Surface Water Monitoring Work Plan
Boeing Auburn Facility
Auburn, Washington

August 28, 2015

Prepared for

The Boeing Company
Seattle, Washington

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1.0 INTRODUCTION

This document presents a work plan to conduct continued surface water monitoring activities near The Boeing Company's (Boeing) Auburn Fabrication Division facility (facility) located at 700 15th Street Southwest (SW) in Auburn, Washington. Boeing is currently undergoing corrective action at the facility. 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 work plan includes a scope of work for long-term surface water monitoring of contaminants of concern and short-term water level monitoring activities for increased understanding of the site conceptual model. The Boeing property[1] location and vicinity map are shown on Figure 1.

1.1 MONITORING OBJECTIVES

The purpose of this work is to continue to monitor concentrations of constituents of concern in surface water to support completion of the RI as well as to confirm the current understanding of groundwater to surface water interactions. Specific monitoring objectives are:

- Objective #1: Monitor select, previously established surface water sampling locations for continued evaluation of constituents of concern
  - Continue monitoring at surface water sample locations which have previously indicated the presence of constituents of concern above screening levels (SLs)
  - Continue monitoring surface water at Mill Creek to document that volatile organic compounds (VOCs) in groundwater are not affecting water quality in Mill Creek
  - Continue monitoring contaminant trends in the Chicago Avenue ditch
- Objective #2: Sample sediment pore water along Mill Creek and the channelized portion of the wetland south of State Route (SR) 18 and west of SR 167 in order to evaluate VOC concentrations below the creek and impacts of the discharging groundwater on surface water.
- Objective #3: Collect a surface water flow measurement at the Chicago Avenue ditch to increase understanding of groundwater to surface water interactions and provide additional data for numerical groundwater model calibration
- Objective #4: Monitor water elevations in and adjacent to Mill Creek to increase understanding of groundwater to surface water interactions and hydraulic gradients near Mill Creek.

[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.

1.2 SCOPE OF WORK

The proposed scope of work presented in this work plan includes the following:

- Collecting semiannual or annual surface water samples at select locations to evaluate VOC concentrations to meet Objective #1
- Collecting one-time co-located surface water and sediment pore water samples along Mill Creek and the channelized portion of the wetland south of SR 18 and west of SR 167 to evaluate VOC concentrations to meet Objective #2
- Collecting surface water flow measurements in the Chicago Avenue ditch to meet Objective #3
- Collecting water levels to monitor hydraulic gradients between groundwater and surface water adjacent to Mill Creek to meet Objective #4.

Background information to support this scope of work and previous surface water investigation activities are presented in Section 1.3. The monitoring approach is presented in Section 2.0. The field procedures are presented in Section 3.0. Schedule and reporting are discussed in Section 4.0.

1.3 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 about 80 to 100 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.

Various surface water, wetland, and stormwater features are present in these areas 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. These surface water, wetland, and stormwater features eventually drain into Mill Creek as described in Section 1.3.1. The location of these surface water features are shown on Figure 2.

1.3.1 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 in turn 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 the ditch on the northwest side of the stormwater ponds. This ditch combines with flow from the Auburn 400 north pond and discharges to a wetland on the west side of SR 167 via a culvert pipe under SR 167. A channelized portion of the wetland carries water north where it joins Mill Creek at the east end of Peasley Canyon Road South (near the intersection of SR 167 and SR 18). Mill Creek then flows northward through various wetland complexes before it joins with the Green River several miles downstream. Surface water features and flow patterns are presented on Figure 2.

1.3.2 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 influenced by groundwater discharge to surface water and is most pronounced in the shallow zone where groundwater is in direct hydraulic connection with the surface water features.

1.4 PREVIOUS SURFACE WATER INVESTIGATIONS

Surface water sampling investigation activities near the Boeing facility were first conducted in June 2012. The June 2012 field activities included sample collection from 11 surface water locations. VOCs of concern were detected in the Chicago Avenue ditch and the Auburn 400 north pond (Landau Associates 2012a). Dry season sampling of surface water at four locations in the Chicago Avenue ditch was conducted in September 2012 to assess the spatial variability of VOC concentrations and to help determine the locations for quarterly monitoring. Constituents of concern were detected at three of the four Chicago ditch

sampling locations (Landau Associates 2012b). Additional surface water investigations occurred in Auburn in July 2013. Surface water VOC samples were collected at six locations. VOCs of concern were detected in samples collected from the Auburn 400 south and north ponds and at the outflow from the Auburn 400 north pond (Landau Associates 2014).

Surface water investigations in 2014 included collection of surface water VOC samples and water level monitoring. Water quality samples were collected quarterly (December 2013 through September 2014) from three locations along the Chicago Avenue. Water quality samples were also collected in Auburn from 12 locations during the wet season (March 2014) and 8 locations in the dry season (September 2014). Constituents of concern were only detected at the Chicago Avenue ditch, the Auburn 400 ponds, and at the outflow from the Auburn 400 north pond into the wetland west of SR 167 (Landau Associates 2015). TCE, cis-1,2-DCE, and VC results from all of the previous sampling investigations are presented on Figure 2.

Water level monitoring at a staff gauge in the Auburn 400 north pond and adjacent wells occurred over 12 months, from November 2013 through October 2014. Water level monitoring also occurred at a staff gauge in the Chicago Avenue ditch and adjacent monitoring wells over 10 months from January to October 2014. Water level data and VOC concentration data from the Auburn 400 ponds and the Chicago Avenue ditch indicate that groundwater is discharging to surface water at these locations throughout the year (Landau Associates 2015).

2.0 MONITORING APPROACH

The monitoring approach consists of surface water sample collection, sediment pore water sample collection, surface water flow measurements, and evaluating hydraulic gradients using surface water and groundwater elevation measurements. Surface water sample collection consists of continued sampling at six surface water locations for VOCs; the purpose of the continued monitoring is to verify that conditions within the surface water system are stable over time. Co-located surface water and sediment pore water sample collection consists of a one-time sampling event. The purpose of this sampling is to enhance the understanding of groundwater quality directly below the surface water and how groundwater discharge affects surface water quality. Surface water flow measurements will be conducted in the Chicago Avenue ditch to evaluate base flow into the ditch and enhance understanding of surface water and groundwater interactions. Hydraulic gradient evaluation is proposed at one location in Mill Creek and adjacent groundwater monitoring wells and will continue for 4 quarters.

