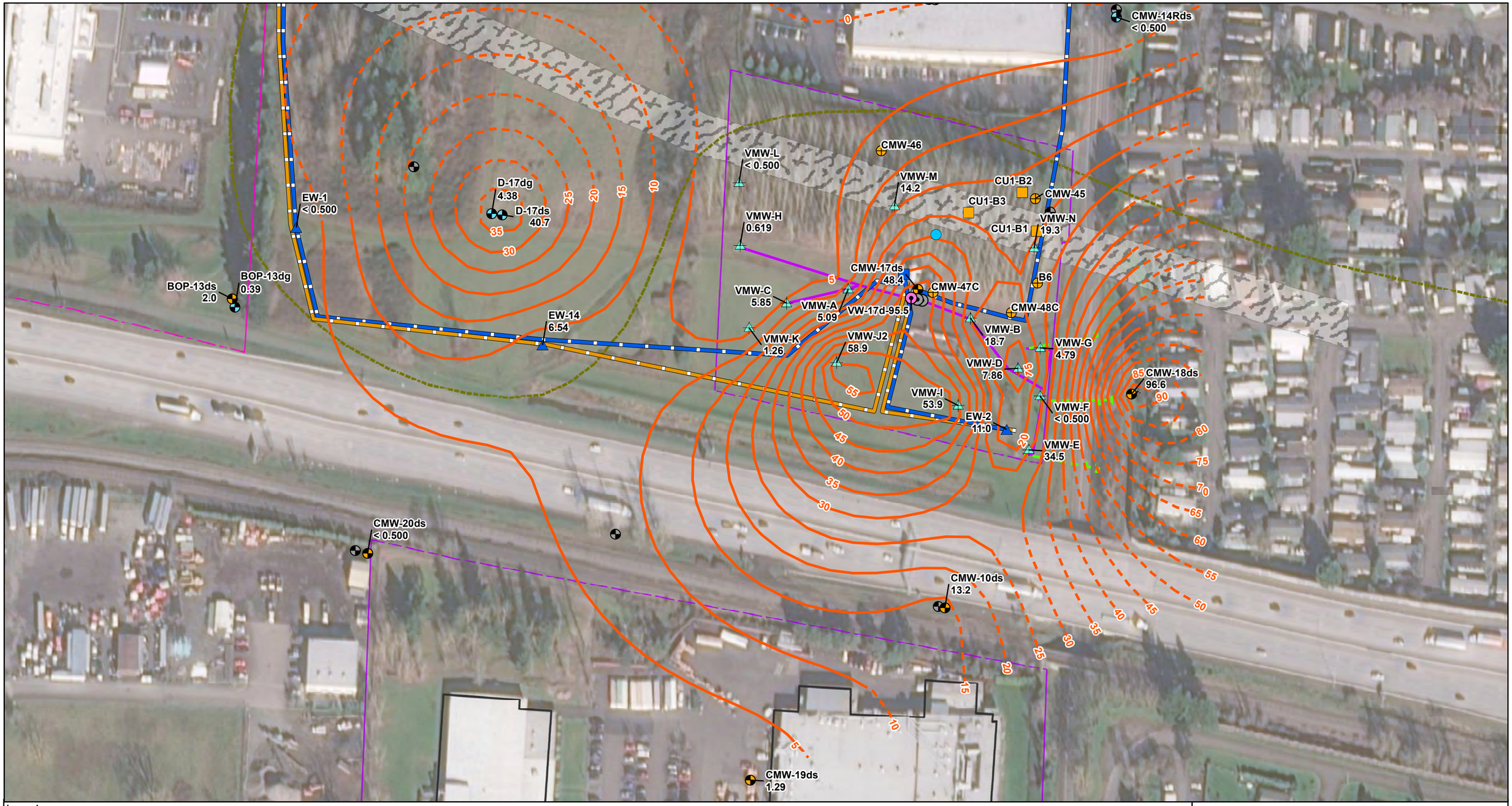
TSA Data Gaps
Groundwater Elevation Contours
August 2020
East Multnomah County

Geosyntec consultants

Santa Barbara | February 2021

Figure 12

SantaBarbara-01\P:\GIS\PNG0564 - Cascade\Projects\2020\2020Q4 Data Contours\Fig04A_Data_Gaps_Boring_Locations_GWE_Contours_Aug2020.mxd 2/9/2021 (Author: GCatlin) 1:44:38 PM



Legend

- CU1 Soil Sample Boring
- CU1 Monitoring Well
- Soil Vapor Extraction and Groundwater Monitoring Well
- Decommissioned TSA Monitoring Well
- Decommissioned Soil Vapor Monitoring Well
- Soil Vapor Extraction Well
- Upper & Lower TSA Monitoring Well
- Upper TSA Monitoring Well
- Lower TSA Monitoring Well
- Lower TSA Extraction Well
- Decommissioned Extraction Well
- Groundwater Treatment System
- Spring
- Inferred Upper TSA Trichloroethene Contour (µg/L)
- Known Upper TSA Trichloroethene Contour (µg/L)
- Extracted Groundwater Conveyance
- Extraction Well Power Line
- Angled VMW Screen Direction and Location
- Soil Vapor Extraction Piping
- Structure
- Boeing Property Boundary
- Cascade Corporation Property Boundary
- Approximate Area of Unsaturated Upper TSA
- Approximate Area of TGA/CU1 Truncation

VMW-E, VMW-F, VMW-G, and D-17dg were excluded from contour generation

N

0 150 Feet

TSA Data Gaps
TCE Concentration Contours
August 2020

East Multnomah County

Geosyntec consultants

Santa Barbara | February 2021

Figure 13

SantaBarbara-01\P:\GIS\PNG0564 - Cascade\Projects\2020\2020Q4 Data Contours\Fig04B_Data_Gaps_Boring_Locations_TCE_GW_Contours_Aug2020.mxd 2/9/2021 (Author: GCatlin) 2:32:55 PM

ATTACHMENT 1

Borehole/Well Construction Logs, Stratigraphic Column

Geosyntec consultants
920 SW Sixth Avenue, Suite 600
Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-I **SHEET** 1 OF 7
START DATE 6/8/2020 **Elevation** 128.73 FT. MSL
FINISH DATE 6/16/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
0	Light reddish brown (2.5YR 6/3) moist silty TOPSOIL. Medium-dense, fine silt with grass and rootlets.	4" SCH 40 PVC well casing. 2x2ft concrete pad with steel monument. 3 steel bollards.				100	0.0	TOPSOIL	Plastic sheeting/liner in soil.
	Grey/black dry BASALT boulder. Massive, vesicular.						0.0	VOLC	
			125			100			
5							0.4		
	Reddish grey (7.5R 6/1) moist silty GRAVEL. Well graded gravel with well rounded volcanic and quartzite clasts ranging 0.5-8in in diameter in a silty matrix. Trace angular sand. [Troutdale Gravel Aquifer]						0.9	GW-GM	
							2.6		
							4.3	GW-GM	
							0.7		
	Transitions to light brown (10YR 8/3) with higher concentration of fines, increasing moisture with depth. Wet from 9-10ft.		120				0.2		
							0.0		Apparent groundwater 9-10ft.
10	Transitions to light grey (10YR 7/1) Well rounded volcanic clasts from gravel to boulder size, set in powdery silt matrix.					100	0.0	SILTSTONE	
			115						
15						0			
			110						
20	Brown (10YR 5/3) dry SILT/SILTSTONE. Very fine, dense, weakly cemented, silt with occasional subrounded-subangular lithic clasts. [Siltstone Unit 1, Subunit A (SU1A)]					100	0.0	SILTSTONE	
			105			100			
25									

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689242.682
EASTING 7700614.926
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135623

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

Geosyntec consultants
920 SW Sixth Avenue, Suite 600
Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-I **SHEET** 2 OF 7
START DATE 6/8/2020 **Elevation** 128.73 FT. MSL
FINISH DATE 6/16/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
		(25-30ft) CETCO Pure Gold Bentonite - medium chips for seal. 6 50lb bags hydrated with 1 hour cure time.							10" to 9" steel casing step down, 6" core barrel. Bentonite seal at TGA/CU1 contact.
	Greenish grey (5GY 6/1) dry SILTSTONE. Very firm, well cemented siltstone. No visible fracturing. [Confining Unit 1, SU1B]		100					SILTSTONE	
30									
			95			100	0.0		
35	Transitions to mottled reddish grey (5YR 5/1).							SILTSTONE	
			90						
40	Transitions to dark greenish grey (10Y 3/1). Siltstone displays gnarled texture with rolled edges when split, lightly cemented, slightly sticky.							SILTSTONE	
	Reddish brown (5YR 5/6) dry SANDSTONE. Weathered, oxidized, weakly cemeented and highly fractured. Sandstone is friable, crumbles into angular pieces. [SU1C]							SANDSTONE	
			85			100			
45	Grey (10YR 5/1) moist SILTSTONE. Firm, well cemented, breaks into well rounded pieces.							SILTSTONE	
	Reddish brown (5YR 4/4) dry SANDSTONE. Weathered, oxidized, moderately cemented, and highly fractured. Friable disks <1in thick, crumble into angular sand pieces.							SANDSTONE	
								SILTSTONE	
	Light brownish grey (10YR 6/2) dry SILTSTONE. Subangular/subrounded, firm, moderately cemented, siltstone pieces 1-2in in size, silt matrix.							ML	
			80						
50	Light brownish grey (10YR 6/2) dry SILT. Soft, nonplastic silt.								

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689242.682
EASTING 7700614.926
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135623

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

Geosyntec consultants
920 SW Sixth Avenue, Suite 600
Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-I **SHEET** 3 OF 7
START DATE 6/8/2020 **Elevation** 128.73 FT. MSL
FINISH DATE 6/16/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Light brownish grey (10YR 6/2) dry SILTSTONE. Subangular/subrounded, firm, moderately cemented, siltstone pieces 1-2in in size, silt matrix.									SILTSTONE	
	Grey (10YR 5/1) damp SILTSTONE. Firm, well cemented, breaks into well rounded pieces, slightly sticky.									SILTSTONE	
	Light reddish brown (5YR 6/4) dry SILTSTONE. Highly fractured, soft, weakly cemented. Breaks into small angular pieces under slight hand pressure.			(0-105ft) Sakrete Portland Type I-II for grout. 14 50lb bags, hydrated, mixed, placed via tremie pipe.	75			100	0.0		
55											
					70						
60											
					65			100			
65											
	Greenish grey (10G 7/1) dry SILTSTONE. Hard, well cemented, highly fractured into small angular pieces 0.5-2in in size. [SU1D]									SILTSTONE	
	Transitions to light bluish gray (10B 8/1).				60					SILTSTONE	
70											
	Transitions to light tan (5YR 8/3).							100		SILTSTONE	
									0.0		
	Transitions to dark olive gray (5Y 3/2).				55					SILTSTONE	
75											

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689242.682
EASTING 7700614.926
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135623

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

Geosyntec consultants
920 SW Sixth Avenue, Suite 600
Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-I **SHEET** 4 OF 7
START DATE 6/8/2020 **Elevation** 128.73 FT. MSL
FINISH DATE 6/16/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Transitions to reddish yellow (7.5YR 7/6).									SILTSTONE	
80	Slowly transitions to tan (2.5Y 8/4), becomes primarily SILT with siltstone pieces. Silt percentage increases with depth.				50			100		ML	
85	White (5Y 8/1) dry SILT. Powdery, very loose, non plastic.				45					ML	
	Tan (2.5Y 8/4) dry SILT with siltstone pieces. Loose, nonplastic silt with 0.5-3in pieces of weakly cemented siltstone.									ML	
90	Light olive grey (5Y 6/2) dry SANDSTONE. 1-3in thick horizontally fractured, hard, well cemented, sandstone disks. Highly weathered and oxidized into very coarse, angular, vitric, sands. [Upper Troutdale Sandstone Aquifer]				40			100	0.0	SANDSTONE	
	Light brown (2.5Y 6/3) dry SAND with gravel sized sandstone and trace silt. Highly weathered and oxidized, coarse, angular sands with small gravel sized pieces of well cemented, subrounded sandstone.									SW-SM	
95	Tan (5Y 7/3) moist SAND. Poorly graded, uniform, fine, angular sand. Soft, medium dense, non cemented, fine sand.				35					SP	
100	Light grey to grey (10YR 6/1) dry silty SAND. Fine grained, loose, sand with silt, trace gravel sized pieces of subrounded weakly cemented sandstone.				30					SW-SM	

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689242.682
EASTING 7700614.926
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135623

COORDINATE SYSTEM: NAGVD29
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

Geosyntec consultants
920 SW Sixth Avenue, Suite 600
Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-I **SHEET** 5 OF 7
START DATE 6/8/2020 **Elevation** 128.73 FT. MSL
FINISH DATE 6/16/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
105	Tan (7.5YR 7/4) dry SANDSTONE. Highly weathered and fractured sandstone consists of small angular pieces <0.5in.							SANDSTONE	
	Light grey (5Y 7/1) moist SAND. Poorly graded, uniform, fine, angular sand. Medium dense, non cemented, fine sand.	(105-108ft) CETCO Pure Gold Bentonite - medium chips for seal. 2 50lb bags.						SP	
	Light grey to grey (10YR 6/1) dry silty SAND. Fine grained, loose, sand with silt, trace gravel sized pieces of subrounded weakly cemented sandstone.		20					SW-SM	
110	White (5YR 8/1) dry silty SAND. Fine grained, loose, sand with silt, trace cobble sized pieces of rounded, well cemented sandstone.							SW-SM	
	Grey (5Y 5/1) moist SAND. Poorly graded, uniform, fine, angular sand. Medium dense, non cemented, fine sand.					100	0.0	SP	
	Light brown (2.5Y 6/3) dry SAND with gravel sized sandstone and trace silt. Highly weathered and oxidized, coarse, angular sands with small gravel sized pieces of well cemented, subrounded sandstone.		15					SW-SM	
115									
	Greyish black (5Y 5/4) wet basalt SAND. Coarse black angular basalt sand, loose, with well rounded basalt <3in.							SW	6/9/2020- 8in casing will not advance past 116ft. Added 250gal of water to try and free casing. 6/10/2020-Over drill with 9in casing with 10in to 30ft, make new bentonite seal. Over drill 8in steel casing with 9in casing until 8in is freed. Measured GW Moisture undefined due to water used for drilling.
	Greyish black (5Y 5/4) moist GRAVEL. Coarse black angular basalt sand, loose, with well rounded basalt and qtz cobbles <4in. [Lower Troutdale Sandstone Aquifer]		10					GW	
120						0			
	Greyish black (5Y 5/4) GRAVEL. Coarse black angular basalt sand, loose, with well rounded basalt and qtz cobbles <4in.							GW	
			5			100			
125									

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689242.682
EASTING 7700614.926
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135623

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

Geosyntec consultants
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Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-I **SHEET** 6 OF 7
START DATE 6/8/2020 **Elevation** 128.73 FT. MSL
FINISH DATE 6/16/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
130	Light to dark grey GRAVEL. Coarse to fine sand with silt, loose, with well rounded basalt and qtz cobbles <4in.			(108-160ft) CEMEX Lapis Lustre Sand #2/12 for filter pack. 35 50lb bags.	0			0			6/10/2020- Casing repeatedly stuck at 126ft and below. Keep flooding borehole and slowly advancing.
								70	0.0	GW	(131-160ft bgs) Moisture undefined due to drilling. Roughly 70 percent recovery throughout.
135					-5			75			
140					-10			70	0.0		
145					-15			65			
150					-20						

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689242.682
EASTING 7700614.926
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135623

COORDINATE SYSTEM: NAGVD29
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-I **SHEET** 7 OF 7
START DATE 6/8/2020 **Elevation** 128.73 FT. MSL
FINISH DATE 6/16/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
								70	0.0		6/11/2020- 6in core barrel becomes stuck at 150ft, rig blows hydraulic hose during recovery attempt. 6/12/2020 6in core barrel recovered. Complete boring to 160ft.
					-25			70			
155								80	0.0		
					-30						
160	150ft well TD, 160ft borehole TD.										6/15/2020 8in casing becomes stuck during removal, not removed until 6/16/2020-well completed same day.

