Stantec Consulting Services Inc.
2321 Club Meridian Dr., Suite E
Okemos, MI 48864
Tel: (517) 349-9499
Fax: (517) 349-6863

March 8, 2017

Attention: Ms. Mary Monahan
Department of Ecology
Central Regional Office
1250 West Alder Street
Union Gap, WA 98903-0009

Reference: Submittal of the Revised Groundwater Remedy Engineering Design Report for the Bee-Jay Scales Site

Dear Ms. Monahan,

Enclosed for your files is the final version of the *Groundwater Remedy Engineering Design Report* for the Bee-Jay Scales Site, located at 116 N 1st Street in Sunnyside, Washington. If you have any questions, please do not hesitate to contact me.

Regards,

Stantec Consulting Services Inc.

Marisa Kaffenberger

Marisa Kaffenberger, P.E.
Senior Engineer
Phone: 517-202-0459
marisa.kaffenberger@stantec.com

cc:

Ms. Caryl Weekley, Chevron Environmental Management Company, 6101 Bollinger Canyon Road, San Ramon, CA 94583

Mr. Kyle Christie, Atlantic Richfield Company, 4 Centerpointe Drive, LPR 4-221, La Palma, CA 90623-1006 – Electronic Copy

Mr. Eric Bassett, Stantec Consulting Services Inc., 2335 Highway 36 West, St. Paul, MN 55113 – Electronic Copy

Groundwater Remedy Engineering Design Report

Bee-Jay Scales
116 N 1st Street
Sunnyside, Washington 98944

Submitted to:
Ms. Mary Monahan
Department of Ecology
Central Regional Office
1250 West Alder Street
Union Gap, WA 98903-0009

Prepared for:
Chevron Environmental Management Company
6101 Bollinger Canyon Road
San Ramon, California 94583

Atlantic Richfield Company
4 Centerpointe Drive, LPR 4-221
La Palma, California 90623-1006

Prepared by:
Stantec Consulting Services Inc.
2321 Club Meridian Drive, Suite E
Okemos, Michigan 48864

December 16, 2015
Revised November 15, 2016

Sign-off Sheet

This document entitled Groundwater Remedy Engineering Design Report was prepared by Stantec Consulting Services Inc. for the account of Chevron Environmental Management Company and Atlantic Richfield Company. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by _____
(signature)

Eric Bassett
Project Engineer

Reviewed by _____
(signature)

Angus McGrath
Principal Geochemist

Reviewed by _____
(signature)

Jeremy Rasmussen
Senior Engineer

Reviewed by _____
(signature)

Marisa Kaffenberger, P.E.
Senior Engineer

Stantec

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1.0 Introduction

Stantec Consulting Services Inc. (Stantec) is submitting this Groundwater Remedy Engineering Design Report (EDR) to the Washington Department of Ecology (Ecology) for the Bee-Jay Scales Site (the Site), on behalf of Chevron Environmental Management Company (CEMC) and Atlantic Richfield Company (ARC). This EDR has been prepared under the provisions of the Washington State Model Toxics Control Act (MTCA) Washington Administrative Code (WAC) 173-340 to address Consent Decree No. 132017660 (Consent Decree) between Ecology, CEMC, and ARC.

The Groundwater EDR was originally submitted to Ecology on December 16, 2015, and has been revised per Ecology's comments in letters dated May 26, 2016 and June 30, 2016, which are included in Appendix A. The EDR has also been revised to incorporate comments during conference calls between Ecology, Stantec, CEMC, and ARC on September 30 and November 10, 2016.

Elements of this EDR address requirements of WAC 173-340-400 (WAC, 2007), including but not limited to:

- A description of the Site background and current conditions;
- A description and conceptual plan of the cleanup action;
- Definition of the goals of the cleanup action;
- Design criteria of the cleanup action; and
- Schedule for implementation of the cleanup action plan.

The cleanup action plan (CAP), dated March 8, 2013 and prepared for the Site by Ecology, contains both soil and groundwater cleanup objectives. The selected cleanup action includes a combination of the removal of contaminated soil overlying groundwater, in-situ bioremediation of the Site groundwater plume via injection wells and/or vertical barrier wall treatment system(s), natural attenuation of the groundwater and soil contamination to meet the cleanup levels (CULs) at the defined points of compliance (POCs), and institutional controls (ICs) to protect against the use of groundwater by the public.

In addition, the implemented cleanup action must meet the following requirements: protect human health and the environment; comply with remedial action levels; comply with applicable state and federal laws; provide for compliance monitoring; and provide a permanent solution to the maximum extent practicable.

This EDR documents the engineering concepts and design criteria used in the design of the groundwater remedy (in-situ bioremediation, natural attenuation, and ICs) portion of the CAP, which addresses the groundwater cleanup objectives for the Site.

The remaining sections of this report are organized as follows:

- Section 2 includes a summary of the Site background, historical operations, area geology and hydrogeology, previous investigations, and the CAP;
- Section 3 describes the objectives of the CAP and the groundwater cleanup actions;
- Section 4 describes the groundwater remedy design;
- Section 5 gives a general description of the compliance monitoring that will be performed as part of the groundwater remedy;
- Section 6 presents the schedule and reporting requirements; and
- Section 7 lists references.

Field activities and final design details for the groundwater remedy will be presented in the *Groundwater Remedy Construction Plans and Specifications* (GW CPS).

The other portion of the CAP, which included the removal of contaminated soil overlying groundwater, was completed in 2014 to conform to the engineering design criteria and objectives detailed in the *Shallow Soil Excavation Engineering Design Report* and *Shallow Soil Excavation Construction Plans and Specifications*. The *Shallow Soil Excavation As-Built Completion Report* documenting the removal of soil was submitted to Ecology on April 23, 2015 (Stantec, 2015a).

2.0 Site Description & Background

2.1 SITE DESCRIPTION

The Site is located in the City of Sunnyside (City), within Yakima County, and includes the two parcels where contaminants were historically released and the parcels where those contaminants have come to be located. The Site location is shown on **Figure 1**.

The two parcels where contaminants were historically released include Parcel No. 22102522014, located at 116 North 1st Street and owned by Bee-Jay Scales, Inc. (BJS), and Parcel No. 22102522015, located at 301 Warehouse Avenue and owned by Western General Land, LLC (WGL). The BJS parcel is approximately 3.0 acres in size. Three businesses currently operate at the parcel: Sandy Farms, a local trucking company; Sanleco, Inc., an interstate trucking company with a tractor-trailer repair garage; and Bee-Jay Scales, a commercial scale operation. The WGL parcel is approximately 0.9 acres in size and is currently used to park semi-trucks and trailers as well as store other equipment used by the food processing facility to the east.

