2014 Surface Water Investigation Report
Boeing Auburn Facility
Auburn, Washington

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Prepared for

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1.0 INTRODUCTION

The Boeing Company (Boeing) is currently undergoing corrective action at their Auburn Fabrication Division facility (facility) located at 700 15th Street Southwest (SW) in Auburn, Washington. Corrective action requirements are documented in an Agreed Order (Order; No. DE 01HWTRNR-3345) dated August 14, 2002 and the First Amended Agreed Order dated February 21, 2006, both with the Washington State Department of Ecology (Ecology). The Order includes a requirement to conduct a remedial investigation (RI) of facility contamination impacts both on Boeing property and at downgradient properties (off Boeing property). This report documents 2014 surface water investigations in Algona and Auburn, Washington. The Boeing property[1] location and vicinity map are shown on Figure 1.

1.1 INVESTIGATION SCOPE AND OBJECTIVES

The 2014 surface water investigation was conducted to address surface water data gaps to support the completion of the RI in accordance with the 2*014 Surface Water Investigation Work Plan* (Work Plan; Landau Associates 2014a). The objectives of this investigation are presented in the Work Plan and are summarized below:

- Determine the extent of volatile organic compounds (VOCs) in surface water and whether VOCs are discharging to Mill Creek
- Monitor water levels at select surface water bodies and adjacent shallow wells to evaluate hydraulic gradients, for discharge and recharge patterns between groundwater and surface water
- Collect data to support a long-term surface water monitoring plan.

1.2 BACKGROUND

Boeing has been implementing RI activities to characterize the nature and extent of two groundwater plumes: the Area 1 plume (Plume 1) and the western plume (Plume 2). The plumes are defined by detections of trichloroethene (TCE) and its breakdown products: cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC). TCE and VC are the primary constituents of concern due to their relative toxicity and low cleanup levels.

The groundwater plumes are located in the uppermost aquifer which consists of saturated portions of Modern Alluvium and recent alluvium deposited by the Green and White rivers. The Osceola Mudflow serves as a regional aquitard between the uppermost aquifer and deeper aquifers. Locally, beneath the Boeing property and off Boeing property to the north, the uppermost aquifer is approximately 80 to 100

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[1] The facility as defined in the First Amended Agreed Order consists of the Boeing property and the Prologis property directly north of the Boeing property.

feet (ft) thick. For the purpose of the RI, the uppermost aquifer has been subdivided into three groundwater zones based on depth beneath ground surface (BGS):

- A shallow zone from approximately ground surface to 30 ft BGS. The shallowest wells within this zone are screened at or near the water table; water table data is considered a subset of the shallow zone data.
- An intermediate zone from approximately 40 and 60 ft BGS.
- A deep zone from approximately 80 and 100 ft BGS. The bottom of the deep zone is defined by the contact with the Osceola Mudflow, the depth of which varies based on location.

The groundwater plumes appear to originate at the north end of the Boeing property and extend north and northwest beneath the southwestern portion of Auburn and the northeastern portion of Algona (Landau Associates 2015).

Various surface water, wetland, and stormwater features are present in the vicinity of the plumes and include the Chicago Avenue ditch, the O Street wetland, the Auburn 400 north and Auburn 400 south flood storage ponds (Auburn 400 north and south ponds), The Outlet Collection stormwater ponds, and various unnamed ditches. Portions of the plumes also underlie parts of the wetlands that comprise the Auburn Environmental Park. These surface water, wetland, and stormwater features eventually drain into Mill Creek as described in Section 1.2.1. The location of these surface water features are shown on Figure 2.

1.2.1 Surface Water Flow

Water in the Chicago Avenue ditch flows north and enters the City of Auburn's piped stormwater system at Boundary Boulevard. Water from the O Street wetland is also channelized and flows into the City of Auburn's piped stormwater system. The piped water flows west to the Auburn 400 south pond, which then discharges to the Auburn 400 north pond. The Auburn 400 north pond also captures stormwater from 15th Street SW and the southern portion of The Outlet Collection complex. Water from The Outlet Collection stormwater ponds appears to discharge into a ditch on the northwest side of the stormwater ponds. This ditch combines with flow from the Auburn 400 north pond and discharges to a channel in the wetland on the west side of State Route (SR) 167. A channelized portion of the wetland carries water north where it joins Mill Creek at the east end of Peasley Canyon Road. Mill Creek then flows northward through various wetland complexes before it joins the Green River several miles downstream. Surface water features and flow patterns are presented on Figure 2.

1.2.2 Groundwater Flow

Groundwater flow in the Auburn Valley is generally northward, parallel to the valley sidewalls (Pacific Groundwater Group 1999). However, in the vicinity of the northern portion of the Boeing facility, there is a strong northwestern component to groundwater flow. The northwestern component of flow appears to be caused by groundwater discharge to surface water features mentioned above. This northwestern component of flow is most pronounced in the shallow zone where groundwater is in direct hydraulic connection with the surface water features. Shallow zone groundwater contours are shown on Figure 3.

1.3 PREVIOUS SURFACE WATER INVESTIGATIONS

Surface water sampling investigation activities near the Boeing facility were first conducted in June 2012. Surface water samples were collected from 11 locations during the initial sampling event. There were no detections of constituents of concern at 9 of the 11 surface water sampling locations. Low-level concentrations of VOCs of concern were detected at sample location (SW-4) in the Chicago Avenue ditch and at sample location (SW-11) in the Auburn 400 north pond (Landau Associates 2012a).

Additional dry season surface water sampling was conducted at four locations (SW-CD1 through SW-CD4) throughout the Chicago Avenue ditch on September 17, 2012 to assess spatial variability of VOC concentrations and to help determine a location for quarterly sampling. Low levels of VOCs were detected only in the northernmost three of the four samples, with the highest concentrations at the north end of the ditch (Landau Associates 2012b). Results from the 2012 sampling events are presented on Figure 4.

Recommendations for additional surface water investigations in Auburn and Algona were presented to Ecology (Landau Associates 2013a). The Algona portion of the work was delayed due to additional discussions needed with Ecology and City of Algona. The Auburn portion of the investigation included sampling at six locations and occurred on July 2, 2013. Low-level concentration of VOCs of concern were detected in samples collected from one location in the Auburn 400 south pond (SW-14), one location in the Auburn 400 north pond (SW-16), and from one sample collected from the wetland west of SR-167 (SW-17). There were no detections of VOCs of concern in samples collected in the other three sampling locations (Landau Associates 2014b). Results from the 2013 sampling event are presented on Figure 4.

1.4 SCREENING LEVELS

Screening levels for surface water under the Model Toxics Control Act (MTCA), which governs environmental cleanup in Washington, use exposure scenarios related to drinking water and consumption of fish. While these scenarios are applicable to portions of the site that include Mill Creek, they are not applicable to exposure in stormwater collection systems. As such, Ecology has approved site-specific surface water screening levels for ditches in northern Algona based on a more typical exposure scenario (worker scenario) for this type of surface water feature. The worker scenario assumes the population most frequently exposed to water in the ditches is public works employees who are responsible for regularly cleaning the ditches. The worker scenario includes an evaluation of dermal contact, inhalation, and incidental ingestion. The Algona ditch screening levels based on direct contact exposure scenarios for adult workers were provided for Ecology review in the Screening Levels for Yard and Ditch Surface Water technical memorandum (Landau Associates 2013b) [2]. Ecology approved these screening levels in a letter dated November 22, 2013 (Ecology 2013) and indicated that these screening levels are applicable to ditches within the project area in northern Algona.

Screening levels for Mill Creek are based on an assumption that water from the creek may be used as drinking water. Domestic water supply is a listed use designation for Mill Creek under the Washington Administrative Code 173-201A-602. However, the wetlands, stormwater ponds, pipes, and ditches that drain to Mill Creek are features that are not used for recreation or drinking water. Boeing proposes that screening levels for the aforementioned features that are not part of Mill Creek be based on non-potable surface water standards. Surface water screening levels for VOCs of concern are provided in the table below.

COMPOUND	PCE	TCE	cis-1,2-DCE	VC
Screening level for Algona ditches (based on site specific risk scenario; µg/L)	--	58 (a)	--	98 (a)
Screening level for Mill Creek (based on consumption of drinking water and organisms; µg/L) (b)	10 (c)	0.6 (c)	16 (d)	0.022 (c)
Screening level for non-potable surface water including Auburn wetlands, stormwater ponds, pipes, and ditches that drain to Mill Creek (based on consumption of organisms only; µg/L) (e)	29 (c)	7.0 (c)	--	1.6 (c)

µg/L = micrograms per liter

Notes:

(a) Ecology-approved screening level based on site-specific exposure scenario for ditches. Screening criteria for tetrachloroethene (PCE) and cis-1,2-DCE have not been calculated.
(b) Screening level for protection of human health for surface water used as drinking water.
(c) Screening level based on June 2015 Final National Recommended Water Quality Criteria, which is less than or equal to the MTCA Method B standard formula value.
(d) Screening level based on MTCA Method B standard formula value for groundwater as drinking water. No surface water criteria available. No data available for protection of fresh surface water that is not drinking water.
(e) Screening level for protection of human health for surface water not used as drinking water (non-potable surface water).

[2] This memorandum evaluated two exposure scenarios, child exposure to standing water in residential yards and worker exposure to surface water while working in ditches. Child exposure to water in ditches was not evaluated due to the depth of the ditches and other exposure concerns regarding children playing in stormwater ditches.

2.0 FIELD INVESTIGATION ACTIVITIES

The scope of the 2014 surface water field investigation activities is presented in the Work Plan (Landau Associates 2014a). Field activities included wet season and dry season surface water sampling in Auburn, quarterly surface water sampling in Algona, and collection of surface water and co-located groundwater levels for determining groundwater-surface water interactions. Wet season is considered to be the months of October through approximately May and dry season is considered to be the months of approximately June through September. Prior to beginning field activities, permits were obtained from the City of Algona and Washington State Department of Transportation. Boeing also contacted City of Auburn, Glimcher, and Southern Financial Group (property owner of the O Street wetland) for permission to access sampling locations. Figure 2 shows the 2014 surface water sampling locations.

2.1 WATER LEVEL MONITORING

Water level monitoring activities included surface water level monitoring in the Chicago Avenue ditch in Algona and in the Auburn 400 north flood storage pond in Auburn. Groundwater level monitoring was conducted in wells adjacent to each of the surface water monitoring stations in order to evaluate the relationship between groundwater and surface water elevations throughout the year..

A staff gauge, SWSG-2, and datalogger station were installed in the Chicago Avenue ditch adjacent to shallow well AGW225. Dataloggers were also installed in shallow wells AGW225 and AGW226. The dataloggers collected hourly pressure transducer measurements, which were compensated for barometric pressure with a barologger installed at the datalogger station. Hand measurements were also periodically collected from the staff gauge and from the wells using an electronic water level indicator. These hand measurements were used to verify that the dataloggers were accurately recording water elevations. Water level monitoring in Algona was conducted for 10 months[3], beginning January 2014 and ending October 2014. Chicago Avenue ditch water level results are discussed in Section 3.1.

Water level monitoring activities in Auburn included monthly measurements at the staff gauge in the Auburn 400 north flood storage pond and groundwater elevation measurements at the adjacent wells (AGW235 and AGW236). Water level measurements were collected on a monthly basis at these locations. Water level measurements from multi-level well AGW235 were collected from the two shallowest channels (AGW235-1 and AGW235-2), plus a channel from the intermediate zone (AGW235-4) in order to characterize vertical hydraulic gradients adjacent to the Auburn 400 north pond[4]. One monitoring event was completed following a period of heavy rainfall (at least 0.5 inches in 24 hours). The purpose for

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[3] Water level monitoring occurred for 1 month more than specified in the work plan to verify September data.
[4] Vertical gradients will be discussed in a separate report.

collecting a measurement after a storm event was to determine if groundwater/surface water gradients are temporarily reversed during heavy rain events. Water level monitoring was conducted for 12 months, beginning November 2013 and ending October 2014. Auburn 400 north pond results are discussed in Section 3.2.

2.2 SURFACE WATER SAMPLING

Wet season surface water sampling in Auburn occurred on March 24 and April 2, 2014[5]. Dry season surface water sampling in Auburn occurred on September 5, 2014. Sampling at the Chicago Avenue ditch in Algona occurred quarterly on December 5, 2013; February 27, 2014; May 30, 2014; and September 4, 2014. All surface water sampling occurred after a period of no measureable precipitation over the preceding 48-hour period to minimize stormwater runoff contribution at sampling locations. Sampling was scheduled to coincide with groundwater monitoring events when weather allowed.

Sampling was conducted using either a peristaltic pump and dedicated tubing or a dedicated composite liquid waste sampler (COLIWASA). COLIWASAs were used to collect water samples at all locations, except where water was too deep to use a COLIWASA sampler or next to steep banks. Peristaltic pumps were used to collect water samples at all sample locations at the Chicago Avenue ditch, at sample location SW-14 and SW-19 in the Auburn 400 ponds, and at all sample locations in the wetland west of SR 167 and at Mill Creek. All samples were collected from no more than 4 inches above the substrate and at least 2 inches below the water surface or in the approximate mid-point of the water column where the water depth was less than 4 inches. A more complete description of the use of COLIWASA samplers is presented in the Work Plan (Landau Associates 2014a). When using the peristaltic pump, sample tubing was attached to a rigid pole to control the sampling location and depth. Field parameters (pH, conductivity, dissolved oxygen, temperature, and oxidation-reduction potential) were measured with a multi-parameter probe (YSI 556 MPS) either via a peristaltic pump and flow-through cell or by placing the probe directly in the water at the sampling depth.