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689242.682
EASTING 7700614.926
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135623

COORDINATE SYSTEM: NAGVD29
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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J **SHEET** 1 OF 6
START DATE 6/17/2020 **Elevation** FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
0	Brown moist SILT with organics (roots and rootlets).	4" SCH 40 PVC well casing. Well abandoned and replaced with VMW-J2.			100	0.0	ML	
						0.0		
	Brown moist sandy GRAVEL. Large rounded basalt and quartzite cobbles <10". Thin beds of grey gravel. [Troutdale Gravel Aquifer]					0.4	GM	
5					100	1.2		
						4.8		Wet from 7.2-13ft.
						8.2		
						20.1		
10					100	0.2 0.0		
15					100			6/17/2020- Drill head breaks at 15ft. Shut down until replaced. Resume 6/18/2020.
	Greyish red moist SANDSTONE. Fine grained, firm, and well cemented. Occasional fine interbeds of loose, fine grained sand. [Siltstone Unit 1, Subunit A (SU1A)]						SANDSTONE	
20					100	0.0		
	Reddish brown moist SANDSTONE. Highly oxidized and poorly cemented. 23.7-24.2' interbedded brown sandstone, very firm, very well cemented.						SANDSTONE	
								10" to 9" steel casing step
25								

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING
EASTING
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: WELL ABANDONED. Replaced with VMW-J2 10ft W/NW.

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J **SHEET** 2 OF 6
START DATE 6/17/2020 **Elevation** FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
				(24-29ft) CETCO Pure Gold Bentonite - medium chips for seal. 3 50lb bags, hydrate, 1hr cure.				100			down with 6" core barrel. Bentonite seal at TGA/CU1 contact.
	Greenish grey dry SILTSTONE. Firm, weak cementation. [Confining Unit 1, SU1B]									SILTSTONE	
30								100	0.0		
	Mottled grey and brown dry SILTSTONE. Very hard, medium cementation. 34.9-35.1 Brown GRAVEL interbed, silty gravel with angular sand and subangular sandstone pieces <2in. 38.8-41.									SILTSTONE	
35											
								100			
40	Brown SANDSTONE. Weathered, loose sand with 2"-4" sandstone pieces, medium cementation. [SU1C]									SANDSTONE	
	Dark grey SILTSTONE. Hard, micaceous, friable.									SILTSTONE	
	Reddish brown dry SANDSTONE. Highly wethered, oxidized, sandstone is hard, firmly cemented, highly fractrued and friable.									SANDSTONE	
45											
								100	0.0		
50											

CONTRACTOR Cascade **NORTHING**
EQUIPMENT Pro Sonic Truck Rig **EASTING**
DRILL MTHD Sonic **ANGLE** Vertical
DIAMETER 10"-9"-6" **BEARING** ------
LOGGER S. Parton **REVIEWER** C Bartlett **PRINTED** 02/18/21

REMARKS: WELL ABANDONED. Replaced with VMW-J2 10ft W/NW.

COORDINATE SYSTEM: NAGVD29
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J **SHEET** 3 OF 6
START DATE 6/17/2020 **Elevation** FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Brown dry SILTSTONE. Soft, poor cementation, occasional thin (1-2in) consolidated, well cemented, sandstone interbed.			(0-101ft) Quik-Grout Bentonite for grout. Approximatly 20 bags, hydrated, mixed, placed via tremie.						SILTSTONE	
55											
	Light brown dry SAND. Well graded coarse angular sand, very loose, little to no cementation.									SW	
	Light brown moist sandy SILT.							100		ML	
60	Brown dry SANDSTONE. Very hard interbed.									SANDSTONE	
	Brown dry SAND. Fine, coarse, angular qtz sand.									SW	
	Brownish red moist silty SAND. Very fine, non plastic, weak cementation, some cross bedding present. 63.2-63.4 very hard and well cemented micaceous SANDSTONE. [SU1D]									SM	
65											
	Transitions to olive color SAND with trace reddish brown, coarse, angular sand.									SM	
	Dark reddish brown SILTSTONE. Highly weathered, oxidized, loose, occasional lenses of well cemented , hard siltstones. Interbedded silty sand unit (77.5-77.6), and very hard sandstone (79.1-79.2).							100	0.0	SILTSTONE	
70											
75											

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING
EASTING
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: WELL ABANDONED. Replaced with VMW-J2 10ft W/NW.

COORDINATE SYSTEM: NAGVD29
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J **SHEET** 4 OF 6
START DATE 6/17/2020 **Elevation** FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
80	Reddish brown dry SANDSTONE. Coarse grained, vitric, angular sand. Heavily oxidized, very hard, very well cemented. [Upper Troutdale Sandstone Aquifer]							100		SANDSTONE	
85	Transitions to black dry SANDSTONE. Angular, coarse, vitric sandstone interbedded with finer loose basaltic sands.									SANDSTONE	6/18/2020- Core barrel stuck at 85ft. Flood well with 300+ gal of water. Resume 6/19/2020.
90	Transitions to tan dry SANDSTONE. Highly oxidized and weathered, loose with little to no cementation, vitric.							100	0.0	SANDSTONE	
95	Black moist basaltic SAND. Coarse, angular, loose.									SW	
	Transitions to dark tan dry basaltic SAND. Occasional thin interbeds of heavily weathered, well cemented sandstones.									SW	
100								100			

CONTRACTOR Cascade **NORTHING**
EQUIPMENT Pro Sonic Truck Rig **EASTING**
DRILL MTHD Sonic **ANGLE** Vertical
DIAMETER 10"-9"-6" **BEARING** ------
LOGGER S. Parton **REVIEWER** C Bartlett **PRINTED** 02/18/21

REMARKS: WELL ABANDONED. Replaced with VMW-J2 10ft W/NW.

COORDINATE SYSTEM: NAGVD29
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J **SHEET** 5 OF 6
START DATE 6/17/2020 **Elevation** FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
105	Grey dry silty SAND. Fine, loose. Very thin interbeds of well cemented vitric sandstones.			(101-103ft) CETCO Pure Gold Bentonite - medium chips for seal. 2 50lb bags.						SM	
	Tan dry SANDSTONE. Coarse well cemented grains, very hard. Interbeds of loose, fine, silty sands.									SANDSTONE	
110								100	0.0		
	Greyish black wet GRAVEL. Coarse black angular basaltic sand, loose, with well rounded basalt and qtz cobbles <4in. Minor beds of weakly cemented conglomerate. [Lower Troutdale Sandstone Aquifer]									GW	Apparent GW. Wet 112.8-136ft.
115				(103-136) CEMEX Lapis Lustre Sand #2/12 for filter pack. 22 50lb bags.				0			
								100	0.0		
120											
125	Transitions to reddish brown sandy GRAVEL.									GW	

CONTRACTOR Cascade **NORTHING**
EQUIPMENT Pro Sonic Truck Rig **EASTING**
DRILL MTHD Sonic **ANGLE** Vertical
DIAMETER 10"-9"-6" **BEARING** ------
LOGGER S. Parton **REVIEWER** C Bartlett **PRINTED** 02/18/21

REMARKS: WELL ABANDONED. Replaced with VMW-J2 10ft W/NW.

COORDINATE SYSTEM: NAGVD29
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J **SHEET** 6 OF 6
START DATE 6/17/2020 **Elevation** FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Fine, subangular sand, loose, with well rounded basalt and quartz cobbles <4in.							100	0.0		6/22/2020- Reach TD of 136ft, 8in casing stuck at TD. Break 4in PVC during removal attemp. Clear PVC. Over drill with 9in casing to 70ft. 6/23/2020- Advance 9in casing to 130ft, continually flooding well. 6/24/2020- Advance 9in to 136ft, begin retrieval of 8in casing. Break 4in PVC a second time. 6/25/2020- Remove all 8in casing. Reset 4in casing. Complete sand pack, bentonite, seal, and begin grout. During retriveal of 9in casing PVC pulled up 4ft into the grout, compromising the screen. All casing was removed, entire borehole filled with grout to abandon.
130								0			
135								100			
	135ft = Well TD. 136ft = Borehole TD.										

CONTRACTOR Cascade **NORTHING**
EQUIPMENT Pro Sonic Truck Rig **EASTING**
DRILL MTHD Sonic **ANGLE** Vertical
DIAMETER 10"-9"-6" **BEARING** ------
LOGGER S. Parton **REVIEWER** C Bartlett **PRINTED** 02/18/21

REMARKS: WELL ABANDONED. Replaced with VMW-J2 10ft W/NW.

COORDINATE SYSTEM: NAGVD29
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J2 **SHEET** 1 OF 5
START DATE 6/26/2020 **Elevation** 126.87 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
0	Reddish brown SILT with organics (roots and rootlets).	4" SCH 40 PVC well casing. 2x2ft concrete pad with steel monument. 3 steel bollards.	125			100		TOPSOIL	Begin 6/26/2020
5	Dark brown sandy GRAVEL. Large rounded basalt and quartzite cobbles <10". Thin beds of grey gravel. [Troutdale Gravel Aquifer]		120			100		GM	Drill water used to bore abandoned VMW-J, 700+ gallons, appears to have seeped over to new location. PID, moisture and density are not determined as core is too wet from 0-60ft.
10	Transitions to Grey GRAVEL. Large decrease in fines.		115			100		GM	
15	Transitions to reddish grey silty sandy GRAVEL. Large increase in fines. Saturated with water from drilling VMW-J. Moisture and density indeterminate.		110			100		GM	
	Greyish red moist SANDSTONE. Fine grained, firm, and well cemented. Occasional fine interbeds of loose, fine grained sand. [Siltstone Unit 1, Subunit A (SU1A)]							SANDSTONE	
	Dark reddish brown silty SAND with sandstone. Highly weathered, loose, coarse, angular, sand with minor silt. Occasional interbeds of well cemented sandstone <1" thick.							SW	
20	Reddish brown moist SANDSTONE. Highly oxidized, heavily fractured, 1-2" sized sandstone pieces set in coarse, angular sand matrix.		105			100		SANDSTONE	
25						100			10in to 8in steel casing step

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER S.P / C. B. **REVIEWER** C Bartlett

NORTHING 689306.883
EASTING 7700421.033
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135624

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J2 **SHEET** 2 OF 5
START DATE 6/26/2020 **Elevation** 126.87 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
		(24-29ft) CETCO Pure Gold Bentonite - medium chips for seal. 3 50lb bags, hydrate, 1hr cure.	100						down and 8in to 6in core barrel step down at TGA/CU1 contact.
	Greenish grey and light brown mottled dry SILTSTONE. Hard, weak cementation. [Confining Unit 1, SU1B]							SILTSTONE	
30	Transitions to a pale green (5G 6/2). Very hard, well cemented.							SILTSTONE	
			95						
	Transitions to dark brownish red and grey mottling.					100		SILTSTONE	
35									
	Transitions to black and bluish mottling.							SILTSTONE	
			90						
	Reddish brown sandy SANDSTONE. Weathered, highly fractured, loose. Gravel to cobble sized pieces of moderately cemented sandstone in a subrounded, fine sand matrix. (SU1C)							SANDSTONE	
40									
		(0-86ft) Quik-Grout Bentonite for grout. 9 50lb bags, mixed with 315gal of water, placed via tremie.	85						
	Transitions to light brown.					100		SANDSTONE	At 44' no recovery
45						0			
			80			100			
	Reddish brown silty SAND with trace sandstone pieces. Loose, subrounded, fine silty sand. Occasional gravel sized pieces of moderetly cemented subangular sandstone.							SW	
50									

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER S.P / C. B. **REVIEWER** C Bartlett

NORTHING 689306.883
EASTING 7700421.033
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135624

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

Geosyntec consultants
920 SW Sixth Avenue, Suite 600
Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J2 **SHEET** 3 OF 5
START DATE 6/26/2020 **Elevation** 126.87 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
55	Light brown SAND. Poorly graded coarse angular sand, very loose, little to no cementation.				75			0		SP	
60					70			100		SANDSTONE	Crew lost core barrel at 61ft. Recovered and continued with shorter secton.
65	Reddish Brown and grey mottled wet silty SAND. Poorly graded, loose, some silt. Basalt boulder at 70'. [SU1D]				65			100	0.0	SP-SM	Stop 6/26/2020. Resume 6/29/2020.
70	Reddish brown dry SANDSTONE. Weathered into a medium-coarse, loose, angular sand. Contains dark grey vitric sandstone pieces.				60				0.0	SANDSTONE	
75	Transitions from medium yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2).				55				0.0	SANDSTONE	

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER S.P / C. B. **REVIEWER** C Bartlett

NORTHING 689306.883
EASTING 7700421.033
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135624

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J2 **SHEET** 4 OF 5
START DATE 6/26/2020 **Elevation** 126.87 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
						100			Drillers begin using new 6in core barrel.
			50				0.2		
	Transitions to light grey, dry, loose, with fine to very coarse sand. 0.5' boulder at 79'.							SANDSTONE	
80	Addition of minor silt						1.8	SANDSTONE	
	Dark grey, wet sand. 0.25' silt interbed at 82.75-83'.		45					SM	81-84 wet to moist.
							0.0		
	Dark brownish grey moist silty SAND. Dense, coarse grained sand with sandstone pieces. Dry at 84'.			Soil Sample VMWJ2-82.75-20200629				SANDSTONE	
85							0.0		
	Orangish brown, dry SANDSTONE. Weathered, coarse, vitric. [Upper Troutdale Sandstone Aquifer]	(86-88.5ft) CETCO Pure Gold Bentonite - medium chips for seal. 2 50lb bags.	40			100		SANDSTONE	
90	Becomes brown and loose.							SANDSTONE	
	Black, wet, sandy SANDSTONE. Coarse gravel sized sandstone pieces in sandy matrix.					100		SANDSTONE	Wet at 91ft. Apparent GW.
	Becomes grayish brown (5YR 3/2). Medium dense sand with sandstone pieces. Slight oxidation. Fine sand to silt. 95-96 is olive black (5Y 2/1).		35				0.1	SANDSTONE	
95									
	Dark olive black (5Y 2/1), wet, sandy SANDSTONE. Loose, medium dense, fine to coarse, rounded sand with trace silt.					100	0.4	SANDSTONE	
	Increase in silt 10-30%.		30					SANDSTONE	
							0.0		
	Wet, well sorted sand with some sandstone pieces, trace silt.							SANDSTONE	
100									

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER S.P / C. B. **REVIEWER** C Bartlett

NORTHING 689306.883
EASTING 7700421.033
ANGLE Vertical
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REMARKS: Well Tag # L135624

COORDINATE SYSTEM: NAGVD29

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-J2 **SHEET** 5 OF 5
START DATE 6/26/2020 **Elevation** 126.87 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Dark grey to black dry to moist silty, sandy, GRAVEL. Slightly oxidized. [Lower Troutdale Sandstone Aquifer]		25			100	0.0	SANDSTONE	
								SANDSTONE	Very hot core.
							3.3		
105	Black dry to moist SANDSTONE. Coarse grained, very hard, not oxidized, vitric and basalt grains visible. Possible water along fractures.		20			100		SANDSTONE	
110	Very competent. Partings/fractures are perpendicular to the core.	(90.5-121) CEMEX Lapis Lustre Sand #2/12 for filter pack. 16 50lb bags.					0.1	SANDSTONE	
						100			
	Very competent. 6-12in pieces.		15					SANDSTONE	
	Introduction of vitric basalt with micorhematite/magnetite.						0.1	SANDSTONE	
115									
	Oxidized last 1ft. Patchy oxidation 117-118.					100	0.4	SANDSTONE	
			10						
	Black to dark grey wet SANDSTONE. Vitric to basaltic, medium dense to loose with large pieces of sandstone. Less competent, no oxidation, fairly well sorted, fine to coarse sand.							SANDSTONE	
120							0.1		
	121ft = Well and borehole TD.								121ft - Stop 6/29/2020 DTW 91ft. 6/30/2020- DTW 99ft after bailing >70gal.