2.1 SURFACE WATER SAMPLING

Continued sampling for VOCs in surface water will consist of annual (dry season) sampling at five locations and semiannual (wet season and dry season) sampling at one location. Annual sampling is proposed for five locations in the dry season because concentrations tend to be highest when precipitation and related stormwater runoff is minimal. Semiannual sampling is proposed for one location in the Chicago Avenue ditch to monitor temporal trends in concentrations of constituents of concern. Proposed sampling locations are shown on Figure 3. The locations and objectives of each of the sampling locations are described below.

- **Chicago Avenue ditch (SW-CD4):** Semiannual sampling is proposed at sampling location SW-CD4. SW-CD4 is located in the Chicago Avenue ditch where 11th Avenue North intersects Chicago Avenue. This location in the ditch has the highest concentrations of constituents of concern. TCE concentrations have previously been the highest during the dry season sampling event and VC concentrations have been the highest during the wet season sampling events. Continued semiannual monitoring is proposed to evaluate seasonal variations in concentrations and to monitor changes in concentrations over time. If the results of the ongoing surface water sampling in Chicago Avenue ditch are increasing over time (increasing trend line over the course of four or more sampling events), then Boeing will re-evaluate the need for additional surface water sampling locations both upgradient and downgradient of SW-CD4.
- **Auburn 400 south and north ponds (SW-14 and SW-16):** Annual sampling is proposed at sampling location SW-14 in the Auburn 400 south pond and at sampling location SW-16 in the Auburn 400 north pond. SW-14 is located at the inlet (southeast corner) of the Auburn 400 south pond. SW-16 is located at the southeast corner of the Auburn 400 north pond. TCE, cis-1,2-DCE, and VC were detected in samples collected from both SW-14 and SW-16 in July 2013, March 2014, and September 2014. Concentrations were the highest during dry season sampling events (July and September). Continued dry season annual sampling is proposed in order to monitor changes in concentrations over time.

- **Auburn 400 north pond outflow (SW-17):** Annual sampling is proposed at sampling location SW-17. SW-17 is located at the outflow from the Auburn 400 north pond to the wetland complex west of SR 167. Cis-1,2-DCE and VC were detected from samples collected at SW-17 in July 2013 and September 2014. VOCs were the highest during the dry season sampling events and were not detected during the wet season sampling event in March 2014. Continued dry season annual sampling is proposed in order to monitor changes in concentrations over time.
- **Wetlands west of SR 167 to Mill Creek (SW-20):** Annual sampling is proposed at sampling location SW-20. SW-20 is located in the channelized portion of the wetland west of SR 167 just upstream of the confluence with Mill Creek. No constituents of concern have been detected at this sampling location during wet or dry season sampling events. Continued dry season annual sampling is proposed at this location in order to verify that constituents of concern continue to be non-detect in the wetland before it combines with Mill Creek.
- **Mill Creek (SW-18):** Annual sampling is proposed at sampling location SW-18. SW-18 is located where Mill Creek crosses under West Main Street. No constituents of concern have been detected at this sampling location. Similar to SW-20, continued dry season annual sampling is proposed at SW-18 in order to verify that constituents of concern are not detected in Mill Creek.

2.2 CO-LOCATED SURFACE WATER AND SEDIMENT PORE WATER SAMPLING

Co-located surface water and sediment pore water sampling will consist of a one-time sampling event at four locations along Mill Creek and the channelized portion of the wetland south of SR 18 and west of SR 167. Two of the locations will be along Mill Creek north of the SR 167 and SR 18 interchange and two of the locations will be along the channelized portion of the wetland south of SR 167 and SR 18 interchange. The four locations will coincide with Ecology's requested sampling locations (Ecology 2015) to the extent feasible. Proposed sampling locations are shown on Figure 3.

2.3 SURFACE WATER FLOW MONITORING

Surface water flow measurements are proposed at one location in the Chicago Avenue ditch. The flow measurements will be used in calibration of the Auburn groundwater model and to supplement the water level monitoring information already collected at the Chicago Avenue ditch (Landau Associates 2015). Flow measurements will enhance our understanding of groundwater and surface water interactions. The flow measurement location is proposed at the northernmost point of the Chicago Avenue ditch before the ditch enters the piped stormwater system. Flow measurements will be collected once if conditions allow, at a time that represents approximately average flow levels, to evaluate the base flow into the Chicago Avenue ditch.

2.4 GROUNDWATER AND SURFACE WATER HYDRAULIC GRADIENT CHARACTERIZATION

Characterization of the hydraulic gradients between groundwater and surface water at Mill Creek is proposed by collecting quarterly groundwater and surface water elevation measurements. Vertical gradients will be calculated from these water level measurements. Water elevation measurements are proposed in Mill Creek adjacent to the surface water monitoring location SW-18 at the gauging station location named SWSG-4 (Figure 3). Water elevations will also be measured from all channels at the adjacent multi-level well (AGW254) and the adjacent deep zone well (AGW259).

3.0 FIELD ACTIVITIES

The following sections describe field activities and procedures for obtaining access agreements, sampling surface water and sediment pore water, measuring surface water flows, and measuring water elevations. Field activities will be performed in accordance with the project Health and Safety Plan (Appendix A). The surface water sampling matrix is presented in Table 1.