Samples were collected in laboratory-provided 40 milliliter volatile organic analysis (VOA) glass vials and preserved with hydrochloric acid. Five VOA vials were collected for each sample location. Samples were preserved in a cooler on ice and submitted under chain-of-custody protocols to Eurofins Lancaster Laboratories, Inc. in Lancaster, Pennsylvania. Surface water samples were analyzed for VOCs by U.S. Environmental Protection Agency (EPA) Methods 8260 and 8260 selected ion monitoring (SIM). SIM analysis was performed for VC in order to achieve reporting limits below site screening levels. SIM

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[5] A surface water sample was collected at the O Street wetland on April 2, 2014, after the other wet season surface water sampling due to delays in access approval.

analysis was also performed for TCE and PCE for the first two quarterly sampling events at the Chicago Avenue ditch per Ecology's request until the Work Plan was approved with updated analytical requirements. Trip blanks and blind duplicate samples were analyzed for quality assurance. VOC results are discussed in Section 4.0.

3.0 WATER LEVEL DATA

Water level data was collected at surface water locations in the Chicago Avenue ditch and the Auburn 400 north ponds and adjacent monitoring wells. Collection of water level data from these surface water bodies and adjacent monitoring wells allowed for analysis of groundwater-surface water interactions in these areas. Rainfall data obtained from a local rainfall gauge at Lakeland Hills – Orovitz Pump Station I & I (King County website 2014) was used to evaluate the impacts of precipitation and stormwater on both groundwater and surface water levels. Water level data collected at the Chicago Avenue ditch occurred over 10 months from January to October 2014 and water level data collected at the Auburn 400 north pond occurred over 12 months from November 2013 to October 2014. These time spans covered both dry and wet seasons. Monthly water level measurements collected with a handheld, electronic water-level indicator are presented on Table 1 for the Chicago Avenue ditch and on Table 2 for the Auburn 400 north pond. Water level monitoring locations are shown for the Chicago Avenue ditch on Figure 5 and for the Auburn 400 north pond on Figure 6.

3.1 CHICAGO AVENUE DITCH

Groundwater elevations, at shallow zone well AGW225 located approximately 12 ft west of the Chicago Avenue ditch, were higher than surface water elevations in the ditch at staff gauge SWSG-2 over the entire 10 months of monitoring. These data indicate there was a hydraulic gradient from groundwater to surface water during the entire monitoring period and confirms that the ditch is capturing groundwater flow. The relationship between groundwater levels at AGW225 and ditch surface water levels is presented on the graph on Figure 7.

Both the surface water in the Chicago Avenue ditch and nearby shallow groundwater at AGW225 and AGW226 respond quickly to rain events. However, even during large rain events, an upward gradient is maintained from groundwater to surface water. The steepness of the gradient between groundwater and surface water varies throughout the year. While the average monthly ditch water level remains relatively constant[6], seasonal groundwater levels at AGW225 vary almost 2 ft (excluding short term increases associated with rain events)[7]. Consequently, during seasonal high water levels (measured March through May 2014), the gradient from groundwater to surface water is appreciably steeper.

Groundwater discharge to the Chicago Avenue ditch comes from shallow zone groundwater flow upgradient of the ditch. A relatively small portion of the shallow zone downgradient of the ditch would

[6] The average monthly water level at SWSG2 based on hourly datalogger readings was a maximum of 68.24 ft in March 2014 and a minimum of 67.89 ft in June 2014.

[7] The average monthly water level at AGW225 based on hourly datalogger readings was a maximum of 70.49 ft in March 2014 and a minimum of 68.53 ft in September 2014.

also be expected to contribute to groundwater flow to the ditch. The portion of the aquifer that contributes water to the ditch is known as the ditch capture zone or contribution zone. The depth and downgradient extent of groundwater that is captured by the ditch can be estimated based on measured water levels in the ditch and aquifer, the width of the ditch[8] and aquifer groundwater flow parameters[9] (Chambers and Bahr 1992; Zheng et al. 1988). Based on these parameters, the estimated depth of groundwater captured by the Chicago Avenue ditch ranges from approximately 14 ft BGS in September 2014 to approximately 31 ft BGS in April 2014. The estimated downgradient extent of groundwater captured by the ditch ranged from approximately 16 ft in September to 34 ft in April. Capture zone calculations are presented in Appendix A and should be considered rough approximations for the Chicago Avenue ditch. The purpose of the capture zone calculations is to provide a working conceptual understanding of how the ditch interacts with groundwater.

Dataloggers were installed at both AGW225 and AGW226. AGW225 is adjacent to the Chicago Avenue ditch while AGW226 is approximately 400 ft west of the ditch, appreciably outside the estimated downgradient extent of the ditch capture zone. However, both wells responded similarly to rain events. Water levels at both wells rise immediately after rain events. This immediate spike in water levels subsequently declines over the following few days or weeks depending on the rain intensity and number of consecutive rainfall days. Infiltration of precipitation to shallow groundwater is an important factor of groundwater flow and VOC concentrations in shallow groundwater and surface water in the Algona area. Hydrographs for AGW225 and AGW226 along with precipitation data are presented on Figure 8.

3.2 AUBURN 400 NORTH POND

Water level data indicate that the Auburn 400 north pond is also capturing groundwater. The groundwater elevation at shallow zone well AGW236 was higher than the surface water elevation at the Auburn 400 north pond staff gauge SWSG-3 during the 12 months of monitoring indicating an upward hydraulic gradient from groundwater to surface water. The groundwater elevation in the shallowest channel of well AGW235 was also higher than the surface water elevation at the Auburn 400 north pond staff gauge SWSG-3 during the 12 months of monitoring. These data indicate that groundwater discharge is likely occurring to the Auburn 400 north pond during the entire year. During additional monitoring events in January 2014 following heavy rainfall[10], the gradient was maintained from groundwater to surface water.

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[8] The width of the ditch was measured at the staff gauge SWSG-2. The width of the ditch is assumed to be approximately 6 ft for the purposes of these calculations; however, the ditch width varies throughout the year.

[9] Regional gradient was calculated from shallow zone groundwater elevations collected in July 2014 from AGW083 to AGW243-3. Regional gradient was 0.0019. Anisotropy ratio (horizontal divided by vertical hydraulic conductivity) was assumed to be 5.

[10] Additional monitoring events included January 9, 2014 after 0.95 inch of rain in 72 hours, and January 13, 2014 after 1.29 inches of rain in 72 hours.

Hydrographs of the monthly water level measurements at the Auburn 400 north pond and monitoring well AGW236 and the shallowest channel of AGW235, along with precipitation data, are presented on Figure 9.

Groundwater levels at well AGW235-1 are approximately 1 ft greater than the surface water level in the pond throughout the year. Groundwater levels at well AGW236 are on average about 2.9 ft greater than the surface water level in the pond between March through May 2014; and on average about 1.8 ft greater than the pond throughout the rest of the year. These data indicate there was an upward hydraulic gradient from groundwater to surface water during the entire monitoring period and confirms that the pond is capturing groundwater flow. The capture zone of the Auburn 400 north pond was not calculated since the analytical equation (Appendix A) for a linear feature like a ditch does not directly apply to pond geometry. Also, downgradient surface water features like Mill Creek and adjacent wetland areas will affect groundwater capture and the effect of these features cannot be quantified using simple equations.

4.0 WATER QUALITY DATA

Surface water quality data was collected quarterly at three locations from the Chicago Avenue ditch from December 2013 through September 2014 (Figure 2). Surface water quality data was also collected at 12 other surface water locations in Auburn (Figure 2). All 12 locations were sampled during the wet season (March 2014) and 8 of the 12 locations were sampled during the dry season (September 2014). Water quality data was also compared to surface water data collected in 2012 and 2013 to evaluate temporal variability in surface water VOC concentrations. Analytical results from the quarterly sampling at the Chicago Avenue ditch are presented in Table 3. Analytical results from the wet season and dry season surface water sampling from Auburn surface water locations are presented in Table 4.

4.1 CHICAGO AVENUE DITCH

Surface water samples were collected quarterly at three locations (SW-CD2, SW-CD13, and SW-CD4) from the Chicago Avenue ditch. Quarterly data was collected to evaluate seasonal variations in VOC concentrations. Location SW-CD13 was selected because it was adjacent to the Chicago Avenue well cluster [AGW191(I), AGW192(D), and AGW225(S)] and provides for comparisons of VOC concentrations in the ditch with concentrations in adjacent shallow groundwater (AGW225). SW-CD2 is located upstream of SW-CD13 and SW-CD4 is located downstream of SW-CD13. The Chicago Avenue ditch quarterly sampling results at these three locations (SW-CD2, SW-CD13, and SW-CD4) from December 2013 through September 2014, along with quarterly groundwater concentrations at AGW225 are presented on Figure 10. Figure 10 also presents sampling results from previous 2012 sampling activities at SW-CD4 and SW-CD2, and at two additional sampling locations (SW-CD3 and SW-CD1) that were only sampled in 2012.

TCE was not detected above the EPA Method 8260C reporting limit at sample locations SW-CD2 or SW-CD13[11], but low-level concentrations of TCE was detected at SW-CD4 at all sampling events. Low-level concentrations of cis-1,2-DCE[12] and VC were detected at some time during the sampling period at all three Chicago Avenue ditch quarterly sampling locations. Where detected, TCE was well below the screening level for the Chicago Avenue ditch (58 µg/L); the maximum concentration of TCE at 1.7 µg/L was detected at SW-CD4 in September 2014. There is no surface water screening level for cis-1,2-DCE at the Chicago Avenue ditch. For all sample results during the monitoring period, VC was well below the screening level for the Chicago Avenue ditch (98 µg/L); the maximum concentration of VC at 0.48 µg/L was detected at SW-CD13 in February 2013.

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[11] TCE concentrations detected at sample locations SW-CD2 and SW-CD13 were below the EPA Method 8260C reporting limit (0.2 µg/L). SIM analysis of TCE was discontinued after the second quarterly sampling event.

[12] Cis-1,2-DCE was not detected at SW-CD2 during the December 2013 or the September 2014 sampling events.

VOC concentrations collected during 2013-2014 were generally consistent with previous results from 2012. For example, 2012 concentrations in the ditch were lowest at the upstream sampling station (SW-CD3) and increase downstream. During the 2013-2014 quarterly sampling events, concentrations of VOCs were also lowest at the upstream sample location (SW-CD2). TCE concentrations were the highest at the furthest downstream quarterly sampling location (SW-CD4). Cis-1,2-DCE concentrations were the similar at SW-CD13 and SW-CD4. VC concentrations were highest at the middle sampling location (SW-CD13).

Concentrations of constituents of concern at surface water sampling location SW-CD13 were lower than concentrations at adjacent water table well AGW225 during all four quarterly sampling events (Figure 10). TCE and cis-1,2-DCE concentrations were roughly 10 times lower in surface water than groundwater. In contrast, VC concentrations were roughly the same in surface water and groundwater.

Groundwater discharge is the source of VOCs detected in the ditch. Consequently, it is expected that ditch VOC concentrations will be less than groundwater VOC concentrations due to dispersion (i.e., mixing or dilution with cleaner water in the ditch). Degradation (i.e., reductive dechlorination where anaerobic conditions occur near the groundwater-surface water interface) is also a process that may affect VOC concentrations. The observation that TCE and cis-1,2-DCE concentrations are considerably lower in surface water than ground water while VC concentrations are similar in groundwater and surface water may be an indication that degradation is a significant process as groundwater discharges to surface water. TCE and cis-1,2-DCE breakdown to VC through reductive dechlorination. Therefore degradation can cause TCE and cis-1,2-DCE concentrations to decrease and VC concentrations to increase. If this process is significant, it could result in an increase in VC concentrations in surface water that offsets the concentration decrease due to dispersion. A plot of surface water versus groundwater VOC concentrations is presented on Figure 11. This figure includes a 10:1 concentration line (concentrations in groundwater are 10 times surface water) and a 1:1 concentration line.

Quarterly TCE concentrations tended to be highest during the dry season sampling events in September. Figure 12 presents a time series plot for SW-CD4, where trends are particularly evident, showing TCE concentrations highest during September. In contrast, VC concentrations tended to be highest during wet season sampling events in December and March. These inverse trends could be due to a number of factors including: larger capture zones in the wet season, changes in groundwater elevation due to increased precipitation in the wet season, variability in biodegradation, and volatilization of VC in dry, hotter months. Cis-1,2-DCE concentrations show a seasonal trend with concentration highest during the dry season sampling events at SW-CD4 and at SW-CD13; however, concentration of cis-1,2-DCE at SW-CD2 remained near or below the reporting limit during all sampling events. Time series plots for SW-

CD2 and SW-CD13are presented in Appendix B. Additional sampling is needed to determine if these seasonal trends in TCE, cis-1,2-DCE and VC concentrations continue.

4.2 AUBURN SURFACE WATER

Surface water samples were collected during the wet season (March/April) 2014 at 12 locations. Eight of these locations had been previously sampled during the dry season sampling events in 2012 and/or 2013. The other four locations were new sampling locations. Wet season sampling occurred to evaluate if higher groundwater levels correlate with increases in VOC concentrations in surface water. Additional dry season (September) 2014 sampling occurred at four locations that had completed previous dry season sampling and three of the new sampling locations. The wet and dry season 2014 sampling results are presented along with the previous sampling results from 2012 and 2013 on Figure 13. Results are compared to screening levels for non-potable surface water for all surface water features except for Mill Creek, which has screening levels for surface water used as drinking water.

O Street Wetland

One sample was collected at the O Street Wetland (SW-12) during the wet season sampling event in 2014; there were no detections of constituents of concern. There were also no detections of constituents of concern during the previous dry season sampling event in July 2013. There is no evidence of VOC-impacted groundwater discharging to the O Street wetland during the wet or dry seasons.

The Outlet Collection Stormwater Ponds and Associated Ditch

Surface water location SW-3 is located in the ditch draining stormwater southward to The Outlet Collection stormwater ponds. SW-10 is located in the northeast corner of The Outlet Collection southern pond. There were no detections of constituents of concern at either of these locations during the wet season sampling in 2014 or the previous dry season sampling event in June 2012. There is no evidence of VOC-impacted groundwater discharging to The Outlet Collection stormwater ponds or the associated ditch during the wet or dry seasons.

