# Supplemental Groundwater Well Installation Work Plan
# PCC Large Parts Campus
# Portland, Oregon

March 30, 2016

Prepared for

PCC Structurals, Inc.

LANDAU ASSOCIATES

333 SW 5th Avenue, Suite 700
Portland, OR 97204
(503) 542-1080

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## APPENDICES

# LIST OF ABBREVIATIONS AND ACRONYMS

AC ..... Associated Chemists
bgs ..... below ground surface
CSM ..... conceptual site model
DCE ..... cis-1,2-dichloroethene
ESA ..... Environmental Site Assessment
foot or feet ..... ft
HVOCs ..... halogenated volatile organic compounds
L/min ..... liters/minute
LPC ..... Large Parts Campus
µg/L ..... micrograms/liter
MW ..... monitoring well
ODEQ ..... Oregon Department of Environmental Quality
PCC ..... PCC Structurals, Inc.
PCE ..... tetrachloroethene
PVC ..... polyvinyl chloride
RI ..... Remedial Investigation
Site ..... PCC Structurals, Inc., Large Parts Campus
TGA ..... Troutdale Gravel Aquifer
TCE ..... trichloroethene
USA ..... unconsolidated sedimentary aquifer
Work Plan ..... Supplemental Downgradient Monitoring Well Installation Work Plan

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# 1.0 PURPOSE AND OBJECTIVES

This Phase II Remedial Investigation (RI) Supplemental Monitoring Well Installation Work Plan (Work Plan) has been prepared on behalf of PCC Structurals, Inc. (PCC) to describe the planned installation of four groundwater monitoring wells in the vicinity of PCC's Large Parts Campus (LPC), located at 4600 SE Harney Drive in Portland, Oregon (Site; Figure 1). Installation of the additional monitoring wells is proposed to comply with the Oregon Department of Environmental Quality's (ODEQ) requirement to further characterize groundwater downgradient of the Site.

The purpose of the additional groundwater characterization is to further evaluate the lateral and vertical extent of dissolved halogenated volatile organic compounds (HVOCs) in groundwater downgradient of PCC's property, and specifically at the property owned by Associated Chemists (AC; Figure 2). Previous sampling conducted by the owner of the AC property identified HVOCs in groundwater samples (PNG 2013) Wells at the AC property are designated as "shallow" (well designation "S" on Figure 2) and "deep" (designation "D" on Figure 2), with the former generally being screened at depths less than approximately 30 feet (ft) below ground surface (bgs) and the latter being screened at depths from approximately 50 to 60 ft bgs.

As described in Section 2.1, ODEQ has attributed the presence of HVOCs identified in shallow well samples to former AC property activities, based on analysis provided by AC (PNG 2013). However, the detections of HVOCs in the deeper well samples is thought to be associated with the hydraulically downgradient portion of the dissolved HVOC plume emanating from the PCC property; this conceptual model is consistent with available data from the RI and AC's investigations. Additional characterization of the zone screened by AC's "deep" wells, which extends to depths greater than 60 ft, is an objective of the proposed work outlined in this Work Plan. An additional objective is characterizing the lateral extent of the dissolved plume to the south of PCC's property.

The activities outlined in this Work Plan constitute additional scope under the ongoing RI and will be conducted in general accordance with the methods and procedures outlined in the Phase II RI Work Plan (LAI 2010) and summarized in the subsequent sections.

# 2.0 BACKGROUND

Site background information, including details regarding the Site's location, ownership history, detailed historical use of chlorinated solvents, and the conceptual site model (CSM) was presented in the Agency Review Draft RI Report (LAI 2013). The CSM will be revised, as appropriate, based on the results of the investigation outlined in this Work Plan and other ongoing RI activities. The following section briefly summarizes information relevant to the planned groundwater monitoring well installation program.

## 2.1 Groundwater Investigations

Since 2009, a total of 57 borings have been advanced at the Site to collect depth-discrete groundwater samples. A total of 13 groundwater monitoring wells were installed on the LPC property and downgradient (i.e., offsite) during three separate installation events (Phase I and II RI events); the well locations are presented on Figure 2. Groundwater sampling was conducted on a quarterly basis, with a minimum of 4 quarters of sampling conducted at each well between 2009 and 2013.

At the AC property, a Phase II Environmental Site Assessment (ESA) was conducted in 1996, which included the advancement of seven soil borings and temporary well points (PNG 2013). Low-level detections of HVOCs were identified in groundwater collected from the temporary soil borings and subsequently in 1997, four permanent monitoring wells (MW) were installed (i.e., MW-1S, MW-2S, MW-3S, and MW-4S). These four wells were screened between approximately 10 to 30 ft bgs. A second Phase II ESA was conducted in 2011 including the advancement of 12 shallow borings across the AC property.

As part of a property transaction in 2012, an additional investigation of the AC property was conducted, at which time monitoring wells MW-5D, MW-6D, and MW-7D were installed with screens at a depth greater than the aforementioned four wells (Figure 2). These three wells were screened from approximately 50 to 60 ft bgs. The 2012 AC investigation also included the assessment of surface soil quality, soil gas sampling, a geophysical survey, and 4 quarters of groundwater sampling.

## 2.2 Site-Specific Hydrogeology

Soil textural data from borings and the results of groundwater sampling during investigation activities conducted by PCC and AC were used to evaluate Site-specific hydrogeologic conditions. The subsurface hydrogeology in the vicinity of the Site encountered during investigation activities can be grouped into four units based on the units described by Swanson, et al. (1993), as follows:

- Unconsolidated Sedimentary Aquifer (USA) – The USA unit consists of heterogeneous, fluvial deposits consisting of silt, clay, sand, and gravel at the Site. The base of the unit ranges from approximately 20 to 30 ft bgs.

The USA represents a relatively low permeability upper portion of a continually saturated sequence that includes the underlying Troutdale Gravel Aquifer (TGA). Fill overlies the USA in places. Where the fill was encountered during drilling, it was generally less than 2 ft thick and consists of ¾-inch minus gravel used as a pavement base course.

- Troutdale Gravel Aquifer – At the Site, the TGA consists of matrix-supported fine to medium gravel and coarse sand with varying percentages of silt and clay. The top of the unit begins at the base of the USA. Discontinuous lenses of silt and clay are also present. One continuous clay layer was encountered during RI drilling as described below. The transition between the USA and the TGA was interpreted during the RI by the observation of weathered and clayey gravels. Although the RI drilling investigation did not extend deeper than approximately 148 ft bgs, the Site's industrial water supply well logs (i.e., Well #2 and Well #3; Figures 3 and 4) indicate that the base of the TGA is approximately 195 ft bgs.
- Clay Layer within the TGA; Confining Unit – Clay lenses are common in the TGA (Swanson et al. 1993). One continuous clay layer was encountered locally beneath the Site. The top of the clay layer ranges from 120 to 140 ft bgs. During the RI drilling activities, the clay layer was never completely penetrated. According to the Site water supply well logs for Well #2 and Well #3, the clay layer extends to about 150 ft bgs (i.e., 10 to 20 ft thick). The clay layer was encountered in every deep sonic boring advanced during the RI, and appears to be continuous across the Site. The clay lens is underlain by approximately 40 ft of TGA gravels (Well #2 and Well #3), which are present to a depth of approximately 195 ft bgs.
- Undifferentiated Fine Grained Sediments; Confining Unit – This unit consists of clays, vitric sand beds, and sandy and gravelly clays. The top of the unit in the Site's vicinity ranges from 193 to 197 ft bgs, and extends to the bottom of Well #3, the deepest boring at or near the Site.

Four hydrogeologic cross sections were prepared based on monitoring well and PCC Site water supply well boring logs, with reference locations shown on Figure 3. Cross sections are presented on Figures 4 through 6 and show the lateral extent of units, monitored groundwater zones, and associated groundwater elevations (at the time the location was last sampled).

The "shallow" wells at the AC property (i.e., "S" designated) and PCC wells MW-5A, MW-6A, MW-7 through MW-9, and MW-11 are screened primarily within the USA. The "deep" wells at the AC property (i.e., "D" designated), and PCC wells MW-1 through MW-4, MW-5B, and MW-6B are screened within the TGA. Further characterization of groundwater flow and quality in the TGA is one of the objectives of the work proposed in this plan.

## 2.3 2015 Groundwater Monitoring

ODEQ requested two quarters of sampling of monitoring wells located downgradient of potential source areas at the PCC Site to inform future characterization efforts (Ryals 2014), including installation of the proposed monitoring wells discussed in this Work Plan.

A total of 16 groundwater monitoring wells were selected for two rounds of sampling (May and August 2015), including:

- MW-3, MW-4, MW-7, MW-8, and MW-9 (PCC Site monitoring wells).
- MW-5A and MW-5B (PCC wells located offsite on the City of Portland's property west of the Site).
- MW-6A and MW-6B (PCC wells located offsite to the southwest of the Steel Building on private property).
- MW-1S, MW-2S, MW-3S, MW-4-S, MW-5D, MW-6D, and MW-7D (located southwest of Johnson Creek on AC's property).

The focus of the proposed work was associated with groundwater occurring in the TGA. Generally, HVOCs have not been detected at depths less than 30 ft at locations that are not within source areas; therefore, downgradient transport of HVOCs in the USA is limited. Additionally, shallow contamination at the AC property has been attributed to past AC property operations.

Figures 7 and 8 show groundwater elevation contours based on water level data collected in May and August 2015, respectively, from wells screened in the TGA. Consistent with previous sampling events, the groundwater flow direction is from east-northeast to west-southwest, generally conforming to the local topography and the alignment of Johnson Creek. Although groundwater elevations varied within the range of 2 to 3 ft between the May and August 2015 events, the slope of the gradient and the inferred direction of groundwater flow remains relatively constant. The AC property is downgradient of PCC[1].

Figure 9 presents the results of the May and August 2015 groundwater monitoring events for wells screened within the TGA. The results are discussed in conjunction with presenting the rationale for the location of the four proposed additional groundwater monitoring wells in Section 3.0.

[1] Groundwater elevations within the USA are substantially influenced by local factors including subsurface infrastructure and Johnson Creek; groundwater contour maps based on the shallower well data are provided in Appendix A.

# 3.0 CHARACTERIZATION PLAN

In general, the lateral and vertical extent of the dissolved HVOC plume at PCC has been characterized by collecting groundwater samples through the use of several techniques: direct-push sampling, depth-discrete sampling in an open borehole (advanced using a sonic drilling rig), and monitoring well sampling. Direct push sampling was used primarily to identify source areas. Depth-discrete sampling was used to characterize the vertical distribution of HVOCs and identify target screen intervals for monitoring well installation. Monitoring wells were then installed to allow for periodic sampling over time. This same approach will also be used to characterize the vertical HVOC distribution in the downgradient plume area.