The BJS and WGL parcels and the surrounding area have been the location of agricultural warehouses, lumber yards, coal storage, and railroad transportation activities since approximately 1906. Portions of these two parcels were owned by the Northern Pacific Railroad Company from 1906 until 1989 when they were purchased by the Glacier Park Company. An agricultural distribution facility operated at the BJS parcel from the 1960s through at least 1986. This facility consisted of buildings and aboveground storage tanks (ASTs), and was operated by at least two separate companies: Laneger Agricultural Services and Valley Agricultural, Inc. The ASTs have since been removed from the parcel. Documentation also indicates that American Oil Company (Amoco), now part of BP, leased portions of the parcels from Northern Pacific Railroad Company between 1965 and 1972. A lagoon was constructed by Valley Agricultural, Inc. in the early 1980s to collect water from the washdown of farm chemical applicator vehicles.

The western portion of Lot 10 was purchased by Chevron Chemical Company in 1981 and sold to BJS in 1987. BJS purchased additional portions of Lots 10 and 11 in 1995 and 1996. Lots 10 and 11 are referenced in the Summary of Ownership included as Appendix B of the Remedial Investigation/Feasibility Study Work Plan (CH2M Hill, 2003) and are not shown on any available figures.

Hickenbottom & Sons, Inc. leased the WGL parcel from the Northern Pacific Railroad Company beginning in 1961 and purchased portions of Lots 10 and 11 in 1992. The WGL parcel was previously used as pastureland; since 1961, it has been used for food packing, storage, and a transportation business. The parcel was purchased by WGL in 2010.

The BJS and WGL parcels were historically divided into six main study areas throughout the environmental investigation and assessment process. Those six study areas are shown on **Figure 2**.

Historical releases from the BJS and WGL parcels have impacted the groundwater at those parcels and have extended down-gradient to affect several additional parcels. As of August 2015, the following parcels are affected by the contaminant groundwater plumes defined by this EDR:

- Parcel 22102522016 is located adjacent to the WGL parcel to the east, and is owned by Northwest American Land LLC. The parcel is approximately 1.8 acres in size and contains a fruit processing facility.

- Parcels 22102522902 and 22102522903 are located south of the BJS and WGL parcels. Both parcels are owned by Burlington Northern Santa Fe Railway Company (BNSF) and are adjacent to or surrounded by the railroad right-of-way (ROW).

- Parcel 22102522555 is located south of the railroad ROW and is owned by Valley Processing Inc. The parcel is approximately 3.6 acres in size and contains a fruit processing facility.

- Parcel 22102522502 is a long narrow parcel approximately 0.3 acres in size located south of Parcel 22102522555 and north of Blaine Avenue. The parcel is owned by Union Pacific Railroad, but appears to be used by the Valley Processing Inc. facility to the north, possibly under a lease.

- Parcels 22102523416, 22102523418, 22102523419, 22102523420, 22102523421, 22102523437, 22102523438, 22102523439, 22102523440, and 22102523441 comprise the northeast portion of the triangular area bordered by Blaine Avenue to the north, S. 3rd Street to the east, a railroad spur to the south and S. 1st Street to the west. The parcels combined have an area of approximately 1.3 acres and are owned by Mary Ann Bliesner. These parcels are used as transportation parking associated with the local fruit processing facilities.

- Parcel 22102523901 coincides with the location of a large structure located south of Blaine Avenue. The parcel is owned by Valley Processing Inc. and occupies an area of 0.21 acres. The building appears to contain a fruit processing facility.

- Parcel 22102523417 is a square parcel 0.13 acres in size located at the southwest corner of Blaine Avenue and S. 3rd Street. The parcel is owned by George and Evelyn Johnson and is used as transportation parking.

The Site layout, including parcel numbers, monitoring well locations, the extent of contaminants (as of August 2015), and other important features, is shown on **Figure 2**.

2.2 REGIONAL AND LOCAL GEOLOGY AND SOILS

The Site is located in the Columbia Basin, an intermontane basin located between the Cascade and Rocky Mountains, and within the Yakima Fold Belt, a structural subprovince characterized

by dominantly east-west trending anticlinal ridges and synclinal valleys (Reidel et al, 1994). Snipes Mountain, located just west of Sunnyside, is an anticlinal ridge measuring approximately 8 miles in length and 1 mile in width. Cenozoic age volcanic rocks from the Columbia River Basalt Group (CRBG) and sediments fill the basin. Underlying the CRBG are Tertiary and Quaternary fluvial and glaciofluvial deposits on top of Tertiary age continental sedimentary rocks.

Three geologic units have been identified in the vicinity of the Site based on subsurface information derived from well-drilling logs. They are, from youngest to oldest, Quaternary Alluvium, the Ellensberg Formation, and Columbia River Basalts. The Quaternary Alluvium consists of sandy silt and extends to a depth of 30 feet below ground surface (bgs) (SECOR, 2003). The Ellensberg Formation, interbedded silt, sand, gravel, and clay, underlies the alluvium and extends to a depth of approximately 450 feet bgs, based on logs for nearby City water wells. The Ellensberg Formation is underlain by CRBG rocks to an unknown depth.

According to past assessment activities, soil at the Site consists mostly of sand and silt in various proportions to 30 feet bgs. At 30 feet bgs, soils consisting of clayey silt were found to a depth of 31.5 feet bgs and may indicate a confining layer of soil.

2.3 REGIONAL AND LOCAL HYDROGEOLOGY

The Site is located in the lower Yakima River basin, which covers about 4,350 square miles in Yakima and Benton counties in south-central Washington. The lower Yakima River basin is bounded by the Cascade Mountains on the west, Cleman Mountain to the north, the Rattlesnake Hills on the east, and the Heaven Hills to the south. Surface waters join the Yakima River which flows to the southeast to join the Columbia River, which eventually flows westward to the Pacific Ocean. Groundwater in the area occurs principally in: 1) the unconsolidated alluvial sand and gravel of Quaternary age; 2) partially consolidated sand, silt, and gravel, and consolidated sandstone, siltstone, and conglomerate of the Ellensburg Formation, and; 3) basalt lava flows and associated sedimentary interbeds of the CRBG of Miocene age (Molenaar, 1985).

The alluvium of the Quaternary age is composed of unconsolidated sedimentary material deposited by streams along their flood plains with thicknesses of a few feet to more than 150 feet. The alluvium is generally permeable and contains groundwater under unconfined conditions. Shallow drilled or dug wells readily obtain water from coarser material in the alluvium at rates up to 10 to 20 gallons per minute (gpm).

The Ellensburg Formation comprises partly consolidated sand and gravel and consolidated sedimentary rocks, with some conglomerate and claystone. The formation occurs at depths of 100 feet or more at the centers of major valleys and gradually rises to the ground surface at valley margins. The thickness of the formation can range from a few feet to 1,000 feet. The sand and gravel strata form the principal water-yielding materials. Where these materials are less than 50 feet bgs the aquifer is unconfined. In deeper zones underlying finer-grained and more

consolidated sand, the water occurs under confined conditions. Yields of properly constructed wells in the more productive zones of this formation are as much as 1,500 gpm.