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REMARKS: Well Tag # L135624

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-K **SHEET** 1 OF 5
START DATE 7/1/2020 **Elevation** 126.55 FT. MSL
FINISH DATE 7/2/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
0	Brown moist SILT. Topsoil with rootlets, soft, trace mica.			4" SCH 40 PVC well casing. 2x2ft concrete pad with steel monument. 3 steel bollards.	125			100	0.0	TOPSOIL	
5	Reddish brown dry silty sandy GRAVEL. Fine sand and silt matrix with large round clasts gravel to boulder size. Moist at 7ft. [Troutdale Gravel Aquifer]				120			100	0.0	GP-GM	
10					115				0.0		
15					110			100	0.0		Driller reports very little water in borehole.
20	Mottled red and brown moist silty sandy GRAVEL. Increase in silt, sand becomes coarse, decrease in cobbles and gravels. Sand becomes coarse. Some oxidation. As depth increases cementation visible as sugary sandy coating on lithics. Wet at 26ft. [Siltstone Unit 1, Subunit A (SU1A)]				105				0.0	GM	
25											

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER C. B. / J. L. **REVIEWER** C Bartlett

NORTHING 689359.158
EASTING 7700281.144
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135622

COORDINATE SYSTEM: NAGVD29

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BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-K **SHEET** 2 OF 5
START DATE 7/1/2020 **Elevation** 126.55 FT. MSL
FINISH DATE 7/2/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
							0.0		
			100			0			Apparent GW.
	Bluish green/grey, dry, SILTSTONE, dense to very dense. Transitions to mottled dark brown/grey siltstone at depth. [Confining Unit 1, SU1B]	(28-32ft) CETCO Pure Gold Bentonite - medium chips for seal. 2 50lb bags. Hydrate and cure.						SILTSTONE	10"-8" steel casing stepdown with 8" core barrel to TGA/CU1 contact. Bentonite seal. Reduce to 6" core barrel thereafter.
30			95			80			
	Transitions to dark brown to black dry SILTSTONE. Interbeds of round to coarse gravel and basaltic sands <1in thick. Sands are moist, fall apart under pressure but does compress.							SILTSTONE	
35			90						
40	Dark brown dry to moist SILTSTONE/SANDSTONE. Weathered, friable, dense. Breaks into angular 2-4in pieces. [SU1C]					100		SILTSTONE-SANDSTONE	
		(0-85ft) Quik-Grout Bentonite for grout. 9 50lb bags mixed with 315gal of water, placed via tremie.	85						
45	Transitions from reddish brown to grey brown dry to moist SILTSTONE. Breaks apart into smaller sized angular pieces 1-2in.							SILTSTONE	
			80						
50									

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER C. B. / J. L. **REVIEWER** C Bartlett

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REMARKS: Well Tag # L135622

COORDINATE SYSTEM: NAGVD29

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BOREHOLE LOG

BORING VMW-K **SHEET** 3 OF 5
START DATE 7/1/2020 **Elevation** 126.55 FT. MSL
FINISH DATE 7/2/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
55	Mottled brown/grey, moist SILT. Soft, medium dense with trace angular gravel-sized siltstone pieces.				75			100	0.0	ML	
60	Greyish green, dry, SILT. Dense with slight brown mottling. Breaks easily under hand pressure. [SU1D]				70				0.0	ML	
65	Dark brown dry SILT. Medium dense, breaks apart easily. Orange/brown dry SANDSTONE competent interbeds up to 3in thick. Sandstone is heavily oxidized, angular grains, non friable.				65				0.0		
70	Orange brown dry SANDSTONE. Increase in fine grained sands with trace coarse sand.				60			100	0.0	SANDSTONE	
75					55				0.0	SANDSTONE	Stop 7/1/2020. Resume

CONTRACTOR Cascade
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DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER C. B. / J. L. **REVIEWER** C Bartlett

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REMARKS: Well Tag # L135622

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-K **SHEET** 4 OF 5
START DATE 7/1/2020 **Elevation** 126.55 FT. MSL
FINISH DATE 7/2/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
						100			7/2/2020.
	Greyish brown dry SANDSTONE. Strong sandstone with trace fine gravel interbeds, broken into 5-8in pieces by drilling. Competent, very hard. [Upper Troutdale Sandstone Aquifer]		50			100	0.0	SANDSTONE	
	Transitions to weak sandstone, becomes more grey and weathered with depth. Less competent, breaks under hand pressure.							SANDSTONE	
80			45				0.0		
85	Breaks into 1-3in pieces.	(85-89ft) CETCO Pure Gold Bentonite - medium chips for seal. 2 50 lb bags.					0.0	SANDSTONE	
			40			100			
90							0.0		
			35						92-96ft section of core fell back into borehole. Retrieved.
95							0.0		
	Becomes moist at 96ft, increasing moisture.		30					SANDSTONE	
						100			
100							0.0		

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
DRILL MTHD Sonic
DIAMETER 10"-8"-6"
LOGGER C. B. / J. L. **REVIEWER** C Bartlett

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-K **SHEET** 5 OF 5
START DATE 7/1/2020 **Elevation** 126.55 FT. MSL
FINISH DATE 7/2/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Grey dry SANDSTONE. Weak and powdery.	(91-121) CEMEX Lapis Lustre Sand #2/12 for filter pack. 15 50lb bags.	25				SANDSTONE 0.0		
105	Moist at 105ft, decreasing moisture thereafter, less weathered at depth.		20			100	SANDSTONE 5		Measured GW.
110			15			100	0.0		Drilling progress slows.
115	Grey, moist, silty, SANDSTONE. Weak.		10			100	0.0 SANDSTONE		
	Dark grey, wet, silty sandy GRAVEL. Rounded to coarse gravel. [Lower Troutdale Sandstone Aquifer]							GW	
120							0.0		
	121- Well and borehole TD.								

CONTRACTOR Cascade
EQUIPMENT Pro Sonic Truck Rig
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LOGGER C. B. / J. L. **REVIEWER** C Bartlett

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-L **SHEET** 1 OF 5
START DATE 6/23/2020 **Elevation** 111.98 FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Dark brown moist SILT. Topsoil with roots.	4" SCH 40 PVC well casing. 2x2ft concrete pad with steel monument. 3 steel bollards.				100		TOPSOIL	
	Mottled light brown and red moist SILT. Heavy oxidation. Low-non plastic, occasional rootlets to 6ft.		110				0.0	ML	
5							0.0		
							0.0		
	Brown wet sandy GRAVEL with trace silt. 50% well rounded quartzite and basalt cobbles <4in. [Troutdale Gravel Aquifer]		105					GW	Water bearing unit.
	At 8.5', black non vesicular BASALT boulder.	(8-15ft) CETCO Pure Gold medium bentonite chips for seal. 3 50lb bags, hydrate and cure.				100	0.0	VOLC	
10	Bluish grey dry SILTSTONE. Very friable, soft and highly fractured. [Confining Unit 1, Subunit B (SU1B)]						0.0	SILTSTONE	9in to 6in steel casing stepdown, 6in core barrel.
	Transitions from bluish grey to grey brown mottled SILTSTONE.		100					SILTSTONE	Bentonite seal at TGA/CU1 contact.
15							0.0		
	Reddish brown dry SILTSTONE. Weathered, firm, med-cementation.		95					SILTSTONE	
	At 18.25-18.5 black dry SILT. Medium-firm, medium plastic.					100		ML	
	Mottled light brown and red SILTSTONE. Oxidized, firm, weakly cemented.							SILTSTONE	
20	Reddish brown moist SILTSTONE. Weathered, large boulder sized siltstone pieces in finer silty matrix.							SILTSTONE	
							0.0		End 6/23/220. Resume 6/24/2020.
	Black moist vitric basaltic SANDSTONE. Highly weathered, into coarse sand and gravel sized pieces. Few larger, vuggy. [Siltstone Unit 1, Subunit C (SU1C)]		90					VOLC SANDSTONE	
	Brown dry SANDSTONE. Highly weathered and very fractured, loose, fine grained sands. Occasional interbeds of well cemented, coarse sandstone.								
25									

CONTRACTOR Cascade
EQUIPMENT Terra Sonic Track Rig
DRILL MTHD Sonic
DIAMETER 9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689588.329
EASTING 7700260.401
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135625

COORDINATE SYSTEM: NAGVD29

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-L **SHEET** 2 OF 5
START DATE 6/23/2020 **Elevation** 111.98 FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
30	Light brown dry poorly graded SAND. Dense sand crumbles into fine grains under slight pressure.		85			100	0.0	SP	
	Light reddish brown dry SILTSTONE. Highly fractured, angular, gravel sized, moderately cemented siltstone pieces. [SU1D]		80				0.0	SILTSTONE	
35		(0-78ft) Quik-Grout Bentonite for grout. 8 50lb bags, mixed with water, placed via tremie.	75			100	0.0		
40	Light brown dry sandy silty SANDSTONE. Weakly cemented, weathered, vitric, horizontally fractured interbeds <1in thick of competent sandstone comprised primarily of coarse, angular sand. Interbeds are separated by loose, coarse grained silty sands. [Upper Troutdale Sandstone Aquifer]		70				0.0	SANDSTONE	
	Transitions to light grey.							SANDSTONE	
45	At 45', dark grey to black BASALT boulder.					100		SANDSTONE	
	Light brown dry SANDSTONE. Weathered, oxidized, very hard, well cemented, vitric, coarse, angular grains. Interbedded with oxidized silty sand.		65				0.0	SANDSTONE	
50									

CONTRACTOR Cascade
EQUIPMENT Terra Sonic Track Rig
DRILL MTHD Sonic
DIAMETER 9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

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REMARKS: Well Tag # L135625

COORDINATE SYSTEM: NAGVD29

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-L **SHEET** 3 OF 5
START DATE 6/23/2020 **Elevation** 111.98 FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
55	Light greyish brown dry silty SAND. Loose, no cementation. Occasional thin siltstone lenses less than 1in thick. (55.7-55.9, 57.5-57.6, and 58-58.2)				60			100	0.0	SM	
60					55						
65	Dark brown to black wet SAND. Poorly graded, loose, coarse, angular grains. Perched water bearing unit.				50			100	0.0	SP	Water bearing unit.
					45	VMW-L-67 collected 6/24/20 @1612		0	0.0		
70	Reddish brown dry SANDSTONE. Well cemented, coarse, angular sandstone.							100		SANDSTONE	
	Dark brown to black wet SAND. Poorly graded, loose, angular grains. Perched water bearing unit.				40					SP	Water bearing unit.
	Brown, damp, silty SAND. Loose with trace gravel sized rounded sandstone fragments.					VMW-L-72 collected 6/24/20 @1614			0.3	SM	
75	Very dark brown, moist, silty sandy SANDSTONE. Highly weathered and oxidized. Fractured into small, gravel sized, hard pieces in									SANDSTONE / SM	

CONTRACTOR Cascade
EQUIPMENT Terra Sonic Track Rig
DRILL MTHD Sonic
DIAMETER 9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689588.329
EASTING 7700260.401
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135625

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

Geosyntec consultants
920 SW Sixth Avenue, Suite 600
Portland, Oregon 97204
Phone: 971.271.5916

GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-L **SHEET** 4 OF 5
START DATE 6/23/2020 **Elevation** 111.98 FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	a silty sand matrix.						0.0		
	Light greyish brown dry silty SAND. Occasional interbeds of angular, heavily oxidized coarse sand, very well cemented and hard (75.7-75.8, 76.5-76.6, and 78.4-78.5). Trace lithic fragments.		35			100			
80		(78-80) CETCO Pure Gold medium bentonite chips for seal. 1 50lb bag.							
	Very dark brown, moist, silty sandy SANDSTONE. Highly weathered and oxidized. Fractured into small, gravel sized, hard angular pieces in a silty sand matrix.		30					SANDSTONE	
	Light brown dry silty SAND. Loose coarse angular grains. BASALT boulder (84-84.2).							SM	
85							0.0		
			25			98			
	Light brown dry SAND. Primarily coarse silty sand with minor well rounded basalt and quartzite cobbles <2in in diameter.							SW SM	
	Tan dry silty SAND with occasional sandstone lenses. Black vissicular BASALT boulder, 88.8-89ft.							SANDSTONE	
90	White dry silty SAND. Powdery, loose, trace well rounded quartzite and basalt cobbles.							SW	
	Black very moist basaltic SAND. Heavily weathered, and fractured, trace angular basalt fragments.		20					SM	Apparent GW level.
	Light grey wet silty SAND. Coarse angular sand with trace silt.							SM	
	Becomes moist, with slightly higher silt percentage.								
95	Light gray moist silty sandy GRAVEL. 50% well rounded quartzite and basalt cobbles intrained in light grey silty sand. Trace reddish yellow oxidized angular sands. [Lower Troutdale Sandston Aquifer]					100	0.0	GW	End 6/24/2020. Resume 6/25/2020.
		(80-110.5) CEMEX Lapis Lustre Sand #2/12 - sand for filter pack. 16 50lb bags.	15						
100									

CONTRACTOR Cascade
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DRILL MTHD Sonic
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LOGGER S. Parton **REVIEWER** C Bartlett

NORTHING 689588.329
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REMARKS: Well Tag # L135625

COORDINATE SYSTEM: NAGVD29

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-L **SHEET** 5 OF 5
START DATE 6/23/2020 **Elevation** 111.98 FT. MSL
FINISH DATE 6/25/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
105					10			100			
					5				0.0		
110				(110.5-115) Borehole collapsed, native material.	0			100			
									0.0		
115	112ft = Well TD. 115 = Borehole TD.										Well completion 6/25/2020.

CONTRACTOR Cascade
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DRILL MTHD Sonic
DIAMETER 9"-6"
LOGGER S. Parton **REVIEWER** C Bartlett

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EASTING 7700260.401
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REMARKS: Well Tag # L135625

COORDINATE SYSTEM: NAGVD29

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-M **SHEET** 1 OF 5
START DATE 6/26/2020 **Elevation** 111.47 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
0	Reddish brown moist silty SAND. Med-firm, dense.	4" SCH 40 PVC well casing. 2x2ft concrete pad with steel monument. 3 steel bollards.	110			100	0.0	SM	
	Reddish brown very moist silty sandy GRAVEL. Large rounded quartzite and basalt cobbles <5in. [Troutdale Gravel Aquifer]							GM	
	Grey moist sandy SILT. Very firm, brittle, non plastic.							ML	
5	Reddish brown moist silty SAND. Heavily oxidized, dense, micaceous, fine grained sand.	(7-15ft) CETCO Pure Gold medium bentonite chips for seal. 3 50lb bags, hydrate, 1hr cure.	105				0.3	SM	
	Reddish brown very moist sandy SILT with trace gravel. Very soft, highly plastic with fine gravel <0.5in. [Siltstone Unit 1, Subunit A (SU1A)]							ML	
	Bluish green, dry, SILTSTONE. Very firm, nonplastic, brittle. [Confining Unit 1, SU1B]							SILTSTONE	9in to 6in steel casing stepdown with 6in core barrel and bentonite seal at TGA/CU1 contact.
10	Becomes highly fractured.					100		SILTSTONE	
			100				0.0		
	Transitions to a reddish grey.							SILTSTONE	
15	Reddish brown dry SILTSTONE. Highly oxidized,coarse iron red sand grains/nodules, firm, medium cementation. [SU1C]							SILTSTONE	
			95				0.0		
	Transitions to dark brown, wet and highly fractured. Visible water between subangular siltstone pieces.							SILTSTONE	Visible water 19.2-19.8.
20	Brown moist highly plastic SILT.					0		ML	
						100			
			90				0.0		
	Reddish brown dry SANDSTONE. Very hard, well cemented, vitric, coarse, angular grains.							SANDSTONE	
	Brown moist highly plastic SILT.							ML	
	Brown dry SILTSTONE. Very firm, medium cementation.							SILTSTONE	
	Transitions to reddish brown, highly fractured, SILTSTONE. Firm, but poorly cemented. "Rolled"							SILTSTONE	
25									

CONTRACTOR Cascade
EQUIPMENT Terra Sonic Track Rig
DRILL MTHD Sonic
DIAMETER 9"-6"
LOGGER S. P. / C. B. **REVIEWER** C Bartlett

NORTHING 689556.759
EASTING 7700507.574
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L133600