3.1 PERMITS AND ACCESS AGREEMENTS

Boeing will pursue permits and access agreements for surface water sampling and for water level and surface water flow measurements, where required. The owners of the properties at which the proposed field activities will occur include City of Algona, City of Auburn, and Washington State Department of Transportation (WSDOT). Boeing will obtain verbal approval from the City of Auburn for surface water sampling activities at SW-14, SW-16, and SW-18 and for surface water elevation measurements along Mill Creek. Boeing will update the permit to access the surface water locations on WSDOT right-of-way (SW-17 and SW-20) and co-located pore water and surface water sampling locations. Boeing recently submitted a permit extension request to the City of Algona[2] for the semiannual surface water sampling at SW-CD4. Verbal approval will be sought from the City of Algona for the flow monitoring at the Chicago Avenue ditch since no structures will be required and no samples will be collected.

3.2 SURFACE WATER SAMPLING PROCEDURES

Surface water sampling will occur only after no measureable precipitation for a 48-hour period to minimize stormwater runoff contribution at sampling locations. Sampling is scheduled to occur coinciding with groundwater monitoring events when weather allows. Collection of surface water samples co-located with sediment pore water samples is described in Section 3.3 below.

Where feasible, sampling will be conducted using a peristaltic pump and dedicated tubing. However, a composite liquid waste sampler (COLIWASA) will be used to collect the samples where access is difficult and power to operate a peristaltic pump is not available. The COLIWASA is a rigid, hollow tube with a stopper on one end and an open/close mechanism on the other. The COLIWASA is constructed of polyethylene, which will not react with VOCs. Each sampler will be used at a single location and will be disposed of after one use. Sampling procedures for the COLIWASA will be consistent with previous sampling events and are as follows:

- The stopper end is lowered to the desired sampling depth; the stopper is then released and water from the desired depth fills the tube

[2] This work is expected to fall under existing permit #C13-17.

- The stopper is then closed and the sampler is removed from the water
- An appropriate sample volume is collected from the COLIWASA and placed in the designated sample container
- The sampling process will be repeated until all sample bottles are filled for a particular location.

All samples will be placed in laboratory-provided, clean sample containers. Samples will be collected no more than 4 inches above the bed of the sediment and at least 2 inches below the water surface. If less than 4 inches of water is present, the sample will be collected from the approximate mid-point of the water column. When using the peristaltic pump, sample tubing will be attached to a rigid pole to allow control of the sampling location and depth. At the time of sampling, a multi-parameter probe (YSI 556 MPS) will be used to monitor the following field parameters: pH, conductivity, dissolved oxygen, temperature, and oxidation-reduction potential. Field parameters will be measured either using a flow cell when using a peristaltic pump or by submerging the instrument probe directly into the surface water when using a COLIWASA.

3.3 CO-LOCATED SURFACE WATER AND SEDIMENT PORE WATER SAMPLING

Sediment pore water samplers will be deployed as close as possible to the four locations along Mill Creek and the channelized portion of the wetland south of SR 18 and west of SR 167 shown on Figure 3. Sediment pore water samplers consist of an EON Sediment Diffusion Sampler canister (canister) with a pre-filled passive diffusion bag (PDB). The canister is a 20-inch-long, 2-inch-diameter slotted PVC casing with a pointed tip and screw-top lid. The PDB consists of an 18-inch-long, 1¾ -inch-diameter, low-density polyethylene (LDPE) bag filled with deionized water. The LDPE acts as a semi-permeable membrane that allows VOCs in the ambient water around the canister to diffuse across the membrane into the deionized water until a chemical equilibrium is established between the ambient water and the deionized water. A photograph of the canister and PDB are shown on Figure 4.

The entire assembly (canister and PDB) will be placed vertically into the streambed until the top of the canister is at or below the sediment surface. The assembly will be left in place for a minimum of 2 weeks to allow for equilibration. The assembly will be placed so the canister will remain fully under the sediment during the equilibration period. A cord or rope will be placed through the top loop of the canister and tied off to a length of clean rebar and flagging that will be placed near the canister and lodged into the streambed to mark the location of the canister in the sediment. Locations will also be documented using a hand-held GPS.

After the equilibration time has elapsed, and prior to retrieval of the pore water sampler, a co-located surface water sample will be collected using the procedures described in Section 3.2. Upon

completion of the co-located surface water sampling, the pore water sampler will be extracted from the sediment. The PDB will be removed from the canister and water will be sampled from the PDB using the following procedures:

- A sampling straw will be used to puncture the side of the PDB (or a corner will be cut from the top)
- The contained water in the PDB will be carefully poured into laboratory-provided, clean sample containers. To facilitate pouring the sample, field personnel may suspend the bag by monofilament line attached at the top.
- After sample collection, any excess water contained in the PDB will be collected and disposed of as described in Section 3.7. The empty PDB will be disposed of as solid waste.

3.4 SURFACE WATER AND SEDIMENT PORE WATER SAMPLE ANALYSIS

Surface water samples will be analyzed for VOCs by U.S. Environmental Protection Agency (EPA) Methods 8260 and 8260 selected ion monitoring (SIM). SIM analysis will only be completed for VC, as VC is the only constituent with SLs lower than the laboratory target limits of quantitation for EPA Method 8260. Samples will be analyzed by Eurofins Lancaster Laboratories, Inc. in Lancaster, Pennsylvania. Samples will be collected in laboratory-provided 40-milliliter volatile organic analysis (VOA) containers preserved with hydrochloric acid. Five VOA containers will be collected for each sample. Trip blanks and blind duplicate samples will be used for quality assurance of water results. A trip blank will accompany each cooler of samples. One set of duplicate samples will be collected for each 20 samples (identified as SW-900, SW-901, etc.).

Surface water samples will have the following sample naming convention: location name, year, month, and day. For example, sample number SW-14-20150910 indicates a sample collected from location SW-14 on September 10, 2015.

Surface water samples that are co-located with sediment pore water samples will be numbered according to Figure 3 and both co-located samples with have the appropriate sample-type prefix with the same number. The surface water sample will have the prefix SW and the pore water sample will have the prefix PW. The samples will then be labeled with the year, month, and day that the sample is collected. For example, if the surface water sample number were SW-23-20150910, the co-located pore water sample number would be PW-23-20150910. In this example, both samples were collected from location 23 on September 10, 2015.