## 3.1 Data Gaps Analysis

As described in Section 2.3, groundwater elevation contours indicate that groundwater flow is generally from east-northeast to west-southwest, conforming to the local topography and the alignment of Johnson Creek. Based on this assessment, the AC property is hydraulically downgradient of the PCC Steel Building.

### 3.1.1 Vertical Extent

Figure 3 shows the locations of borings advanced during the RI, where depth discrete samples were collected. Note that borings B-12, B-14, B-15, B-16, B-17, and B-18 form a section that is roughly perpendicular to both the general groundwater flow direction and the axis of the HVOC plume emanating from the identified source areas associated with the Steel Building. Appendix B contains grid-based illustrations of the vertical distribution of tetrachloroethene (PCE), trichloroethene (TCE), and *cis*-1,2-dichloroethene (DCE) concentrations along this section, Figures B-1 through B-3, respectively. The figures in Appendix B also show the vertical distribution along the groundwater flow path from B-16 to MW-6A/6B, and for well pair MW-1S/7D at the AC property. Concentrations of less than 2 micrograms/liter (µg/L) are shaded yellow, concentrations greater than 5 µg/L are shaded blue, and areas where concentrations greater than 5 µg/L are not bounded (i.e., by non-detections or very low concentrations) are shaded green. Green-shaded zones are targeted for additional characterization as outlined this Work Plan.

As shown in Figures B-1 through B-3, zones for additional characterization are deeper than 60 ft bgs in the vicinity of boring B-16 and downgradient well pair MW-6A/6B, and deeper than 60 ft bgs in the vicinity of well pair MW-1S/7D. The highest offsite PCE concentration was detected in samples from well MW-7D at the AC property. The planned installation program for new monitoring wells will include advancing a new borehole adjacent to this location on the AC property. The borehole (B-19) will be advanced to the clay layer within the TGA (described in Section 2.2 and shown on Figure 9) and is expected to occur at about 130 to 145 ft bgs, or to a maximum depth of 160 ft bgs.

Depth-discrete samples will be collected and subsequently analyzed on a rapid-turnaround basis (i.e., 24-hour) to determine the vertical distribution of dissolved HVOCs. The resulting information will be used to target the screened interval for the well to be completed in the advanced boring adjacent to MW-7D (i.e., MW-12). Two of the three additional planned wells (i.e., MW-14 and MW-15) will also be screened at this same depth interval. The rationale for placement of the additional three monitoring wells was determined based on a review of existing information and the data gaps analysis; the rationale for well placement is discussed further in Section 3.2.

### 3.1.2 Lateral Extent

As discussed above, the AC property is downgradient of PCC and the longitudinal axis of the dissolved HVOC plume extends from PCC toward the AC property. The lateral extent of HVOC migration is well characterized except along the southern periphery (vicinity of well MW-6B and downgradient) and at the most downgradient periphery (i.e., downgradient of well MW-7D at the AC property). These two areas are targeted for additional characterization. ODEQ has also requested additional characterization of the area south of the Steel Building to verify that the dissolved HVOC plume does not extend to the south in this area.

## 3.2 Proposed Monitoring Wells

Based on the data gap analysis presented in Section3.1, four groundwater monitoring wells will be installed at the proposed locations shown on Figure 10. The rationale for the location and target screened interval for each well is presented in the following table. As discussed in Section 3.1.1, the final screened interval for wells MW-12, MW-14, and MW-15 will be determined based on the results of the depth-discrete sample analysis to be conducted during boring advancement at B-19.

| Well Number and Target Screened Interval | Rationale |
|---|---|
| **MW-12 (and boring B-19)**<br><br>**75-85 ft bgs** | This well will be located as close as practical to existing wells MW-1S and MW-7D at the AC property. The purpose of the well is to evaluate the vertical extent of migration in the downgradient portion of the plume.<br><br>The highest HVOC concentration at the AC property during RI sampling (PCE at 31.3 µg/L) was detected during the August 2015 sampling event in the sample from MW-7D, which is screened between 50 to 60 ft bgs. Examining the vertical distribution of dissolved PCE at locations potentially hydraulically upgradient of MW-7D (i.e., borings B-14, B-15, B-16, and B-17), the PCE concentrations decreased to less than 2 µg/L at depths of 65 ft or less (i.e., there were no detections over 2 µg/L at depths greater than 65 ft bgs).<br><br>It is not expected that recharge from Johnson Creek would cause vertical migration to significantly greater depths as the plume migrates beneath that potential recharge area. Based on this CSM, it is expected that the well screen at this location will be placed at approximately 75 to 85 ft bgs; however, this will be confirmed by depth-discrete borehole groundwater sampling to a maximum depth of 160 ft bgs prior to constructing the well.<br><br>Data collected during the borehole sampling will also inform selection of an appropriate screen interval for wells MW-14 and MW-15. |

| Well Number and Target Screened Interval | Rationale |
|---|---|
| **MW-13**<br><br>**65-75 ft bgs** | This well will be located on PCC-owned property (parking area) south of the Steel Building, south of Johnson Creek Boulevard, and just north of Johnson Creek. The purpose of the well is to verify that the vertical extent of HVOC migration was characterized by groundwater data from borings B-17 and B-18, which are located nearby. ODEQ has requested additional characterization to verify that the dissolved HVOC plume does not extend to the south in this area.<br>The maximum sampling depth at B-17 and B-18 was 46 ft and 50 ft, respectively. The maximum HVOC concentration was 1.18 µg/L at 50 ft for PCE. The target screen interval depth, based on the stated objective, is about 15 to 25 ft below previously sampled depths.<br>Water level data from this well will also provide additional understanding of groundwater patterns and gradients. |
| **MW-14**<br><br>**Target screen depth pending results of depth-discrete sampling at B-19** | This well will be located as close as practical to the western property boundary at the AC property. The purpose of the well is to evaluate the vertical extent (i.e., depth) of potential migration in the most hydraulically downgradient portion of the plume.<br>The target screened interval will correspond to that determined for well MW-12, near well MW-7D, where the highest HVOC concentrations at the AC property have been detected. If depth-discrete borehole groundwater sampling indicates higher concentrations at other depths, the screen interval depth will be modified accordingly, in collaboration with ODEQ. |
| **MW-15**<br><br>**Target screen depth pending results of depth-discrete sampling at B-19** | The purpose of this well is to evaluate the lateral extent of migration on the southern periphery of the hydraulically downgradient portion of the plume. The target screened interval will correspond to that of well MW-7D, where the highest HVOC concentrations have been detected during RI groundwater sampling.<br>The location is also downgradient of boring B-16 and well MW-6B, where the maximum detected PCE concentration in groundwater was 19.2 µg/L (MW-6B) at a depth of about 40 ft (screen interval 35 to 45 ft bgs). Placement of the screen of MW-15 at 50 to 60 ft bgs will address the potential data gap regarding vertical extent along this flow path. If discrete interval borehole groundwater sampling near well MW-7D indicates higher concentrations at other depths, the screen interval depth will be modified accordingly, in collaboration with ODEQ.<br>The actual location will be based on access, with the first option being on the Space-Pak property south of AC's property, as shown on Figure 10. Nearby properties will be considered if timely access is determined to be infeasible. |

AC = Associated Chemists
bgs = below ground surface
CSM = conceptual site model
ft = feet
HVOC = halogenated volatile organic compounds
µg/L = micrograms per liter
MW = monitoring well
ODEQ = Oregon Department of Environmental Quality
PCE = tetrachloroethene
RI = remedial investigation

### 3.2.1 Soil Sampling Procedures

Prior to commencing drilling activities, a utility check will be performed. Boring locations will be clearly marked in the field. PCC personnel will review and approve each marked location. An Oregon one-call utility notification request will be submitted at least 48 hours prior to drilling activities. In addition, a private utility location service will be used to check for the presence of underground utilities, pipelines, or tanks in the vicinity of each marked location. The final location of each monitoring well will be based on the findings of the field check.

The borings for the four planned monitoring wells will be advanced using a Roto-Sonic® drill rig with a maximum depth of 160 feet bgs (boring B-19) at the MW-12 location. Soil samples for logging will be obtained by advancing a 4-inch inside diameter cutting edge and core barrel into the undisturbed soil using high frequency vibration and low-speed rotation. The core barrel is typically advanced in intervals up to 10 ft in length. The core barrel is then withdrawn and the soil core is ejected into disposable polyethylene, tube-shaped sample bags. The sample bags are cut open lengthways to expose the recovered soil sample. The boring is advanced as soil is withdrawn with the core barrel. An outer temporary casing is advanced to maintain an open borehole before the core barrel is reinserted. The core barrel is then reinserted to clean out any sloughed soil within the temporary casing. When the sloughed soil has been removed from the boring, the core barrel is advanced into undisturbed soil to obtain the next soil core sample. This drilling method results in a continuous soil core sample to the total targeted depth.

### 3.2.2 Groundwater Sampling Procedures

The boring for monitoring well MW-12 (boring B-19) will be advanced to 60 ft bgs using the Roto-Sonic® drill rig at which point the first depth-discrete groundwater samples will be collected (depth coincides with bottom of adjacent MW-7D screened interval). Advancement of the boring will continue and additional depth-discrete groundwater samples will be collected every 25 ft until the clay aquitard layer identified in previous investigations is intersected (typically about 130 to 145 ft bgs) or to a maximum drilling depth of 160 ft bgs, whichever occurs first. If the maximum drilling depth is reached, a total of five groundwater samples will have been collected for analysis.

Depth-discrete groundwater samples from MW-12 will be collected using a Hydropunch II™ groundwater sampling device. The Hydropunch II sampling device is a decontaminated, shielded, temporary well screen. The temporary well screen is typically a 4-ft long, 1-inch outside diameter, 0.010-in slot size, stainless steel screen attached to drive rod tooling on a sonic drill rig. The borehole will be advanced using sonic drilling techniques to approximately 2 ft above the desired depth from where the water sample will be collected. The Hydropunch II tool's body will be advanced into undisturbed soil below the open borehole to the desired sample depth, the shield withdrawn exposing the screen, and groundwater extracted using one of two sampling methods. One method involves fitting the tool's body with check valves and creating a sample reservoir; when the screen is opened, water fills the reservoir, and the tool body is then withdrawn to the surface and the

groundwater sample collected. Another sampling method involves removing the check valves and collecting the groundwater sample by lowering either disposable polyethylene tubing for use with a peristaltic pump or a bailer down the hollow drive rod to the exposed screen. Either sampling method may be employed depending on subsurface conditions identified at the time of drilling.