The basalt flows and associated sedimentary interbeds of the CRBG form the most productive aquifer system in the basin. Groundwater occurs principally in fracture and rubble zones, in vesicular and scoriaceous interflow zones, and in sand and gravel layers that occur between some flow units. Water yielding zones range from a few feet to 50 feet in thickness and may extend laterally only short distances or several miles. Yields of basalt wells range from 50 to more than 2,200 gpm.

Groundwater at the Site monitoring wells has been measured since 2005 to be approximately 5 to 14 feet bgs, depending on the location. The groundwater flow direction is generally to the northeast in the northern extent of the Site and to the southeast through most of the Site, with a groundwater flow divide observed at the northern extent of the current Site groundwater plume. The groundwater gradient observed at the Site typically ranges from approximately 0.003 to 0.024 feet per foot (ft/ft), with an average hydraulic gradient of approximately 0.012 ft/ft.

2.4 PREVIOUS INVESTIGATIONS AND REMEDIAL MEASURES

Investigations conducted by previous consultants before July 2003 are summarized in the RI/FS Work Plan. Key investigations, evaluations, and interim remedial measures related to groundwater that were conducted by Stantec (formerly SECOR) at the Site since 2003 are documented in the following reports:

- *Bee-Jay Scales Site Phase I Remedial Investigation Report* (SECOR, 2003);
- *Phase II Remedial Investigation Report for the Bee-Jay Scales Site* (SECOR, 2005);
- *Phase III Remedial Investigation Report for the Bee-Jay Scales Site* (SECOR, 2007a);
- *2006 Interim Remedial Measures Completion Report for the Bee-Jay Scales Site* (SECOR, 2007b);
- *Down-Gradient Assessment Documentation Report for the Bee-Jay Scales Site* (SECOR, 2008);
- *Human Health Risk Assessment* (Stantec, 2008);
- *Revised Feasibility Study Report* (Stantec, 2009);
- *Storm Drain Assessment Results for the Bee-Jay Scales Site* (Stantec, 2012);
- *Off-Property Assessment and Well Installation* (Stantec, 2013); and
- *Groundwater Monitoring and Sampling Reports* (Stantec 2003-2015).

Investigations, evaluations, and interim remedial measures related to soil are not specifically discussed in this report. The following subsections summarize the key findings of each investigation or the remedial actions implemented.

2.4.1 Phase I Remedial Investigation

The Phase I remedial investigation (RI) activities were conducted in July 2003. SECOR installed three groundwater monitoring wells (MW-5, MW-6, and MW-7) to supplement groundwater quality information provided by three previously installed wells (MW-1, MW-3, and MW-4). The potential IHSs detected in groundwater included: 1,2-dichloropropane, 2,4-dichlorophenol, ammonia, arsenic, chloride, chlorobenzene, copper, iron, manganese, nickel, o-xylene, p,m-xylene, phosphate, sulfate, total nitrates and nitrites, and zinc. The Phase I groundwater investigation indicated nitrogen compounds, iron, and sulfate exceedances of CULs or secondary Maximum Contaminant Levels (MCLs) in groundwater samples collected down-gradient of potential source areas and at the southern boundary of the BJS and WGL parcels.

2.4.2 Phase II Remedial Investigation

The Phase II RI was conducted in 2004. The Phase II groundwater investigation consisted of the advancement of 18 vertical profile boreholes, and installation of five permanent monitoring wells (MW-8 through MW-12). The average hydraulic conductivity from single well pump tests was 1.45E-04 centimeters per second (cm/s).

During the Phase II, nitrate was detected in the newly installed monitoring wells at concentrations above CULs. The concentrations observed in MW-8 and MW-12 were contained within the main nitrate source areas defined in the Phase I RI. High concentrations of nitrate were also detected in well MW-9. The nitrate concentrations detected at MW-10 and MW-11 likely represent background concentrations. Concentration isopleths of nitrate developed from the vertical profile sampling showed that source areas are primarily located in the southeastern portion of the BJS and WGL parcels (Area 1 and the southern section of Area 6).

Ammonia was also detected at MW-8 and MW-12, within the source areas identified during the Phase I RI. Ammonia was not detected in MW-9, which suggests the ammonia is being naturally attenuated and is not migrating off the BJS and WGL parcels. Additional constituents above CULs included 2,4-D (at MW-12 only) and benzene (at MW-10 only). Exceedances of CULs were also observed in the vertical profile borings for 2,4-D, ammonia, arsenic, dinoseb, nitrate, and nitrite. Arsenic concentrations in the five newly installed monitoring wells exceeded CULs; however, the range of arsenic concentrations observed was fairly consistent across the Site and appeared to be within normal background concentrations for arsenic.

A treatability investigation, including both a bench-scale study and field pilot study (consisting of in-situ injection of sodium acetate into four injection wells around well MW-4), was conducted as part of the Phase II RI to guide potential nitrate and herbicide remediation activities. The treatability study determined the most effective treatment among those tested was denitrification using acetate as an electron donor. The pilot study demonstrated that injection of

acetate was successful in remediating nitrate, nitrite, and dinoseb concentrations to below detectable limits in groundwater at well MW-4 within a 10-foot radius for the duration of the monitoring period and reducing concentrations of those constituents in saturated soils.

2.4.3 Interim Remedial Measures

In 2006, SECOR conducted interim remedial measures including: 1) lagoon closure activities; and 2) treatment of petroleum hydrocarbon impacts using persulfate injections. The former lagoon was removed as a potential source and safety hazard, and calcium acetate was placed into the excavation to mitigate residual impacts remaining in the soil. In-situ injection of sodium persulfate into four injection wells was conducted in Area 3 of the BJS parcel for the treatment of petroleum hydrocarbons, and favorable geochemical conditions were observed in the injection wells during and immediately after injection. Groundwater samples collected from a nearby well three months after injection showed an average reduction in petroleum hydrocarbon concentrations of over 78%.

2.4.4 Phase III Remedial Investigation

The Phase III RI was conducted in 2007 and included additional groundwater investigation to evaluate horizontal and vertical extent of nitrate impacts down-gradient of the BJS and WGL parcels. Twelve vertical profile boreholes and one permanent groundwater monitoring well (MW-13) were installed. The Phase III RI determined the nitrate plume extends down-gradient of the two parcels where contaminants were released and is delineated to the east and west; however, the plume was not fully delineated to the south because a probable second source of nitrate and ammonia was encountered.

2.4.5 Down-Gradient Assessment

The down-gradient assessment was conducted in 2008 to further evaluate: 1) the down-gradient extent of nitrate concentrations; and 2) a potential separate down-gradient source. One vertical profile boring was advanced and sampled in Parcel 22102523442, southwest of the current Site groundwater plume. The assessment results provided further evidence of a potential additional source based on the detached ammonia plumes and relatively higher concentrations of several constituents down-gradient rather than up-gradient of the potential second off-site source. However, a commingled nitrate plume was observed.