COORDINATE SYSTEM: NAGVD29
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BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-M **SHEET** 2 OF 5
START DATE 6/26/2020 **Elevation** 111.47 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	rounded clumps of siltstone .25-.5in in size.							0		SILTSTONE	
	Bluish green dry SILTSTONE. [SU1D]				85			100		SILTSTONE	
	Highly fractured, firm but poorly cemented, crumbles under slight pressure.								0.0		
	Transitions to reddish brown. Highly fractured with rolled subrounded edges.									SILTSTONE	
30								99			
	Light reddish brown dry SANDSTONE. Angular vitric, coarse sand, very well cemented and competent. [Upper Troutdale Sandstone Aquifer]				80					SANDSTONE	
	Transitions to dark grey.									SANDSTONE	
35	At 34.5', transitions to weathered, loose sand with thin (1") thick pieces of competent, well cemented, vitric sandstone.									SANDSTONE	
					75						
	Transitions to light brown.									SANDSTONE	
40								100			
	Olive grey (5Y 5/2) dry SAND. Loose, interbedded vitric, angular sandstone pieces (5Y 3/2).			(0-70ft) Quik-Grout Bentonite for grout. 9 50lb bags mixed with 270gal water, placed via tremie.	70				0.2	SANDSTONE	Stop 6/26/2020. Resume 6/29/2020.
45									0.9		
					65						
	Olive brown (5Y 4/4) dry SAND with trace silt. Loose, oxidized, angular grains.								0.1	SANDSTONE	
	Light grey dry SAND. Very fine and loose.									SANDSTONE	
50											

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BOREHOLE LOG

BORING VMW-M **SHEET** 3 OF 5
START DATE 6/26/2020 **Elevation** 111.47 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
55			60			100			
						0			Hot core blew out 55-60ft.
60	Light grey to greyish brown (5Y 5/2 to 8Y 3/2) dry SAND. Fine to coarse angular sand with trace silt. Abundant gravel sized, coarse, vitric sandstone pieces. Interbed of competent sandstone at 64ft.		55			100	0.0	SANDSTONE	
65			50			0	0.0		Hot core blew out 65-70ft.
70	Light greyish brown dry SAND. Fine to coarse angular sand with trace silt. Thin interbeds <1in of coarse, vitric, sandstone.	(70-78ft) CETCO Pure Gold medium bentonite chips for seal. 2 50lb bags overnight cure.	45			100	0.0	SANDSTONE	
75			40						

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BOREHOLE LOG

BORING VMW-M **SHEET** 4 OF 5
START DATE 6/26/2020 **Elevation** 111.47 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
80	Sandstone interbeds get thicker, 1-3in.				35			100	0.0		
									0.4		
					30			100	0.1	SANDSTONE	Very hot core. 100% recovery.
85	Light brownish grey, dry, SANDSTONE. Highly weathered, loose.									SANDSTONE	
	At 86.5', black BASALT boulder.				25			100		SANDSTONE	
	Dark grey to black wet SAND. Loose, well graded, coarse, rounded grains.									SW	Apparent GW level.
90	Black wet SANDSTONE. Very hard, non weathered, vitric.									SANDSTONE	
	Reddish brown wet SAND with trace silt. Loose, medium dense, well sorted, micaceous.				20			100	2.3	SW	Measured DTW 6/30/2020.
	Dark grey black wet GRAVEL. Various sized volcanic and quartzite cobbles in a fine silty sand matrix. [Lower Troutdale Sandstone Aquifer]								7.9	GW-GM	
95				(78-110) CEMEX Lapis Lustre Sand #2/12 - sand for filter pack. 26 50lb bags.	15			100	0.1		Hot core, water baked off.
100											

CONTRACTOR Cascade
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BOREHOLE LOG

BORING VMW-M **SHEET** 5 OF 5
START DATE 6/26/2020 **Elevation** 111.47 FT. MSL
FINISH DATE 6/30/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
					10			100	0.1		
105					5			100	0.0		Stop 6/29/2020. Resume 6/30/2020.
110	110ft = Well and borehole TD.								0.0		6/30/2020 Well completion.

CONTRACTOR Cascade
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DIAMETER 9"-6"
LOGGER S. P. / C. B. **REVIEWER** C Bartlett

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GS FORM: CORE3 10/00

BOREHOLE LOG

BORING VMW-N **SHEET** 1 OF 5
START DATE 7/6/2020 **Elevation** 112.52 FT. MSL
FINISH DATE 7/9/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Brown, soft, moist, SILT with organics (root and rootles).	4" SCH 40 PVC well casing. 2x2ft concrete pad with steel monument. 3 steel bollards.				100	0.0	ML	
	Grayish brown, firm, moist, SILT with sand, trace roots.		110					ML	
5	Grayish brown, mottled, strong, dry, SILTSTONE. [Siltstone Unit 1, Subunit A (SU1A)]						0.0	SILTSTONE	
	Reddish orange, weak, moist, SILTSTONE.							SILTSTONE	
	Greyish brown, dry weak, SILTSTONE. Breaks into 3-5" pieces.		105					SILTSTONE	
10		(10-15ft) CETCO Pure Gold medium bentonite chips for seal. 3 50lb bags, hydrate and cure.				100	0.0		
	Greenish blue, moderately strong, dry, SILTSTONE (weathered). [Confirming Unit 1, SU1B]		100				0.0	SILTSTONE	10"-8" steel casing stepdown with 8" core barrel to TGA/CU1 contact. Bentonite seal. Reduce to 6" core barrel thereafter.
15	Dark brown, weak dry, weathered SILTSTONE. [SU1C]					100	0.0	SILTSTONE	
	Transitions to orange and stronger with depth.		95				0.0	SILTSTONE	
20	Transitions to dark brown, moist, SILTSTONE with medium weathered sandstone pieces.					100		SILTSTONE	
			90				0.0		
25									

CONTRACTOR Cascade
EQUIPMENT Terra Sonic Track Rig
DRILL MTHD Sonic
DIAMETER 10"-8"
LOGGER J. Laurance **REVIEWER** C Bartlett

NORTHING 689494.495
EASTING 7700730.268
ANGLE Vertical
BEARING ------
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REMARKS: Well Tag # L135621

COORDINATE SYSTEM: NAGVD29

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BOREHOLE LOG

BORING VMW-N **SHEET** 2 OF 5
START DATE 7/6/2020 **Elevation** 112.52 FT. MSL
FINISH DATE 7/9/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	At 26', 1' dark gray, moist, SILTSTONE lens.					100	0.0	SILTSTONE	
	Brown, strong, dry SILTSTONE, breaks into 2" pieces. [SU1D]		85					SILTSTONE	
30	Grayish brown, weak, dry SANDSTONE with silt (weathered). [Upper Troutdale Sandstone Aquifer]					100	0.0	SANDSTONE	
			80						
35	Transitions to gray and stronger with depth.	(0-68ft) Quik-Grout Bentonite for grout. 6 50lb bags, mixed with water, placed via tremie.				100	0.0	SANDSTONE	
			75						
40	Brown, weak, dry SANDSTONE (weathered) with intact pieces up to 8".					100	0.0	SANDSTONE	
			70				0.0		
45	Transitions to weathered and breaks into 1" to 2" pieces.							SANDSTONE	
			65						
50									

CONTRACTOR Cascade
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DRILL MTHD Sonic
DIAMETER 10"-8"
LOGGER J. Laurance **REVIEWER** C Bartlett

NORTHING 689494.495
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ANGLE Vertical
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REMARKS: Well Tag # L135621

COORDINATE SYSTEM: NAGVD29

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BOREHOLE LOG

BORING VMW-N **SHEET** 3 OF 5
START DATE 7/6/2020 **Elevation** 112.52 FT. MSL
FINISH DATE 7/9/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
55	Brown, weak, very dry SANDSTONE (weathered). pieces of 1" sandstone.				60			100	0.0	SANDSTONE	Very hot; core barrel melted liner.
									0.0		
60					55			100	0.0		
	Dark grayish brown, moist, SILTSTONE with sand.				50				0.0	SILTSTONE	Switched drill riggs to truck rig.
65								100			
	Grayish brown, weak, dry SANDSTONE (a weathered, vitric basaltic coarse sand).			(68-78) CETCO Pure Gold medium bentonite chips for seal. 3 50lb bag.	45					SANDSTONE	
70					40						
75											

CONTRACTOR Cascade
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DIAMETER 10"-8"
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BOREHOLE LOG

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START DATE 7/6/2020 **Elevation** 112.52 FT. MSL
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DEPTH (ft)	MATERIAL DESCRIPTION	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
80	Grayish brown, moderate strength SANDSTONE.		35			100		SANDSTONE	
	Transitions to stronger and more competent.		30					SANDSTONE	
85	Gray, moist, medium SAND with trace silt and fine to coarse gravels.	(78-110.5) CEMEX Lapis Lustre Sand #2/12 - sand for filter pack. 16 50lb bags.	25			100	0.0	SP	
	Becomes wet.						0.0		
90	Brown, most, fine SAND.		20					SP	
	Dark grayish brown, soft, wet SANDY SILT.							SP	
95	Brown, moist, fine SAND.		15			100	0.0	SP	
100									

CONTRACTOR Cascade
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DRILL MTHD Sonic
DIAMETER 10"-8"
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BOREHOLE LOG

BORING VMW-N **SHEET** 5 OF 5
START DATE 7/6/2020 **Elevation** 112.52 FT. MSL
FINISH DATE 7/9/2020
PROJECT Cascade Corporation
LOCATION 2525 NE 201st; Fairview, OR
PROJECT NUMBER PNG0564S20

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOLIC LOG	WELL LOG	WELL CONSTRUCTION MATERIAL	ELEVATION (ft)	SAMPLES: SAMPLE NAME	SAMPLES: TYPE	SAMPLES: % RECOVERY	SAMPLES: PID READING (ppm)	USCS Classification	COMMENTS
	Grayish brown, wet, coarse GRAVEL with sand and cobbles.							100	0.0	GM	
					10						
	Brown, wet, medium SAND with corase gravel and cobbles.									SP	
105									0.0		
	Grayish brown, wet, coarse GRAVEL with sand and cobbles (coarse rounded gravels of basalt, quartzite, rhyolite), weak, fine sandy cementation. [Lower Troutdale Sandstone Aquifer]									GM	
					5						
	Gray, wet, fine GRAVEL with sand.									GM	
110	Grayish black, wet, coarse SAND with fine to coarse gravel and cobbles.			Flat cylinder PVC sump from 110.25 to 110.50					0.0	SW	
	110.5ft = Well and borehole TD.										

CONTRACTOR Cascade
EQUIPMENT Terra Sonic Track Rig
DRILL MTHD Sonic
DIAMETER 10"-8"
LOGGER J. Laurance **REVIEWER** C Bartlett

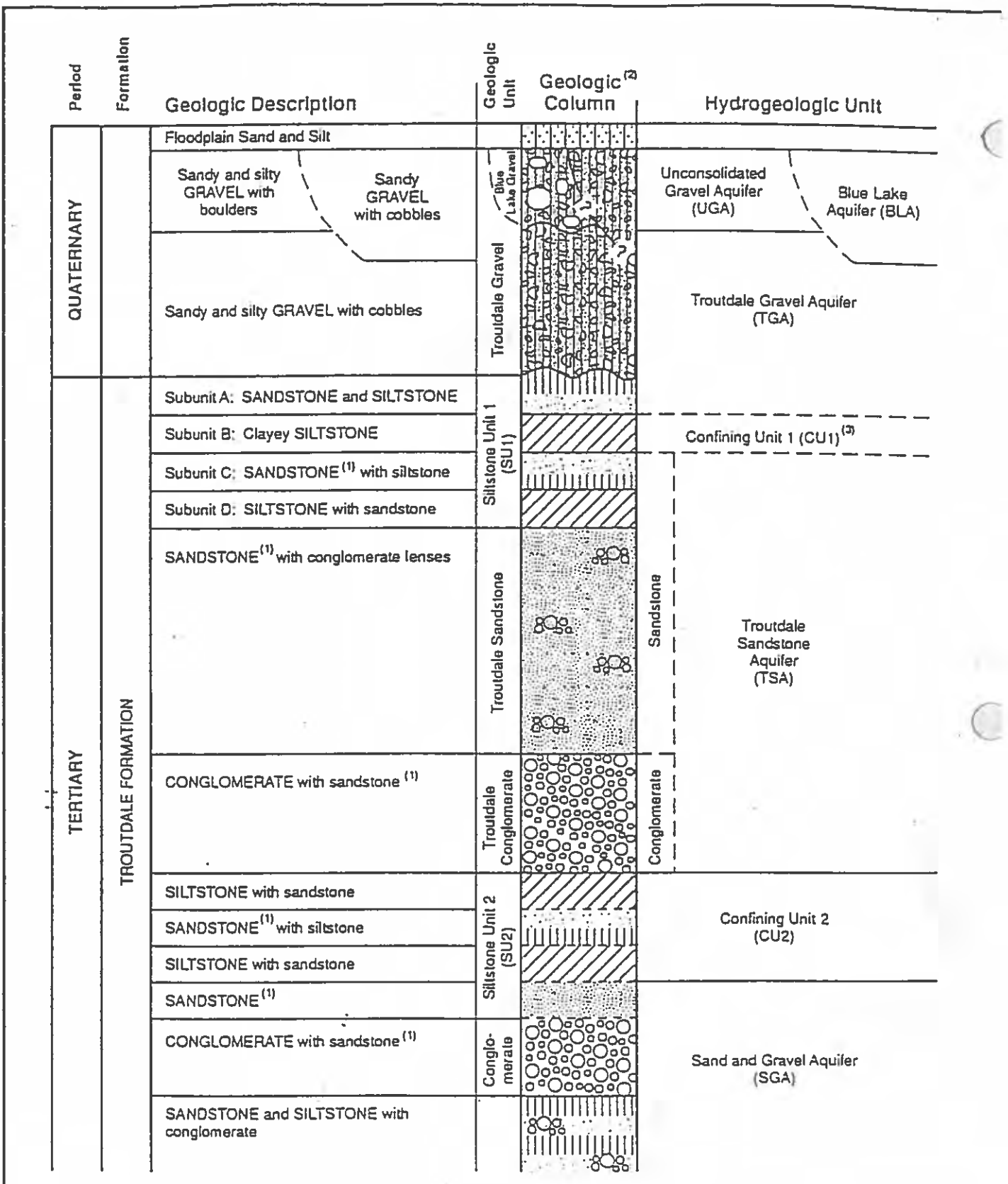
NORTHING 689494.495
EASTING 7700730.268
ANGLE Vertical
BEARING ------
PRINTED 02/18/21

REMARKS: Well Tag # L135621

COORDINATE SYSTEM: NAGVD29

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

BORING LOG W/WELL SONIC (PORTLAND) PNG0564S16 (GINT VMW A-D).GPJ PNW DEFAULT GINT LIBRARY.GLB 2/18/21



Notes: 1. Sandstone may contain large amounts of vitric lithic sand.
2. Geologic column is intended to represent a composite for the study area. Local variations may exist.
3. The designation of CU1 in this report is based on designations used by Landau (1995c), but different than designations used by EMCON (1995b) and the TSA RI report (EMCON and Landau Associates 1995a). Landau (1995c) designates CU1 as being equivalent to SU1 Subunit B.

23110.630 Boeing Portland/TSARIOD/Fig. 3-2 (M) 8/96

Typical Geologic and Hydrogeologic Column

Figure 3-4

ATTACHMENT 2

Photolog

GEOSYNTEC CONSULTANTS

Photographic Record

Geosyntec consultants

Client:	Cascade Corporation
Project Number:	PNG0564S20
Subject Site:	Cascade Corporation TSA Data Gaps

Photograph 1	
Date: July 2020	
Comments: **VMW-J** 5-10 ft bgs: TGA, rounded gravels/cobbles, wet, sand-silt matrix, cementation visible on some gravels	

Photograph 2	
Date: July 2020	
Comments: **VMW-J2** Top row: TGA, rounded gravels Middle row: TGA transitions to SU1a, greyish red to reddish brown weathered sandstone; contact at 18 ft bgs. Bottom row: 26-30 ft bgs, SU1a and CU1 (SU1b) contact at 26.5 ft bgs, visible in right of bottom row, greenish grey, hard siltstone.	

engineers | scientists | innovators

GEOSYNTEC CONSULTANTS

Photographic Record

Client: Cascade Corporation Project Number: PNG0564S20

Subject Site: Cascade Corporation TSA Data Gaps

Photograph 3

Date: July 2020

Comments:

VMW-J2
Top row: CU1 (SU1b) greenish-grey siltstone transitions to brown-grey mottled siltstone.

Bottom row: 40-45 ft bgs, SU1c dark reddish brown sandstone

Photograph 4

Date: July 2020

Comment:

VWM-M
Top row: TGA rounded gravels, approximately 1-5 ft bgs visible in photo.