The well's screen interval will be adjusted, if necessary, to account for changes in lithology encountered and/or nonproductive groundwater zones. If HVOC concentrations higher than those observed in samples from MW-7D are detected in boring B-19, the monitoring well screen placement for MW-12 will be coordinated with ODEQ representatives prior to construction.

Monitoring well installation and development will be performed in accordance with the procedures provided in the ODEQ-approved sampling and analysis plan that was submitted as an appendix to the Phase I RI Work Plan (LAI 2009) and as described in Sections 3.2.3 and 3.2.4. Once the appropriate well screened interval is identified for MW-12, the screened interval for wells MW-14 and MW-15 will be confirmed with ODEQ.

### 3.2.3 Well Construction

Each monitoring well will be installed after drilling is complete in the associated borehole. At B-19 (i.e., MW-12), the boring will be backfilled with tremied Volclay® grout or a high-solids bentonite grout and bentonite pellets to the depth of the bottom of the monitoring well[2]. The grout will be allowed to set up for a minimum of 12 hours prior to the placement of sand (a minimum of 1 ft) and well installation. The monitoring wells installed in drilled holes will be constructed of 2-inch (nominal) flush-threaded Schedule 40 polyvinyl chloride (PVC) casing with 0.010-in, machine-slotted PVC screen. The well casing will be installed to the target depth through the temporary steel casing. Stainless steel centralizers will be installed above and below the screen.

A filter pack will be installed around the screen extending from the end cap to a maximum of 3 ft above the screen. Filter pack material will consist of commercially prepared, pre-sized, prewashed No. 10-20 Colorado silica sand or equivalent. The filter pack will be carefully poured down the annulus between the well casing and the temporary casing as the temporary casing is slowly withdrawn. During filter pack placement, the distribution and depth of the filter pack will be monitored with a weighted tape. Once the well casing and the screen are installed, the total length of the well will be verified and documented by lowering a weighted tape to the bottom of the inside of the well casing. The vibration of the sonic drill rig, which settles the filter pack, negates the need to surge the well.

[2] The depth of boring at locations MW-13 through MW-15 will coincide with the targeted well depth, so grouting will not be necessary.

The annular space above the filter pack will be filled with a tremied high-solids bentonite grout to within 5 ft of the surface. Bentonite chips will then be placed to within 2 ft of the ground surface. The surface will be completed with a concrete seal at least 2 ft thick and a steel flush-mount monument will be cemented in place at the surface to a depth of at least 2 ft. Wells will be secured using a lockable cap with a waterproof seal. Monitoring well construction information including the depth of the well, filter pack thickness, screen interval, and other pertinent construction information will be recorded on an As-Built Well Completion Form.

### 3.2.4 Well Development

After installation, monitoring wells will be developed to remove soil introduced during drilling activities and to establish hydraulic continuity between filter pack and formation. The wells will be developed prior to groundwater sampling. The wells will not be developed for at least 24 hours after completion.

Monitoring wells will be developed by appropriate combinations of surging, bailing, or pumping with a peristaltic pump, inertial pump, air lift, or electrical submersible pump. Development will continue until turbidity clears, or until 10 casing volumes have been purged. Groundwater produced during development will be managed as described in Section 3.5. Details of well development will be recorded on a Well Development Record and included in the RI report.

### 3.2.5 Well Survey

The location of the four new monitoring wells will be surveyed by a licensed surveyor. The elevation of the top of the PVC casing and the top of the protective flush-mount well monument at each monitoring well will be surveyed to the nearest 0.01 ft by a licensed surveyor. Surveying will include horizontal coordinates (x, y) using Oregon North Zone (NAD83[91]) state plane coordinate system and ground surface elevations using mean sea level datum (NGVD 1929[47]) in ft.

## 3.3 Quarterly Groundwater Monitoring

Groundwater levels will be measured with an electric water level probe from a surveyed reference point marked on the well and recorded to the nearest 0.01 ft. Water level measurements will be recorded on the Groundwater Elevation Record. To avoid cross-contamination between wells, the water level probe will be decontaminated before the first measurement of the day, between each measurement location, and at the end of the monitoring day.

Groundwater samples will be collected on a quarterly basis for a total of four quarters from the four new monitoring wells. The 16 monitoring wells previously sampled as part of the hydraulically downgradient investigation will be also sampled during the first two quarters of new groundwater monitoring well sampling. Monitoring wells will be sampled using low-flow groundwater sampling techniques, described in the Phase II RI Work Plan (LAI 2010) and below:

- Groundwater samples will be collected with a peristaltic pump connected to polyethylene tubing. The intake end of the tubing will be positioned near the midpoint of the monitoring well screened interval.
- Before beginning purge, a depth-to-water measurement will be collected.
- Sample collection notes will be recorded on a Groundwater Low Flow Sample Collection Form.
- Purging will be started at a rate near the minimum pump capabilities, approximately 0.1-0.4 liters/minute (L/min). Depth-to-water measurements will be collected every 3 to 5 minutes to insure drawdown is less than 0.3 ft.
- Dissolved oxygen, specific conductance, temperature, pH, and oxidation reduction potential will be measured by directing purge water past a multimeter contained within a flow-through cell to minimize disturbance and aeration. Turbidity measurements will be collected using a turbidity meter without the water passing through a flow through cell. Parameter readings will be collected every 3 to 5 minutes during purging.
- Purging will continue until parameter values have stabilized. Stabilization will be considered complete when at least three consecutive parameter readings, taken between 3 to 5 minute intervals are within the following limits
  - Turbidity (+/- 10% if greater than 1 Nephelometric Unit
  - Dissolved oxygen (+/- 10%)
  - Specific conductance (+/- 3%)
  - Temperature (+/- 3%)
  - pH (+/- 0.1 unit)
  - oxidation reduction potential (+/- 10 millivolts)
- Water will be pumped directly from the sample tubing into the appropriate sample containers at a rate of less than 0.5 L/min.

Samples will be collected into laboratory-provided containers and labeled with a sample container label. The samples will be preserved by cooling to a temperature of 4$^{o}$C as required by the analytical method. Maximum holding and extraction times will be strictly adhered to by field personnel and the analytical laboratory. Samples will be submitted to APEX Laboratories of Tigard, Oregon, for processing and analysis.

## 3.4 Analysis

The monitoring well laboratory analyses will be limited to HVOCs. A summary table that includes the proposed analytes and their respective reporting and method detection limits is provided in Table 1.

## 3.5 Management of Investigation-Derived Waste

Investigation-derived waste such as soil cuttings, purge water, and decontamination water generated during the investigation will be drummed and contained onsite pending determination of appropriate disposal.

# 4.0 DATA EVALUATION AND REPORTING

Formal presentation of the work completed under this Work Plan will be included in the RI report. The following information will be transmitted to ODEQ with quarterly progress reports:

- Boring logs for wells MW-12 through MW-15.
- Updated cross-section B-B' showing newly installed wells and screened intervals.
- Updated table showing monitoring well construction details (elevation, depth, screened interval).
- Tables and figures summarizing groundwater elevation data and analytical results.

# 5.0 PROJECT SCHEDULE

Groundwater monitoring well installation involves access to the AC property and the adjacent property to the south, so the schedule will be dependent on obtaining access agreements. PCC will notify ODEQ prior to beginning any of the sampling activities described in this Work Plan and if access is denied to any of the offsite properties. Follow-on sampling of groundwater will occur as described in Section 3.3.

# 6.0 USE OF THIS WORK PLAN

This Work Plan has been prepared by Landau Associates for the exclusive use of PCC's LPC, located at 4600 SE Harney Drive in Portland, Oregon, and for ODEQ under the Voluntary Cleanup Program. Landau Associates has prepared this document in accordance with generally accepted engineering and consulting standards for environmental work in Oregon.

# 7.0 REFERENCES

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# 8.0 USE OF THIS REPORT

This Supplemental Groundwater Well Installation Work Plan has been prepared for the exclusive use of PCC Structurals, Inc. for specific application to the PCC LPC Supplemental Groundwater Well Installation. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

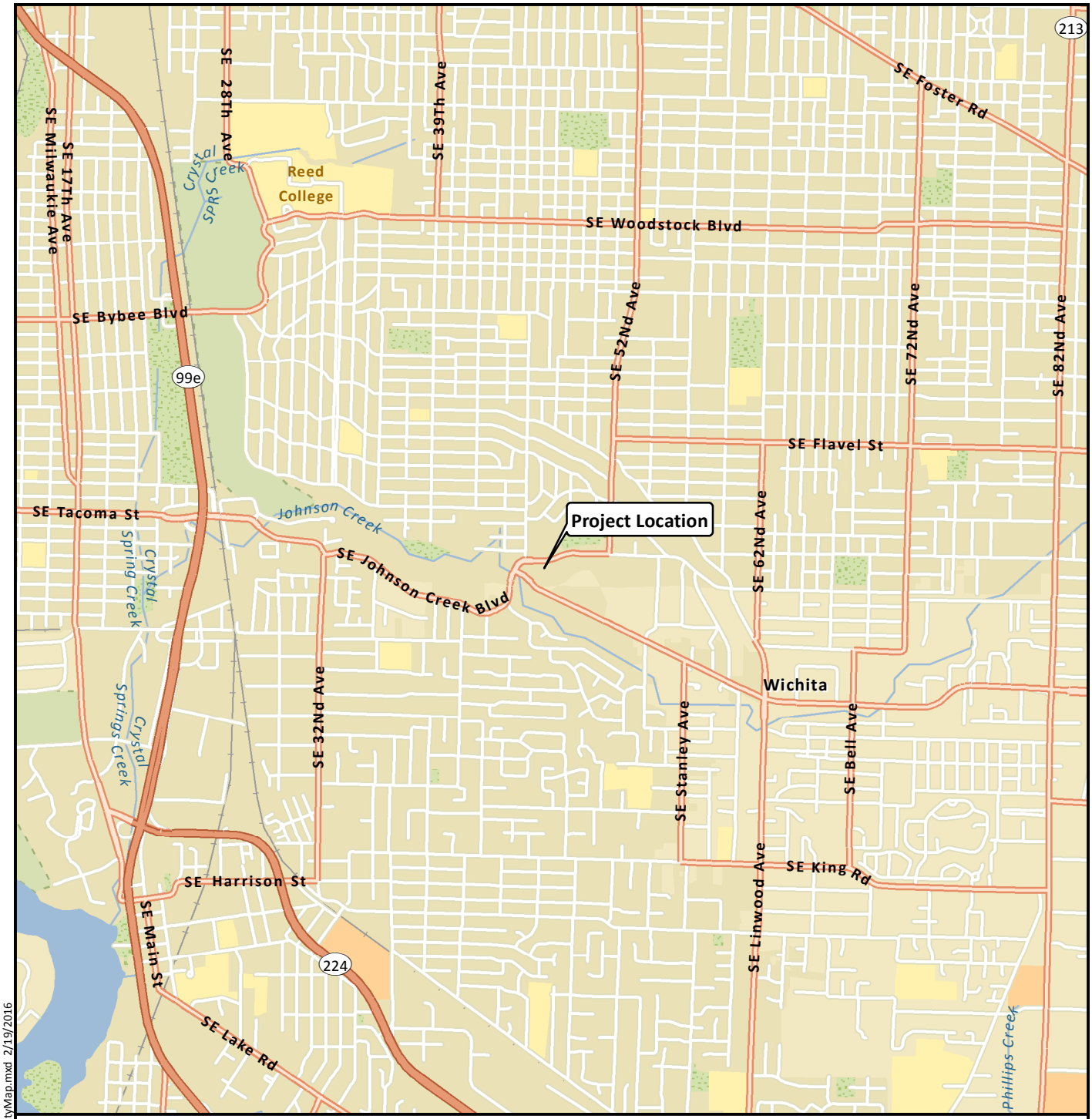
This document has been prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.