2.4.6 Human Health Risk Assessment

A Human Health Risk Assessment (HHRA) was completed to quantify risks associated with indicator hazardous substances (IHSs) in the soil and groundwater both on the BJS and WGL parcels and within the down-gradient groundwater plume (Stantec, 2008). The HHRA indicated that the groundwater ingestion exposure pathway for nitrate is potentially complete for down-gradient receptors due to the lack of regulatory restrictions on installing water wells. Based on current land use (including locations of existing buildings), there is limited risk to current BJS and WGL parcel exposure populations. However, for hypothetical future commercial or residential

land use on the BJS and WGL parcels, ingestion of groundwater containing nitrate and indoor inhalation of vapors containing 1,2,4-trimethylbenzene (from soil) and 1,2-dichloropropane (from groundwater) could result in an unacceptable risk.

2.4.7 Revised Feasibility Study Report

Stantec evaluated remedial alternatives to address soil and groundwater concentrations of IHSs above specified CULs at the Site. The remedial alternatives were evaluated with respect to threshold criteria that must be met for all cleanup actions conducted under Ecology's authority. Based on the evaluation of Site remedial alternatives, the following combination of remedial actions was recommended:

- In-situ bioremediation, groundwater monitoring, soil excavation with off-site disposal and/or ex-situ biological treatment, and ICs for the BJS and WGL parcels; and
- Monitored natural attenuation (MNA), ICs, and a contingency plan for down-gradient parcels.

Following review, Ecology requested modifications to the remedial alternatives for down-gradient parcels, and revised alternatives were presented in the CAP.

2.4.8 Storm Drain Assessment

A storm drain assessment was conducted in 2012 to determine if the groundwater impacts at the Site are affecting the storm drain network in the vicinity. Water from the storm drains in the vicinity of the Site was sampled at 20 manhole locations. Nitrate concentrations in manholes down-gradient of the Site were found to be similar to the nitrate concentrations in manholes up-gradient of the Site. Nitrate and ammonia concentrations in the manholes were generally at least one to two orders of magnitude less than the concentrations observed in the Site wells (MW-4, MW-9, MW-12, and MW-13). In addition, there were no exceedances of CULs or water quality standards for surface waters (WQSs) in manhole M-21, which is the furthest down-gradient manhole.

2.4.9 Off-Property Assessment and Well Installation

In August, 2013, Stantec conducted an investigation which included the advancement of seven soil boreholes and subsequent installation of seven down-gradient groundwater monitoring wells (MW-14 through MW-20) to the south and east of the BJS and WGL parcels. Three soil samples were collected from each of the boreholes (one from the vadose zone, one from the groundwater table, and one sample from the saturated zone [from the maximum depth of exploration]) and submitted for laboratory analysis of nitrate and ammonia.

The maximum detected nitrate concentration was 199 milligrams per kilogram (mg/kg) observed in borehole MW-16 at 16 feet bgs. Ammonia was only detected in one soil sample, at an estimated concentration of 140 J mg/kg in borehole MW-19 at 10 feet bgs. There were no

exceedances of the Site-specific soil CUL for nitrate (220 mg/kg) or ammonia (385 mg/kg); however, it should be noted that the reporting limits were above the Site-specific CUL for ammonia in seven of the soil samples.

2.4.10 Groundwater Monitoring and Sampling

Groundwater monitoring and sampling has been conducted at the Site since July 2003. Wells MW-4, MW-5, and MW-12 were destroyed in preparation for shallow soil excavation, and replacement wells were installed in February 2015. The following monitoring wells are currently sampled on a semi-annual basis: MW-1, MW-3, MW-4R, MW-5R, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12R, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, MW-19, and MW-20. Following the installation of down-gradient groundwater monitoring wells MW-14 through MW-20 in Third Quarter 2013, the groundwater monitoring wells at the Site were sampled quarterly through Second Quarter 2014. This was done to obtain additional data and verify the groundwater flow direction and concentration trends for use in designing the remedial actions detailed in this report. Groundwater monitoring returned to a semi-annual frequency in Third Quarter 2014. The most recent groundwater monitoring and sampling was conducted August 11 through 13, 2015 and documented in the *Second Half 2015 Semi-Annual Groundwater Monitoring Report*, dated November 4, 2015 (Stantec, 2015b).

Cumulative groundwater elevation data from the Third Quarter 2005 (3Q05) event through the Second Half 2015 (2H15) event are summarized in **Table 1**. Groundwater elevation contours generated for the 2H15 groundwater monitoring event are shown on **Figure 3**.

Table 2 summarizes detected concentrations in each groundwater sample during the 2H15 event. Concentrations of detected constituents exceeding CULs are shown at each well location on **Figure 4**. Also shown on this figure are the constituent concentrations measured at each well location during the three previous groundwater sampling events, if applicable. Concentrations of nitrate are shown at all wells on **Figure 4**, though nitrate concentrations at some wells are below the CUL or not detected. A nitrate isoconcentration map for the 2H15 event is included as **Figure 5**.

3.0 Cleanup Action Objectives

This section summarizes the cleanup action objectives and CULs applicable to this EDR as addressed in the CAP. These objectives and Site-specific cleanup criteria were developed to address the MTCA and other applicable state and federal regulatory requirements.

3.1 GROUNDWATER REMEDIATION OBJECTIVES

The objectives for the planned groundwater cleanup action described in this EDR are to:

- Mitigate potential for ingestion of groundwater with nitrate in excess of the Federal MCL of 10 mg/L by Site receptors by reducing nitrate concentrations in groundwater to less than 10 mg/L; and
- Design a groundwater remediation system, to the extent practicable, to reduce the potential for impacted Site groundwater to infiltrate storm/irrigation drains that may discharge to surface water. If it is determined that any contaminated Site groundwater is infiltrating storm or irrigation drains and adversely affecting surface water quality, the groundwater cleanup action shall prevent or remove the contamination so that surface water cleanup standards are met.

3.2 GROUNDWATER CLEANUP STANDARDS

Cleanup standards include CULs and POCs, as explained in WAC 173-340-700 through WAC 173-340-760, and are described in the following sections.

CULs for the Site consist of applicable MTCA and other protective regulatory criteria. The CULs indicate the lowest applicable MTCA or applicable or relevant and appropriate requirements (ARARs) established for the complete exposure pathways at the Site. The proposed POCs were identified in accordance with standard MTCA protocols.

It is intended that remedial actions implemented as part of this phase of the CAP apply to both groundwater and soils in the saturated zone.

Site-specific CULs for groundwater constituents have been developed from a combination of primary MCLs, standard MTCA Method A CULs, and standard and modified MTCA Method B CULs. When primary MCLs have been developed for Site groundwater constituents, they are set as the CUL. If no MCL has been established, modified MTCA Method B CULs are generally used. In cases where modified MTCA Method B CULs have not been developed, standard MTCA Method A or Method B CULs are used.