Middle row: 10-15 ft bgs, CU1 (SU1b), greenish grey siltstone transitions to reddish grey siltstone. In contrast to VMW-J2, siltstone unit is much thinner and less competent, more weathered.

Bottom row: SU1c, reddish brown dry siltstone

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GEOSYNTEC CONSULTANTS

Photographic Record

Client: Cascade Corporation Project Number: PNG0564S20

Subject Site: Cascade Corporation TSA Data Gaps

Photograph 5 Date: July 2020 Comment: **VMW-J** Top row: 62-66 ft bgs, SU1c/d contact at approximately 62 ft bgs, brownish red, sandstone/sand. Bottom row: 72-76 ft bgs, SU1d, dark reddish brown, weathered siltstone.	
Photograph 6 Date: July 2020 Comment: **VMW-J** Top row: SU1c sandstone as seen in Photograph 5. Bottom row: 81.5-86.0 ft bgs, competent, hard reddish brown sandstone, heavily oxidized and well cemented. Note, the Upper TSA Sandstone contact is at 81 ft bgs, just off left side of photograph.	

GEOSYNTEC CONSULTANTS

Photographic Record

Client: Cascade Corporation Project Number: PNG0564S20

Subject Site: Cascade Corporation TSA Data Gaps

Photograph 7 Date: July 2020 Comment: **VMW-M** Top row: SU1c sandstone at 21-25 ft bgs. Bottom row: 30-35 ft bgs, Upper TSA Sandstone. Competent, well cemented sandstone, more weathered/oxidized at contact, transitions to dark grey, less weathered.	
Photograph 8 Date: July 2020 Comment: **VMW-J2** Upper TSA Sandstone, close up photo at 111 ft bgs, shows competent grey unweathered sandstone on the left and orange oxidized (weathered) sandstone on the right; significant oxidation occurred within a very short distance/depth.	

GEOSYNTEC CONSULTANTS

Photographic Record

Client: Cascade Corporation Project Number: PNG0564S20

Subject Site: Cascade Corporation TSA Data Gaps

Photograph 9 Date: July 2020 Comment: **VMW-J** 108-111 ft bgs, Upper TSA, dry brown sandstone, less competent overall in contrast to VMW-J2, with hard sandstone discs (or "pucks") and loose, weathered, friable sandstone/sand.	
Photograph 10 Date: July 2020 Comment: **VMW-K** Top row: 67-72 ft bgs, SU1d, dry dark brown silt with oxidized orange/brown sandstone interbeds up to 3 inches thick. Middle row: 87-91 ft bgs, Upper TSA Sandstone, dry greyish brown, competent sandstone. Bottom row: 106-109 ft bgs, Upper TSA Sandstone, dark grey, wet, loose weathered sandstone/sand.	

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GEOSYNTEC CONSULTANTS

Photographic Record

Client: Cascade Corporation Project Number: PNG0564S20

Subject Site: Cascade Corporation TSA Data Gaps

Photograph 11 Date: July 2020 Comment: **VMW-J** 111-113 ft bgs, Contact between Upper TSA Sandstone and Lower TSA Conglomerate is at approximately 112.8 ft bgs visible in the right side of the photograph. Conglomerate gravel/cobbles are not well cemented, wet, with sandy matrix.	
Photograph 12 Date: July 2020 Comment: **VMW-L** 100-105 ft bgs, wet, dark grey Lower TSA Conglomerate; rounded gravels with sand matrix.	

ATTACHMENT 3

Soil Analytical Laboratory Reports

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

July 06, 2020

Cascade Corporation- Fairview, OR

Sample Delivery Group:	L1233953
Samples Received:	06/26/2020
Project Number:	PNG 0564S/20/02-2
Description:	TSA Data Gaps

Report To: Cindy Bartlett
2201 NE 201st Avenue
Fairview, OR 97024-9718

Entire Report Reviewed By:

Brian Ford
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

TABLE OF CONTENTS

VMW-L 67 L1233953-01 Solid

Collected by: S. Parton
Collected date/time: 06/24/20 16:12
Received date/time: 06/26/20 08:45

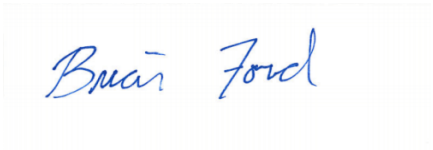
Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1501712	1	06/30/20 23:21	06/30/20 23:36	KBC	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1502044	1	06/24/20 16:12	07/01/20 02:06	BMB	Mt. Juliet, TN

VMW-L 72 L1233953-02 Solid

Collected by: S. Parton
Collected date/time: 06/24/20 16:14
Received date/time: 06/26/20 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1501714	1	06/30/20 23:01	06/30/20 23:14	KBC	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1502044	1	06/24/20 16:14	07/01/20 02:25	BMB	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Brian Ford
Project Manager

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	86.5		1	06/30/2020 23:36	WG1501712

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result (dry)	Qualifier	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg		date / time	
Acetone	ND		0.0578	1	07/01/2020 02:06	WG1502044
Acrylonitrile	ND		0.0144	1	07/01/2020 02:06	WG1502044
Benzene	ND		0.00116	1	07/01/2020 02:06	WG1502044
Bromobenzene	ND		0.0144	1	07/01/2020 02:06	WG1502044
Bromodichloromethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
Bromoform	ND		0.0289	1	07/01/2020 02:06	WG1502044
Bromomethane	ND		0.0144	1	07/01/2020 02:06	WG1502044
n-Butylbenzene	ND		0.0144	1	07/01/2020 02:06	WG1502044
sec-Butylbenzene	ND		0.0144	1	07/01/2020 02:06	WG1502044
tert-Butylbenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
Carbon tetrachloride	ND		0.00578	1	07/01/2020 02:06	WG1502044
Chlorobenzene	ND		0.00289	1	07/01/2020 02:06	WG1502044
Chlorodibromomethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
Chloroethane	ND		0.00578	1	07/01/2020 02:06	WG1502044
Chloroform	ND		0.00289	1	07/01/2020 02:06	WG1502044
Chloromethane	ND		0.0144	1	07/01/2020 02:06	WG1502044
2-Chlorotoluene	ND		0.00289	1	07/01/2020 02:06	WG1502044
4-Chlorotoluene	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,2-Dibromo-3-Chloropropane	ND		0.0289	1	07/01/2020 02:06	WG1502044
1,2-Dibromoethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
Dibromomethane	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,2-Dichlorobenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,3-Dichlorobenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,4-Dichlorobenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
Dichlorodifluoromethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
1,1-Dichloroethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
1,2-Dichloroethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
1,1-Dichloroethene	ND		0.00289	1	07/01/2020 02:06	WG1502044
cis-1,2-Dichloroethene	ND		0.00289	1	07/01/2020 02:06	WG1502044
trans-1,2-Dichloroethene	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,2-Dichloropropane	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,1-Dichloropropene	ND		0.00289	1	07/01/2020 02:06	WG1502044
1,3-Dichloropropane	ND		0.00578	1	07/01/2020 02:06	WG1502044
cis-1,3-Dichloropropene	ND		0.00289	1	07/01/2020 02:06	WG1502044
trans-1,3-Dichloropropene	ND		0.00578	1	07/01/2020 02:06	WG1502044
2,2-Dichloropropane	ND		0.00289	1	07/01/2020 02:06	WG1502044
Di-isopropyl ether	ND		0.00116	1	07/01/2020 02:06	WG1502044
Ethylbenzene	ND		0.00289	1	07/01/2020 02:06	WG1502044
Hexachloro-1,3-butadiene	ND		0.0289	1	07/01/2020 02:06	WG1502044
Isopropylbenzene	ND		0.00289	1	07/01/2020 02:06	WG1502044
p-Isopropyltoluene	ND		0.00578	1	07/01/2020 02:06	WG1502044
2-Butanone (MEK)	0.120	B	0.116	1	07/01/2020 02:06	WG1502044
Methylene Chloride	ND		0.0289	1	07/01/2020 02:06	WG1502044
4-Methyl-2-pentanone (MIBK)	ND		0.0289	1	07/01/2020 02:06	WG1502044
Methyl tert-butyl ether	ND		0.00116	1	07/01/2020 02:06	WG1502044
Naphthalene	ND		0.0144	1	07/01/2020 02:06	WG1502044
n-Propylbenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
Styrene	ND		0.0144	1	07/01/2020 02:06	WG1502044
1,1,1,2-Tetrachloroethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
1,1,2,2-Tetrachloroethane	ND		0.00289	1	07/01/2020 02:06	WG1502044

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result (dry) mg/kg	Qualifier	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
1,1,2-Trichlorotrifluoroethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
Tetrachloroethene	ND		0.00289	1	07/01/2020 02:06	WG1502044
Toluene	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,2,3-Trichlorobenzene	ND		0.0144	1	07/01/2020 02:06	WG1502044
1,2,4-Trichlorobenzene	ND	J4	0.0144	1	07/01/2020 02:06	WG1502044
1,1,1-Trichloroethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
1,1,2-Trichloroethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
Trichloroethene	ND		0.00116	1	07/01/2020 02:06	WG1502044
Trichlorofluoromethane	ND		0.00289	1	07/01/2020 02:06	WG1502044
1,2,3-Trichloropropane	ND		0.0144	1	07/01/2020 02:06	WG1502044
1,2,4-Trimethylbenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,2,3-Trimethylbenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
1,3,5-Trimethylbenzene	ND		0.00578	1	07/01/2020 02:06	WG1502044
Vinyl chloride	ND		0.00289	1	07/01/2020 02:06	WG1502044
Xylenes, Total	ND		0.00751	1	07/01/2020 02:06	WG1502044
(S) Toluene-d8	*109*		*75.0-131*		*07/01/2020 02:06*	WG1502044
(S) 4-Bromofluorobenzene	*98.2*		*67.0-138*		*07/01/2020 02:06*	WG1502044
(S) 1,2-Dichloroethane-d4	*104*		*70.0-130*		*07/01/2020 02:06*	WG1502044

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	83.9		1	06/30/2020 23:14	WG1501714

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result (dry)	Qualifier	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg		date / time	
Acetone	ND		0.0596	1	07/01/2020 02:25	WG1502044
Acrylonitrile	ND		0.0149	1	07/01/2020 02:25	WG1502044
Benzene	ND		0.00119	1	07/01/2020 02:25	WG1502044
Bromobenzene	ND		0.0149	1	07/01/2020 02:25	WG1502044
Bromodichloromethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
Bromoform	ND		0.0298	1	07/01/2020 02:25	WG1502044
Bromomethane	ND		0.0149	1	07/01/2020 02:25	WG1502044
n-Butylbenzene	ND		0.0149	1	07/01/2020 02:25	WG1502044
sec-Butylbenzene	ND		0.0149	1	07/01/2020 02:25	WG1502044
tert-Butylbenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
Carbon tetrachloride	ND		0.00596	1	07/01/2020 02:25	WG1502044
Chlorobenzene	ND		0.00298	1	07/01/2020 02:25	WG1502044
Chlorodibromomethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
Chloroethane	ND		0.00596	1	07/01/2020 02:25	WG1502044
Chloroform	ND		0.00298	1	07/01/2020 02:25	WG1502044
Chloromethane	ND		0.0149	1	07/01/2020 02:25	WG1502044
2-Chlorotoluene	ND		0.00298	1	07/01/2020 02:25	WG1502044
4-Chlorotoluene	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,2-Dibromo-3-Chloropropane	ND		0.0298	1	07/01/2020 02:25	WG1502044
1,2-Dibromoethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
Dibromomethane	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,2-Dichlorobenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,3-Dichlorobenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,4-Dichlorobenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
Dichlorodifluoromethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
1,1-Dichloroethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
1,2-Dichloroethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
1,1-Dichloroethene	ND		0.00298	1	07/01/2020 02:25	WG1502044
cis-1,2-Dichloroethene	ND		0.00298	1	07/01/2020 02:25	WG1502044
trans-1,2-Dichloroethene	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,2-Dichloropropane	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,1-Dichloropropene	ND		0.00298	1	07/01/2020 02:25	WG1502044
1,3-Dichloropropane	ND		0.00596	1	07/01/2020 02:25	WG1502044
cis-1,3-Dichloropropene	ND		0.00298	1	07/01/2020 02:25	WG1502044
trans-1,3-Dichloropropene	ND		0.00596	1	07/01/2020 02:25	WG1502044
2,2-Dichloropropane	ND		0.00298	1	07/01/2020 02:25	WG1502044
Di-isopropyl ether	ND		0.00119	1	07/01/2020 02:25	WG1502044
Ethylbenzene	ND		0.00298	1	07/01/2020 02:25	WG1502044
Hexachloro-1,3-butadiene	ND		0.0298	1	07/01/2020 02:25	WG1502044
Isopropylbenzene	ND		0.00298	1	07/01/2020 02:25	WG1502044
p-Isopropyltoluene	ND		0.00596	1	07/01/2020 02:25	WG1502044
2-Butanone (MEK)	0.120	B	0.119	1	07/01/2020 02:25	WG1502044
Methylene Chloride	ND		0.0298	1	07/01/2020 02:25	WG1502044
4-Methyl-2-pentanone (MIBK)	ND		0.0298	1	07/01/2020 02:25	WG1502044
Methyl tert-butyl ether	ND		0.00119	1	07/01/2020 02:25	WG1502044
Naphthalene	ND		0.0149	1	07/01/2020 02:25	WG1502044
n-Propylbenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
Styrene	ND		0.0149	1	07/01/2020 02:25	WG1502044
1,1,1,2-Tetrachloroethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
1,1,2,2-Tetrachloroethane	ND		0.00298	1	07/01/2020 02:25	WG1502044

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result (dry) mg/kg	Qualifier	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
1,1,2-Trichlorotrifluoroethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
Tetrachloroethene	ND		0.00298	1	07/01/2020 02:25	WG1502044
Toluene	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,2,3-Trichlorobenzene	ND		0.0149	1	07/01/2020 02:25	WG1502044
1,2,4-Trichlorobenzene	ND	J4	0.0149	1	07/01/2020 02:25	WG1502044
1,1,1-Trichloroethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
1,1,2-Trichloroethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
Trichloroethene	ND		0.00119	1	07/01/2020 02:25	WG1502044
Trichlorofluoromethane	ND		0.00298	1	07/01/2020 02:25	WG1502044
1,2,3-Trichloropropane	ND		0.0149	1	07/01/2020 02:25	WG1502044
1,2,4-Trimethylbenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,2,3-Trimethylbenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
1,3,5-Trimethylbenzene	ND		0.00596	1	07/01/2020 02:25	WG1502044
Vinyl chloride	ND		0.00298	1	07/01/2020 02:25	WG1502044
Xylenes, Total	ND		0.00774	1	07/01/2020 02:25	WG1502044
(S) Toluene-d8	*111*		*75.0-131*		*07/01/2020 02:25*	WG1502044
(S) 4-Bromofluorobenzene	*99.5*		*67.0-138*		*07/01/2020 02:25*	WG1502044
(S) 1,2-Dichloroethane-d4	*105*		*70.0-130*		*07/01/2020 02:25*	WG1502044

Method Blank (MB)

(MB) R3545230-1 06/30/20 23:36

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.000			

L1233917-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1233917-01 06/30/20 23:36 • (DUP) R3545230-3 06/30/20 23:36

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	84.7	82.6	1	2.52		10

Laboratory Control Sample (LCS)

(LCS) R3545230-2 06/30/20 23:36

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3545228-1 06/30/20 23:14

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.00100			

L1233953-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1233953-02 06/30/20 23:14 • (DUP) R3545228-3 06/30/20 23:14

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	83.9	84.0	1	0.0969		10

Laboratory Control Sample (LCS)