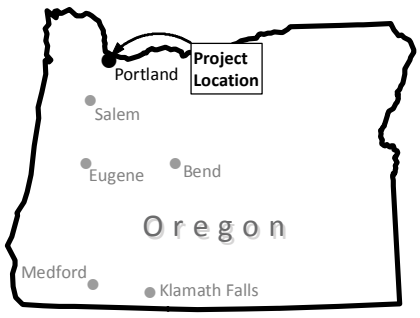
Della M Fawcett

Della Fawcett, R.G.
Project Manager

Reference initials
DMF/JPB/JAF/jln






Data Source: Esri 2012

G:\Projects\883\002\040\044\Phase II RI Report\F01 VicinityMap.mxd 2/19/2016

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| | | |
|---|---|---|
| PCC Structurals, Inc.<br>Large Parts Campus<br>Portland, Oregon | **Vicinity Map** | Figure<br>1 |

## Legend

- Phase I RI Groundwater Monitoring Well
- Phase II RI Groundwater Monitoring Well - August 2011
- Phase II RI Groundwater Monitoring Well - November 2012
- Water Supply Well
- Associated Chemists Groundwater Monitoring Wells - 1997 & 2012
- Groundwater Flow Direction
- 150 Existing Ground Surface Contour

N

Southeast Harney Drive

MW-9
Well #1
MW-1
MW-10
MW-3
Steel Building
Well #2
Well #3
MW-8
MW-11
Titanium Building
MW-5A
MW-5B
MW-7
MW-4
MW-2
Johnson Creek
Southeast Johnson Creek Boulevard

MW-5D
MW-4S
MW-3S
MW-7D
MW-6B
MW-6A
Associated Chemists Building
MW-1S
MW-6D
MW-2S

## Note

1. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data Monitoring Well Locations, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 200 400
Scale in Feet

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

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**Groundwater Monitoring Well Locations**

Figure 2

I:\Projects\883\002\040\044\Phase II RI Report\F02 GroundwaterMonitoringWellLocations.dwg (A) "Figure 2" 3/1/2016

Legend

- Direct-Push Sample Location
- Sonic Boring
- Groundwater Monitoring Well
- Water Supply Well
- 150 Existing Contour
- Groundwater Flow Direction
- A A' Cross Section Location

N

Southeast Harney Drive

Steel Building

Titanium Building

Associated Chemists Building

Southeast Johnson Creek Boulevard

Johnson Creek

DP-31, MW-9, B-11, DP-30, DP-13, Well #1, DP-32, DP-33, DP-18, DP-34, DP-22, DP-23, DP-12, MW-3/B-7, B-12, DP-35, DP-25, Well #2, DP-24, DP-21, DP-19, MW-8, DP-20, Well #3, B-14, B-13, B-6, DP-11, B-15, DP-15, DP-14, DP-16, MW-7, DP-5, DP-6, DP-17, B-10, DP-4, MW-5A, MW-5B, MW-4/B-5, DP-10, DP-9, B-9, DP-8, B-4, DP-36, DP-37, DP-7, MW-2/B-3, DP-3, B-2, DP-2, DP-39, B-16, MW-6B, MW-6A, B-17, B-18, MW-5D, MW-4S, MW-3S, MW-7D, MW-1S, MW-2S, MW-6D, MW-1/B-1A, DP-1, MW-10, DP-29, DP-27, DP-26, MW-11, DP-28

A, A', B, B', C, C', D, D'

Note

1. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data Monitoring Well Locations, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 250 500
Scale in Feet

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

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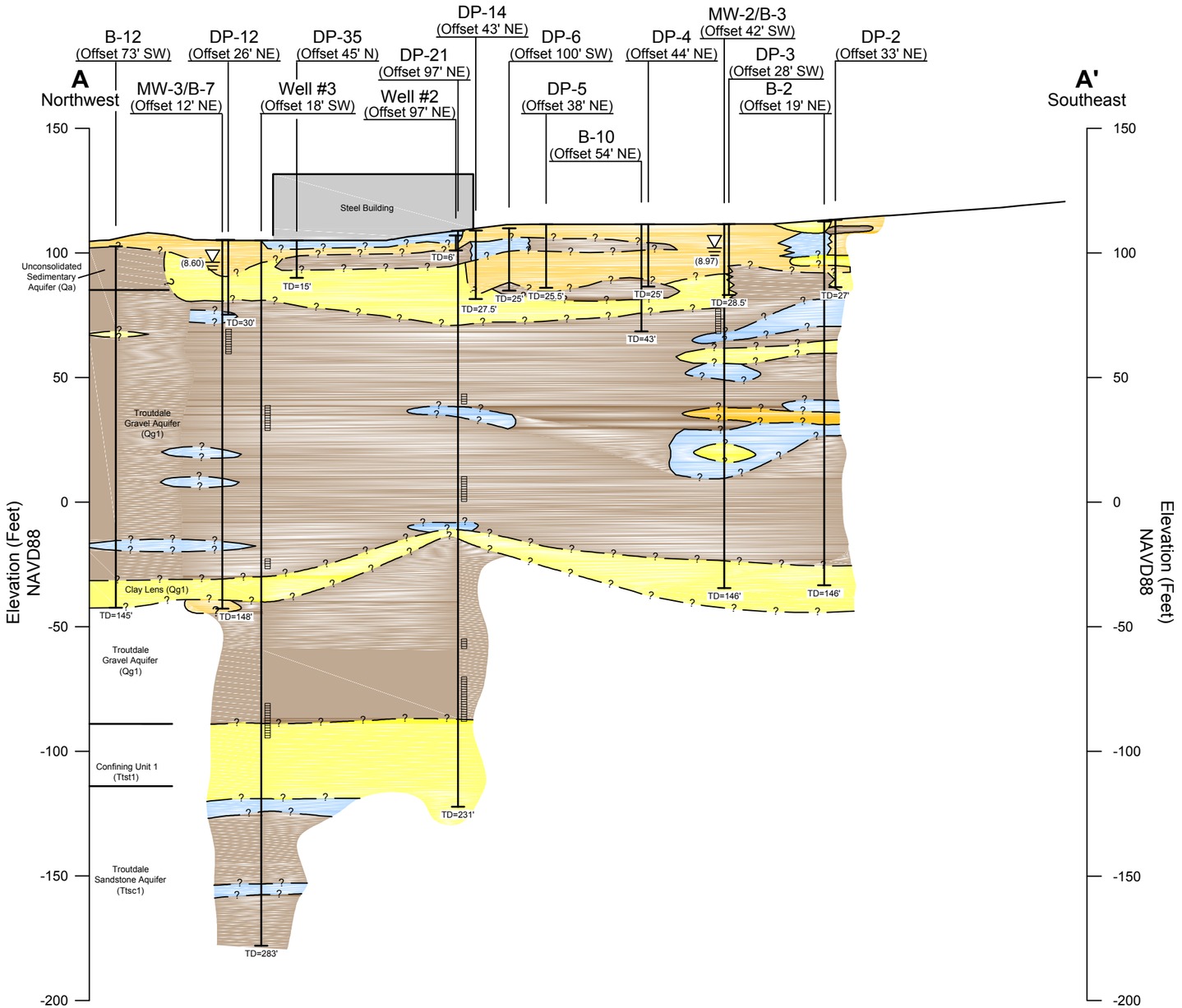
Portland, Oregon

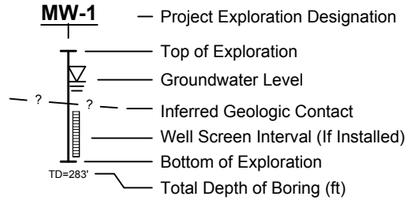
**Cross Section Location Map**

Figure 3

| G:\Projects\883\002\040\044\Phase II RI Report\F03 Cross Section Location Map.dwg (A) "Figure 3" 3/1/2016




## Legend




## Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. See report text for descriptions of geologic units.
3. For cross-section profile location, see the Cross Section Location Map.
4. Shallow soil textural data is from recent investigation and is used in place of data from supply wells #1, #2, and #3.
5. Groundwater elevations at PCC wells collected March 2012. Groundwater elevations at Associated Chemists wells collected February 2012.
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 200 400

Horizontal Scale: 1" = 200'
Vertical Scale: 1" = 50'