Though nitrate in groundwater above the MCL of 10 mg/L is the main driver, CULs have been established for 24 constituents for groundwater at the Site. The constituents, CULs, and basis for the CUL are shown in **Table 3**. Per WAC 173-340-703, when defining cleanup requirements at a

site that is contaminated with a large number of hazardous substances, some of those substances may be eliminated from consideration where those substances contribute a small percentage of the overall threat to human health and the environment. The remaining hazardous substances shall serve as IHSs for purposes of defining cleanup requirements.

Twelve groundwater IHSs have been identified from the 24 groundwater constituents based on the remedial investigation and feasibility study process completed for the Site. The 12 Site groundwater IHSs were identified in the CAP and are shown in **bold** in **Table 3**. Only the IHSs are planned to be used to monitor compliance with the Site cleanup requirements.

The POC for Site groundwater constituents is defined in the CAP as monitoring wells MW-4R, MW-5R, MW-6, and MW-12R, and all monitoring wells, including those to be constructed as part of the remedial action, that are located down-gradient of those wells. The POC includes all groundwater from the POC to the outer boundary of the Site plume. This plume is considered to apply to groundwater that has migrated from the historical releases at the BJS and WGL parcels, and any off-site sources would need to be considered separately. If monitoring of groundwater in the boundary wells shows that nitrate concentrations exceed the Site-specific CUL, additional groundwater monitoring wells may be constructed to define the Site plume and sampling may be conducted pursuant to a contingency plan as required by the CAP.

3.3 APPLICABLE REGULATORY REQUIREMENTS FOR GROUNDWATER REMEDIATION ACTIVITIES

A wide range of federal, state, and local compliance requirements are applicable to the groundwater remediation activities that are planned for the Site. These compliance requirements are included on the list of ARARs shown in **Table 4**. Several of the identified ARARs pertain to the Site cleanup standards regulated under the MTCA and are described in greater detail throughout this report.

3.4 SITE ENVIRONMENTAL CONDITION AND EXTENT OF CONTAMINANTS

3.4.1 Nitrate, Nitrite, and Ammonia in Groundwater

Liquid and dry fertilizers were managed at the BJS parcel during its operation as an agricultural distribution facility from the 1960s through at least 1986. The fertilizers were primarily composed of ammonium salts, nitrate salts, and liquid ammonia. No specific leak or spill information is available for the facility, but it is believed that nitrogen-containing compounds were introduced to the soils during these historical operations. Once nitrogen was introduced into the soil and groundwater, there are several chemical and physical processes that can affect its status. The most influential processes at the Site are believed to be adsorption, nitrification, and denitrification. These processes are described in further detail below.

Ammonia (present as the ammonium ion, NH_4^+) is readily dissolved in groundwater but is largely immobile because of its properties as an adsorbent to soil minerals and/or organic matter. Nitrification is the biochemical oxidation of ammonia to nitrate. In the presence of specific

bacteria and oxygen, ammonia is enzymatically oxidized in a stepwise process to nitrite and then nitrate, as shown in the equations below:

$$2NH_4^+ + 3O_2 \rightarrow 2NO_2^- + 2H_2O + 4H^+ + \text{energy}$$

$$2NO_2^- + O_2 \rightarrow 2NO_3^- + \text{energy}$$

Nitrification will only occur in oxidizing environments. Nitrate and nitrite are both readily soluble in groundwater, but unlike ammonia, both will migrate with groundwater as they are not typically adsorbed by soil minerals and/or organic matter.

Denitrification is the biochemical reduction of nitrate to nitrogen gas, as shown in the following equation:

$$5C + 4NO_3^- + 2H_2O \rightarrow 2N_2 + 4HCO_3^- + CO_2$$

Where C signifies a carbon atom from a carbon source

Denitrification will only occur in anaerobic or reducing environments where dissolved oxygen (DO) levels are at or below 2 mg/L. Secondary parameters affecting both nitrification and denitrification include the bacterial population, temperature, moisture content, nutrient availability, and pH.

Nitrate

Nitrate is currently analyzed at all 19 Site groundwater monitoring wells. The most recent groundwater monitoring data indicated nitrate above the Site CUL of 10 mg/L in eight of the 19 Site groundwater monitoring wells (MW-3, MW-4R, MW-5R, MW-8, MW-9, MW-12R, MW-13, and MW-19) with concentrations ranging from 26.4 to 535 mg/L. The nitrate plume consisting of concentrations above the Site CUL covers an area of approximately 4.2 acres. The nitrate plume extends from historic source areas south to down-gradient parcels as indicated on **Figure 5**. The extent of the nitrate plume attributed to the Site is well defined except at the south and southwest extent where MW-13 and MW-19 both have nitrate concentrations exceeding 10 mg/L.

The average depth to groundwater within the nitrate plume is approximately 8 feet bgs, and a clay aquitard exists at approximately 30 feet bgs. Geotechnical soil analyses conducted during the Phase I RI activities in 2003 indicated that Site soil had an estimated soil porosity of 44.4%. Therefore, the estimated volume of groundwater impacted with nitrates above 10 mg/L is approximately 13.3 million gallons.

Nitrite

Nitrite is currently analyzed at all 19 Site groundwater monitoring wells. The most recent groundwater monitoring data indicated nitrite above the Site CUL of 1 mg/L in MW-3 and MW-5R

at concentrations of 1.1 mg/L and 6.9 mg/L, respectively. Nitrite groundwater concentrations above the Site CUL are located within the larger nitrate plume described above and may be a result of the incomplete denitrification of nitrate or the incomplete nitrification of ammonia depending on the oxidation-reduction conditions present.

Ammonia

Although ammonia has not been identified as a groundwater IHS at the Site and does not have a CUL, it has been included here because it can be converted to either nitrate or nitrite via the nitrogen cycle outlined above. Ammonia is currently analyzed in eight of the 19 Site groundwater monitoring wells. In those wells where ammonia is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. For the basis of this discussion, groundwater will be considered to contain elevated ammonia concentrations when above 10 mg/L.

The most recent groundwater monitoring data indicated elevated ammonia concentrations in five Site groundwater monitoring wells (MW-3, MW-4R, MW-5R, MW-9, and MW-12R) with concentrations ranging from 73.4 to 544 mg/L. Elevated ammonia concentrations are observed in the north portion of the larger nitrate plume, consistent with the historic source areas and the less mobile nature of ammonia in groundwater.

3.4.2 Other Groundwater Indicator Hazardous Substances

In addition to nitrate and nitrite, there are 10 other IHSs that have been identified for the Site. The condition and extent of each IHS is discussed below.

1,2-Dichloropropane

1,2-Dichloropropane is a colorless flammable liquid that is used to make organic chemicals and is found in some paint strippers, varnishes, and finish removers. Before the early 1980s, it was also used as a soil fumigant and as a stored grain insecticide. Most of the 1,2-dichloropropane released to the environment will end up in the air or groundwater, and it has a slow breakdown rate in either media.