(LCS) R3545228-2 06/30/20 23:14

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3546148-2 06/30/20 21:37

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Acetone	U		0.0365	0.0500
Acrylonitrile	U		0.00361	0.0125
Benzene	U		0.000467	0.00100
Bromobenzene	U		0.000900	0.0125
Bromodichloromethane	U		0.000725	0.00250
Bromoform	U		0.00117	0.0250
Bromomethane	U		0.00197	0.0125
n-Butylbenzene	U		0.00525	0.0125
sec-Butylbenzene	U		0.00288	0.0125
tert-Butylbenzene	U		0.00195	0.00500
Carbon tetrachloride	U		0.000898	0.00500
Chlorobenzene	U		0.000210	0.00250
Chlorodibromomethane	U		0.000612	0.00250
Chloroethane	U		0.00170	0.00500
Chloroform	U		0.00103	0.00250
Chloromethane	U		0.00435	0.0125
2-Chlorotoluene	U		0.000865	0.00250
4-Chlorotoluene	U		0.000450	0.00500
1,2-Dibromo-3-Chloropropane	U		0.00390	0.0250
1,2-Dibromoethane	U		0.000648	0.00250
Dibromomethane	U		0.000750	0.00500
1,2-Dichlorobenzene	U		0.000425	0.00500
1,3-Dichlorobenzene	U		0.000600	0.00500
1,4-Dichlorobenzene	U		0.000700	0.00500
Dichlorodifluoromethane	U		0.00161	0.00250
1,1-Dichloroethane	U		0.000491	0.00250
1,2-Dichloroethane	U		0.000649	0.00250
1,1-Dichloroethene	U		0.000606	0.00250
cis-1,2-Dichloroethene	U		0.000734	0.00250
trans-1,2-Dichloroethene	U		0.00104	0.00500
1,2-Dichloropropane	U		0.00142	0.00500
1,1-Dichloropropene	U		0.000809	0.00250
1,3-Dichloropropane	U		0.000501	0.00500
cis-1,3-Dichloropropene	U		0.000757	0.00250
trans-1,3-Dichloropropene	U		0.00114	0.00500
2,2-Dichloropropane	U		0.00138	0.00250
Di-isopropyl ether	U		0.000410	0.00100
Ethylbenzene	U		0.000737	0.00250
Hexachloro-1,3-butadiene	U		0.00600	0.0250
Isopropylbenzene	U		0.000425	0.00250

Method Blank (MB)

(MB) R3546148-2 06/30/20 21:37

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
p-Isopropyltoluene	U		0.00255	0.00500
2-Butanone (MEK)	0.0736	J	0.0635	0.100
Methylene Chloride	U		0.00664	0.0250
4-Methyl-2-pentanone (MIBK)	U		0.00228	0.0250
Methyl tert-butyl ether	U		0.000350	0.00100
Naphthalene	U		0.00488	0.0125
n-Propylbenzene	U		0.000950	0.00500
Styrene	U		0.000229	0.0125
1,1,1,2-Tetrachloroethane	U		0.000948	0.00250
1,1,2,2-Tetrachloroethane	U		0.000695	0.00250
Tetrachloroethene	U		0.000896	0.00250
Toluene	U		0.00130	0.00500
1,1,2-Trichlorotrifluoroethane	U		0.000754	0.00250
1,2,3-Trichlorobenzene	U		0.00733	0.0125
1,2,4-Trichlorobenzene	U		0.00440	0.0125
1,1,1-Trichloroethane	U		0.000923	0.00250
1,1,2-Trichloroethane	U		0.000597	0.00250
Trichloroethene	U		0.000584	0.00100
Trichlorofluoromethane	U		0.000827	0.00250
1,2,3-Trichloropropane	U		0.00162	0.0125
1,2,3-Trimethylbenzene	U		0.00158	0.00500
1,2,4-Trimethylbenzene	U		0.00158	0.00500
1,3,5-Trimethylbenzene	U		0.00200	0.00500
Vinyl chloride	U		0.00116	0.00250
Xylenes, Total	U		0.000880	0.00650
(S) Toluene-d8	*110*			*75.0-131*
(S) 4-Bromofluorobenzene	*103*			*67.0-138*
(S) 1,2-Dichloroethane-d4	*104*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3546148-1 06/30/20 20:40

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Acetone	0.625	0.784	125	10.0-160	
Acrylonitrile	0.625	0.794	127	45.0-153	
Benzene	0.125	0.122	97.6	70.0-123	
Bromobenzene	0.125	0.108	86.4	73.0-121	
Bromodichloromethane	0.125	0.116	92.8	73.0-121	

Laboratory Control Sample (LCS)

(LCS) R3546148-1 06/30/20 20:40

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Bromoform	0.125	0.118	94.4	64.0-132	
Bromomethane	0.125	0.132	106	56.0-147	
n-Butylbenzene	0.125	0.115	92.0	68.0-135	
sec-Butylbenzene	0.125	0.111	88.8	74.0-130	
tert-Butylbenzene	0.125	0.111	88.8	75.0-127	
Carbon tetrachloride	0.125	0.0998	79.8	66.0-128	
Chlorobenzene	0.125	0.118	94.4	76.0-128	
Chlorodibromomethane	0.125	0.111	88.8	74.0-127	
Chloroethane	0.125	0.115	92.0	61.0-134	
Chloroform	0.125	0.122	97.6	72.0-123	
Chloromethane	0.125	0.116	92.8	51.0-138	
2-Chlorotoluene	0.125	0.117	93.6	75.0-124	
4-Chlorotoluene	0.125	0.110	88.0	75.0-124	
1,2-Dibromo-3-Chloropropane	0.125	0.119	95.2	59.0-130	
1,2-Dibromoethane	0.125	0.109	87.2	74.0-128	
Dibromomethane	0.125	0.129	103	75.0-122	
1,2-Dichlorobenzene	0.125	0.113	90.4	76.0-124	
1,3-Dichlorobenzene	0.125	0.120	96.0	76.0-125	
1,4-Dichlorobenzene	0.125	0.111	88.8	77.0-121	
Dichlorodifluoromethane	0.125	0.142	114	43.0-156	
1,1-Dichloroethane	0.125	0.115	92.0	70.0-127	
1,2-Dichloroethane	0.125	0.126	101	65.0-131	
1,1-Dichloroethene	0.125	0.123	98.4	65.0-131	
cis-1,2-Dichloroethene	0.125	0.118	94.4	73.0-125	
trans-1,2-Dichloroethene	0.125	0.128	102	71.0-125	
1,2-Dichloropropane	0.125	0.114	91.2	74.0-125	
1,1-Dichloropropene	0.125	0.110	88.0	73.0-125	
1,3-Dichloropropane	0.125	0.117	93.6	80.0-125	
cis-1,3-Dichloropropene	0.125	0.120	96.0	76.0-127	
trans-1,3-Dichloropropene	0.125	0.114	91.2	73.0-127	
2,2-Dichloropropane	0.125	0.115	92.0	59.0-135	
Di-isopropyl ether	0.125	0.128	102	60.0-136	
Ethylbenzene	0.125	0.113	90.4	74.0-126	
Hexachloro-1,3-butadiene	0.125	0.163	130	57.0-150	
Isopropylbenzene	0.125	0.119	95.2	72.0-127	
p-Isopropyltoluene	0.125	0.109	87.2	72.0-133	
2-Butanone (MEK)	0.625	0.700	112	30.0-160	
Methylene Chloride	0.125	0.117	93.6	68.0-123	
4-Methyl-2-pentanone (MIBK)	0.625	0.637	102	56.0-143	
Methyl tert-butyl ether	0.125	0.129	103	66.0-132	

Laboratory Control Sample (LCS)

(LCS) R3546148-1 06/30/20 20:40

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCS Rec. %	Rec. Limits %	LCS Qualifier
Naphthalene	0.125	0.128	102	59.0-130	
n-Propylbenzene	0.125	0.107	85.6	74.0-126	
Styrene	0.125	0.106	84.8	72.0-127	
1,1,1,2-Tetrachloroethane	0.125	0.112	89.6	74.0-129	
1,1,2,2-Tetrachloroethane	0.125	0.109	87.2	68.0-128	
Tetrachloroethene	0.125	0.112	89.6	70.0-136	
Toluene	0.125	0.117	93.6	75.0-121	
1,1,2-Trichlorotrifluoroethane	0.125	0.108	86.4	61.0-139	
1,2,3-Trichlorobenzene	0.125	0.171	137	59.0-139	
1,2,4-Trichlorobenzene	0.125	0.186	149	62.0-137	J4
1,1,1-Trichloroethane	0.125	0.125	100	69.0-126	
1,1,2-Trichloroethane	0.125	0.107	85.6	78.0-123	
Trichloroethene	0.125	0.116	92.8	76.0-126	
Trichlorofluoromethane	0.125	0.123	98.4	61.0-142	
1,2,3-Trichloropropane	0.125	0.126	101	67.0-129	
1,2,3-Trimethylbenzene	0.125	0.0962	77.0	74.0-124	
1,2,4-Trimethylbenzene	0.125	0.104	83.2	70.0-126	
1,3,5-Trimethylbenzene	0.125	0.117	93.6	73.0-127	
Vinyl chloride	0.125	0.111	88.8	63.0-134	
Xylenes, Total	0.375	0.347	92.5	72.0-127	
(S) Toluene-d8			*106*	*75.0-131*	
(S) 4-Bromofluorobenzene			*104*	*67.0-138*	
(S) 1,2-Dichloroethane-d4			*110*	*70.0-130*	

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
RDL (dry)	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
J	The identification of the analyte is acceptable; the reported value is an estimate.
J4	The associated batch QC was outside the established quality control range for accuracy.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

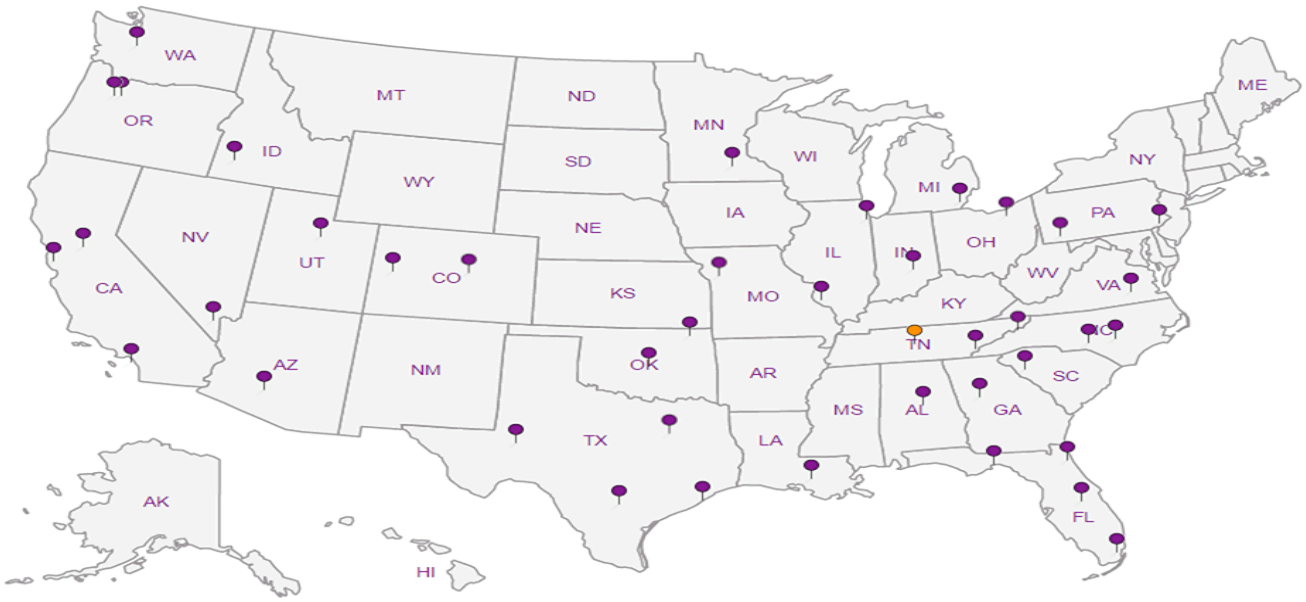
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



Cascade Corporation- Fairview, OR

2201 NE 201st Avenue
Fairview, OR 97024-9718

Billing Information:
Cascade Corp.
Accounts Payable
P.O. Box 20187
Portland, OR 97294-0187

Pres Chk

Analysis / Container / Preservative

RCRA8 Metals 6020 4ozClr-NoPres	VOCs 8260D 40mlAmb/MeOH5ml/Syr	
	X	X VOCs 8260 4oz amb. SP
	X	X

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

Report to: Cindy Bartlett

Email To: CBartlett@Geosyntec.com;bwebb@Geosyntec.c

Project Description: TSA Data Gaps

City/State Collected: Gresham, OR

Please Circle: PT MT CT ET

Phone: 503-669-6286

Client Project # PNG0564S/20/02.2

Lab Project # CASCORFOR-PNG0564

SDG # C123753

G117

Collected by (print): S. Parton

Site/Facility ID #

P.O. # Cascade Corp

Acctnum: CASCORFOR

Template: T166332

Collected by (signature):

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Prelogin: P768262

PM: 110 - Brian Ford

PB:

Shipped Via:

Immediately Packed on Ice N ___ Y X

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	Remarks	Sample # (lab only)
VMW-L 67	Comp	SS	67	6/24/20	1612	2		-01
VMW-L 72	Comp	SS	72	6/24/20	1614	2		-02

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: email cbartlett@geosyntec.com
elves@landauinc.com
ckimmel@landauinc.com

pH _____ Temp _____

Flow _____ Other _____

Samples returned via: __ UPS __ FedEx __ Courier _____

Tracking # 1411 1755 8066

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR	If preservation required by Login: Date/Time
Relinquished by : (Signature)	6/25/20	1715			
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 1.7 +.1=.6 °C Bottles Received: 4	
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 6/26/20 Time: 8:45	Hold: Condition: NCF / OK

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

July 11, 2020

Cascade Corporation- Fairview, OR

Sample Delivery Group:	L1235402
Samples Received:	07/01/2020
Project Number:	PNG0564S20-02.2
Description:	Data Gaps VMW-J2
Site:	DATA GAPS
Report To:	Cindy Bartlett 2201 NE 201st Avenue Fairview, OR 97024-9718

Entire Report Reviewed By:

Brian Ford

Brian Ford
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

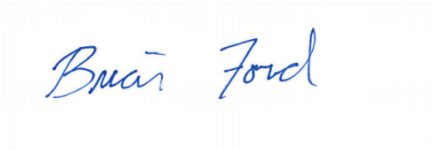
TABLE OF CONTENTS

VMWJ2-82.75-20200629 L1235402-01 Solid

Collected by: Cindy Bartlett
Collected date/time: 06/29/20 11:30
Received date/time: 07/01/20 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Total Solids by Method 2540 G-2011	WG1504974	1	07/07/20 23:08	07/07/20 23:19	KBC	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260D	WG1504838	1	06/29/20 11:30	07/07/20 18:18	JHH	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Brian Ford
Project Manager

Total Solids by Method 2540 G-2011

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	%			date / time	
Total Solids	79.7		1	07/07/2020 23:19	WG1504974