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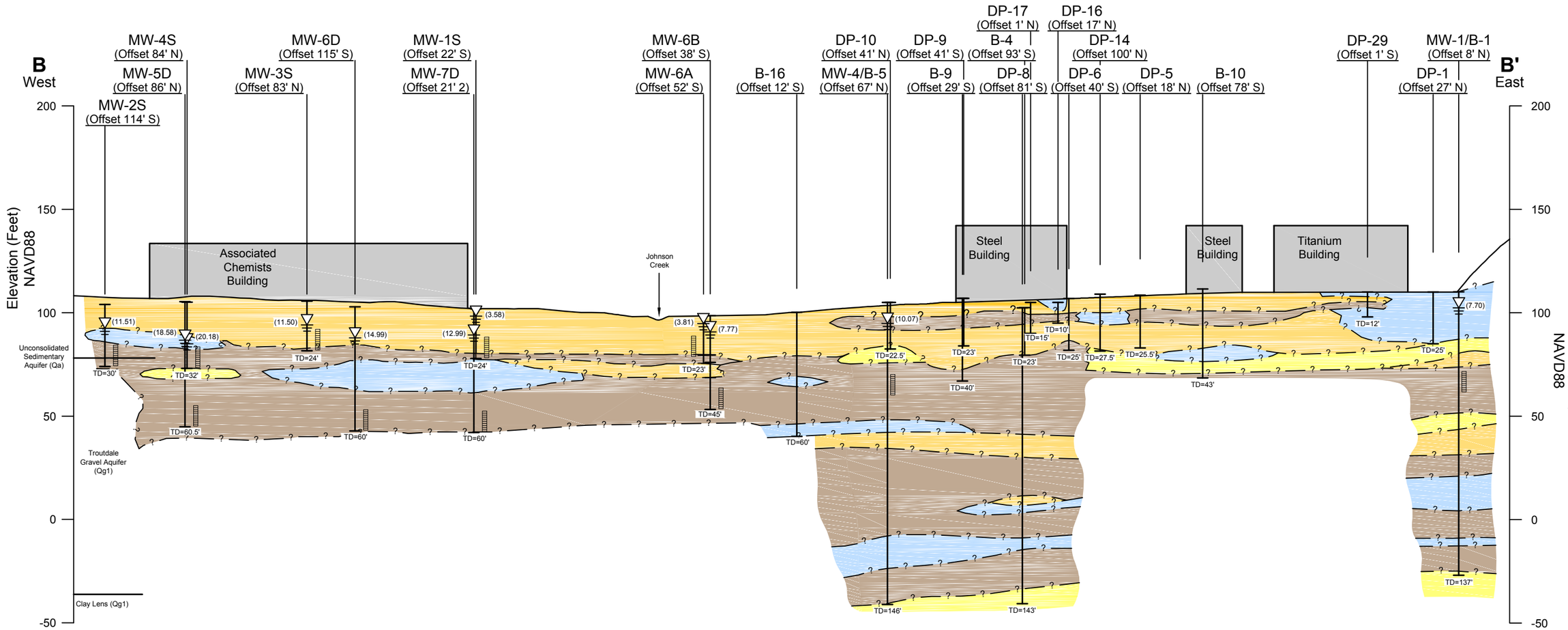
**Cross Section A-A'**

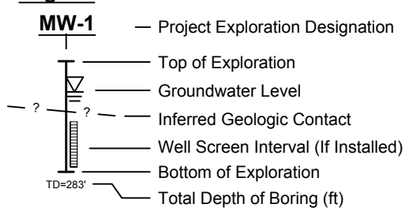
Figure 4




## Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. See report text for descriptions of geologic units.
3. For cross-section profile location, see the Cross Section Location Map.
4. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data Monitoring Well Locations, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
5. Groundwater elevations at PCC wells collected March 2012. Groundwater elevations at Associated Chemists wells collected February 2012.
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

## Legend




0 200 400

Horizontal Scale: 1" = 200'
Vertical Scale: 1" = 50'

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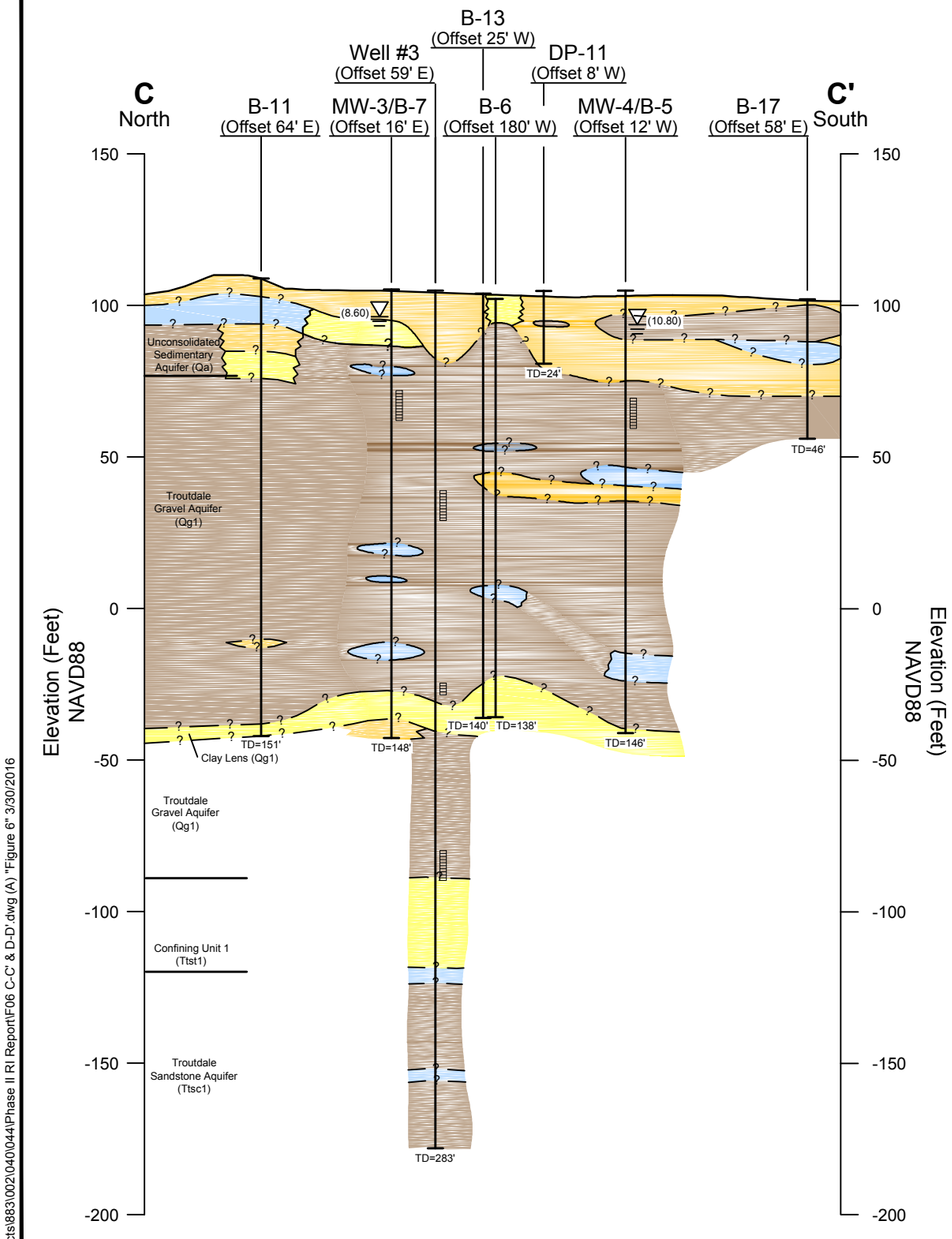
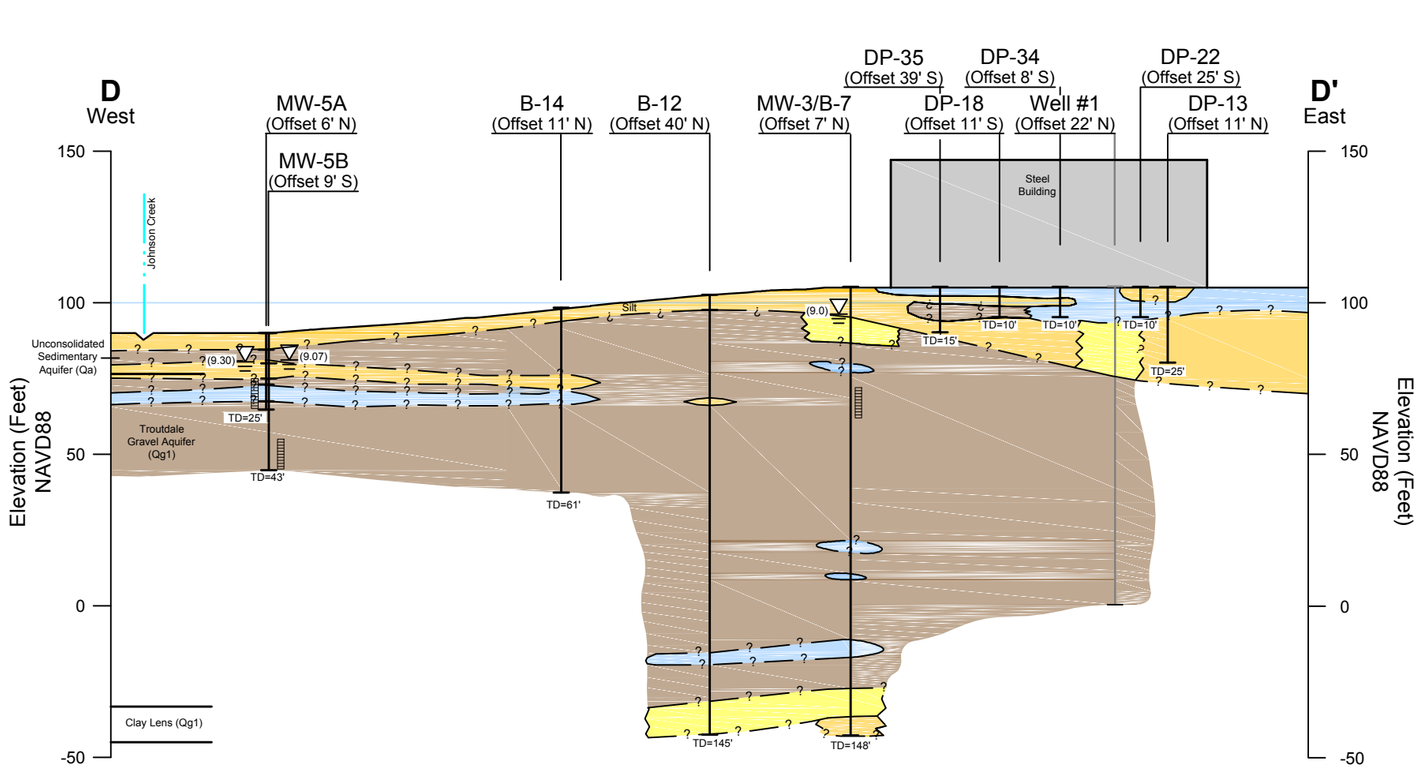
**Cross Section B-B'**