Auburn 400 South Pond

Two sample locations at the Auburn 400 south pond were monitored during both the wet season and the dry season in 2014. Location SW-14 is near the southeastern stormwater outfall and location SW-15 is near the outlet on the northwestern edge of the Auburn 400 south pond. During both wet and dry season sampling events, TCE, cis-1,2-DCE, and VC were detected at location SW-14; none of these constituents were detected at location SW-15 during any of the sampling events. The dry season 2014 results are consistent with previous dry season sampling results at both locations in July 2013. The 2014 maximum TCE concentration at SW-14 of 0.9 µg/L is below the screening level for non-potable surface water of 7.0 µg/L. No screening criteria are available for cis-1,2-DCE in non-potable surface water. The maximum 2014 VC concentration at SW-14 of 0.2 µg/L is below the screening level for non-potable surface water of 1.6 µg/L.

VOC-impacted groundwater may be discharging along the eastern edge of the Auburn 400 south pond. However, water from the Chicago Avenue ditch is piped into the stormwater system and discharges to Auburn 400 south pond at the eastern stormwater outfall, which may contribute to the detections observed at SW-14. There were no detections of VOCs near the outlet at the northwestern portion of the Auburn 400 south pond, which may be a result of dilution, volatilization, and degradation of VOCs.

Auburn 400 North Pond

Two sample locations at the Auburn 400 north pond were monitored during both the wet season and the dry season in 2014. Location SW-16 is near the southeast corner and SW-19 is near the outlet in the northwestern portion of the Auburn 400 north pond where the water passes through a culvert under SR 167.

TCE, cis-1,2-DCE, and VC were detected at SW-16 during both the wet and dry season sampling events in 2014, and during the previous dry season sampling event in July 2013. VC was the only constituent of concern detected at location SW-19 and was only detected during the 2014 dry season sampling event. Concentrations are considerably lower in the northwest corner than in the southeast corner of the pond; similar to results from the Auburn 400 south pond, this may indicate contaminated groundwater is discharging along the eastern edge of the pond. The wet season results were lower than the dry season sampling results at both sampling locations in the Auburn 400 north pond. This is most likely due to dilution of impacted groundwater with stormwater during the wet season. TCE concentrations are below screening levels for non-potable surface water of 7.0 µg/L. No screening criteria are available for cis-1,2-DCE in non-potable surface water. VC concentrations are also below screening levels for non-potable surface water of 1.6 µg/L.

The detections of constituents of concern are consistent with groundwater discharging to surface water along the eastern edge of the Auburn 400 ponds. At the locations where VOCs were detected, concentrations were generally less during the wet season sampling than during the dry season sampling. This is most likely due to dilution of impacted surface water with stormwater runoff during the wet season.

Wetlands - West of SR 167 to Mill Creek

Two samples were collected in the channelized portion of the wetland west of SR 167 during both the wet and dry season sampling events. SW-17 is located just west of SR 167 at the outflow culvert from the Auburn 400 north pond. SW-20 is located south of SR 18 and just upstream of the wetland confluence with Mill Creek, which flows downstream from Peasley Canyon. VC was the only constituent of concern detected and only during the dry season sampling events at SW-17 (during July 2013 and September 2014). During the July 2013 sampling event, cis-1,2-DCE was also detected at the detection limit. VC concentrations detected at SW-17 were below the screening level for non-potable surface water of 1.6 µg/L; no screening criteria are available for cis-1,2-DCE in non-potable surface water. VOC detections at SW-17 are likely associated with surface water discharge from the Auburn 400 north pond, as the sample is collected from within the culvert structure. No constituents of concern were detected at SW-20.

Wetlands – Auburn Environmental Park

One sample was collected from location SW-22 in the Auburn Environmental Park during the wet season in 2014. No VOCs have been detected in shallow groundwater near SW-22; however, concern was expressed that intermediate groundwater may potentially discharge to the wetland. A sample was collected only during the wet season from location SW-22 to evaluate whether VOC-impacted intermediate zone groundwater is discharging to the surface water in this area when groundwater elevations are highest. VOCs were not detected at location SW-22, indicating that VOC-impacted groundwater is not discharging to surface water in the wetland.

Mill Creek - SR 18 to West Main Street

Two samples were collected from Mill Creek at SW-18 (near West Main Street) and SW-21 (near SR 18) during both the wet and dry season. There were no detections of constituents of concern in samples collected from Mill Creek. This is consistent with previous sample results in Mill Creek. Data collected to date do not show evidence of VOC-impacted groundwater discharging to Mill Creek.

5.0 CONCLUSIONS AND RECOMMENDATIONS

There were no detections of constituents of concern in samples collected from the O Street wetland, The Outlet Collection stormwater ponds and associated ditches, or Mill Creek and associated wetlands. Constituents of concern were detected at low levels at the Chicago Avenue ditch, the Auburn 400 ponds, and at the outlet from the Auburn 400 north pond into the wetlands west of SR 167. Concentrations detected were all below applicable surface water screening levels. Water level data and VOC concentration data from the Auburn 400 ponds and the Chicago Avenue ditch both indicate that groundwater is discharging to surface water at these locations throughout the year. There is no evidence that VOC-impacted groundwater is discharging directly to Mill Creek.

Continued semiannual surface water sampling is recommended at the Chicago Avenue ditch (wet season and dry season) to evaluate temporal trends in TCE and VC concentrations. TCE concentrations at the Chicago Avenue ditch appear to be highest in the dry season while VC concentrations appear to be highest in the wet season; additional data is needed to confirm these trends.

Continued annual surface water sampling is recommended at the Auburn 400 ponds to continue monitoring VOC concentrations in surface water and at Mill Creek to continue to ensure that contaminated groundwater is not impacting the creek. Annual water quality monitoring should occur during the dry season because the highest concentrations of constituents of concern occur during the dry season. Wet season sampling is not recommended because dilution is likely occurring during the wet season from stormwater inputs to the system. Recommendations for continued surface water monitoring locations will be presented in a separate submittal detailing a work plan for continued surface water monitoring.

6.0 USE OF THIS REPORT

This report has been prepared for the exclusive use of The Boeing Company for specific application to the Auburn Fabrication Division facility remedial investigation. 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.

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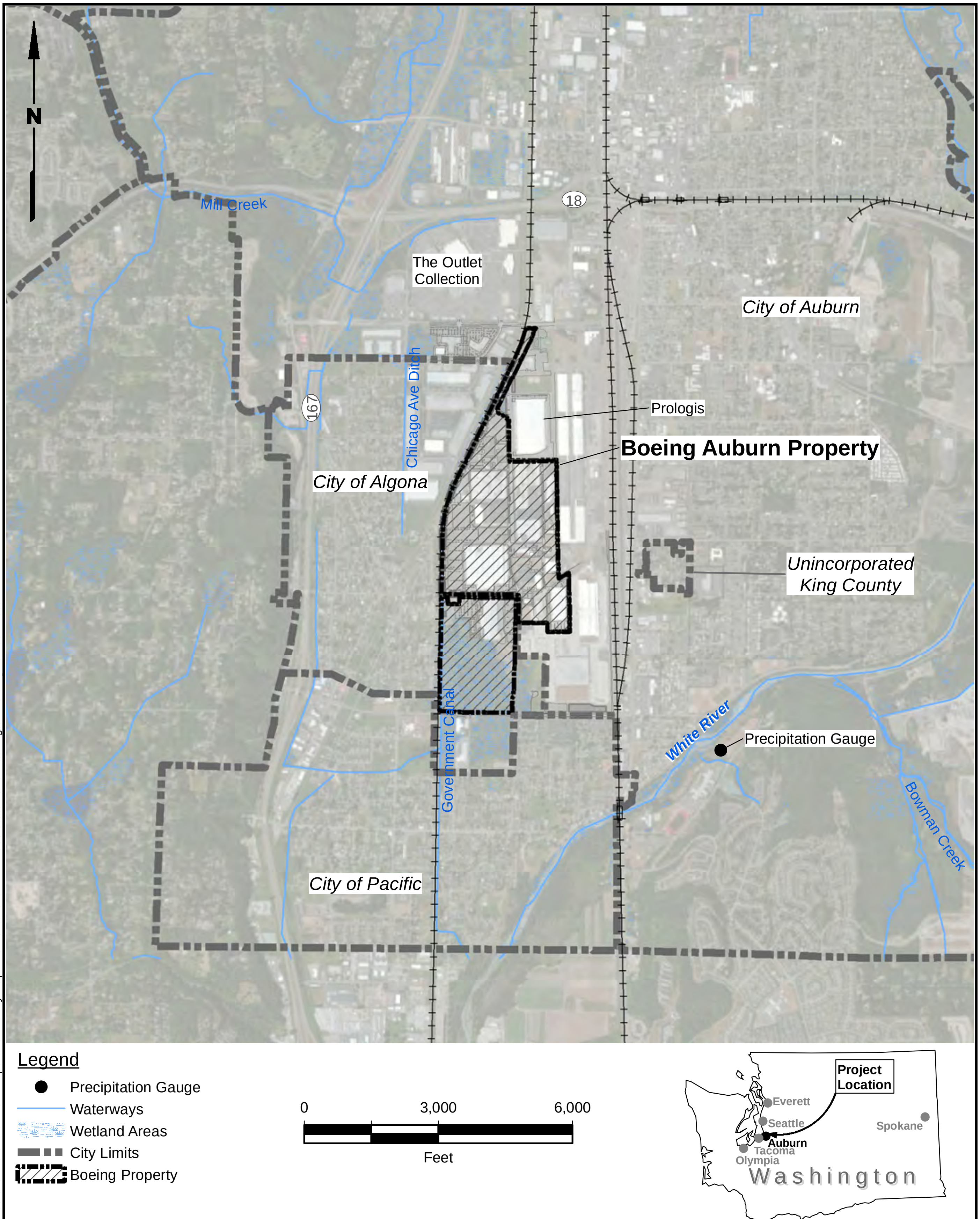

Base map source: Geometrix 2003; Aerial Photo Source: ESRI World Imagery; Parcel Data Source: King County GIS 2012

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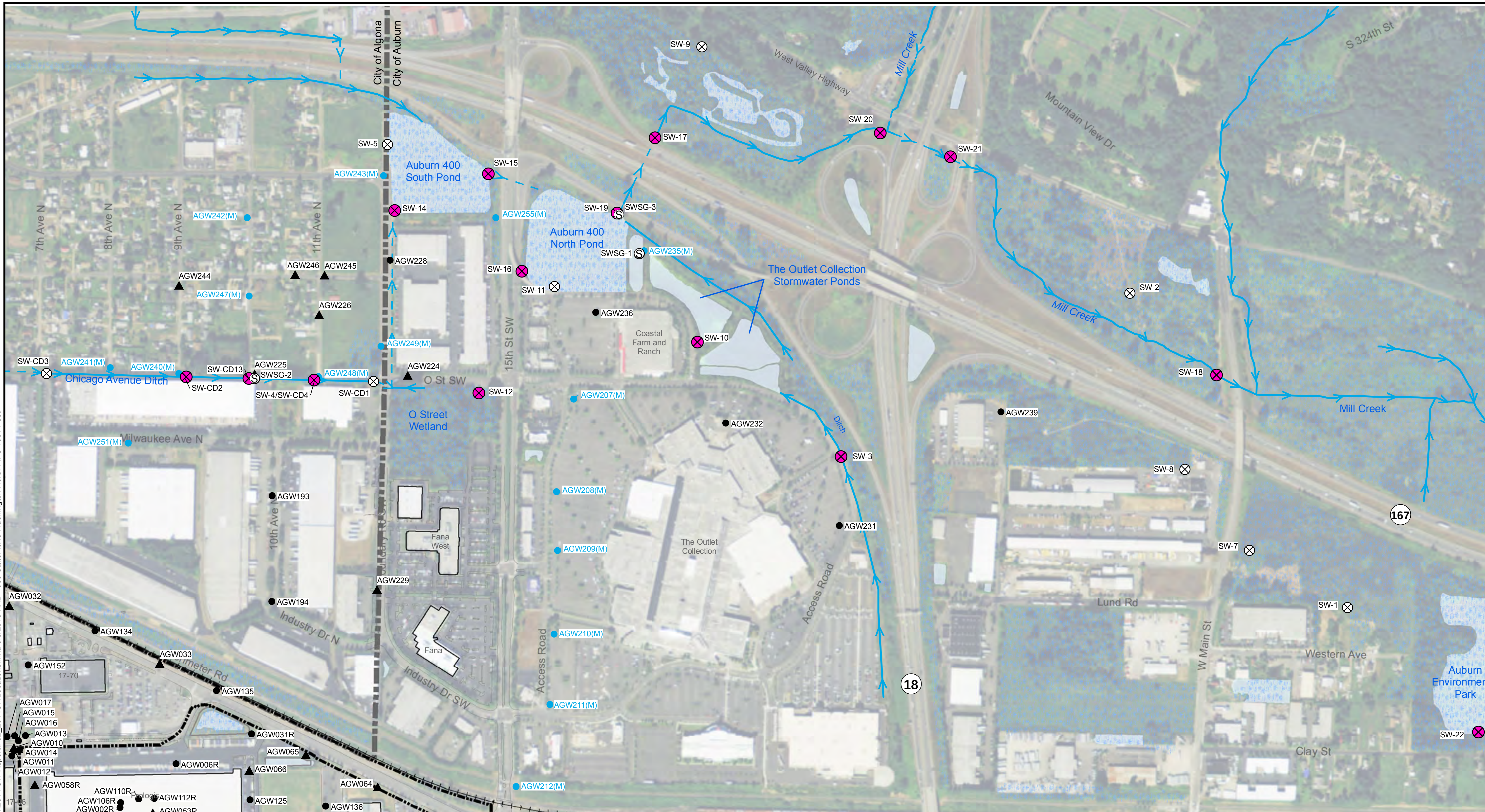
LANDAU ASSOCIATES

Boeing Auburn Auburn, Washington	**Vicinity Map**	Figure 1



G:\Projects\025\164\120\1012014 SW Report\F02_2014SWLocations.mxd 5/5/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Notes

1. The locations of surface water features are approximate.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- 2014 Surface Water Sample Location
- Previous Surface Water Sample Location
- Staff Gauge
- Offsite Water Table Well
- Shallow Monitoring Well (2 to 30 ft BGS)
- Multi-Level Well
- Open Waterways
- Piped Waterways
- Wetland Areas
- Water Bodies

N

0 600 1,200

Scale in Feet

Base map source: Geometrix 2003; Aerial Photo Source: ESRI World Imagery; Parcel Data Source: King County GIS 2013.