1,2-Dichloropropane is currently being analyzed in five of 19 Site monitoring wells. In those wells where 1,2-dichloropropane is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. The most recent groundwater monitoring data indicated 1,2-dichloropropane above the Site CUL of 0.005 mg/L in five monitoring wells (MW-4R, MW-9, MW-12R, MW-16, and MW-19) at concentrations ranging from 0.19 to 1.1 mg/L. The 1,2-dichloropropane plume consisting of concentrations above the Site CUL is approximately 2.8 acres in area and is primarily located within the larger nitrate plume. The 1,2-dichloropropane plume extends from the south extent of the BJS and WGL parcels, near the former lagoon, south to down-gradient parcels as indicated on **Figure 6**.

2-Methylnaphthalene

2-Methylnaphthalene is a white aromatic solid that is used to make other chemicals such as dyes and resins, as well as to manufacture vitamin K. It is also used in moth repellents with other naphthalene compounds.

2-Methylnaphthalene is currently being analyzed in five of 19 Site monitoring wells. In those wells where 2-methylnaphthalene is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data.

The most recent groundwater monitoring data collected in August 2015 did not indicate 2-methylnaphthalene above the detection limit in any of the Site groundwater monitoring wells. 2-Methylnaphthalene has not been found above the detection limit during any groundwater monitoring conducted at the Site since 2003. Therefore, Stantec will not carry this IHS into the compliance monitoring program.

2,4-Dichlorophenoxyacetic Acid

2,4-Dichlorophenoxyacetic acid (2,4-D) is a colorless, odorless powder used as an herbicide for broadleaf weeds and woody plants. It is not persistent and will typically breakdown quickly under most environmental conditions.

2,4-D is currently being analyzed in five of 19 Site monitoring wells. In those wells where 2,4-D is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past data. The most recent groundwater monitoring data indicated 2,4-D above the Site CUL of 0.07 mg/L in MW-12R at a concentration of 0.16 mg/L. This is the first exceedance since December 2013. Concentrations of 2,4-D above the Site CUL appear to be isolated to the area around MW-12R and are within the larger nitrate plume.

Arsenic

Arsenic is a naturally occurring element widely distributed in the earth's crust. Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

Arsenic is currently being analyzed in 11 of 19 Site monitoring wells. In those wells where arsenic is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. The most recent groundwater monitoring data indicated arsenic above the Site CUL of 0.01 mg/L in nine monitoring wells (MW-3, MW-6, MW-10, MW-11, MW-12R, MW-15, MW-18, MW-19, and MW-20) at concentrations ranging from 0.0134 to 0.0608 mg/L. The arsenic concentrations exceeding the Site CUL do not present as a single plume and are found at several wells that have not historically exceeded any other Site CULs.

The GW EDR, initially submitted on December 16, 2015, included a discussion and statistical analysis of groundwater arsenic concentrations at the Site and proposed an arsenic area background concentration for the Site. The proposed area background groundwater arsenic concentration was based on groundwater data obtained at Site monitoring wells that have not exceeded the CULs for any other groundwater IHSs.

Ecology provided comments to the initial GW EDR in a letter dated May 26, 2016, which included a determination that the proposed area background arsenic concentration used data from impacted wells within the Site contaminant plume. The Ecology rejection of the proposed area background arsenic concentration was further detailed in a letter dated June 30, 2016, and included a technical assessment of arsenic at the Site. Both of these Ecology letters are provided in **Appendix A**.

Stantec responded to Ecology's technical assessment of the Site arsenic background analysis in an email dated August 31, 2016. In a conference call between Stantec, Ecology, CEMC, and ARC on September 30, 2016, Ecology proposed the implementation of a remediation level (RL) of 0.04 mg/L for arsenic in groundwater at the Site per WAC 173-340-355. In establishing a groundwater RL for arsenic at the Site, Ecology, Stantec, CEMC, and ARC recognize the following:

- Arsenic is not the main driver in the required groundwater remedial actions at the Site;
- Arsenic in Site groundwater is believed to result in part from the reducing conditions associated with the Site; and
- Groundwater remediation of nitrogen-containing compounds at the Site will likely result in short term increases in groundwater arsenic concentrations at the Site.

The groundwater arsenic RL will be used to define when particular components of the Site groundwater remedy (e.g., groundwater remediation versus MNA) will be implemented. The groundwater arsenic CUL will remain as a requirement for the completion of the groundwater remedial action at the Site. However, the issue of arsenic area background concentration will continue to be analyzed at the Site and additional requests for the establishment of an area background concentration for arsenic in groundwater may be submitted to Ecology under the process established under WAC 173-340-709.

Benzene

Benzene is a colorless aromatic liquid and is a member of the volatile organic compound (VOC) chemical classification. It is widely used in the United States, ranking in the top 20 chemicals for production volume, and is used to make some types of pesticides.

Benzene is currently being analyzed in five of 19 Site monitoring wells. In those wells where benzene is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. The most recent groundwater

monitoring data indicated benzene above the Site CUL of 0.005 mg/L in MW-12R at a concentration of 0.011 mg/L. Concentrations of benzene above the Site CUL appear to be isolated to the area around MW-12R and are within the larger nitrate plume.

Chlorobenzene

Chlorobenzene is a colorless, flammable liquid and a member of the VOC chemical classification. Chlorobenzene is used as a solvent for some pesticide formulations, as a mechanical part degreaser, and as an intermediate in the production of several other chemicals.

Chlorobenzene is currently being analyzed in five of 19 Site monitoring wells. In those wells where chlorobenzene is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. The most recent groundwater monitoring data indicated chlorobenzene above the Site CUL of 0.1 mg/L in MW-12R at a concentration of 0.21 mg/L. Concentrations of chlorobenzene above the Site CUL appear to be isolated to the area around MW-12R and are within the larger nitrate plume.

Dinoseb

Dinoseb is an organic, aromatic, yellowish, crystalline solid. It was historically used as a contact herbicide for post-emergence weed control, but was banned by the EPA in 1986.

Dinoseb is currently being analyzed in five of 19 Site monitoring wells. In those wells where dinoseb is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. The most recent groundwater monitoring data indicated dinoseb above the Site CUL of 0.007 mg/L in four monitoring wells (MW-4R, MW-9, MW-12R, and MW-16) at concentrations ranging from 0.066 to 2.9 mg/L. The dinoseb plume is approximately 2.1 acres in size and is located entirely within the larger nitrate plume. The dinoseb plume extends from the south extent of the BJS and WGL parcels near the former lagoon south to down-gradient parcels as indicated on **Figure 7**.

Iron and Manganese

Iron and manganese are naturally occurring metal elements widely distributed in soils, rocks, and minerals. When groundwater contacts these solids, they can be dissolved, releasing their constituents to the water. The extent to which iron and manganese dissolve in groundwater depends on the amount of oxygen in the water. When DO levels in groundwater are low, iron and manganese will occur in their reduced forms (Fe^{2+} and Mn^{2+}) which are highly soluble. When DO levels are higher, iron and manganese will occur primarily in their oxidized forms and will not readily dissolve.