Figure 5




## Legend

- **MW-1** — Project Exploration Designation
- Top of Exploration
- Groundwater Level
- Inferred Geologic Contact
- Well Screen Interval (If Installed)
- Bottom of Exploration
- TD=283' — Total Depth of Boring (ft)
- Gravel
- Sand
- Silt
- Clay
- Building

## Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. See report text for descriptions of geologic units.
3. For cross-section profile location, see the Cross Section Location Map.
4. Shallow soil textural data is from recent investigation and is used in place of data from supply wells #1, #2, and #3.
5. Groundwater elevations at PCC wells collected March 2012. Groundwater elevations at Associated Chemists wells collected February 2012.
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 200 400

Horizontal Scale: 1" = 200'
Vertical Scale: 1" = 50'

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**Cross Sections C-C' and D-D'**

Figure 6

## Legend

- MW-1 ● Groundwater Monitoring Well Location and Designation
- 105.17 Groundwater Elevation
- ○ Water Supply Well
- Groundwater Flow Direction
- 150 Existing Ground Surface Contour
- NM Not Measured
- 85 Groundwater Elevation Contour

N

Southeast Harney Drive

MW-9

MW-3
94.11

Well #3

Steel Building

MW-8

MW-7

MW-4
92.73

MW-1
105.17

MW-10

MW-11

Titanium Building

MW-2
99.88

Southeast Johnson Creek Boulevard

MW-5A

MW-5B
89.04

MW-5D
84.50

MW-4S

MW-3S

Associated Chemists Building

MW-7D
86.76

MW-1S

MW-6B
NM

MW-6A

MW-2S

MW-6D
86.45

Space-Pak Building

### Note

1. Groundwater elevations collected May 5, 2015.
2. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data Monitoring Well Locations, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 250 500
Scale in Feet

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

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**Groundwater Elevation Contours**
**May 2015**

Figure
7

| G:\Projects\883\002\040\044\Phase II RI Report\F07 DeepGroundwaterMay2015.dwg (A) "Figure 7" 3/30/2016

## Legend

- MW-1 ● Groundwater Monitoring Well Location and Designation
- 103.60 Groundwater Elevation
- ○ Water Supply Well
- Groundwater Flow Direction
- 150 Existing Ground Surface Contour
- NM Not Measured
- 84 Groundwater Elevation Contour

N

Southeast Harney Drive

MW-9

MW-1
103.60

MW-10

MW-3
92.20

Steel Building

Well #3

MW-8

MW-11

Titanium Building

MW-7

MW-5A

MW-5B
87.15

MW-4
90.68

MW-2
97.82

Southeast Johnson Creek Boulevard

MW-5D
82.94

MW-4S

MW-3S

MW-7D
84.74

MW-1S

Associated Chemists Building

MW-6D
84.44

MW-6B
88.46

MW-6A

MW-2S

### Note

1. Groundwater elevations collected August 4-5, 2015. Groundwater elevation at MW-6B collected August 20, 2015.
2. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data Monitoring Well Locations, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 250 500
Scale in Feet

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

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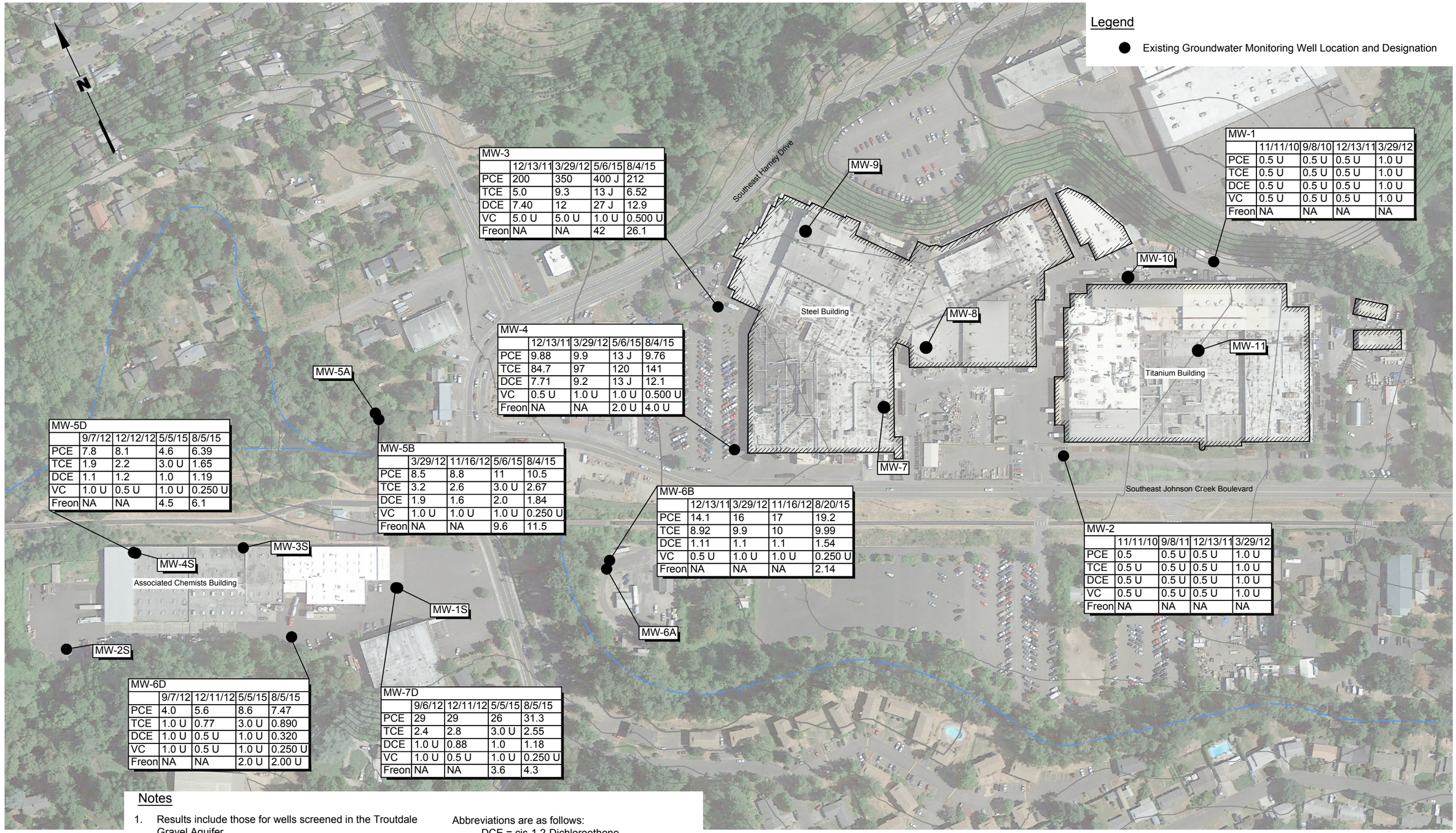
**Groundwater Elevation Contours August 2015**

Figure 8

I:\G\Projects\883002\040\044\Phase II RI Report\F08 DeepGroundwaterAugust2015.dwg (A) "Figure 8" 3/1/2016




## Notes

1. Results include those for wells screened in the Troutdale Gravel Aquifer.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.
3. Results are in µg/L.

Abbreviations are as follows:
DCE = cis-1,2-Dichloroethene
Freon = 1,1,2-Trichloro-1,2,2-trifluoroethane
NA = Not analyzed
PCE = Tetrachloroethene
TCE = Trichloroethene
VC = Vinyl Chloride

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

0 200 400
Scale in Feet

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**Groundwater Monitoring Results**

Figure 9

| G:\Projects\883\002\040\044\Phase II RI Report\F09 Groundwater Monitoring Results.dwg (A) "Figure 9" 3/1/2016

Legend

- Proposed Groundwater Monitoring Well Location
- Groundwater Monitoring Well Location
- Water Supply Well
- Groundwater Flow Direction
- 150 Existing Ground Surface Contour

N

Southeast Harney Drive

MW-9
MW-1
MW-10
MW-3
Steel Building
Well #3
MW-8
MW-11
Titanium Building
MW-7
MW-5A
MW-5B
MW-4
MW-2
Johnson Creek
Southeast Johnson Creek Boulevard
MW-5D
MW-4S
MW-3S
MW-7D
MW-12
MW-6B
MW-6A
Associated Chemists Building
MW-1S
MW-13
MW-14
MW-6D
MW-15
MW-2S

Note

1. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 200 400
Scale in Feet

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

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Large Parts Campus
Portland, Oregon

**Proposed Monitoring Well Locations**

Figure 10

| G:\Projects\883\002\040\044\Phase II RI Report\F10 ProposedMonWellLocations.dwg (A) "Figure 10" 3/1/2016

**Table 1**
**Summary of Groundwater Analyte Detection and Reporting Limits**
**PCC Structurals, Inc.**
**Portland, Oregon**