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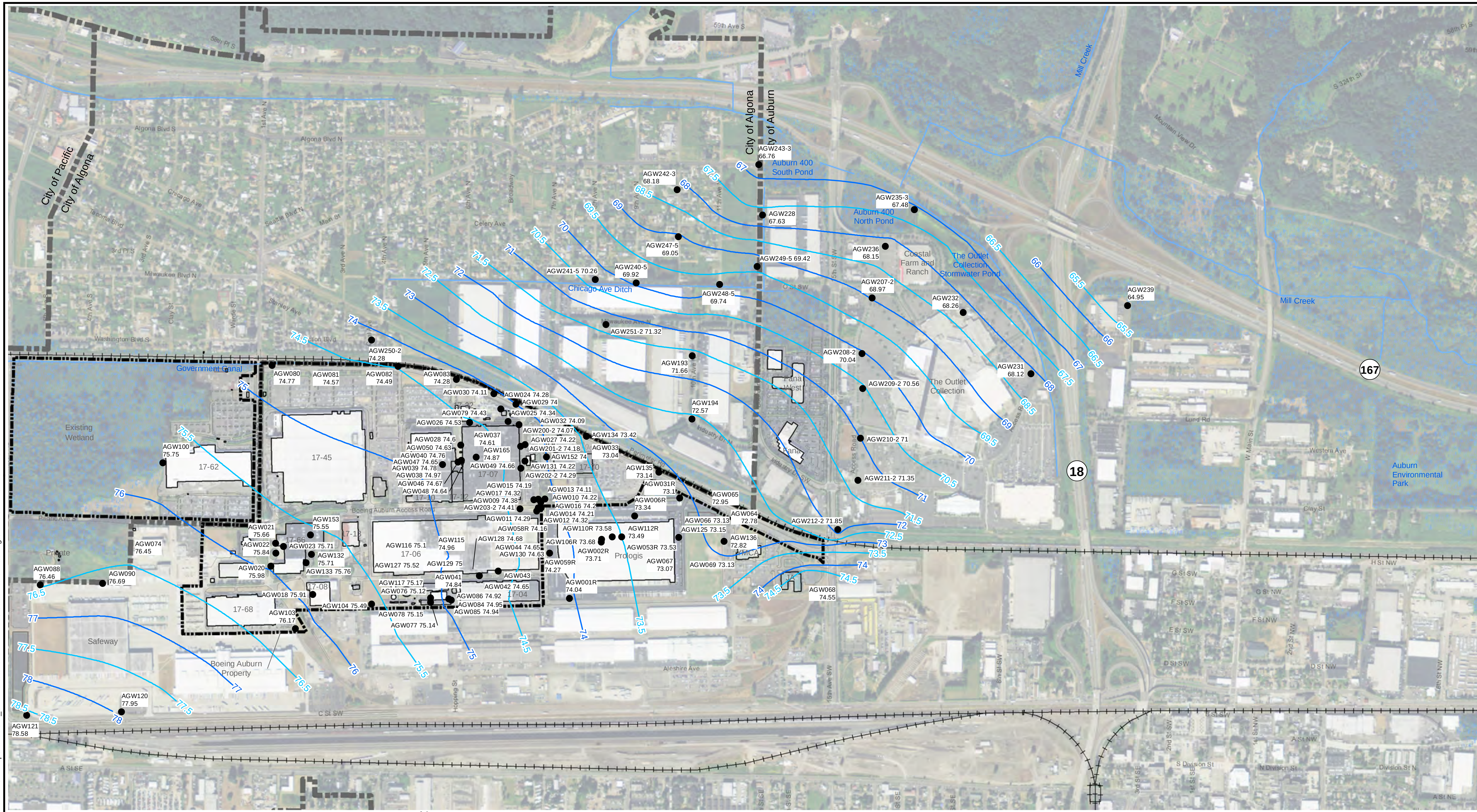
Boeing Auburn Auburn, Washington	**Surface Water Sampling Locations and Shallow Monitoring Well Network**	Figure 2



G:\Projects\025\164\120\101\2014 SW Report\F03GW_SZ.mxd 5/5/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Legend

- ● AGW021 75.83 — Monitoring Well Designation; Groundwater Elevation (ft, MSL)
- 72 / 72.5 — Groundwater Elevation Contours
- Boeing Property
- Waterway
- Wetland Area
- City Limits

Notes

1. All water level data in ft, MSL. Data collected in July 2014.
2. Wells without a water level were inaccessible.
3. Multilevel wells have multiple channels. Channel designations are included in the well ID (ex: AGW208-2). Groundwater elevations listed are for the channel closest to 30 ft below ground surface.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

N

0 1,000 2,000
Scale in Feet

Base map source: Geometrix 2003; Aerial Photo Source: Esri World Imagery; Parcel Data Source: King County GIS 2013

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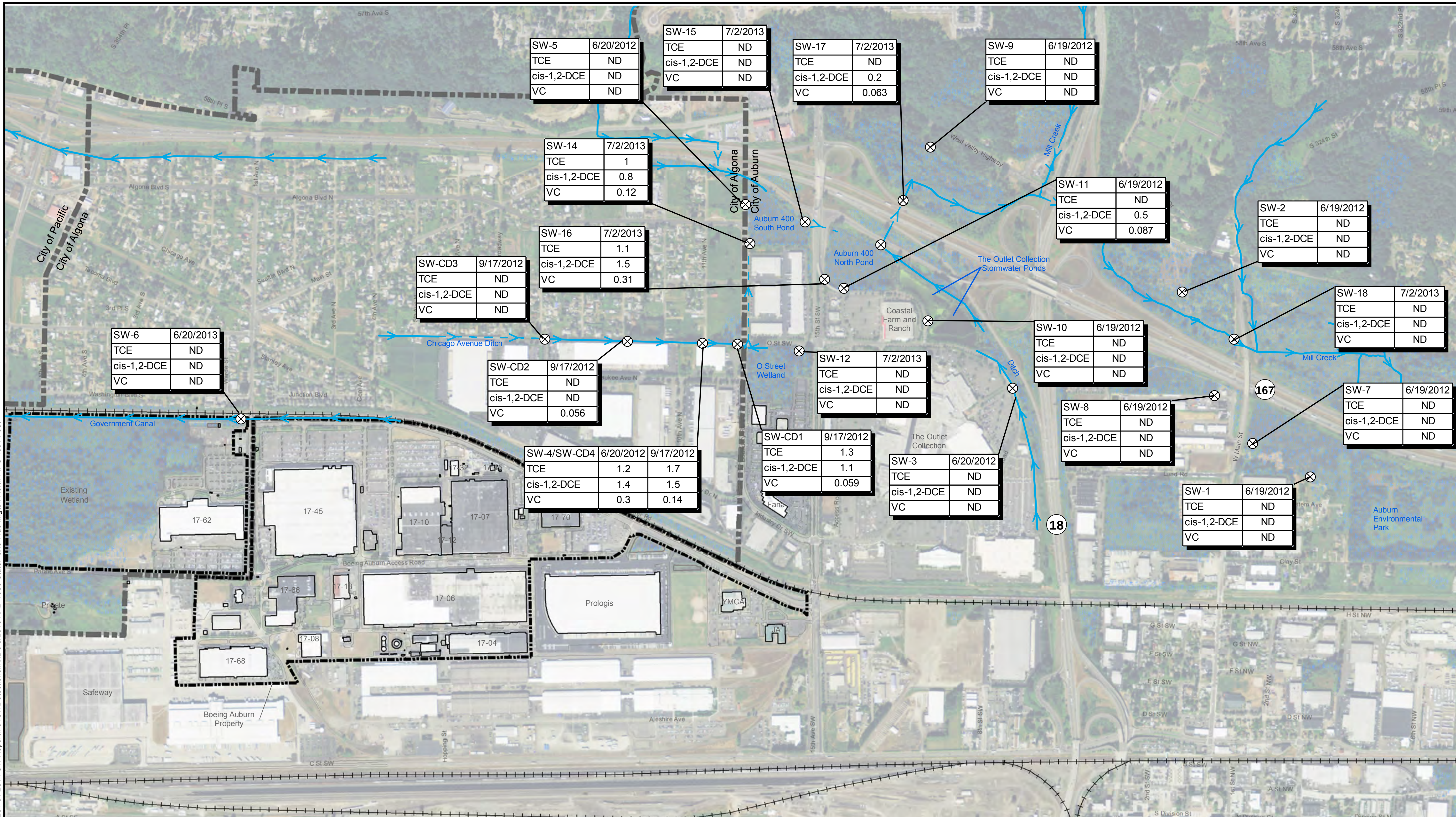
Boeing Auburn Auburn, Washington	**Shallow Zone (20-30 ft) Groundwater Elevation Contours July 2014**	Figure 3



G:\Projects\025\164\120\101\2014 SW Report\F04SWDetections.mxd 5/5/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Notes

1. ND = compound not detected.
2. All concentrations expressed in units of micrograms per liter (µg/L).
3. The locations of surface water features are approximate.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- ⊗ Surface Water Sample Location
- Wetland Areas
- Open Waterways
- Piped Waterways

N

0 1,000 2,000

Scale in Feet

Base map source: Geometrix 2003; Aerial Photo Source: ESRI World Imagery; Parcel Data Source: King County GIS 2013.

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Boeing Auburn
Auburn, Washington

TCE, cis-1,2-DCE, and Vinyl Chloride Detections in Surface Water (2012 and 2013)

Figure 4

Legend

- Staff Gauge
- Water Table Well
- Open Waterways
- Piped Waterways
- Wetland Areas
- Water Bodies

Notes

1. The locations of surface water features are approximate.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 125 250

Scale in Feet

Base map source: Geometrix 2003; Aerial Photo Source: ESRI World Imagery.
Parcel Data Source: King County GIS 2013.

G:\Projects\025\164\120\101\2014 SW Report\F05ChiDitchStaffGaugeCloseup.mxd 4/30/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Landau Associates

Boeing Auburn
Auburn, Washington

Chicago Avenue Ditch Staff Gauge and Adjacent Well Locations

Figure 5

Legend

- Staff Gauge
- Previous Staff Gauge
- Shallow Monitoring Well (2 to 30 ft BGS)
- Multi-Level Well
- Open Waterways
- Piped Waterways
- Wetland Areas
- Water Bodies

Notes

1. The locations of surface water features are approximate.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 125 250

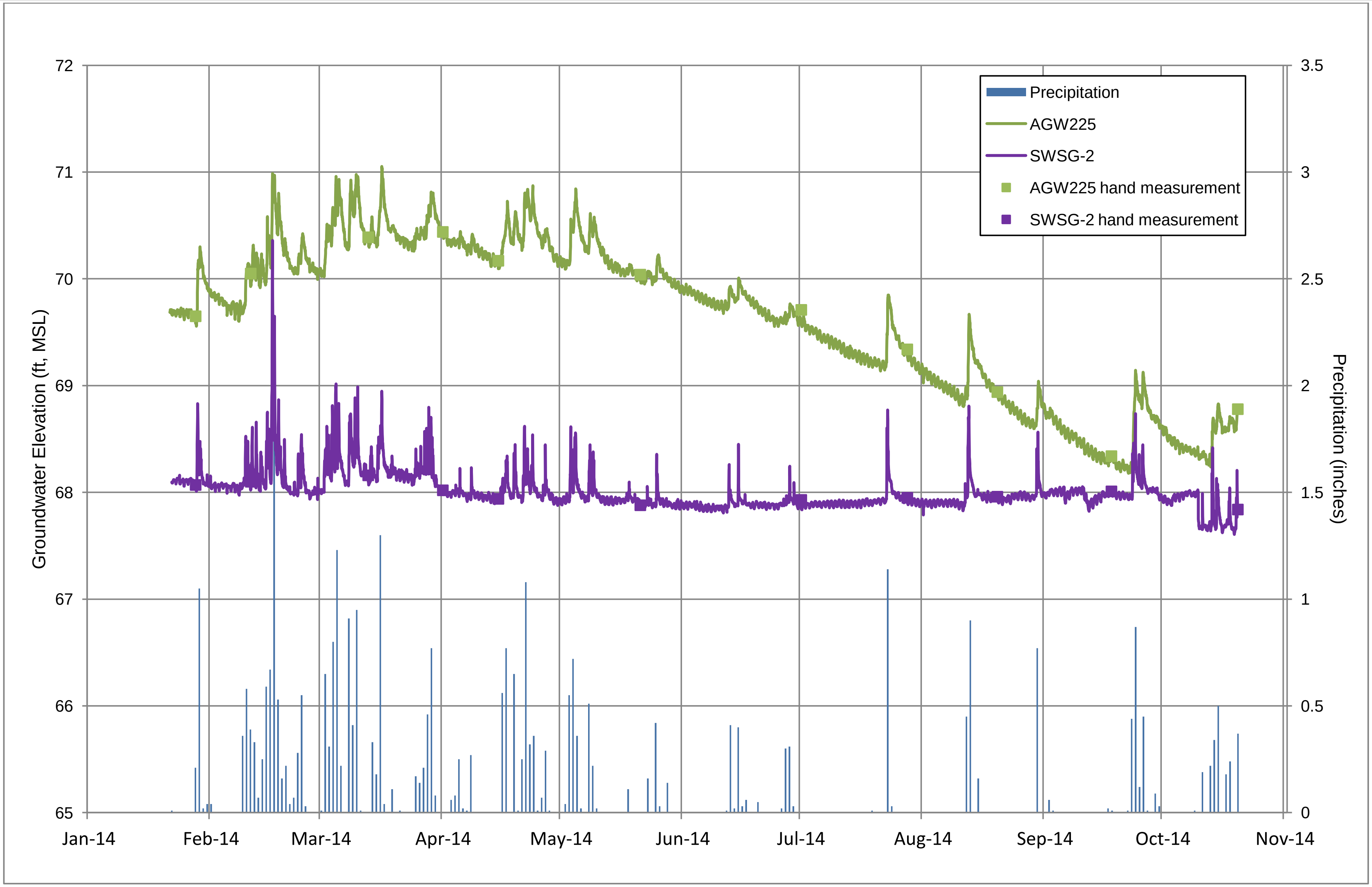
Scale in Feet

Base map source: Geometrix 2003; Aerial Photo Source: ESRI World Imagery.
Parcel Data Source: King County GIS 2013.