Iron is currently being analyzed in three of 19 Site monitoring wells. In those wells where iron is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. The most recent groundwater monitoring data

indicated iron detected in two monitoring wells (MW-12R and MW-19), but the concentrations did not exceed the Site CUL of 11.2 mg/L.

Manganese is currently being analyzed in one of 19 Site monitoring wells. In those wells where manganese is not currently being analyzed, it has been eliminated from the sampling plan with Ecology approval based on past groundwater monitoring data. Manganese was not found above the Site CUL of 2.2 mg/L in the most recent groundwater monitoring data.

Total Petroleum Hydrocarbons as Gasoline

Total petroleum hydrocarbons as gasoline (TPH-Gx) is not currently being analyzed in any of the 19 Site groundwater monitoring wells. TPH-Gx was remediated in Area 3 of the BJS parcel, and has been eliminated from the groundwater sampling plan with Ecology approval based on past groundwater monitoring data. Therefore, Stantec will not carry this IHS into the compliance monitoring program.

4.0 Groundwater Remedy Design

Remediation of the Site groundwater and saturated soil will include a combination of enhanced in-situ bioremediation (EISB) and MNA. In addition, ICs will be implemented to protect human health from potential harm resulting from ingestion of groundwater from the shallow aquifer during the cleanup action. The design of each of these components of the groundwater remedy is detailed in the following sections.

4.1 ENHANCED IN-SITU BIOREMEDIATION

4.1.1 Process Description

The bioremediation process utilizes bacterial populations to breakdown pollutants into less toxic or non-toxic substances. Bacteria responsible for bioremediation require a source of carbon (food source), an electron donor, an electron acceptor, appropriate nutrients, a suitable temperature range, suitable pH, and other environmental conditions. Often the carbon source also serves as the electron donor. The most efficient respiration process utilizes oxygen as the electron acceptor. In the absence of oxygen, bacteria use anaerobic respiration to generate useable energy from carbon sources.

Anaerobic respiration is the generation of energy using an electron acceptor other than oxygen. Anaerobic respiration can be utilized by facultative aerobes (bacteria capable of both aerobic and anaerobic respiration) and obligate anaerobes (bacteria only capable of anaerobic respiration). The most efficient anaerobic respiration process utilizes nitrate as the electron acceptor resulting in its denitrification.

As described in Section 3.4.1, denitrification is the conversion of nitrate and nitrite to nitrogen gas in the absence of oxygen, as shown in the following reaction:

$$5C + 4NO_3^- + 2H_2O \rightarrow 2N_2 + 4HCO_3^- + CO_2$$

Where C signifies a carbon atom from a carbon source

The denitrification process is not a direct conversion to nitrogen gas, but a multistep process, as shown below:

$$NO_3^- \rightarrow NO_2^- \rightarrow NO_{(gas)} \rightarrow N_2O_{(gas)} \rightarrow N_{2(gas)}$$

Each step of the denitrification process is part of the anaerobic respiration process utilized by bacteria to generate energy. When favorable conditions exist for denitrification, including sufficient nitrate, carbon sources, and other nutrients are available at a suitable temperature and pH range, nitrate and nitrite will be reduced to innocuous nitrogen gas.

In addition to the bioremediation of nitrate and nitrite described above, research has indicated that anaerobic conditions may also result in the bioremediation of dinoseb (Hammill and Crawford, 1996; Kaake et al, 1992; and Stevens et al, 1990), benzene (Burland and Edwards, 1999), chlorobenzene (Wenderoth et al, 2003), and 1,2-dichloropropane (Ritalahti and Löffler, 2004).

EISB is a remediation approach that seeks to optimize the existing environmental conditions to breakdown one or more pollutants at a given location. Possible environmental optimization options typically used in EISB include:

- Introduction of desired bacteria (i.e., inoculants);
- Addition of a carbon source;
- Addition of limiting nutrients; and
- Alteration of pH.

The Site groundwater remedy design has examined each of the above options and that design process is described in detail below.

4.1.2 Enhanced In-Situ Bioremediation Design Basis

Indigenous Bacteria Versus Inoculants

Bench-scale treatability testing was performed in 2004 on soil and groundwater collected at the Site to evaluate the potential for stimulating both indigenous microbial populations and inoculants (introduced bacteria) for the desired remediation purposes. Two types of denitrifying inoculants as well as the indigenous Site bacteria were all found to be effective at reducing nitrate and nitrite concentrations below detection limits during the 2004 treatability testing. However, increases in arsenic, iron, and manganese concentrations, as well as pH changes, were minimized during the treatability testing in the sample using only indigenous microbial populations.

Field pilot testing conducted around MW-4 in 2004 utilized EISB to stimulate the indigenous denitrifying bacteria to remediate select IHSs within the Site groundwater and saturated soil. The pilot testing results confirmed that EISB was effective in reducing nitrate, nitrite, and dinoseb to concentrations below the detection limits using only indigenous microbes. The results also indicated a significant increase in indigenous denitrifying bacteria populations resulting from the EISB application.

Based on these results, the groundwater remedy for the Site will utilize indigenous bacteria and inoculants should not be required to achieve the remediation objectives.

Carbon Source Selection

Bench-scale treatability testing was performed in 2004 on soil and groundwater collected at the Site to evaluate the ability of sodium acetate, glucose, and whey powder to act as a carbon source and electron donor in stimulating the reduction of nitrate, nitrite, and dinoseb by the indigenous bacteria. All of the tested carbon sources reduced nitrate, nitrite, and dinoseb in saturated samples to concentrations below detection limits. However, the use of sodium acetate resulted in the best results for several secondary parameters including: the largest decrease in ammonia concentration, the only decrease in manganese concentration, and the smallest increases to arsenic and iron concentrations.

Following the conclusion of the bench-scale testing, field pilot testing was conducted at the Site in 2004 to test the effectiveness of EISB on nitrate, nitrite, and dinoseb using sodium acetate as a carbon source. The pilot testing was implemented using four injection wells installed on 5-foot centers around MW-4, where past groundwater monitoring indicated elevated concentrations of nitrate, nitrite, dinoseb, and ammonia.

The pilot test results confirmed that EISB using sodium acetate as an electron donor was effective in reducing nitrate, nitrite, and dinoseb to concentrations below detection limits. In addition, ammonia concentrations were reduced by almost 30%. Consistent with the bench-scale testing results, increases in the concentration of dissolved arsenic and iron were temporarily observed in the pilot test location. Contrary to the bench-scale testing results, an increase in the concentration of dissolved manganese was temporarily observed in the pilot test location.

Temporary increases in arsenic, iron, and manganese are an anticipated consequence of creating an anaerobic, reducing environment. Such reducing conditions in the groundwater may result in increased solubility of ferric iron hydroxide minerals, manganese oxide minerals, and adsorbed arsenic. However, dissolved iron, manganese, and arsenic concentrations should decrease with the return of aerobic (oxidizing) conditions. The pilot testing and subsequent groundwater monitoring support this concept.