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result (dry)	Qualifier	RDL (dry)	Dilution	Analysis	Batch
	mg/kg		mg/kg		date / time	
Acetone	ND		0.0787	1	07/07/2020 18:18	WG1504838
Acrylonitrile	ND		0.0197	1	07/07/2020 18:18	WG1504838
Benzene	ND		0.00157	1	07/07/2020 18:18	WG1504838
Bromobenzene	ND		0.0197	1	07/07/2020 18:18	WG1504838
Bromodichloromethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
Bromoform	ND		0.0394	1	07/07/2020 18:18	WG1504838
Bromomethane	ND		0.0197	1	07/07/2020 18:18	WG1504838
n-Butylbenzene	ND		0.0197	1	07/07/2020 18:18	WG1504838
sec-Butylbenzene	ND		0.0197	1	07/07/2020 18:18	WG1504838
tert-Butylbenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
Carbon tetrachloride	ND		0.00787	1	07/07/2020 18:18	WG1504838
Chlorobenzene	ND		0.00394	1	07/07/2020 18:18	WG1504838
Chlorodibromomethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
Chloroethane	ND		0.00787	1	07/07/2020 18:18	WG1504838
Chloroform	ND		0.00394	1	07/07/2020 18:18	WG1504838
Chloromethane	ND		0.0197	1	07/07/2020 18:18	WG1504838
2-Chlorotoluene	ND		0.00394	1	07/07/2020 18:18	WG1504838
4-Chlorotoluene	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,2-Dibromo-3-Chloropropane	ND		0.0394	1	07/07/2020 18:18	WG1504838
1,2-Dibromoethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
Dibromomethane	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,2-Dichlorobenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,3-Dichlorobenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,4-Dichlorobenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
Dichlorodifluoromethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
1,1-Dichloroethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
1,2-Dichloroethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
1,1-Dichloroethene	ND		0.00394	1	07/07/2020 18:18	WG1504838
cis-1,2-Dichloroethene	ND		0.00394	1	07/07/2020 18:18	WG1504838
trans-1,2-Dichloroethene	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,2-Dichloropropane	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,1-Dichloropropene	ND		0.00394	1	07/07/2020 18:18	WG1504838
1,3-Dichloropropane	ND		0.00787	1	07/07/2020 18:18	WG1504838
cis-1,3-Dichloropropene	ND		0.00394	1	07/07/2020 18:18	WG1504838
trans-1,3-Dichloropropene	ND		0.00787	1	07/07/2020 18:18	WG1504838
2,2-Dichloropropane	ND		0.00394	1	07/07/2020 18:18	WG1504838
Di-isopropyl ether	ND		0.00157	1	07/07/2020 18:18	WG1504838
Ethylbenzene	ND		0.00394	1	07/07/2020 18:18	WG1504838
Hexachloro-1,3-butadiene	ND		0.0394	1	07/07/2020 18:18	WG1504838
Isopropylbenzene	ND		0.00394	1	07/07/2020 18:18	WG1504838
p-Isopropyltoluene	ND		0.00787	1	07/07/2020 18:18	WG1504838
2-Butanone (MEK)	ND		0.157	1	07/07/2020 18:18	WG1504838
Methylene Chloride	ND		0.0394	1	07/07/2020 18:18	WG1504838
4-Methyl-2-pentanone (MIBK)	ND		0.0394	1	07/07/2020 18:18	WG1504838
Methyl tert-butyl ether	ND		0.00157	1	07/07/2020 18:18	WG1504838
Naphthalene	ND		0.0197	1	07/07/2020 18:18	WG1504838
n-Propylbenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
Styrene	ND		0.0197	1	07/07/2020 18:18	WG1504838
1,1,1,2-Tetrachloroethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
1,1,2,2-Tetrachloroethane	ND		0.00394	1	07/07/2020 18:18	WG1504838

Volatile Organic Compounds (GC/MS) by Method 8260D

Analyte	Result (dry) mg/kg	Qualifier	RDL (dry) mg/kg	Dilution	Analysis date / time	Batch
1,1,2-Trichlorotrifluoroethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
Tetrachloroethene	ND		0.00394	1	07/07/2020 18:18	WG1504838
Toluene	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,2,3-Trichlorobenzene	ND		0.0197	1	07/07/2020 18:18	WG1504838
1,2,4-Trichlorobenzene	ND		0.0197	1	07/07/2020 18:18	WG1504838
1,1,1-Trichloroethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
1,1,2-Trichloroethane	ND	J4	0.00394	1	07/07/2020 18:18	WG1504838
Trichloroethene	0.00535		0.00157	1	07/07/2020 18:18	WG1504838
Trichlorofluoromethane	ND		0.00394	1	07/07/2020 18:18	WG1504838
1,2,3-Trichloropropane	ND		0.0197	1	07/07/2020 18:18	WG1504838
1,2,4-Trimethylbenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,2,3-Trimethylbenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
1,3,5-Trimethylbenzene	ND		0.00787	1	07/07/2020 18:18	WG1504838
Vinyl chloride	ND		0.00394	1	07/07/2020 18:18	WG1504838
Xylenes, Total	ND		0.0102	1	07/07/2020 18:18	WG1504838
(S) Toluene-d8	*107*		*75.0-131*		*07/07/2020 18:18*	WG1504838
(S) 4-Bromofluorobenzene	*89.7*		*67.0-138*		*07/07/2020 18:18*	WG1504838
(S) 1,2-Dichloroethane-d4	*88.3*		*70.0-130*		*07/07/2020 18:18*	WG1504838

Method Blank (MB)

(MB) R3547482-1 07/07/20 23:19

Analyte	MB Result %	MB Qualifier	MB MDL %	MB RDL %
Total Solids	0.00100			

L1235405-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1235405-03 07/07/20 23:19 • (DUP) R3547482-3 07/07/20 23:19

Analyte	Original Result %	DUP Result %	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Total Solids	79.0	79.2	1	0.313		10

Laboratory Control Sample (LCS)

(LCS) R3547482-2 07/07/20 23:19

Analyte	Spike Amount %	LCS Result %	LCS Rec. %	Rec. Limits %	LCS Qualifier
Total Solids	50.0	50.0	100	85.0-115	

Method Blank (MB)

(MB) R3547018-3 07/07/20 12:02

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
Acetone	U		0.0365	0.0500
Acrylonitrile	U		0.00361	0.0125
Benzene	U		0.000467	0.00100
Bromobenzene	U		0.000900	0.0125
Bromodichloromethane	U		0.000725	0.00250
Bromoform	U		0.00117	0.0250
Bromomethane	U		0.00197	0.0125
n-Butylbenzene	U		0.00525	0.0125
sec-Butylbenzene	U		0.00288	0.0125
tert-Butylbenzene	U		0.00195	0.00500
Carbon tetrachloride	U		0.000898	0.00500
Chlorobenzene	U		0.000210	0.00250
Chlorodibromomethane	U		0.000612	0.00250
Chloroethane	U		0.00170	0.00500
Chloroform	U		0.00103	0.00250
Chloromethane	U		0.00435	0.0125
2-Chlorotoluene	U		0.000865	0.00250
4-Chlorotoluene	U		0.000450	0.00500
1,2-Dibromo-3-Chloropropane	U		0.00390	0.0250
1,2-Dibromoethane	U		0.000648	0.00250
Dibromomethane	U		0.000750	0.00500
1,2-Dichlorobenzene	U		0.000425	0.00500
1,3-Dichlorobenzene	U		0.000600	0.00500
1,4-Dichlorobenzene	U		0.000700	0.00500
Dichlorodifluoromethane	U		0.00161	0.00250
1,1-Dichloroethane	U		0.000491	0.00250
1,2-Dichloroethane	U		0.000649	0.00250
1,1-Dichloroethene	U		0.000606	0.00250
cis-1,2-Dichloroethene	U		0.000734	0.00250
trans-1,2-Dichloroethene	U		0.00104	0.00500
1,2-Dichloropropane	U		0.00142	0.00500
1,1-Dichloropropene	U		0.000809	0.00250
1,3-Dichloropropane	U		0.000501	0.00500
cis-1,3-Dichloropropene	U		0.000757	0.00250
trans-1,3-Dichloropropene	U		0.00114	0.00500
2,2-Dichloropropane	U		0.00138	0.00250
Di-isopropyl ether	U		0.000410	0.00100
Ethylbenzene	U		0.000737	0.00250
Hexachloro-1,3-butadiene	U		0.00600	0.0250
Isopropylbenzene	U		0.000425	0.00250

Method Blank (MB)

(MB) R3547018-3 07/07/20 12:02

Analyte	MB Result mg/kg	MB Qualifier	MB MDL mg/kg	MB RDL mg/kg
p-Isopropyltoluene	U		0.00255	0.00500
2-Butanone (MEK)	U		0.0635	0.100
Methylene Chloride	U		0.00664	0.0250
4-Methyl-2-pentanone (MIBK)	U		0.00228	0.0250
Methyl tert-butyl ether	U		0.000350	0.00100
Naphthalene	U		0.00488	0.0125
n-Propylbenzene	U		0.000950	0.00500
Styrene	U		0.000229	0.0125
1,1,1,2-Tetrachloroethane	U		0.000948	0.00250
1,1,2,2-Tetrachloroethane	U		0.000695	0.00250
Tetrachloroethene	U		0.000896	0.00250
Toluene	U		0.00130	0.00500
1,1,2-Trichlorotrifluoroethane	U		0.000754	0.00250
1,2,3-Trichlorobenzene	U		0.00733	0.0125
1,2,4-Trichlorobenzene	U		0.00440	0.0125
1,1,1-Trichloroethane	U		0.000923	0.00250
1,1,2-Trichloroethane	U		0.000597	0.00250
Trichloroethene	U		0.000584	0.00100
Trichlorofluoromethane	U		0.000827	0.00250
1,2,3-Trichloropropane	U		0.00162	0.0125
1,2,3-Trimethylbenzene	U		0.00158	0.00500
1,2,4-Trimethylbenzene	U		0.00158	0.00500
1,3,5-Trimethylbenzene	U		0.00200	0.00500
Vinyl chloride	U		0.00116	0.00250
Xylenes, Total	U		0.000880	0.00650
(S) Toluene-d8	*107*			*75.0-131*
(S) 4-Bromofluorobenzene	*89.4*			*67.0-138*
(S) 1,2-Dichloroethane-d4	*89.4*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3547018-1 07/07/20 10:46 • (LCSD) R3547018-2 07/07/20 11:05

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Acetone	0.625	0.549	0.404	87.8	64.6	10.0-160			30.4	31
Acrylonitrile	0.625	0.502	0.554	80.3	88.6	45.0-153			9.85	22
Benzene	0.125	0.108	0.106	86.4	84.8	70.0-123			1.87	20
Bromobenzene	0.125	0.113	0.107	90.4	85.6	73.0-121			5.45	20
Bromodichloromethane	0.125	0.139	0.137	111	110	73.0-121			1.45	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3547018-1 07/07/20 10:46 • (LCSD) R3547018-2 07/07/20 11:05

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Bromoform	0.125	0.0871	0.0906	69.7	72.5	64.0-132			3.94	20
Bromomethane	0.125	0.108	0.109	86.4	87.2	56.0-147			0.922	20
n-Butylbenzene	0.125	0.128	0.124	102	99.2	68.0-135			3.17	20
sec-Butylbenzene	0.125	0.115	0.110	92.0	88.0	74.0-130			4.44	20
tert-Butylbenzene	0.125	0.153	0.146	122	117	75.0-127			4.68	20
Carbon tetrachloride	0.125	0.114	0.117	91.2	93.6	66.0-128			2.60	20
Chlorobenzene	0.125	0.112	0.110	89.6	88.0	76.0-128			1.80	20
Chlorodibromomethane	0.125	0.101	0.0986	80.8	78.9	74.0-127			2.40	20
Chloroethane	0.125	0.112	0.113	89.6	90.4	61.0-134			0.889	20
Chloroform	0.125	0.129	0.130	103	104	72.0-123			0.772	20
Chloromethane	0.125	0.128	0.135	102	108	51.0-138			5.32	20
2-Chlorotoluene	0.125	0.135	0.127	108	102	75.0-124			6.11	20
4-Chlorotoluene	0.125	0.125	0.120	100	96.0	75.0-124			4.08	20
1,2-Dibromo-3-Chloropropane	0.125	0.102	0.106	81.6	84.8	59.0-130			3.85	20
1,2-Dibromoethane	0.125	0.123	0.122	98.4	97.6	74.0-128			0.816	20
Dibromomethane	0.125	0.118	0.112	94.4	89.6	75.0-122			5.22	20
1,2-Dichlorobenzene	0.125	0.0985	0.0955	78.8	76.4	76.0-124			3.09	20
1,3-Dichlorobenzene	0.125	0.112	0.106	89.6	84.8	76.0-125			5.50	20
1,4-Dichlorobenzene	0.125	0.105	0.101	84.0	80.8	77.0-121			3.88	20
Dichlorodifluoromethane	0.125	0.144	0.145	115	116	43.0-156			0.692	20
1,1-Dichloroethane	0.125	0.126	0.128	101	102	70.0-127			1.57	20
1,2-Dichloroethane	0.125	0.104	0.102	83.2	81.6	65.0-131			1.94	20
1,1-Dichloroethene	0.125	0.116	0.121	92.8	96.8	65.0-131			4.22	20
cis-1,2-Dichloroethene	0.125	0.0964	0.0997	77.1	79.8	73.0-125			3.37	20
trans-1,2-Dichloroethene	0.125	0.146	0.151	117	121	71.0-125			3.37	20
1,2-Dichloropropane	0.125	0.126	0.121	101	96.8	74.0-125			4.05	20
1,1-Dichloropropene	0.125	0.119	0.115	95.2	92.0	73.0-125			3.42	20
1,3-Dichloropropane	0.125	0.117	0.109	93.6	87.2	80.0-125			7.08	20
cis-1,3-Dichloropropene	0.125	0.126	0.119	101	95.2	76.0-127			5.71	20
trans-1,3-Dichloropropene	0.125	0.118	0.111	94.4	88.8	73.0-127			6.11	20
2,2-Dichloropropane	0.125	0.125	0.126	100	101	59.0-135			0.797	20
Di-isopropyl ether	0.125	0.109	0.110	87.2	88.0	60.0-136			0.913	20
Ethylbenzene	0.125	0.122	0.119	97.6	95.2	74.0-126			2.49	20
Hexachloro-1,3-butadiene	0.125	0.101	0.103	80.8	82.4	57.0-150			1.96	20
Isopropylbenzene	0.125	0.115	0.116	92.0	92.8	72.0-127			0.866	20
p-Isopropyltoluene	0.125	0.115	0.111	92.0	88.8	72.0-133			3.54	20
2-Butanone (MEK)	0.625	0.590	0.584	94.4	93.4	30.0-160			1.02	24
Methylene Chloride	0.125	0.0962	0.101	77.0	80.8	68.0-123			4.87	20
4-Methyl-2-pentanone (MIBK)	0.625	0.593	0.588	94.9	94.1	56.0-143			0.847	20
Methyl tert-butyl ether	0.125	0.126	0.132	101	106	66.0-132			4.65	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3547018-1 07/07/20 10:46 • (LCSD) R3547018-2 07/07/20 11:05

Analyte	Spike Amount mg/kg	LCS Result mg/kg	LCSD Result mg/kg	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Naphthalene	0.125	0.109	0.113	87.2	90.4	59.0-130			3.60	20
n-Propylbenzene	0.125	0.121	0.113	96.8	90.4	74.0-126			6.84	20
Styrene	0.125	0.120	0.119	96.0	95.2	72.0-127			0.837	20
1,1,1,2-Tetrachloroethane	0.125	0.119	0.118	95.2	94.4	74.0-129			0.844	20
1,1,2,2-Tetrachloroethane	0.125	0.119	0.113	95.2	90.4	68.0-128			5.17	20
Tetrachloroethene	0.125	0.115	0.112	92.0	89.6	70.0-136			2.64	20
Toluene	0.125	0.115	0.109	92.0	87.2	75.0-121			5.36	20
1,1,2-Trichlorotrifluoroethane	0.125	0.128	0.133	102	106	61.0-139			3.83	20
1,2,3-Trichlorobenzene	0.125	0.102	0.103	81.6	82.4	59.0-139			0.976	20
1,2,4-Trichlorobenzene	0.125	0.0951	0.0979	76.1	78.3	62.0-137			2.90	20
1,1,1-Trichloroethane	0.125	0.121	0.124	96.8	99.2	69.0-126			2.45	20
1,1,2-Trichloroethane	0.125	0.156	0.145	125	116	78.0-123	J4		7.31	20
Trichloroethene	0.125	0.127	0.121	102	96.8	76.0-126			4.84	20
Trichlorofluoromethane	0.125	0.134	0.135	107	108	61.0-142			0.743	20
1,2,3-Trichloropropane	0.125	0.148	0.135	118	108	67.0-129			9.19	20
1,2,3-Trimethylbenzene	0.125	0.100	0.100	80.0	80.0	74.0-124			0.000	20
1,2,4-Trimethylbenzene	0.125	0.102	0.0980	81.6	78.4	70.0-126			4.00	20
1,3,5-Trimethylbenzene	0.125	0.115	0.111	92.0	88.8	73.0-127			3.54	20
Vinyl chloride	0.125	0.118	0.126	94.4	101	63.0-134			6.56	20
Xylenes, Total	0.375	0.320	0.317	85.3	84.5	72.0-127			0.942	20
(S) Toluene-d8				*99.9*	*98.4*	*75.0-131*				
(S) 4-Bromofluorobenzene				*92.9*	*98.5*	*67.0-138*				
(S) 1,2-Dichloroethane-d4				*102*	*103*	*70.0-130*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

(dry)	Results are reported based on the dry weight of the sample. [this will only be present on a dry report basis for soils].
MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
RDL (dry)	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J4	The associated batch QC was outside the established quality control range for accuracy.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