G:\Projects\025\164\120\101\2014 SW Report\F06Auburn400StaffGaugeCloseup.mxd 4/30/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

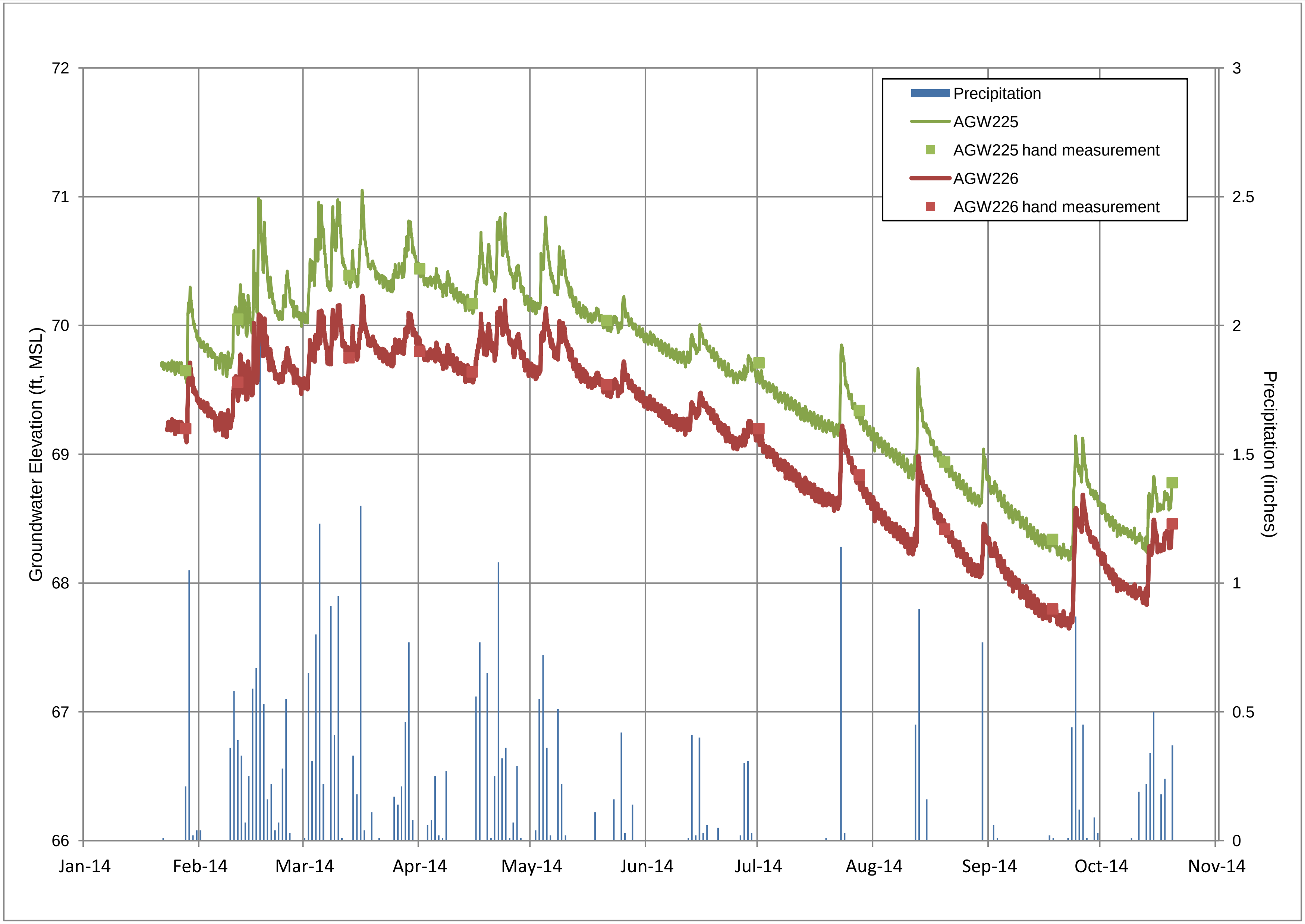
LANDAU ASSOCIATES

Boeing Auburn Auburn, Washington	**Auburn 400 Pond Staff Gauge and Adjacent Well Locations**	Figure 6



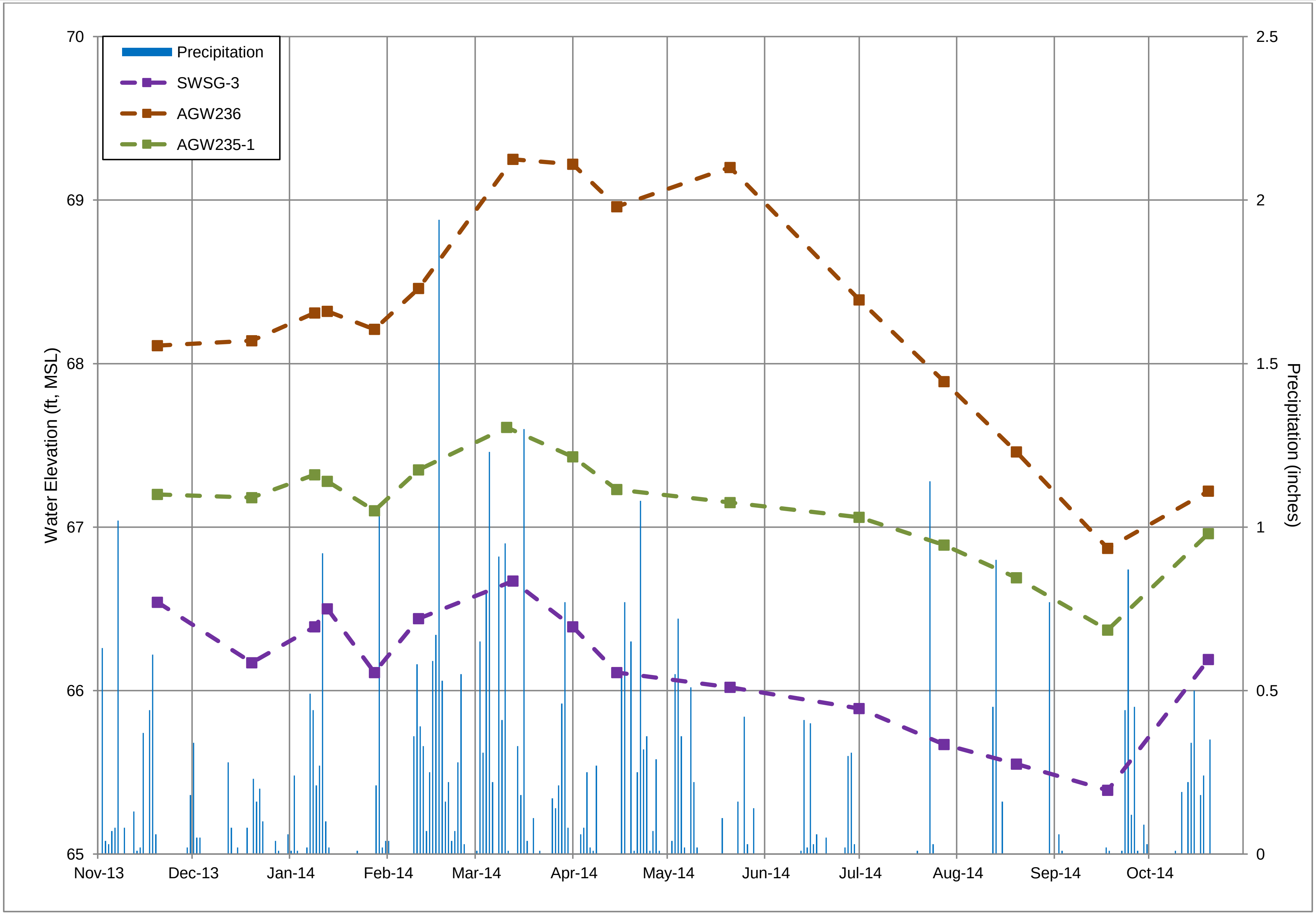
Notes: 1) Supports to the staff gauge appeared bent in October; likely the cause of the sudden drop in groundwater elevation on October 9, 2014.

LANDAU ASSOCIATES	Boeing Auburn Facility Auburn, Washington	**Chicago Avenue Ditch Hydrograph**	Figure 7



LANDAU ASSOCIATES

Boeing Auburn Facility Auburn, Washington	**AGW225 and AGW226 Hydrographs**	Figure 8

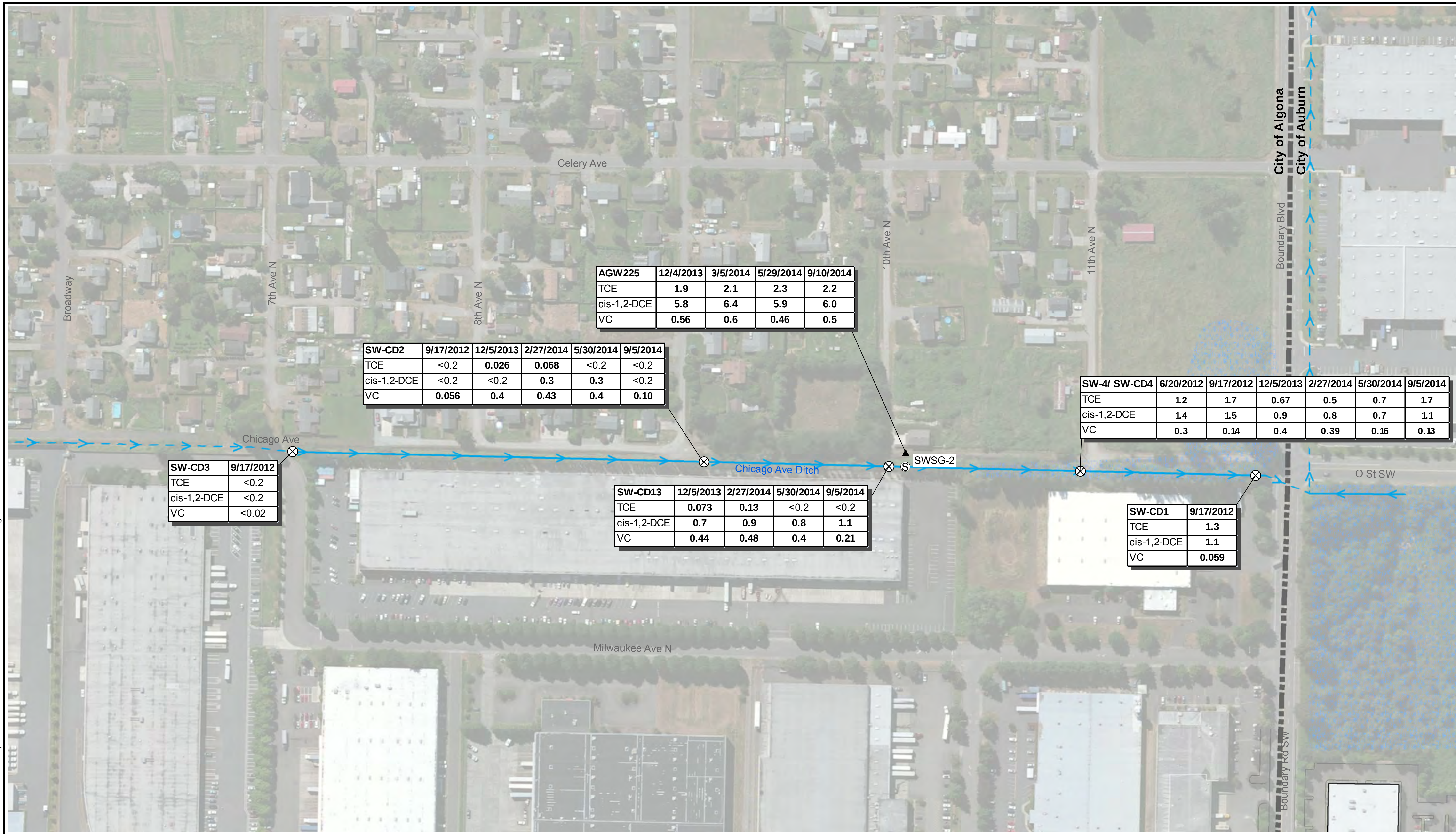


LANDAU ASSOCIATES

Boeing Auburn Facility
Auburn, Washington

Auburn 400 North Pond Hydrograph

Figure
9



AGW225	12/4/2013	3/5/2014	5/29/2014	9/10/2014
TCE	**1.9**	**2.1**	**2.3**	**2.2**
cis-1,2-DCE	**5.8**	**6.4**	**5.9**	**6.0**
VC	**0.56**	**0.6**	**0.46**	**0.5**

SW-CD2	9/17/2012	12/5/2013	2/27/2014	5/30/2014	9/5/2014
TCE	<0.2	**0.026**	**0.068**	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2	**0.3**	**0.3**	<0.2
VC	**0.056**	**0.4**	**0.43**	**0.4**	**0.10**

SW-4/ SW-CD4	6/20/2012	9/17/2012	12/5/2013	2/27/2014	5/30/2014	9/5/2014
TCE	**1.2**	**1.7**	**0.67**	**0.5**	**0.7**	**1.7**
cis-1,2-DCE	**1.4**	**1.5**	**0.9**	**0.8**	**0.7**	**1.1**
VC	**0.3**	**0.14**	**0.4**	**0.39**	**0.16**	**0.13**