3.5 SURFACE WATER FLOW MONITORING PROCEDURES

Surface water flow monitoring includes manual flow measurements at one location in the Chicago Avenue ditch. Flow measurements will occur at the surface water sampling location SW-CD1, which is the northernmost point of the ditch before it enters the piped stormwater system (Figure 3). Flow measurements will be collected once in June 2015. Flow measurements will only be collected after a period of 48 hours with no measurable precipitation.

Flow measurement procedures will follow the widely used and accepted U.S. Geological Survey (USGS) discharge velocity-area measurement methodology. Per the USGS method, the width of the ditch will be measured using a measuring tape perpendicular to the direction of flow to allow the ditch to be divided into regular intervals, based on the approximate width of the ditch. Based on the measured width of the ditch, there will be between 10 to 20 intervals across the ditch. These intervals will represent the cross-sectional area across the channel and accurately capture variations in stream flow. After determining the number of measurement intervals necessary, the water depth and velocity will be measured at each interval. The velocity at each interval will be measured using a Price pygmy meter attached to a graduated wading rod using the six-tenths method. Flow for each interval is calculated by multiplying the cross-sectional area at each interval by the velocity measured at each interval. Total ditch flow is then determined by summing the flow calculated at each interval. The equation for the velocity-area method is presented below (Turnipseed and Sauer 2010).

$$Q = \sum_{i=1}^{n} a_i v_i$$

Where: Q = total discharge (ft^3/sec)
a_i = cross-section area (ft^2) for the *i*th segment of the *n* segments into which the cross section is divided.
v_i = the corresponding mean velocity (ft/sec) of the flow normal to the *i*th segment

ft3/sec = Cubic feet per second
ft2 = Square Foot
ft/sec = Foot per Second

3.6 WATER ELEVATION MEAUSREMENT PROCEDURES

Water elevation measurements will occur at the SW-18 sampling location on Mill Creek and adjacent groundwater wells (AGW254 and AGW259). Water elevations will be measured at this location quarterly for 1 year during the groundwater sampling events. In addition, surface water elevations will continue to be monitored at staff gauges in the Chicago Avenue ditch (SWSG-2) and the Auburn 400 north pond (SWSG-3) during groundwater sampling events and at all active staff gauges during synoptic groundwater elevation collection events.

Water elevation measurements at Mill Creek will consist of measuring the distance between the water surface and a permanent surveyed location on the culvert to determine the water surface elevation. This monitoring location will be identified as SWSG-4 (Figure 3). A permanent mark will be made on the top of the culvert above Mill Creek. A water level indicator will be used to measure the height to water surface from the marked location on the culvert. The mark on the culvert will be surveyed for horizontal location and vertical elevation. The elevation will be surveyed to an accuracy of 0.01 ft (National Geodetic Vertical Datum of 1929) to accurately determine water elevations.

Groundwater elevations will also be measured at the adjacent multi-level well AGW254 and at the deep zone well AGW259[3] using a water level indicator (Figure 3). Water elevation measurements from Mill Creek and the wells will be used to calculate vertical hydraulic gradients from the groundwater to Mill Creek.

3.7 DECONTAMINATION AND INVESTIGATION-DERIVED WASTE

Decontamination of non-dedicated equipment will consist of a manual wash with Alconox® solution followed by a tap water rinse. Investigation-derived wastewater, if generated, may consist of decontamination and purge water (when sampling), which will be temporarily contained in properly labeled buckets and transported back to the facility. At the facility, wastewater will be deposited in a properly labeled drum or water tote located in a secondary containment area designated for wastewater storage. Boeing will be responsible for waste handling and disposal.

[3] AGW259 is the deep zone well installed adjacent to AGW254.

4.0 SCHEDULE AND REPORTING

Surface water sampling activities will be conducted at the Chicago Avenue ditch semiannually (March and September) through the completion of the RI. Surface water sampling activities at all annual surface water sampling locations will be conducted once a year starting in September 2015 until the completion of the RI. The one-time co-located surface water and pore water sampling will occur in September 2015. The sampling events will occur upon approval of this work plan and receipt of verbal approval from the City of Algona and the City of Auburn, and permit approval from WSDOT.

Surface water and groundwater elevation monitoring will occur quarterly during groundwater sampling events for 1 year. These elevation monitoring activities will begin in June 2015. Surface water flow measurements will occur at the Chicago Avenue ditch as conditions allow and when flows are near the annual average levels.

All surface water sampling results will be presented in quarterly reports following the collection of surface water samples in the wet and dry seasons. Sampling results, water elevation, and stream flow measurements will be analyzed and discussed in a technical memorandum for the data collected in 2015.