| EPA Method | Analyte | CAS | MDL | RL | Units |
|---|---|---|---|---|---|
| 8260B | 1,1,1,2-Tetrachloroethane | 630-20-6 | 0.250 | 0.500 | µg/L |
| 8260B | 1,1,1-Trichloroethane | 71-55-6 | 0.250 | 0.500 | µg/L |
| 8260B | 1,1,2,2-Tetrachloroethane | 79-34-5 | 0.250 | 0.500 | µg/L |
| 8260B | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) | 76-13-1 | 2.00 | 2.00 | µg/L |
| 8260B | 1,1,2-Trichloroethane | 79-00-5 | 0.250 | 0.500 | µg/L |
| 8260B | 1,1-Dichloroethane | 75-34-3 | 0.250 | 0.500 | µg/L |
| 8260B | 1,1-Dichloroethene | 75-35-4 | 0.250 | 0.500 | µg/L |
| 8260B | 1,1-Dichloropropene | 563-58-6 | 0.500 | 1.00 | µg/L |
| 8260B | 1,2,3-Trichlorobenzene | 87-61-6 | 1.00 | 2.00 | µg/L |
| 8260B | 1,2,3-Trichloropropane | 96-18-4 | 0.500 | 1.00 | µg/L |
| 8260B | 1,2,4-Trichlorobenzene | 120-82-1 | 1.00 | 2.00 | µg/L |
| 8260B | 1,2,4-Trimethylbenzene | 95-63-6 | 0.500 | 1.00 | µg/L |
| 8260B | 1,2-Dibromo-3-Chloropropane | 96-12-8 | 2.50 | 5.00 | µg/L |
| 8260B | 1,2-Dibromoethane | 106-93-4 | 0.250 | 0.500 | µg/L |
| 8260B | 1,2-Dichlorobenzene | 95-50-1 | 0.250 | 0.500 | µg/L |
| 8260B | 1,2-Dichloroethane | 107-06-2 | 0.250 | 0.500 | µg/L |
| 8260B | 1,2-Dichloropropane | 78-87-5 | 0.250 | 0.500 | µg/L |
| 8260B | 1,3,5-Trimethylbenzene | 108-67-8 | 0.500 | 1.00 | µg/L |
| 8260B | 1,3-Dichlorobenzene | 541-73-1 | 0.250 | 0.500 | µg/L |
| 8260B | 1,3-Dichloropropane | 142-28-9 | 0.500 | 1.00 | µg/L |
| 8260B | 1,4-Dichlorobenzene | 106-46-7 | 0.250 | 0.500 | µg/L |
| 8260B | 2,2-Dichloropropane | 594-20-7 | 0.500 | 1.00 | µg/L |
| 8260B | 2-Butanone | 78-93-3 | 5.00 | 10.0 | µg/L |
| 8260B | 2-Chlorotoluene | 95-49-8 | 0.500 | 1.00 | µg/L |
| 8260B | 2-Hexanone | 591-78-6 | 5.00 | 10.0 | µg/L |
| 8260B | 4-Chlorotoluene | 106-43-4 | 0.500 | 1.00 | µg/L |
| 8260B | 4-Isopropyltoluene | 99-87-6 | 0.500 | 1.00 | µg/L |
| 8260B | 4-Methyl-2-pentanone | 108-10-1 | 5.00 | 10.0 | µg/L |
| 8260B | Acetone | 67-64-1 | 10.0 | 20.0 | µg/L |
| 8260B | Benzene | 71-43-2 | 0.125 | 0.250 | µg/L |
| 8260B | Bromobenzene | 108-86-1 | 0.250 | 0.500 | µg/L |
| 8260B | Bromochloromethane | 74-97-5 | 0.500 | 1.00 | µg/L |
| 8260B | Bromodichloromethane | 75-27-4 | 0.500 | 1.00 | µg/L |
| 8260B | Bromoform | 75-25-2 | 0.500 | 1.00 | µg/L |
| 8260B | Bromomethane | 74-83-9 | 5.00 | 5.00 | µg/L |
| 8260B | Carbon disulfide | 75-15-0 | 5.00 | 10.0 | µg/L |
| 8260B | Carbon tetrachloride | 56-23-5 | 0.250 | 0.500 | µg/L |
| 8260B | Chlorobenzene | 108-90-7 | 0.250 | 0.500 | µg/L |
| 8260B | Chloroethane | 75-00-3 | 5.00 | 5.00 | µg/L |
| 8260B | Chloroform | 67-66-3 | 0.500 | 1.00 | µg/L |
| 8260B | Chloromethane | 74-87-3 | 2.50 | 5.00 | µg/L |
| 8260B | cis-1,2-Dichloroethene | 156-59-2 | 0.250 | 0.500 | µg/L |
| 8260B | cis-1,3-Dichloropropene | 10061-01-5 | 0.500 | 1.00 | µg/L |
| 8260B | Dibromochloromethane | 124-48-1 | 0.500 | 1.00 | µg/L |
| 8260B | Dibromomethane | 74-95-3 | 0.500 | 1.00 | µg/L |
| 8260B | Dichlorodifluoromethane | 75-71-8 | 0.500 | 1.00 | µg/L |
| 8260B | Ethylbenzene | 100-41-4 | 0.250 | 0.500 | µg/L |
| 8260B | Hexachlorobutadiene | 87-68-3 | 2.50 | 5.00 | µg/L |
| 8260B | Hexane | 110-54-3 | 5.00 | 10.0 | µg/L |
| 8260B | Isopropylbenzene | 98-82-8 | 0.500 | 1.00 | µg/L |

**Table 1**
**Summary of Groundwater Analyte Detection and Reporting Limits**
**PCC Structurals, Inc.**
**Portland, Oregon**

| EPA Method | Analyte | CAS | MDL | RL | Units |
|---|---|---|---|---|---|
| 8260B | Methyl tert-butyl ether | 1634-04-4 | 0.500 | 1.00 | µg/L |
| 8260B | Methylene Chloride | 75-09-2 | 2.50 | 5.00 | µg/L |
| 8260B | Naphthalene | 91-20-3 | 1.00 | 2.00 | µg/L |
| 8260B | n-Butylbenzene | 104-51-8 | 0.500 | 1.00 | µg/L |
| 8260B | N-Propylbenzene | 103-65-1 | 0.250 | 0.500 | µg/L |
| 8260B | sec-Butylbenzene | 135-98-8 | 0.500 | 1.00 | µg/L |
| 8260B | Styrene | 100-42-5 | 0.500 | 1.00 | µg/L |
| 8260B | Tetrachloroethene | 127-18-4 | 0.250 | 0.500 | µg/L |
| 8260B | Toluene | 108-88-3 | 0.500 | 1.00 | µg/L |
| 8260B | trans-1,2-Dichloroethene | 156-60-5 | 0.250 | 0.500 | µg/L |
| 8260B | trans-1,3-Dichloropropene | 10061-02-6 | 0.500 | 1.00 | µg/L |
| 8260B | trans-1,4-Dichloro-2-butene | 110-57-6 | 5.00 | 10.0 | µg/L |
| 8260B | Trichloroethene | 79-01-6 | 0.250 | 0.500 | µg/L |
| 8260B | Trichlorofluoromethane | 75-69-4 | 1.00 | 2.00 | µg/L |
| 8260B | Vinyl acetate | 108-05-4 | 5.00 | 10.0 | µg/L |
| 8260B | Vinyl chloride | 75-01-4 | 0.250 | 0.500 | µg/L |
| 8260B | Xylenes, Total | 1330-20-7 | 0.500 | 1.00 | µg/L |

CAS = Chemical Abstract Service
EPA = U.S. Environmental Protection Agency
MDL = method detection limit
µg/L = micrograms per liter
RL = reporting limit

APPENDIX A

# Shallow Groundwater Elevation Contours

## Legend

- MW-1S ● Groundwater Monitoring Well Location and Designation
- 97.41 Groundwater Elevation
- ○ Water Supply Well
- Groundwater Flow Direction
- 150 Existing Ground Surface Contour
- NM Not Measured
- –84 Groundwater Elevation Contour

N

Southeast Harney Drive

MW-9

MW-1

MW-10

MW-3

Steel Building

Well #3

MW-8

MW-11

Titanium Building

MW-7

MW-4

MW-2

Southeast Johnson Creek Boulevard

MW-5A
88.91

MW-5B

MW-5D

MW-4S
82.73

MW-3S
90.10

Associated Chemists Building

MW-7D

MW-1S
97.41

MW-2S
90.60

MW-6D

MW-6B

MW-6A
NM

84 85 86 87 88 89 90 91 92 93 94 95 96

150 125 100

## Note

1. Groundwater elevations collected May 5, 2015.
2. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data Monitoring Well Locations, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 250 500
Scale in Feet

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

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Large Parts Campus
Portland, Oregon

**Shallow Groundwater Elevation Contours - May 2015**

Figure
A-1

| G:\Projects\883\002\040\044\Phase II RI Report\F0A-1 ShallowGroundwaterMay2015.dwg (A) "Figure A-1" 3/1/2016

## Legend

- MW-1S ● Groundwater Monitoring Well Location and Designation
- 96.41 Groundwater Elevation
- ○ Water Supply Well
- Groundwater Flow Direction
- 150 Existing Ground Surface Contour
- NM Not Measured
- 83 Groundwater Elevation Contour

N

Southeast Harney Drive

MW-9
MW-1
MW-10
MW-3
Steel Building
Well #3
MW-8
MW-11
Titanium Building
MW-7
MW-4
MW-2
Southeast Johnson Creek Boulevard

MW-5A
87.00
MW-5B
86
87
88
89
90
91
92
93
94
95
85
84
83
MW-5D
MW-4S
81.93
MW-3S
87.77
Associated Chemists Building
MW-7D
MW-1S
96.41
MW-6B
MW-6A
95.23
MW-6D
MW-2S
88.65

## Note

1. Groundwater elevations collected August 4-5, 2015. Groundwater elevation at MW-6A collected August 20, 2015.
2. Ground surface elevation data originated from USGS NED DEM of Gladstone_OR 2009 and adjusted per field survey data Monitoring Well Locations, Chase, Jones & Associates Inc. June 7, 2009. City of Portland Vertical Datum. All ground surface elevations are approximate.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 200 400
Scale in Feet

Base map source: Aerial Photo Provided by Google 2012, Base Drawing from PCC 1989, USGS NED DEM 2009