SW-CD3	9/17/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.02

SW-CD13	12/5/2013	2/27/2014	5/30/2014	9/5/2014
TCE	**0.073**	**0.13**	<0.2	<0.2
cis-1,2-DCE	**0.7**	**0.9**	**0.8**	**1.1**
VC	**0.44**	**0.48**	**0.4**	**0.21**

SW-CD1	9/17/2012
TCE	**1.3**
cis-1,2-DCE	**1.1**
VC	**0.059**

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Legend

- ▲ Water Table Well
- ⊗ Surface Water Sample
- Ⓢ Staff Gauge
- Wetland Areas
- Open Waterways
- Piped Waterways
- City Limits

0 200 400

Scale in Feet

LANDAU ASSOCIATES

Notes

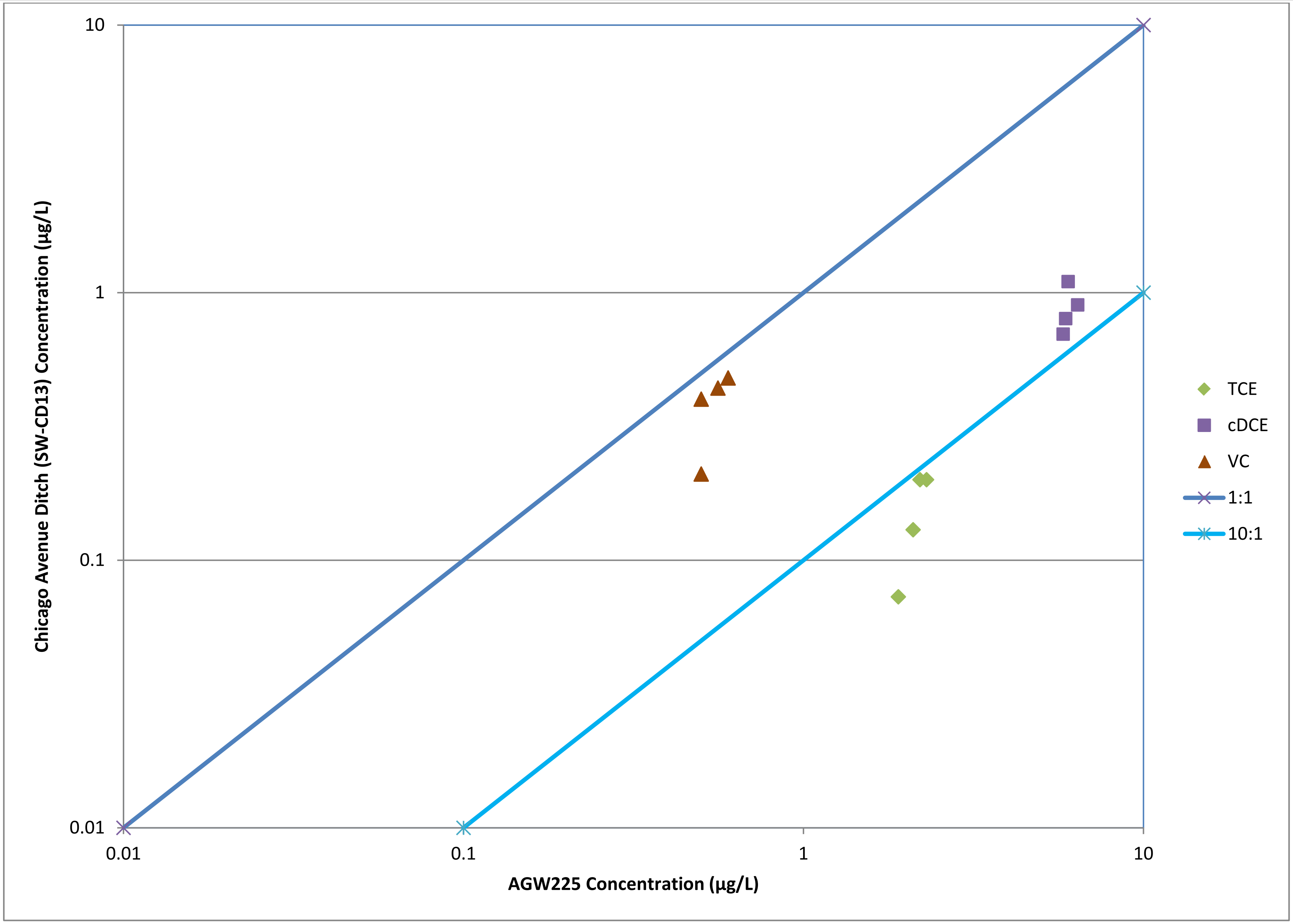
1. <0.2 = compound not detected.
2. All concentrations expressed in units of micrograms per liter (μg/L).
3. Bold indicates constituent detected.
4. The locations of surface water features are approximate.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Base map source: Geometrix 2003; Aerial Photo Source: Esri World Imagery; Parcel Data Source: King County GIS 2013

Boeing Auburn
Auburn, Washington

TCE, cis-1,2-DCE, and Vinyl Chloride at the Chicaco Avenue Ditch and Water Table Well AGW225

Figure 10

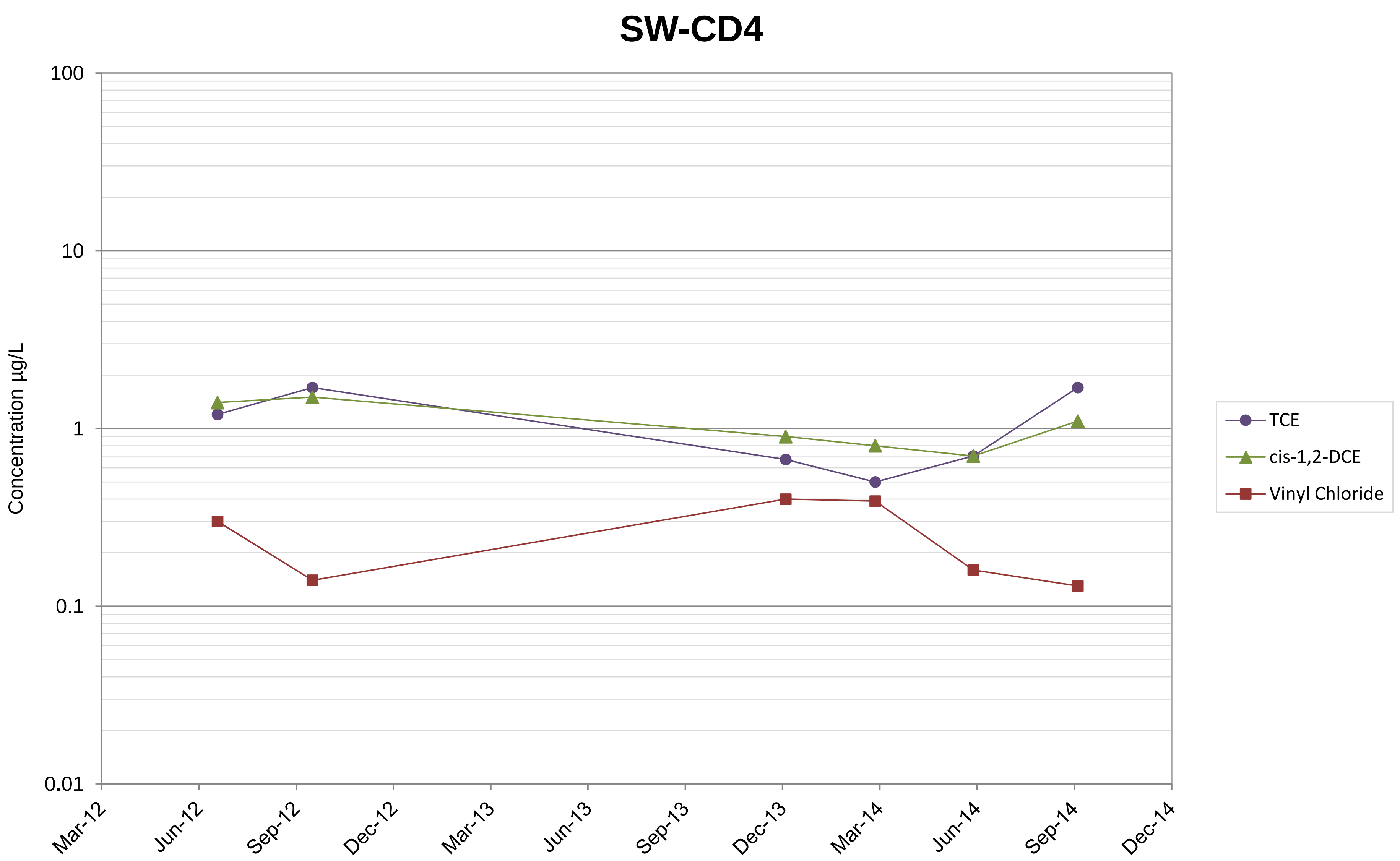


LANDAU ASSOCIATES

Boeing Auburn Facility
Auburn, Washington

Chicago Avenue Ditch and Groundwater Concentration Comparison

Figure 11



Notes: 1) Open markers on graphs denote non-detect values, values shown represent analytical reporting limit.

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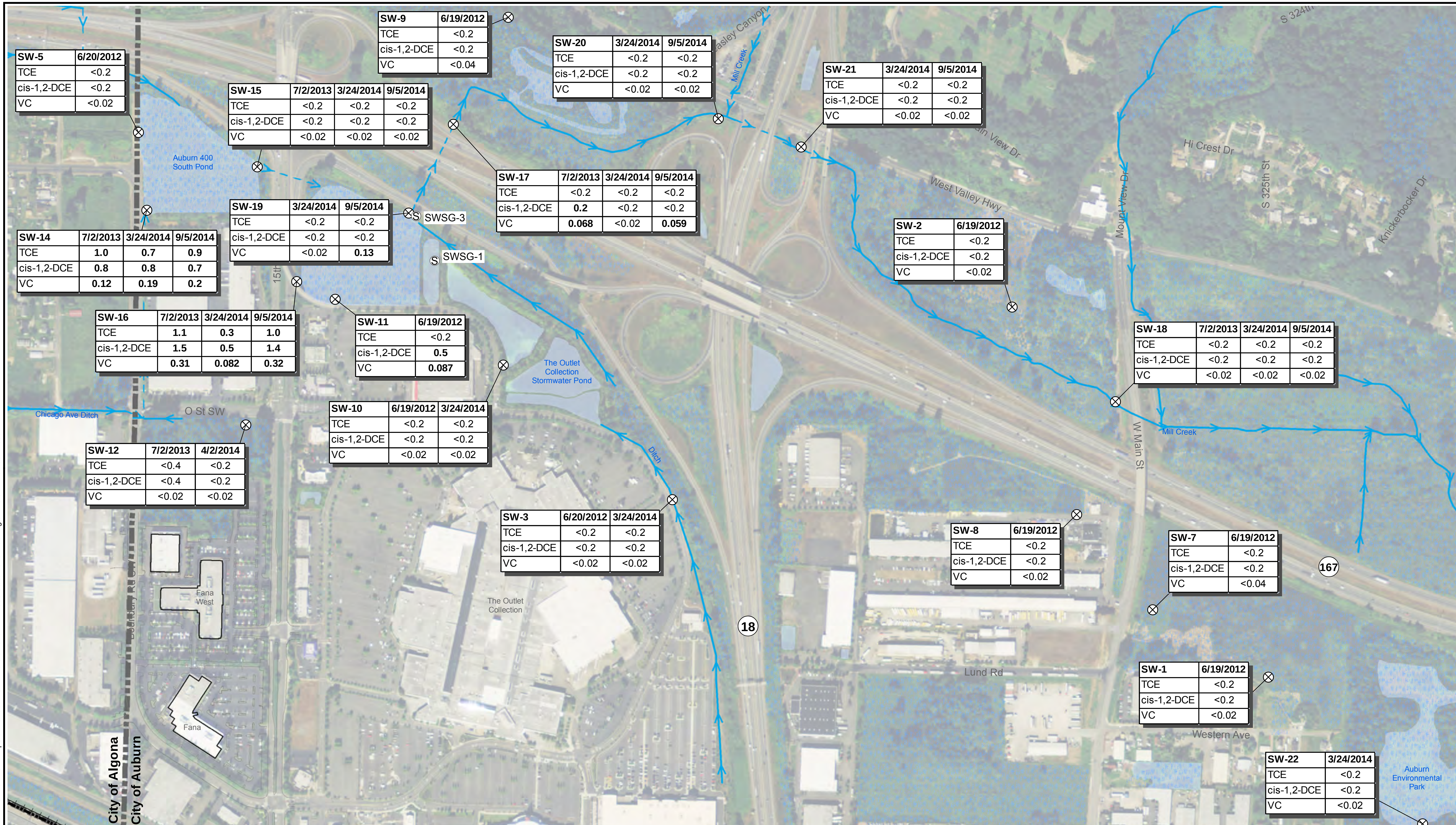
Boeing Auburn
Auburn, Washington

SW-CD4 Volatile Organic Compound Concentrations

Figure
12



SW-5	6/20/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.02

SW-9	6/19/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.04

SW-20	3/24/2014	9/5/2014
TCE	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2
VC	<0.02	<0.02

SW-21	3/24/2014	9/5/2014
TCE	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2
VC	<0.02	<0.02

SW-15	7/2/2013	3/24/2014	9/5/2014
TCE	<0.2	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2	<0.2
VC	<0.02	<0.02	<0.02

SW-17	7/2/2013	3/24/2014	9/5/2014
TCE	<0.2	<0.2	<0.2
cis-1,2-DCE	**0.2**	<0.2	<0.2
VC	**0.068**	<0.02	**0.059**

SW-19	3/24/2014	9/5/2014
TCE	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2
VC	<0.02	**0.13**

SW-14	7/2/2013	3/24/2014	9/5/2014
TCE	**1.0**	**0.7**	**0.9**
cis-1,2-DCE	**0.8**	**0.8**	**0.7**
VC	**0.12**	**0.19**	**0.2**