SEF/JWW/jrc

5.0 REFERENCES

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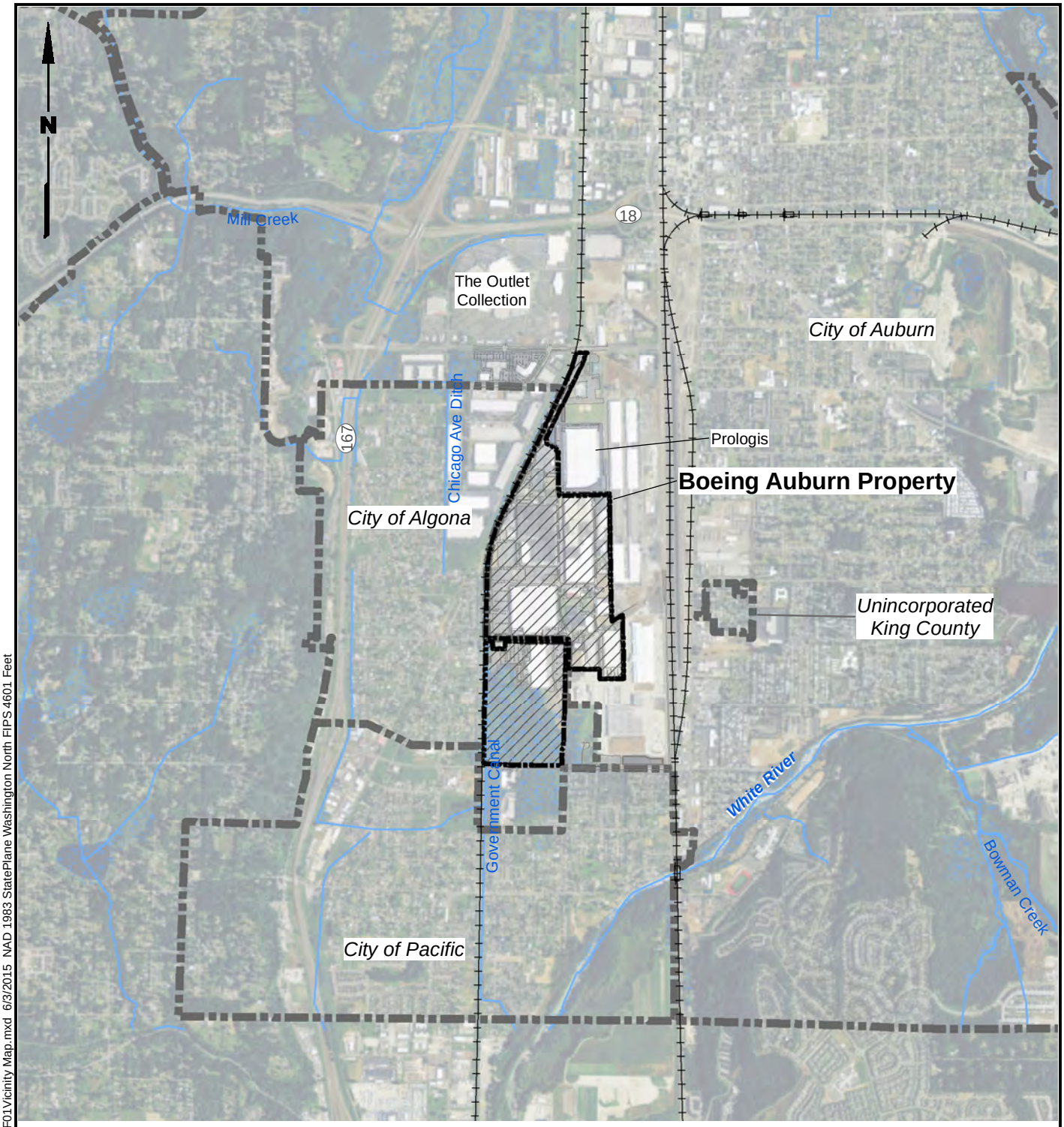

Legend

- Waterways
- Wetland Areas
- City Limits
- Boeing Property

0 3,000 6,000

Feet

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

G:\Projects\025\164\120101\2014 SW Report\F01Vicinity Map.mxd 6/3/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

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

SW-5	6/20/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<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-9	6/19/2012
TCE	<0.2
cis-1,2-DCE	<0.2
VC	<0.04

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-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-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-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-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-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-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

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

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

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

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

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

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

City of Algona
City of Auburn
Auburn 400 South Pond
Auburn 400 North Pond
SWSG-3
SWSG-1
SWSG-2
Coastal Farm and Ranch
The Outlet Collection Stormwater Pond
The Outlet Collection
Mill Creek
Chicago Ave Ditch
West
Fana
Prologis
Auburn Environmental Park
167
18

Legend

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

0 600 1,200
Scale in Feet

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.

N

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

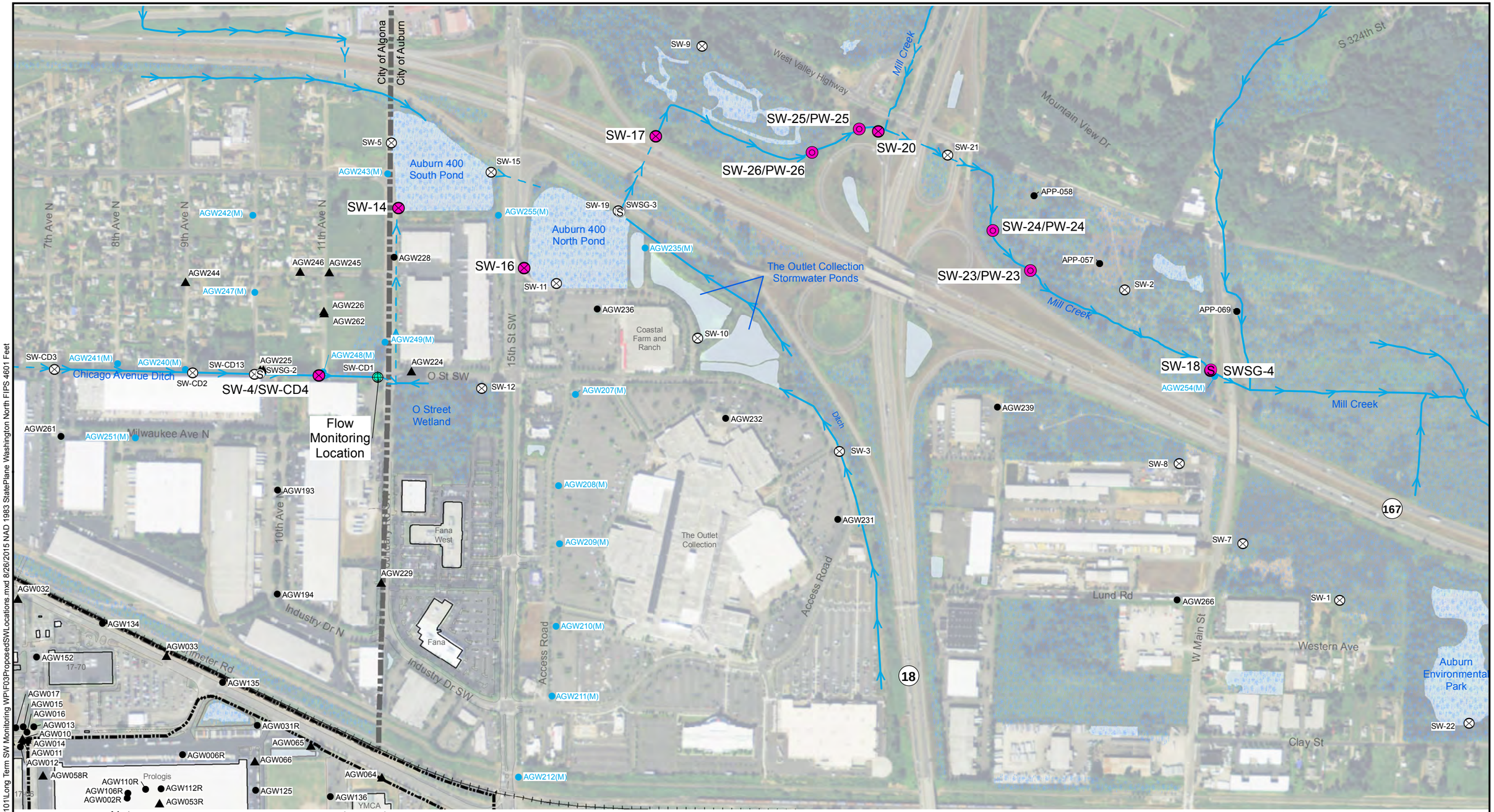
LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