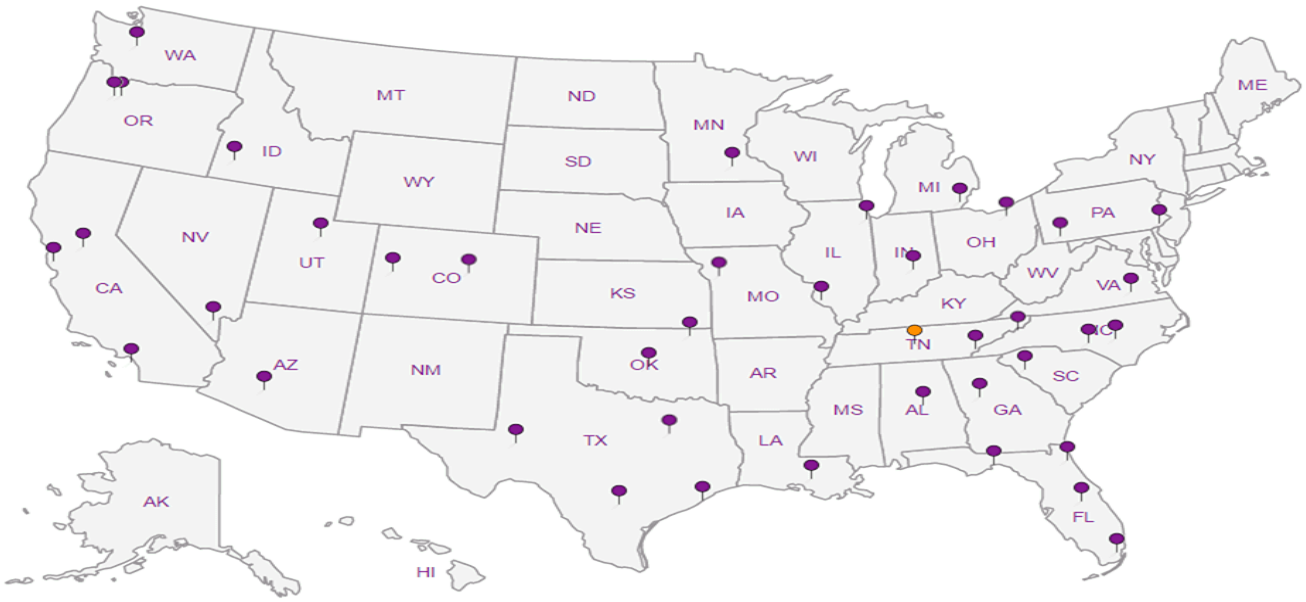
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



Cascade Corporation- Fairview, OR

2201 NE 201st Avenue
Fairview, OR 97024-9718

Billing Information:
Accounts Payable
P.O. Box 20187
Portland, OR 97294-0187

Pres Chk

Report to: Cindy Bartlett

Email To: CBartlett@Geosyntec.com;bwebb@Geosyntec.c

Project Description: ~~VMW-32~~ DATA GAPS VMW-32

City/State Collected:

Please Circle: PT MT CT ET

Phone: 503-669-6286

Client Project # PNG0564S20-02.2

Lab Project # CASCORFOR-PNG0564

Collected by (print): CINDY BARTLETT

Site/Facility ID # DATA GAPS

P.O. # CASC COMP

Collected by (signature): C Bartlett

Quote #

Immediately Packed on Ice N ___ Y ✓

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Date Results Needed

No. of Cntrs

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	VOCs 8260D 2ozClr-NoPres	VOCs 8260D 40mlAmb/MeOH5ml/Syr	Remarks	Sample # (lab only)
VMW-32-82.75-20200629	G	SS	82.75	6.29.20 2.9	1130	2	✓	✓		-01
		SS								
		SS								
		SS								
		SS								
		SS								

Chain of Custody Page ___ of ___

Pace Analytical® National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

SDG # L1235402

J150

Acctnum: CASCORFOR
Template: T168956
Prelogin: P778899
PM: 110 - Brian Ford
PB:

Shipped Via:

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking # 1275 8605 8758

Sample Receipt Checklist
COC Seal Present/Intact: __NP ✓Y __N
COC Signed/Accurate: ✓Y __N
Bottles arrive intact: ✓Y __N
Correct bottles used: ✓Y __N
Sufficient volume sent: ✓Y __N
If Applicable
VOA Zero Headspace: __Y __N
Preservation Correct/Checked: __Y __N
RAD Screen <0.5 mR/hr: ✓Y __N

Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
C Bartlett	6.30.20	1110		
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 4.2 °C Bottles Received: 2
C Bartlett PNAM	6/30/20	1300		If preservation required by Login: Date/Time
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 7/1/20 Time: 8:45
			Pearce	Hold: Condition: NCF / OK

ATTACHMENT 4

DEQ Approval Letter, Landfill IDW Acceptance, Disposal Receipts

Please print or type
(Form designed for use on elite (12-pitch) typewriter.)

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Waste Tracking Number
CESQG	1	888-785-7225	252139/D317219

GENERATOR

5. Generator's Name and Mailing Address

Geosyntec Consultants
900 Broken Sound Parkway NW, Suite 200
Boca Raton, FL 33487-3575
Generator's Phone: 253-334-9256

Generator's Site Address (if different than mailing address)

Cascade Corporation
2525 NE 201st Ave
Fairview, OR 97030

6. Transporter 1 Company Name: Advanced Chemical Transport Inc./DBA ACTenviro
U.S. EPA ID Number: CAR000070540

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address

Waste Managment (Hillsboro)
3205 SE Minter Bridge Rd.
Hillsboro, OR 97123
Facility's Phone: 503-640-9427

U.S. EPA ID Number: NON HAZ

	9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	
1.	Non-RCRA/Non-DOT Regulated Material Solid (SOIL CUTTINGS)	1	CM	15000	P	
2.						
3.						
4.						

13. Special Handling Instructions and Additional Information

Project Number 252139 Document#: D317219

1) 133883OR GEW-(1) 20 CM

14. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Generator's/Offeror's Printed/Typed Name: PAT YADON
Signature: Patrick E Yadon
Month: 10 Day: 1 Year: 20

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Ken Campbell
Signature: Ken Campbell
Month: 10 Day: 1 Year: 20

Transporter 2 Printed/Typed Name:
Signature:
Month: Day: Year:

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)
U.S. EPA ID Number:
Facility's Phone:

17c. Signature of Alternate Facility (or Generator)
Month: Day: Year:

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name: Jon Prime
Signature: Jon Prime
Month: 10 Day: 9 Year: 20

Printed in USA by GC Labels
1-800-997-6966

DESIGNATED FACILITY'S COPY

Reorder Part# MANIFEST-C6NHW
913-897-6966

WASTE MANAGEMENT

Hillsboro Landfill, Inc
3205 SE Minter Bridge
Hillsboro, OR, 97123
Ph: (503)-640-9427

Reprint
Ticket# 1582156

Customer Name	ACTENVIRONMENTAL ACT ENVIRONM	Carrier	ACT		
Ticket Date	10/09/2020	Vehicle#	T-113	Volume	
Payment Type	Credit Account	Container			
Manual Ticket#		Driver	SCOTT		
Hauling Ticket#		Check#			
Route		Billing #	0003432		
State Waste Code		Gen EPA ID	N/A		
Manifest	252139/D317219				
Destination		Grid			
PO	JN252139				
Profile	133883OR (LF02 - Non-Hazardous Waste Solid (soil cuttings))				
Generator	OR-CASCADE CORPORATION CASCADE CORPORATION 2525 NE 201ST AVE GRESHAM OR 9702				

	Time	Scale	Operator	Inbound		
In	10/09/2020 11:07:43	Inbound 1	JPRIME		Gross	43940 lb
Out	10/09/2020 11:30:16	Outbound	AMARTI22		Tare	27280 lb
					Net	16660 lb
					Tons	8.33

Comments

Consumer Comments? We want to know. Please call.

	Product	LD%	Qty	UOM	Rate	Tax	Amount	Origin
1	Cont Soil Pet-RGC-	100	8.33	Tons				MULT-IN
2	EVFt-P10-Environme	100		%				

Total Tax
Total Ticket

Driver`s Signature

State of Oregon
Department of Environmental Quality Memorandum

September 23, 2020

Subject: DEQ accepts the results of the Non-Hazardous Waste Determination for Investigation Derived Waste. East Multnomah County Troutdale Sandstone Aquifer Remedy. 2525 NE 201st Ave. Gresham, Oregon. (ECSI #1479)

To: Cindy Bartlett, Geosyntec Consultants

From: Kenneth Thiessen, NWR Cleanup Program

Through: Paul Seidel, NWR Cleanup Section Manager

DEQ accepts the results of the hazardous waste determination that Geosyntec conducted for investigation-derived waste (IDW) produced as drill cuttings from construction of four new soil borings.

Trichloroethylene (TCE) is the risk driver for the East Multnomah County Troutdale Sandstone Aquifer Remedy. Potentially applicable waste codes that could apply to this waste would be F001 or F002, for waste related to historical parts degreasing using TCE.

The IDW soil is in a roll-off bin and drums and is temporarily stored at 2525 NE 201st Ave. Two multi-part composite samples were analysed for VOCs by U.S. Environmental Protection Agency (EPA) Method 8260D and RCRA 8 metals by EPA Method 6010B/7470. One sample was additionally analysed by Method 1311 TCLP Extraction.

Based on analytical results, neither trichloroethylene (TCE), nor any site-related VOCs were detected in the IDW. The soil sample from the roll-off box contained 105 mg/kg of chromium. Due to this higher concentration of chromium, this sample was further analysed by TCLP extraction. Chromium was not detected in the leachate.

Geosyntec has determined that the IDW is non-hazardous and the waste profiles have been accepted by Waste Management for disposal at the Hillsboro Landfill (roll off box) and by Republic Services for disposal at the Roosevelt Landfill (soil drums).

References:

Sept. 16, 2020. TSA Well Drilling Soil IDW– Investigation Derived Waste Non-Hazardous Determination Request, East Multnomah County Troutdale Sandstone Aquifer Remedy (ECSI No. 1479) Fairview, Oregon.

Waste Management Hillsboro Landfill Non Haz Approval, profile 133883OR

Cc:
Audrey Obrien, Manager, DEQ Environmental Partnerships
Jay Collins, DEQ Hazardous Waste Inspector

Certification No. MC-19192
Billing Acct. No. 690472
Product Code 66

BILL OF LADING

Contaminated Soil - Drummed

REGIONAL DISPOSAL COMPANY
54 S. Dawson Street
Seattle, WA 98134
Telephone: (206) 332-7700 / Fax: (206) 332-7600

This Bill of Lading augments the Master Service Agreement ("Agreement") entered into by ACT Enviro (Generator/Agent) and Regional Disposal Company ("RDC") on 9/18/2020 (date). The terms herein are made a part of the Agreement. In the event of conflict between this Bill of Lading and the Agreement, the terms of the Agreement prevail.

RDC hereby authorizes the Wastes ("Waste") described in Certification No. MC-19192, signed by Generator/Agent on 9/18/2020 (date), for disposal at Roosevelt Regional Landfill. Contractor shall present a copy of this Bill of Lading with each shipment delivered.

Location of Waste: 2525 NE 201st Ave Fairview, OR 97024

Method of Shipment:

Additional Fees (e.g., laboratory fees, transportation fees, special handling fees, etc. If none, so state):

NA

PERFORMANCE DATE

FOR RDC TRANSPORTATION: Generator shall make the Waste available for shipment no later than _____ (date). RDC shall transport the Waste no later than _____ (date), unless RDC notifies the Generator in writing that Waste transport shall be suspended or canceled due to RDC's exercise of its right to inspect or analyze the Waste (as provided in the Agreement).

FOR GENERATOR TRANSPORTATION: Generator shall begin delivery of the Waste at [*check one*]:

■ Roosevelt Regional Landfill. ☐ Seattle Transfer Station located at Third and Lander.

Waste delivery shall begin no later than 9/18/2020 (date), and shall complete delivery of the Waste no later than 9/8/21 (date), unless RDC notifies Generator/Agent in writing to suspend or cancel the waste delivery due to RDC's exercise of its right to inspect or analyze the Waste (As provided in the Agreement).

GENERATOR / AGENT

Signature

Kyle Satterthwaite/Project Manager
Printed Name and Title

09/18/2020
Date

REGIONAL DISPOSAL COMPANY

Signature

Matt Calantas - Special Waste Executive
Printed Name and Title

9/18/20
Date

Detail Contract Activity Report

All Ticket Types | September 01, 2020 to February 04, 2021 | All Facilities

History and Waiting | Specific Contract(s) : 'MC-19192'

* - Confirmed Qty Applied to Billing

MC-19192

Ticket Date	Facility & Ticket Number	Customer	Truck	Material	Contract Rate		Billing Quantity		Ordered Quantity	Minimum Quantity	Maximum Quantity	Material Total	Tax Total	Total
10/06/2020 I	01 3010411	690472 - Advanced Chemical Transpc	ABLE CLEA	Cont Soil	0.00	S	7.40	TN	0.00		$0.00			
10/06/2020 I	01 3010413	690472 - Advanced Chemical Transpc	ABLE CLEA	Cont Soil	0.00	S	15.43	TN	0.00		$0.00			

Tickets Reported: 2 Items Reported: 2 Contract Totals:

Material Summary	Weight Inbound	Weight Outbound		Volume Inbound	Volume Outbound		Count Inbound	Count Outbound	Billing Quantity		Material Total	Tax Total	Total
66 - Cont Soil	22.83	0.00	TN	0.00	0.00	YD	0.00	0.00	22.83	TN			

Cash Totals:	$0.00	$0.00	$0.00
Invoice Totals:			
Report Totals:			

Tickets Reported: 2 Items Reported: 2

ATTACHMENT 5

Copy of SSPA 2011, Table 1, Summary of Slug Test Results (hydraulic conductivity values)

Table 1. SUMMARY OF SLUG TEST RESULTS

Well	Aquifer	Well Casing Diam. (in.)	Well Depth (ft, bgs)	Length of Screened Interval (ft)	Depth to Water (feet MP)	Water Column (feet)	Screen Length for Analysis (ft)	Transmissivity (ft^2/day)		Storativity	Hyraulic Conductivity (ft/day)
								Rising	Falling		
BOP-13(dg)	Lower TSA	2	193	20	122.47	67.2	20.0	**568**	**502**	1.E-03	27
D-17(dg)	Lower TSA	2	172	20	115.14	59.7	20.0	**93**	**86**	1.E-03	4.5
EW-12	Lower TSA	8	142	30	82.11	58.2	30.0	**1143**	865	1.E-06	38
EW-18	Lower TSA	8.6	152	30	121.77	26.0	26.0	**117**	**123**	1.E-06	4.6
EW-5 [MW-24(dg)]	Lower TSA	6	125	50	61.49	58.3	50.0	**138**	**138**	1.E-05	2.8
MW-10(dg)	Lower TSA	2.5	206.5	15	124.98	78.4	15.0	**16**	8	1.E-06	1.1
MW-25(dg)	Lower TSA	4	130.5	10	61.77	57.4	10.0	**193**	**184**	1.E-05	19
MW-8(dg)	Lower TSA	4	196	15	129.20	63.0	15.0	**221**	**226**	1.E-06	15
BOP-13(ds)	Upper TSA	2	132	10	121.86	8.1	8.1	**200**	270	1.E-01	25
D-17(ds)	Upper TSA	2	121	10	114.75	6.6	6.6	**21**	20	1.E-01	3.1
MW-10(ds)	Upper TSA	2.5	130	15	120.90	7.4	7.4	**136**	52	1.E-03	18
MW-14R(ds)	Upper TSA	2	75	20	58.45	16.1	16.1	**27**	32	1.E-01	1.6
MW-17(ds)	Upper TSA	4	109	10	102.41	6.0	6.0	**18**	12	1.E-02	3.0
MW-18(ds)	Upper TSA	4	115	10	101.84	9.6	9.6	**4**	2	1.E-03	0.4
MW-19(ds)	Upper TSA	4	147	10	129.14	15.1	10.0	**231**	**230**	1.E-05	23
MW-20(ds)	Upper TSA	4	155	10	139.88	16.5	10.0	**261**	**263**	1.E-01	26

Note : Bold numbers were used to calculate hydraulic conductivity

Table from SSPA October 18, 2011 Memo: Troutdale Sandstone Aquifer Remedy – Consent Order No. WMCSR-NWR-96-08 Hydraulic Conductivity Testing in Mound Area, August 2011