SW-2	6/19/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.02

SW-16	7/2/2013	3/24/2014	9/5/2014
TCE	**1.1**	**0.3**	**1.0**
cis-1,2-DCE	**1.5**	**0.5**	**1.4**
VC	**0.31**	**0.082**	**0.32**

SW-11	6/19/2012
TCE	<0.2
cis-1,2-DCE	**0.5**
VC	**0.087**

SW-18	7/2/2013	3/24/2014	9/5/2014
TCE	<0.2	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2	<0.2
VC	<0.02	<0.02	<0.02

SW-10	6/19/2012	3/24/2014
TCE	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2
VC	<0.02	<0.02

SW-12	7/2/2013	4/2/2014
TCE	<0.4	<0.2
cis-1,2-DCE	<0.4	<0.2
VC	<0.02	<0.02

SW-3	6/20/2012	3/24/2014
TCE	<0.2	<0.2
cis-1,2-DCE	<0.2	<0.2
VC	<0.02	<0.02

SW-8	6/19/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.02

SW-7	6/19/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.04

SW-1	6/19/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.02

SW-22	3/24/2014
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.02

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Legend

- Surface Water Sample
- Staff Gauge
- Wetland Areas
- Open Waterways
- Piped Waterways
- Surface Water Bodies
- City Limits

0 500 1,000

Scale in Feet

N

Notes

1. <0.2 = compound not detected.
2. All concentrations expressed in units of micrograms per liter (µg/L).
3. Bold indicates constituent detected.
4. The locations of surface water features are approximate.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Base map source: Geometrix 2003; Aerial Photo Source: Esri World Imagery; Parcel Data Source: King County GIS 2013

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

TCE, cis-1,2-DCE, and Vinyl Chloride in Surface Water in Auburn

Figure 13

TABLE 1
CHICAGO AVENUE DITCH MONTHLY WATER LEVELS
BOEING AUBURN

Location	Aquifer Zone	Date	Depth to Water (ft)	Water Elevation (ft, MSL)
SWSG-2	Ditch	1/28/2014	0.69	68.07
AGW225	WT	1/28/2014	2.25	69.65
AGW226	WT	1/28/2014	0.55	69.20
SWSG-2	Ditch	2/11/2014	0.72	68.10
AGW225	WT	2/11/2014	1.85	70.05
AGW226	WT	2/11/2014	0.19	69.56
SWSG-2	Ditch	3/13/2014	0.78	68.16
AGW225	WT	3/13/2014	1.51	70.39
AGW226	WT	3/13/2014	0	69.75
SWSG-2	Ditch	4/1/2014	0.64	68.02
AGW225	WT	4/1/2014	1.46	70.44
AGW226	WT	4/1/2014	-0.05	69.80
SWSG-2	Ditch	4/15/2014	0.56	67.94
AGW225	WT	4/15/2014	1.73	70.17
AGW226	WT	4/15/2014	0.11	69.64
SWSG-2	Ditch	5/21/2014	0.50	67.88
AGW225	WT	5/21/2014	1.86	70.04
AGW226	WT	5/21/2014	0.21	69.54
SWSG-2	Ditch	7/1/2014	0.55	67.93
AGW225	WT	7/1/2014	2.19	69.71
AGW226	WT	7/1/2014	0.55	69.20
SWSG-2	Ditch	7/28/2014	0.57	67.95
AGW225	WT	7/28/2014	2.56	69.34
AGW226	WT	7/28/2014	0.91	68.84
SWSG-2	Ditch	8/20/2014	0.58	67.96
AGW225	WT	8/20/2014	2.96	68.94
AGW226	WT	8/20/2014	1.33	68.42
SWSG-2	Ditch	9/18/2014	0.63	68.01
AGW225	WT	9/18/2014	3.56	68.34
AGW226	WT	9/18/2014	1.95	67.80
SWSG-2	Ditch	10/20/2014	0.46	67.84
AGW225	WT	10/20/2014	3.12	68.78
AGW226	WT	10/20/2014	1.29	68.46

ft = foot
MSL = Mean Sea Level (National Geodetic Vertical Datum of 1929)
WT = Water Table

Note:
Some of the water level data collected was not used in the surface water report.

TABLE 2
AUBURN 400 NORTH POND MONTHLY WATER LEVELS
BOEING AUBURN

Well	Aquifer Zone	Date	Depth to Water (ft)	Water Elevation (ft, MSL)
SWSG-3	Pond	11/20/2013	5.93	66.54
AGW235-1	S	11/20/2013	2.74	67.2
AGW235-2	S	11/20/2013	2.69	67.25
AGW235-4	I	11/20/2013	2.1	67.85
AGW236	S	11/20/2013	6.74	68.11
SWSG-3	Pond	12/20/2013	5.56	66.17
AGW235-1	S	12/20/2013	2.76	67.18
AGW235-2	S	12/20/2013	2.91	67.03
AGW235-4	I	12/20/2013	2.26	67.69
AGW236	S	12/20/2013	6.71	68.14
SWSG-3	Pond	1/9/2014	5.78	66.39
AGW235-1	S	1/9/2014	2.62	67.32
AGW235-2	S	1/9/2014	2.7	67.24
AGW235-4	I	1/9/2014	2.1	67.85
AGW236	S	1/9/2014	6.54	68.31
SWSG-3	Pond	1/13/2014	5.89	66.5
AGW235-1	S	1/13/2014	2.66	67.28
AGW235-2	S	1/13/2014	2.67	67.27
AGW235-4	I	1/13/2014	2	67.95
AGW236	S	1/13/2014	6.53	68.32
SWSG-3	Pond	1/28/2014	5.5	66.11
AGW235-1	S	1/28/2014	2.84	67.1
AGW235-2	S	1/28/2014	2.92	67.02
AGW235-4	I	1/28/2014	2.22	67.73
AGW236	S	1/28/2014	6.64	68.21
SWSG-3	Pond	2/11/2014	5.83	66.44
AGW235-1	S	2/11/2014	2.59	67.35
AGW235-2	S	2/11/2014	2.64	67.3
AGW235-4	I	2/11/2014	1.94	68.01
AGW236	S	2/11/2014	6.39	68.46
SWSG-3	Pond	3/13/2014	6.06	66.67
AGW235-1	S	3/13/2014	2.33	67.61
AGW235-2	S	3/13/2014	2.28	67.66
AGW235-4	I	3/13/2014	1.27	68.68
AGW236	I	3/13/2014	5.6	69.25
SWSG-3	Pond	4/1/2014	5.78	66.39
AGW235-1	S	4/1/2014	2.51	67.43
AGW235-2	S	4/1/2014	2.45	67.49
AGW235-4	I	4/1/2014	1.4	68.55
AGW236	S	4/1/2014	5.63	69.22
SWSG-3	Pond	4/15/2014	5.5	66.11
AGW235-1	S	4/15/2014	2.71	67.23
AGW235-2	S	4/15/2014	2.68	67.26
AGW235-4	I	4/15/2014	1.69	68.26
AGW236	S	4/15/2014	5.89	68.96
SWSG-3	Pond	5/21/2014	5.41	66.02
AGW235-1	S	5/21/2014	2.79	67.15
AGW235-2	S	5/21/2014	2.77	67.17
AGW235-4	I	5/21/2014	1.8	68.15
AGW236	S	5/21/2014	5.65	69.20
SWSG-3	Pond	7/1/2014	5.28	65.89
AGW235-1	S	7/1/2014	2.88	67.06
AGW235-2	S	7/1/2014	3.01	66.93
AGW235-4	I	7/1/2014	2.21	67.74
AGW236	S	7/1/2014	6.46	68.39
SWSG-3	Pond	7/28/2014	5.06	65.67
AGW235-1	S	7/28/2014	3.05	66.89
AGW235-2	S	7/28/2014	3.25	66.69
AGW235-4	I	7/28/2014	2.62	67.33
AGW236	S	7/28/2014	6.96	67.89
SWSG-3	Pond	8/20/2014	4.94	65.55

TABLE 2
AUBURN 400 NORTH POND MONTHLY WATER LEVELS
BOEING AUBURN

Well	Aquifer Zone	Date	Depth to Water (ft)	Water Elevation (ft, MSL)
AGW235-1	S	8/20/2014	3.25	66.69
AGW235-2	S	8/20/2014	3.45	66.49
AGW235-4	I	8/20/2014	2.62	67.33
AGW236	S	8/20/2014	7.39	67.46
SWSG-3	Pond	9/18/2014	4.78	65.39
AGW235-1	S	9/18/2014	3.57	66.37
AGW235-2	S	9/18/2014	3.76	66.18
AGW235-4	I	9/18/2014	3.35	66.6
AGW236	S	9/18/2014	7.98	66.87
SWSG-3	Pond	10/20/2014	5.58	66.19
AGW235-1	S	10/20/2014	2.98	66.96
AGW235-2	S	10/20/2014	3.14	66.80
AGW235-4	I	10/20/2014	2.87	67.08
AGW236	S	10/20/2014	7.63	67.22

-- = Water level measurement not collected.
ft = foot
I = Intermediate Zone
MSL = Mean Sea Level (National Geodetic Vertical Datum of 1929)
S = Shallow Zone
Note:
Groundwater elevations for multi-level wells are only accurate to the 1/10th of a ft.
Some of the water level data collected was not used for the surface water report

TABLE 3
CHICAGO AVENUE DITCH SURFACE WATER ANALYTICAL RESULTS
QUARTERLY SAMPLING (DECEMBER 2013 THROUGH SEPTEMBER 2014)
BOEING AUBURN

					Dup of SW-CD2		Dup of SW-CD4
	SW-CD2	SW-CD2	SW-CD2	SW-CD2	SW-900	SW-CD4	SW-CD900
	1439281	1456053	1478485	1501458	1501458	1439281	1439281
	7305645	7377658	7483884	7590368	7590369	7305643	7305644
	12/5/2013	2/27/2014	5/30/2014	9/5/2014	9/5/2014	12/5/2013	12/5/2013
VOCs (µg/L)							
Method SW8260C							
Acetone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	0.2 U	**0.3**	**0.3**	0.2 U	0.2 U	**0.9**	**0.9**
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**0.6**	**0.7**
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	**0.4**	**0.3**	**0.4**	0.2 U	0.2 U	**0.4**	**0.3**
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOCs-SIM (µg/L)							
Method SW8260CSIM							
Tetrachloroethene	0.020 U	0.020 U				0.020 U	0.020 U
Trichloroethene	**0.026**	**0.068**				**0.67**	**0.72**
Vinyl Chloride	**0.39**	**0.43**	**0.36**	**0.10**	**0.093**	**0.36**	**0.37**

TABLE 3
CHICAGO AVENUE DITCH SURFACE WATER ANALYTICAL RESULTS
QUARTERLY SAMPLING (DECEMBER 2013 THROUGH SEPTEMBER 2014)
BOEING AUBURN

	SW-CD4	Dup of SW-CD4 SW-CD900	SW-CD4	Dup of SW-CD4 SW-CD900	SW-CD4	SW-CD13	SW-CD13
	1456053	1456053	1478485	1478485	1501458	1439281	1456053
	7377656	7377657	7483887	7483888	7590361	7305646	7377659
	2/27/2014	2/27/2014	5/30/2014	5/30/2014	9/5/2014	12/5/2013	2/27/2014
VOCs (µg/L)							
Method SW8260C							
Acetone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	**0.8**	**0.8**	**0.7**	**0.7**	**1.1**	**0.7**	**0.9**
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	0.2 U	0.2 U	**0.2**	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	**0.5**	**0.5**	**0.7**	**0.7**	**1.7**	0.2 U	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	**0.3**	**0.3**	0.2 U	0.2 U	0.2 U	**0.4**	**0.4**
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOCs-SIM (µg/L)							
Method SW8260CSIM							
Tetrachloroethene	0.020 U	0.020 U				0.020 U	0.020 U
Trichloroethene	**0.47**	**0.47**				**0.073**	**0.13**
Vinyl Chloride	**0.39**	**0.38**	**0.16**	**0.15**	**0.13**	**0.44**	**0.48**

TABLE 3
CHICAGO AVENUE DITCH SURFACE WATER ANALYTICAL RESULTS
QUARTERLY SAMPLING (DECEMBER 2013 THROUGH SEPTEMBER 2014)
BOEING AUBURN

	SW-CD13 1478485 7483886 5/30/2014	SW-CD13 1501458 7590367 9/5/2014
VOCs (µg/L)		
Method SW8260C		
Acetone	5.0 U	5.0 U
Benzene	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U
cis-1,2-Dichloroethene	**0.8**	**1.1**
trans-1,2-Dichloroethene	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U
2-Hexanone	5.0 U	5.0 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U
Methylene Chloride	0.5 U	0.5 U
Styrene	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U
Toluene	0.2 U	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U
Trichloroethene	0.2 U	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U
Vinyl Chloride	**0.4**	0.2 U
m,p-Xylene	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U
VOCs-SIM (µg/L)		
Method SW8260CSIM		
Tetrachloroethene		
Trichloroethene		
Vinyl Chloride	**0.35**	**0.21**

U = Indicates the compound was not detected at the reported concentration.
Bold = Detected compound.