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

Figure 2

G:\Projects\025\164120\101\Long Term SW Monitoring WP\F02SurfaceWaterConcentrations.mxd 5/28/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet



G:\Projects\025\164\120\101\Long Term SW Monitoring WP\F03ProposedSWLocations.mxd 8/26/2015 NAD 1983 StatePlane Washington North FIPS 4601 Feet

Notes

1. The locations of surface water features are approximate.
2. Well designations beginning with APP are installed and owned by WSDOT.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Proposed Surface Water Sample Location
- Previous Surface Water Sample Location
- Proposed Staff Gauge
- Staff Gauge
- Proposed Co-Located Surface Water and Sediment Pore Water Sampling Location
- Flow Monitoring Station
- 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.

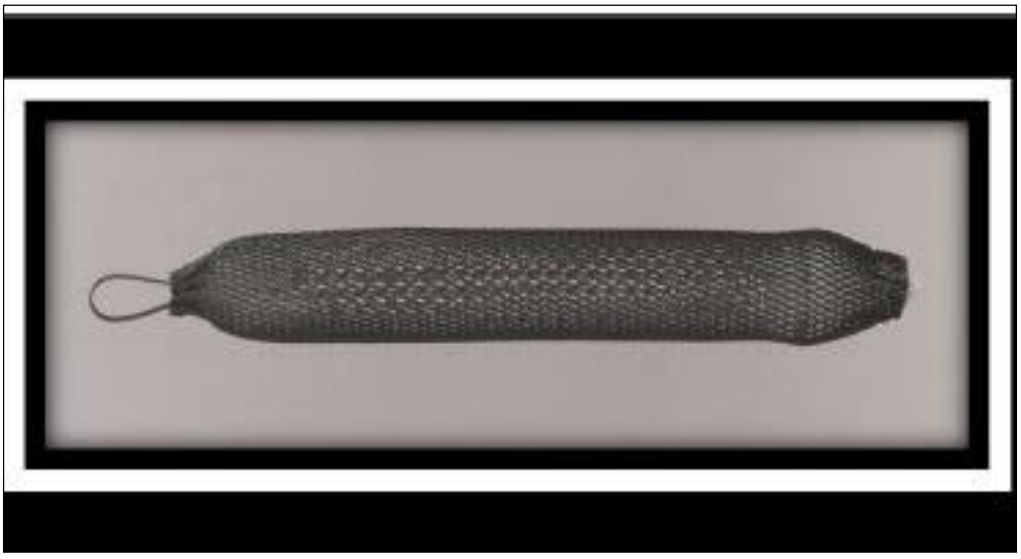
LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

Proposed Surface Water Sampling, Surface Water Flow, and Elevation Monitoring Locations

Figure 3

1. Photograph of EON Sediment Diffusion Sample canister.



2. Photograph of Passive Diffusion Bag (PDB).

LANDAU ASSOCIATES

Boeing Auburn
Auburn, Washington

EON Sediment Diffusion Sample Canister and PDB

Figure
4

TABLE 1
SURFACE WATER SAMPLING MATRIX
BOEING AUBURN

Surface Water Body	Sample ID	Sample Location Description	March	September
Chicago Avenue ditch	SW-CD4	At the intersection of Chicago Avenue and 11th Avenue North.	X	X
Auburn 400 south pond	SW-14	Stormwater inlet structure discharge pipe located at southeast corner of pond.		X
Auburn 400 north pond	SW-16	Near previous SW-11 along southeastern edge of pond where access allows.		X
Auburn 400 north pond outflow	SW-17	Stormwater outflow culvert from the Auburn 400 north pond to the wetland on the west side of SR 167.		X
Wetlands west of SR 167 to Mill Creek	SW-20	Before the channelized portion of the wetland west of SR 167 connects with Mill Creek just south of the intersection of Peasley Canyon Road South with the West Valley Highway near SR 18.		X
Mill Creek	SW-18	Channelized portion of Mill Creek where it passes beneath West Main Street via a box culvert.		X

SW = Surface Water
SW-CD = Surface Water Chicago Avenue ditch

Notes:
1. Field parameters pH, conductivity, dissolved oxygen , temperature, and oxidation-reduction potential will be collected at all sample locations.
2. All surface water samples will be analyzed by U.S. Environmental Protection Agency (EPA) Method 8260 (standard Boeing volaitle organic compound list) and EPA Method 8260 selected ion method (for vinyl chloride only).