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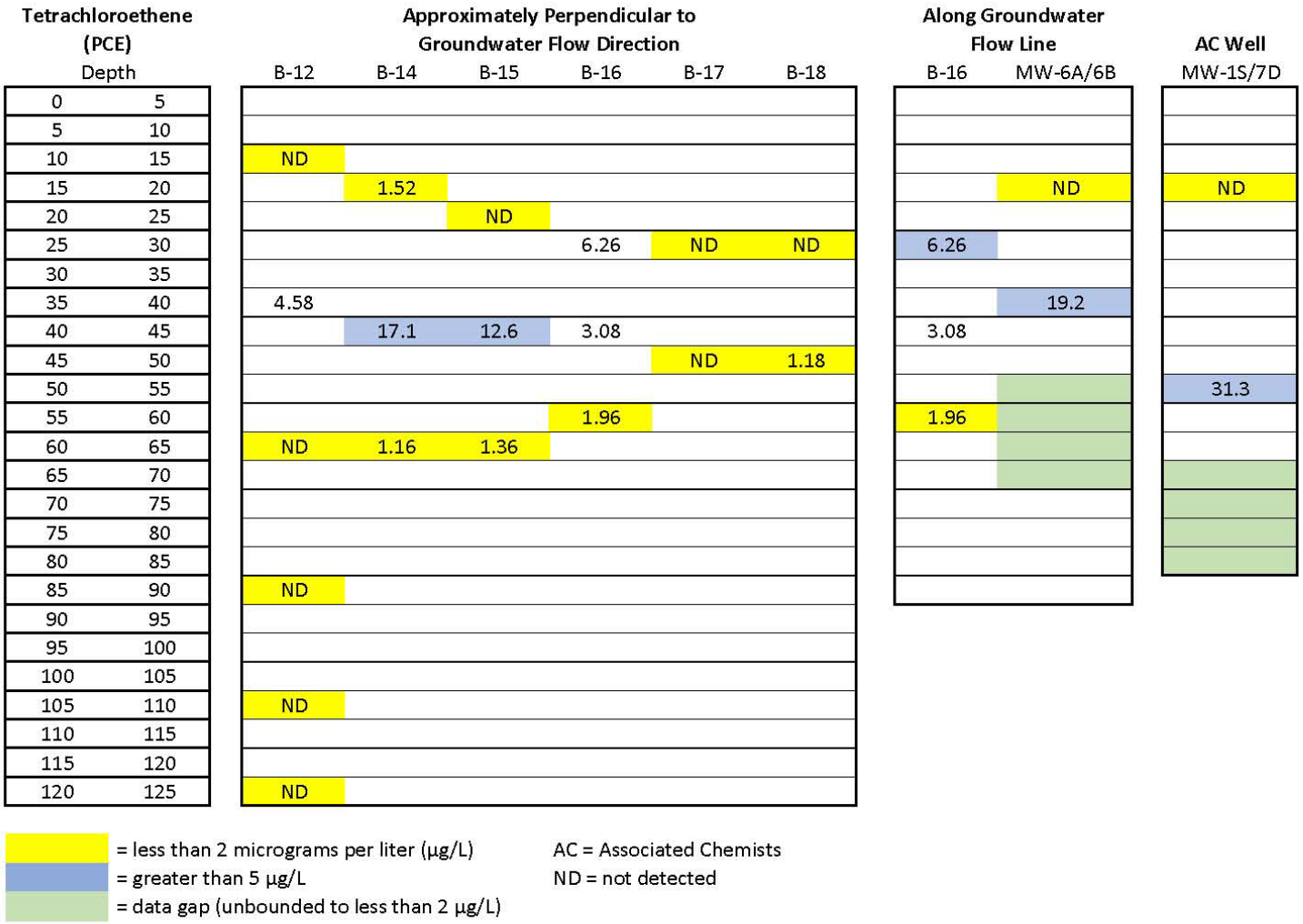
**Shallow Groundwater Elevation Contours - August 2015**

Figure A-2

| G:\Projects\883\002\040\044\Phase II RI Report\F0A-2 ShallowGroundwaterAugust2015.dwg (A) "Figure A-2" 3/1/2016

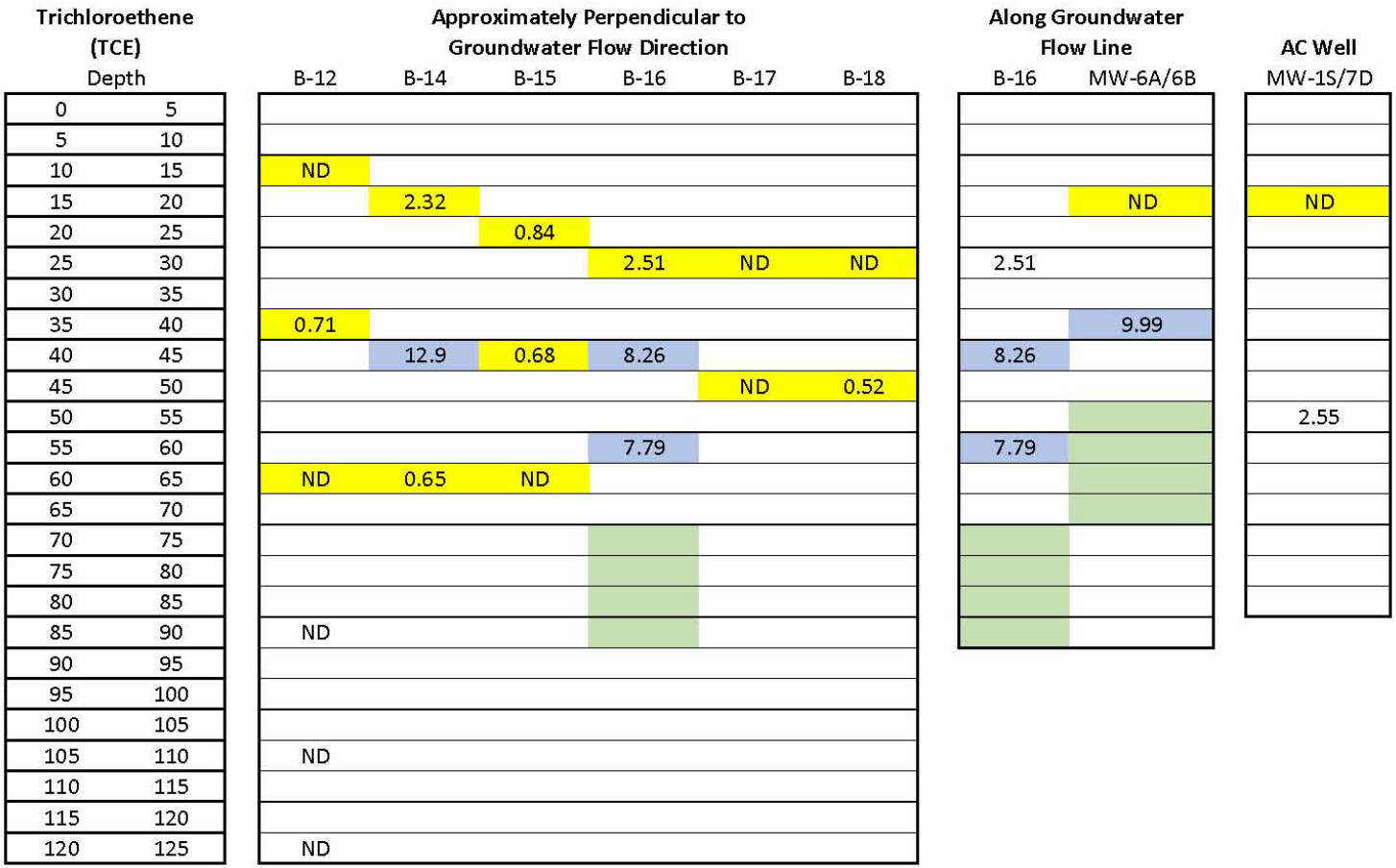
APPENDIX B

# Constituent Concentrations with Depth




| | | |
|---|---|---|
| LANDAU ASSOCIATES | PCC Structurals, Inc.<br>Large Parts Campus<br>Portland, Oregon | **Tetrachloroethene (PCE) Concentrations – Selected Wells** |

Figure
B-1

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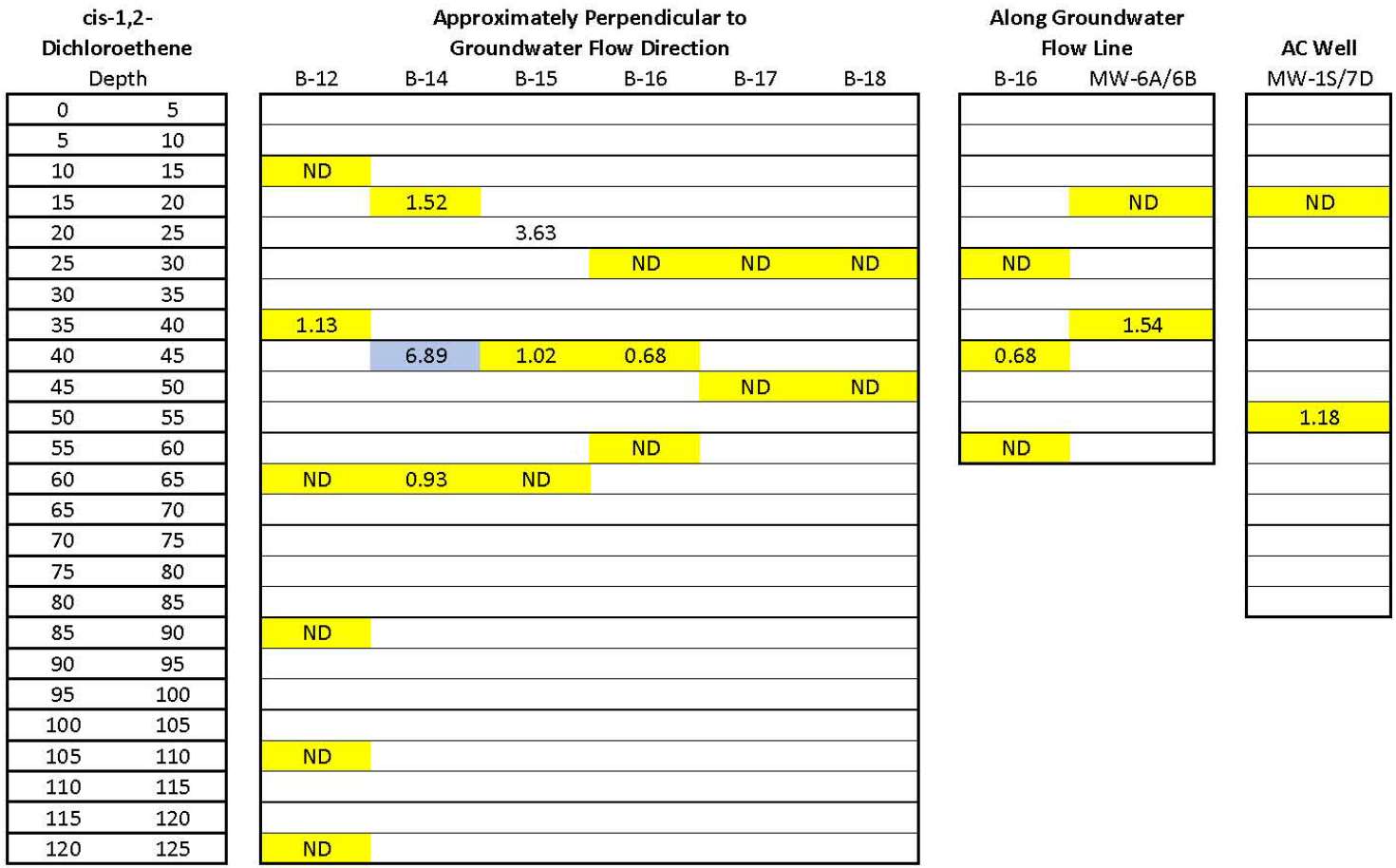
**Trichloroethene (TCE) Concentrations – Selected Wells**

Figure
B-2

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**Cis-1,2-Dichloroethene (DCE) Concentrations – Selected Wells**

Figure
B-3