TABLE 4
AUBURN SURFACE WATER ANALYTICAL RESULTS
WET AND DRY SEASON 2014
BOEING AUBURN

Sample ID:	SW-3	SW-10	SW-12	SW-14	SW-14	SW-15	SW-15
SDG:	1461908	1461908	1464415	1461908	1501458	1461908	1501458
Lab ID:	7406012	7406013	7418677	7406016	7590360	7406014	7590370
Sample Date:	3/24/2014	3/24/2014	4/2/2014	3/24/2014	9/5/2014	3/24/2014	9/5/2014
VOLATILES (µg/L)							
Method SW8260C							
Acetone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	**0.8**	**0.7**	0.2 U	0.2 U
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	0.2 U	0.2 U	**0.4**	0.2 U	0.2 U	**0.5**	**0.3**
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	0.2 U	0.2 U	0.2 U	**0.7**	**0.9**	0.2 U	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	0.2 U	0.2 U	0.2 U	0.2 U	**0.2**	0.2 U	0.2 U
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOLATILES (µg/L)							
Method 8260C SIM							
Vinyl Chloride	0.020 U	0.020 U	0.020 U	**0.19**	**0.061**	0.020 U	0.020 U

TABLE 4
AUBURN SURFACE WATER ANALYTICAL RESULTS
WET AND DRY SEASON 2014
BOEING AUBURN

Sample ID:	SW-16	SW-16	SW-17	SW-17	SW-18	SW-18	SW-19
SDG:	1461908	1501458	1461908	1501458	1461908	1501458	1461908
Lab ID:	7406010	7590371	7406017	7590363	7406018	7590365	7406007
Sample Date:	3/24/2014	9/5/2014	3/24/2014	9/5/2014	3/24/2014	9/5/2014	3/24/2014
VOLATILES (µg/L)							
Method SW8260C							
Acetone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	**0.5**	**1.4**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	**0.3**	**0.3**	0.2 U	**0.7**	0.2 U	**0.3**	0.2 U
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	**0.3**	**1.0**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	0.2 U	**0.3**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOLATILES (µg/L)							
Method 8260C SIM							
Vinyl Chloride	**0.082**	**0.32**	0.020 U	**0.059**	0.020 U	0.020 U	0.020 U

TABLE 4
AUBURN SURFACE WATER ANALYTICAL RESULTS
WET AND DRY SEASON 2014
BOEING AUBURN

	Dup of SW-19						
Sample ID:	SW-900	SW-19	SW-20	SW-20	SW-21	SW-21	SW-22
SDG:	1461908	1501458	1461908	1501458	1461908	1501458	1461908
Lab ID:	7406008	7590362	7406011	7590364	7406009	7590366	7406015
Sample Date:	3/24/2014	9/5/2014	3/24/2014	9/5/2014	3/24/2014	9/5/2014	3/24/2014
VOLATILES (µg/L)							
Method SW8260C							
Acetone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	**5.8**
Benzene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromoform	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bromomethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Butanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Disulfide	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon Tetrachloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Dibromochloromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,2-Dichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Styrene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2,2-Tetrachloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	0.2 U	**19**	**0.4**	**0.3**	0.2 U	**0.4**	**6.6**
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,1-Trichloroethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1,2-Trichloroethane	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Trichlorofluoromethane	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Acetate	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
m,p-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
o-Xylene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
VOLATILES (µg/L)							
Method 8260C SIM							
Vinyl Chloride	0.020 U	**0.13**	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U

U = Indicates the compound was undetected at the reported concentration.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.
Bold = Detected compound.

APPENDIX A

Capture Zone Depth Calculations

APPENDIX A
CAPTURE ZONE DEPTH CALCULATION
CHICAGO AVENUE DITCH
BOEING AUBURN

DOWNGRADIENT EXTENT OF GROUNDWATER CAPTURE

Estimated downgradient extent of groundwater captured by the ditch is calculated by determining the x value for the stagnation point (x_{sp}, y_{sp} ; Zheng et al. 1988). The x value is calculated using Equation 1 as follows:

Equation 1:

$$x_{sp} = -\left[\frac{a(h_O - h_d)}{\pi I}\right]^{1/2}$$

Where:

x_{sp}	Downgradient extent of stagnation point, feet downgradient of the ditch (ft)
a	Half the width of the ditch (ft). The width of the ditch was measured on January 21, 2015 at the staff gauge SWSG-2. The width of the ditch was approximately 6 ft wide. The ditch width varies throughout the year; however, a width of 6 ft is used for the purposes of these calculations. Therefore, a = 3 ft.
h_o	Head in aquifer underlying the ditch (ft, MSL). Average monthly water levels at AGW225 were calculated to determine the average monthly head in the aquifer underlying the ditch.
h_d	Head of the ditch (ft, MSL). Average monthly water levels at SWSG-2 were calculated to determine the average monthly head of the ditch.
I	Uniform water table gradient$\left(\frac{\partial h}{\partial x}\right)$, unitless. The regional gradient was calculated from shallow zone groundwater elevations collected in July 2014 from AGW083 to AGW243-3. I = 0.0019.

The smallest difference in average monthly head between the aquifer and the ditch occurred in September 2014 [0.52 feet (ft)]. The largest difference in average monthly head between the aquifer and the ditch occurred in April 2014 (2.35 ft). The downgradient extent of ditch capture (x_{sp}) was calculated for the months of September and April to determine the approximate minimum and maximum downgradient capture of the ditch. The minimum calculated extent of downgradient ditch capture was approximately 16 ft. The maximum calculated extent of downgradient ditch capture was approximately 34 ft.

Depth of Groundwater Capture

Estimated effective depth of capture is calculated by using Equation 2 as follows (Chambers and Bahr 1992):

Equation 2:

$$D = \left(\frac{2wH}{\pi IR}\right)^{-1/2}$$

Where:

D	Effective depth of capture zone, ft
w	width of ditch, ft
H	Difference in head in the aquifer and stage in the ditch, ft
I	Regional gradient (both upgradient and downgradient of the ditch), unitless
R	Ratio of horizontal to vertical hydraulic conductivity, unitless, value is assumed to be 5 for these calculations.

The smallest difference in average monthly head between the aquifer and the ditch occurred in September 2014 (0.52 ft). The largest difference in average monthly head between the aquifer and the ditch occurred in April 2014 (2.35 ft). The depth of capture was calculated for the months of September and April to determine the approximate minimum and maximum depth capture of the ditch. The minimum depth capture was approximately 14 ft and the maximum extent of downgradient ditch capture was approximately 31 ft.

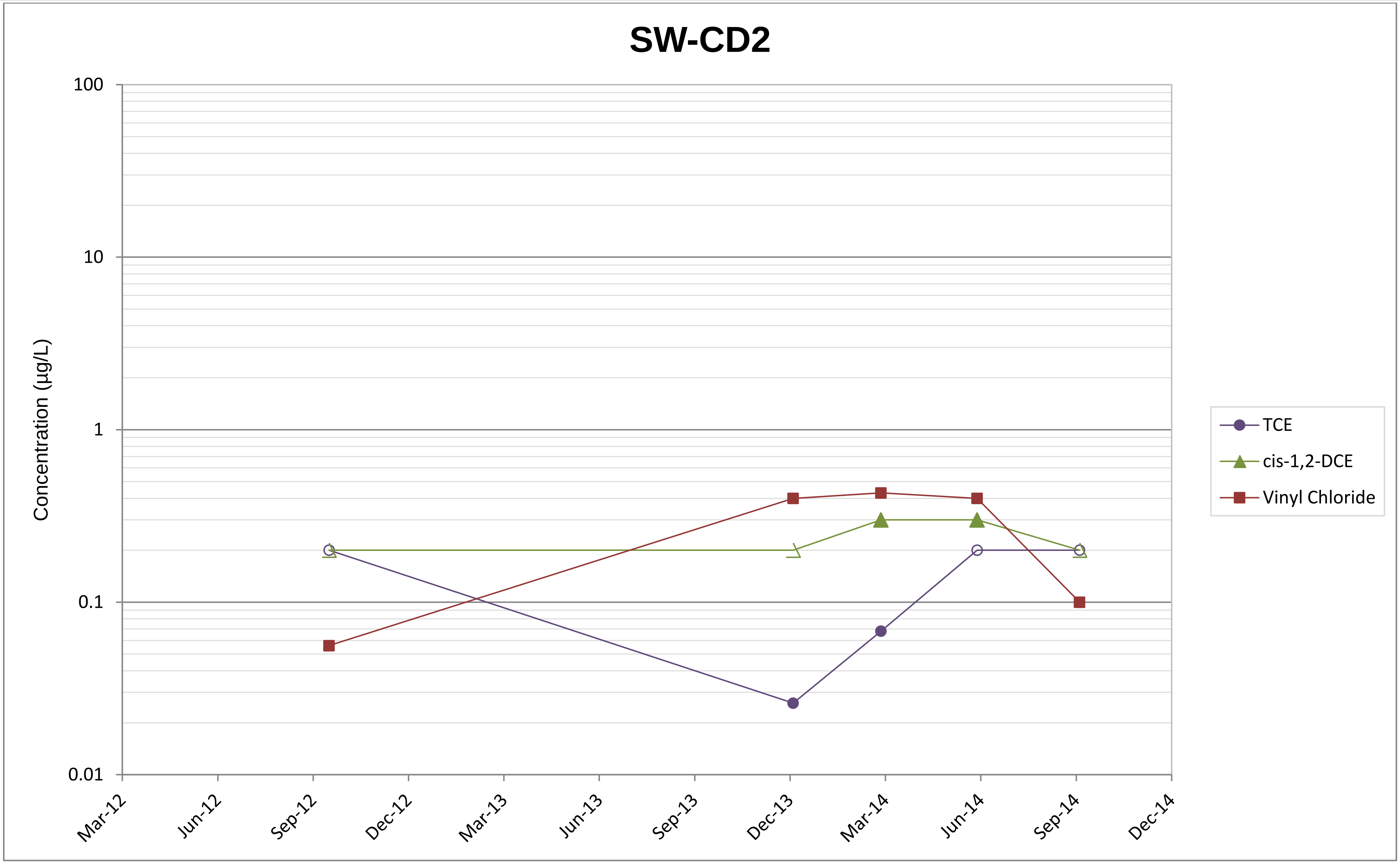
References

Chambers, L. W. and J.M. Bahr. 1992. "Tracer Test Evaluation of a Drainage Ditch Capture Zone." *Ground Water*. 30(5): 667-675.

Zheng, C., H.F. Wang, M.P. Anderson, and K.R. Bradbury. 1988. "Analysis of Interceptor Ditches for Control of Groundwater Pollution." *Journal of Hydrology*. 98: 67-81.

APPENDIX B

Time Series Plots – SW-CD2 and SW-CD13



Notes: 1) Open markers on graphs denote non-detect values, values shown represent analytical reporting limit.

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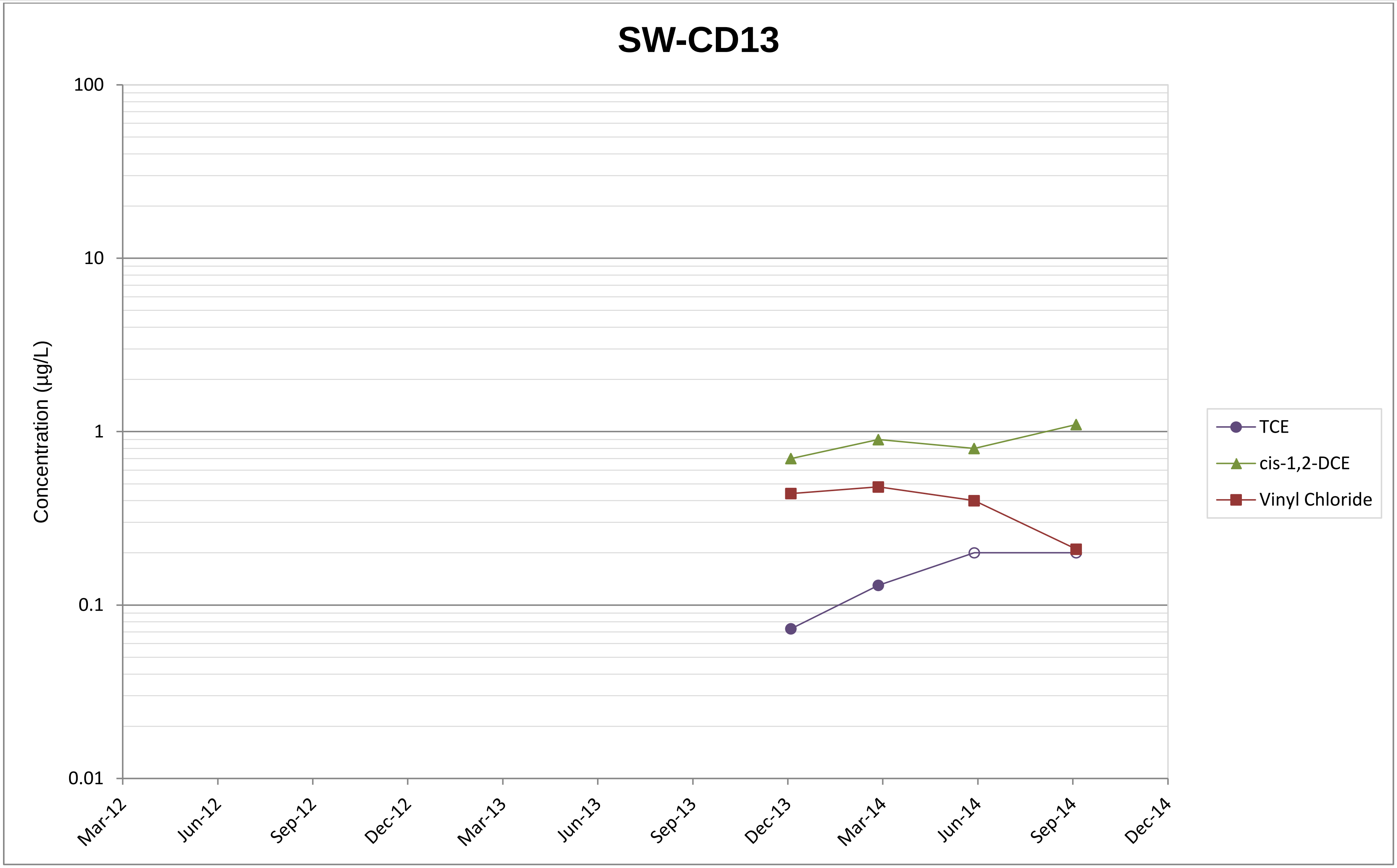
Boeing Auburn Auburn, Washington	**SW-CD2 VOC Concentrations**	Figure B-1



Notes: 1) Open markers on graphs denote non-detect values, values shown represent analytical reporting limit.

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Boeing Auburn Auburn, Washington	**SW-CD13 VOC Concentrations**	Figure B-2