APPENDIX A

Health and Safety Plan

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

WORK LOCATION PERSONNEL PROTECTION AND SAFETY EVALUATION FORM

Attach Pertinent Documents/Data
Fill in Blanks As Appropriate

Job No.:	0025164.120.110	Revised:	
Prepared by:	Sarah Fees	Reviewed by:	Christine Kimmel
Date:	March 26, 2015	Date:	March 27, 2015

A. WORK LOCATIONS DESCRIPTION

1. **Project Name:** Boeing Auburn, Site Wide Corrective Action
2. **Location:** Auburn, Washington
3. **Anticipated Activities:** Surface water and groundwater level monitoring; stream flow monitoring, surface water sampling
4. **Size:** Approximately 42 acres
5. **Surrounding Population:** Mixed industrial, commercial, and residential
6. **Buildings/Homes/Industry:** Industrial buildings, roadways, parking areas, commercial stores, residential areas
7. **Topography:** Flat pavement, unpaved surface, short and steep slopes, work in ponds, ditches and wetlands
8. **Anticipated Weather:** 30-80 degrees Fahrenheit, sun or rain
9. **Unusual Features:** Working in up to 2 feet (ft) of water and on a steep slope. Working near water that is up to 6 ft deep.
10. **Site History:** Various areas of the Auburn facility were designated Areas of Concern (AOCs) or Solid Waste Management Units (SWMUs) during the 1998 RCRA facilities assessment conducted by EPA. Remedial investigation is being conducted onsite and offsite to address volatile organic compounds (VOCs) present in soil, groundwater, surface water, and air.

B. HAZARD DESCRIPTION

1. Background Review: ☒ Complete ☐ Partial

If partial, why?

2. Hazardous Level: ☐ B ☐ C ☒ D ☐ Unknown

Justification: Existing data regarding site conditions

3. Types of Hazards: (Attach additional sheets as necessary)

A. ☒ Chemical ☒ Inhalation ☐ Explosive
☐ Biological ☒ Ingestion ☐ O2 Def. ☒ Skin Contact

Describe: Sampling of surface water potentially impacted by VOCs.

B. ☒ Physical ☒ Cold Stress ☐ Noise ☒ Heat Stress ☒ Drowning

Describe: Physical hazards associated with working near busy roads, on steep slopes and in water. Potential for cold, wet weather to high temperatures.

C. ☐ Radiation

Describe:

4. Nature of Hazards:

☒ Air	Describe: Potential for volatile constituents to be released from contaminated surface water.
☐ Soil	Describe:
☒ Surface Water	Describe: Potential for contact with or ingestion of contaminated surface water.
☐ Groundwater	Describe:
☐ Other	Describe:

5. Chemical Contaminants of Concern ☐ N/A The primary chemical contaminants of concern VOCs. The table below lists information for these primary compounds and other potential contaminants.

Contaminant	PEL (ppm)	I.D.L.H. (ppm)	Source/Quantity Characteristics	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Trichloroethene	50 ppm	1,000 ppm	Present in groundwater	Inhalation, ingestion, dermal contact, ingestion, inhalation	Eye, nose, and throat irritation; headache, nausea	Footnote A
Vinyl Chloride	1 ppm	5 ppm	Present in groundwater	Inhalation, ingestion, dermal contact	Weakness, abdominal pain (carcinogen)	Footnote A
cis-1,2-Dichloroethene	200 ppm	4,000 ppm	Present in groundwater	Inhalation, ingestion, dermal contact	Dizziness, nausea, dermatitis, irritation of mucous membranes	Footnote A
Arsenic	0.002 mg/m^3	5 mg/m^3	Present in groundwater	Inhalation, ingestion, dermal contact	Respiratory irritation, dermatitis, gastro-intestinal distress	
Tetrachloroethene	50 ppm	150 ppm	Present in groundwater	Inhalation, ingestion, dermal contact	Eye, nose, skin and throat irritation, nausea, flushed face and neck, dizziness, incoherent, drowsy	Footnote A

Footnote A: Based on previous samples collected, concentrations of VOCs in surface water are not expected to result in measurable concentrations of VOCs in ambient air.

6. Physical Hazards of Concern ☐ N/A

Hazard	Description	Location	Procedures Used to Monitor Hazard
Slip, trips, and falls	Steep slopes of ditches and ponds	Chicago Avenue ditch is relatively short yet steep. Water in the ditch is typically less than 2 ft deep. Water in ponds is up to 6 feet deep.	Use short ladder to avoid stepping on slope, three points of contact when working on slopes. Ladder to lean against slope with top of ladder extended beyond ditch height, keep hand free of material, wear slip resistant boots.
Vehicle traffic	Road hazards from working along roadways	Surface water sampling locations that are in public right-of-way	Use of traffic cones to delineate work area, wear safety vest, alert observation of surroundings.
Drowning	Working in water	All surface water sampling locations will be in and around standing water	Never be alone when working due to the possibility of slippery ground from standing water. Wear a Coast Guard approved life vest when working in or near water that is deeper than knee height.
Travel to and from project site	Operating motor vehicle in traffic on highways and rural roads.	Route to and from site from Landau Associates office.	Operate motor vehicle while well rested and physically able to drive safely. Conduct pre-trip vehicle inspection, all vehicles to be maintained and in good working order. Obey all traffic laws including no cell phone use while driving. Secure all cargo properly to avoid shifting. Allow sufficient time for travel to site at safe speeds. Engage emergency brake when parking vehicles. Establish planned route prior to departure.

7. Work Location Instrument Readings ☒ N/A

Location: _____

Percent O_2: _____ Percent LEL: _____

Radioactivity: _____ PID: _____

FID: _____ Other: _____

Other: _____ Other: _____

Other: _____ Other: _____

Location: _____

Percent O_2: _____ Percent LEL: _____

Radioactivity: _____ PID: _____

FID: _____ Other: _____

Other: _____ Other: _____

Other: _____ Other: _____

Location: _____

Percent O_2: _____ Percent LEL: _____

Radioactivity: _____ PID: _____

FID: _____ Other: _____

Other: _____ Other: _____

Other: _____ Other: _____

Location: _____

Percent O_2: _____ Percent LEL: _____

Radioactivity: _____ PID: _____

FID: _____ Other: _____

Other: _____ Other: _____

Other: _____ Other: _____

8. Hazards Expected In Preparation For Work Assignment ☒ N/A

Describe:

C. PERSONAL PROTECTIVE EQUIPMENT

1. Level of Protection

☐ A ☐ B ☐ C ☒ D

Location/Activity:

☐ A ☐ B ☐ C ☒ D

Location/Activity:

2. Protective Equipment (specify probable quantity required)

Respirator ☒ N/A

- ☐ SCBA, Airline
- ☐ Full-Face Respirator
- ☐ Half-Face Respirator (Cart. organic vapor) (Only if upgrade to Level C)
- ☐ Escape mask
- ☐ None
- ☐ Other:
- ☐ Other:

Clothing ☐ N/A

- ☐ Fully Encapsulating Suit
- ☐ Chemically Resistant Splash Suit
- ☐ Apron, Specify:
- ☐ Tyvek Coverall
- ☐ Saranex Coverall
- ☒ Personnel floatation device over water
- ☒ Other: Dedicated field clothing; rain gear, as needed to avoid splash. Long shirts and pants will be worn.

Head & Eye ☐ N/A

- ☐ Hard Hat
- ☐ Goggles
- ☐ Face Shield
- ☒ Safety Eyeglasses
- ☐ Other: Hearing protection

Hand Protection ☐ N/A

- ☐ Undergloves; Type:
- ☒ Gloves; Type: Nitrile
- ☐ Overgloves; Type:
- ☐ None
- ☐ Other:

Foot Protection ☐ N/A

- ☒ Waiters/Neoprene Boots
- ☐ Disposable Overboots
- ☐ Other: Steel-toed work boots

3. Monitoring Equipment ☒ N/A

☐ CGI	☐ PID
☐ O^2 Meter	☐ FID
☐ Rad Survey	☐ Other

Type:

D. PERSONNEL DECONTAMINATION

☒ Required ☐ Not Required

Avoid hand to mouth contact. Wash hands and face and change out gloves frequent.

EQUIPMENT DECONTAMINATION (ATTACH DIAGRAM)

☒ Required ☐ Not Required

If required, describe and list equipment:

Decontamination of non-dedicated sampling equipment with Alconox/tap water solution followed by tap water rinse and deionized water rinse

E. PERSONNEL

	Name	Work Location Title/Task	Medical Current	Fit Test Current
1.	Sarah Fees	Site Hydrogeologist	☒	☒
2.	Nick Dosch	Site Engineer	☒	☒
3.	Jennifer Wynkoop	Project Manager	☒	☒
4.	Jamie Sloan	Site Scientist	☒	☒
5.	Sierra Mott	Site Scientist	☒	☒
6.			☐	☐
7.			☐	☐
8.			☐	☐
9.			☐	☐
10.			☐	☐

Site Safety Coordinator: **Sierra Mott**

F. ACTIVITIES COVERED UNDER THIS PLAN

Task No.	Description	Preliminary Schedule
1	Water level monitoring and Stream Flow Monitoring	April 2014 through April 2015
2	Surface water sampling	March and September

G. SUBCONTRACTOR'S HEALTH AND SAFETY PROGRAM EVALUATION

☒ N/A

Name and Address of Subcontractor:

EVALUATION CRITERIA

Item	Adequate	Inadequate	Comments
Medical Surveillance Program	☐	☐	
Personal Protective Equipment Availability	☐	☐	
Onsite Monitoring Equipment Availability	☐	☐	
Safe Working Procedures Specification	☐	☐	
Training Protocols	☐	☐	
Ancillary Support Procedures (if any)	☐	☐	
Emergency Procedures	☐	☐	
Evacuation Procedures Contingency Plan	☐	☐	
Decontamination Procedures Equipment	☐	☐	
Decontamination Procedures Personnel	☐	☐	

GENERAL HEALTH AND SAFETY PROGRAM EVALUATION: ☐ Adequate ☐ Inadequate

Additional Comments:

Evaluation Conducted By: _____ Date: _____

EMERGENCY FACILITIES AND NUMBERS

Hospital:
Auburn Regional Medical Center
202 N Division Street
Auburn WA 98001

Directions: Attachment A

Telephone: 253-833-7711

Emergency Transportation Systems (Fire, Police, Ambulance) – 911

Emergency Routes – Map (Attachment A)

Emergency Contacts:

	Offsite
Landau Associates	
Christine Kimmel	(206) 786-3801
Jennifer Wynkoop	(206) 617-3117
Boeing	
Jim Bet	(206) 679-0433
Fred Wallace	(206) 930-0461
Jennifer Parsons	(206) 715-7981

In the event of an emergency, do the following:

1. Call for help as soon as possible. Call Boeing dispatch and 911. Give the following information:
   - WHERE the emergency is – use cross streets or landmarks
   - PHONE NUMBER you are calling from
   - WHAT HAPPENED – type of injury
   - WHAT is being done for the victim(s)
   - YOU HANG UP LAST – let the person you called hang up first.

2. If the victim can be moved, paramedics will transport to the hospital. If the injury or exposure is not life threatening, decontaminate the individual first. If decontamination is not feasible, wrap the individual in a blanket or sheet of plastic prior to transport.

HEALTH AND SAFETY PLAN
APPROVAL/SIGN OFF FORMAT

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Site Safety Coordinator	Signature	Date
Christine Kimmel Landau Health and Safety Manager	Signature	3/27/15 Date
Project Manager	Signature	Date

Personnel Health and Safety Briefing Conducted By:

Name	Signature	Date

Attachment A
Off Site Work - Route to Hospital

Start	Head NORTH on CELERY AVE toward BOUNDARY BLVD, From **Start Point (Celery Ave and 11th Ave N, Algona, WA)**
1	Go **0.1** miles and then TURN LEFT onto O ST
2	Go **0.1** miles and then TURN RIGHT onto 15th ST SW
3	Go **0.8** miles and then TURN LEFT onto C ST SW
4	Go **1.0** mile and then TURN RIGHT onto 3rd ST NW
5	Go **0.2** miles and then TURN RIGHT onto N DIVISION ST
End	Go **115** ft to **End Point on RIGHT (202 N Division St, Auburn, WA)**