Additional bench-scale treatability testing was performed in 2015 on soil and groundwater collected at the Site to evaluate the ability of sodium acetate, fructose, and sodium lactate to act as a carbon source and electron donor in stimulating the bioremediation of the Site groundwater IHSs. The testing indicated each of the carbon sources evaluated were capable of creating the desired anaerobic and reducing geochemical conditions necessary for enhanced degradation of nitrate, nitrite, ammonia, and dinoseb. However, as was observed during the previous bench-scale testing, optimal reduction of nitrate and other IHSs impacting the groundwater at the Site was achieved using sodium acetate as the carbon source. Nitrate, nitrite, and dinoseb were reduced below analytical detection limits, while greater than 50 percent reduction in ammonia concentrations occurred during the testing timeframe. This treatability testing was used to examine the potential bioremediation of VOCs including benzene, chlorobenzene, and 1,2-dichloropropane; however, results within the amended batches were not significantly different from the control batches for these compounds. The

reducing conditions created as part of the treatment process did result in increases of dissolved-phase arsenic, manganese, and iron concentrations.

Carbon Source Dosing Rate

Bench-scale treatability testing was performed on Site soil and groundwater to determine the optimal carbon source dosing rate of the selected carbon source, sodium acetate. The following criteria will be used to determine the optimal carbon source dosing rate:

- The stimulation of the indigenous denitrifying bacteria populations;
- The bioremediation rates for nitrate and other groundwater IHSs; and
- The increase in soluble metal concentrations in Site groundwater.

A description of the full treatability testing results and the design of the optimal carbon source dosing rate for the Site EISB will be provided in the GW CPS.

Limiting Nutrient Analysis

Phosphorus is a necessary nutrient in the complete denitrification of nitrate. Research has indicated that total phosphorus concentrations greater than 0.16 mg/L are required to reduce nitrate without a large accumulation of nitrite (Hunter, 2003). Baseline testing of Site groundwater during the bench-scale and pilot testing in 2004 indicated a total phosphorus concentration of 0.1 mg/L. As a result, phosphorous was added as disodium phosphate during the 2004 pilot study injection of sodium acetate.

Groundwater samples collected for bench-scale testing in August 2015 indicated total phosphorous concentrations of 0.97 mg/L and 1.2 mg/L at MW-12R and MW-16, respectively. These more recent data indicate that a phosphorous nutrient amendment may not be required during the first injection event. However, a more comprehensive sampling of total phosphorous concentration across the nitrate groundwater plume will be conducted prior to the initiation of any groundwater remedy injection events.

If phosphorous amendments are recommended, it will be added in its useable form, phosphate, so it is not a rate-limiting factor in the denitrification process. Phosphate can react with iron, calcium, and magnesium forming crystalline precipitates, or “scale”, which can block injection wells and constrict flow channels. In addition, the precipitation of metal phosphates makes the phosphate unavailable to the bacteria in the denitrification process. As a result, phosphorus will be injected as tripolyphosphate (sodium triphosphate) to limit scaling by keeping these metal ions in solution during the bioremediation process.

4.1.3 Full-Scale Implementation Design Basis

The full-scale EISB implementation design was selected considering the information obtained throughout the Site assessment activities, remedial goals, regulatory requirements, Site access, and cost. Several factors were considered during the design of the full-scale EISB implementation at the Site including:

- Treatment approach;
- Treatment configuration;
- Well spacing (horizontal); and
- Vertical application.

Treatment Approach

EISB is typically implemented under one of three treatment approaches: active, semi-passive or passive.

Active approaches include continuous circulation of groundwater in the treatment area. Circulation approaches typically increase the hydraulic gradient in the treatment area, thus increasing the distribution and delivery of amendments. Active treatments can effectively treat areas in less time. Circulation systems implemented as part of an active approach require significant capital costs to install injection and extraction wells, conveyance lines, and a system building. Frequent operation and maintenance (O&M) is required to check the system and make adjustments and repairs.

Semi-passive approaches are similar to active approaches in that they implement a circulation system within the treatment area. The primary difference between these treatment approaches is that semi-passive systems are not operated continuously. In semi-passive systems, amendments are circulated through the treatment area in short pulses. While the circulation is stopped, monitoring can be implemented to determine if and when additional amendment circulation is necessary. Semi-passive treatment may result in longer treatment times, but may reduce O&M costs.

Passive treatment approaches do not circulate groundwater, and, instead rely on the natural flow of groundwater to deliver amendments to treatment areas. Passive systems typically have much lower capital infrastructure costs; however, treatment times are typically longer than systems utilizing circulation.

The Site EISB system will likely use a passive treatment approach, unless a temporary circulation system can be designed that can overcome access limitations and would not disrupt normal property activities. The passive treatment approach was selected because of the large size of the treatment area and access issues resulting from its distribution over several properties, many

with active commercial operations. The passive EISB approach, in conjunction with MNA, has the ability to meet the remediation goals set forth in the Consent Decree.

Treatment Configuration

The three most common passive treatment delivery configurations are a grid of injection points, a line of injection points, or a permeable reactive barrier (PRB).

The Site EISB system is planned with several lines of injection wells within the Site groundwater plume. Injection well lines were selected because they can be implemented across the plume creating several treatment zones while also limiting work to properties that are more easily accessible and reducing conflicts with property owners. In addition, injection wells can be easily utilized for additional injection events, as needed, where PRBs are much more difficult to amend after installation.

A total of five injection well lines are planned to be installed within the Site plume, and their approximate locations are shown on **Figure 8**. Three of the five lines are planned for the source areas associated with the BJS and WGL parcels and the remaining two lines are planned at down-gradient locations. One of the three source area injection well lines is planned in an east-west orientation across the plume near the southern boundary of the BJS and WGL parcels, creating a treatment zone for groundwater as it moves down-gradient. The other two source area injection well lines are planned to be oriented north-south from the northern nitrate plume extent to the north extent of the railroad ROW. One line is planned adjacent to the east extent of the former fertilizer building, while the other is planned along the boundary between the BJS and WGL parcels. The intent of these two treatment zones is to address groundwater within the source areas. In addition, the north-south injection well lines can also serve as treatment zones to reduce the potential for impacted groundwater from the Site to infiltrate storm/irrigation drains that may be located down-gradient of the source areas.

The two down-gradient injection well lines are planned to be oriented east-west across the groundwater plume; 1) along the north extent of the Valley Processing parcel south of the BNSF railroad, and 2) along the Blaine Avenue ROW, respectively. The purpose of each of these injection lines is to create treatment zones for groundwater as it migrates south.

The treatment configuration may be refined and/or adjusted in the GW CPS, based on treatability testing results or other implementation considerations.

Injection Well Horizontal Spacing

The horizontal injection well spacing within the injection lines will be designed to implement the most feasible and cost-effective approach considering installation costs, treatment costs, and required injection volumes. Wells spaced more closely together result in higher installation costs but lower treatment costs and injection volumes. As wells are spaced further apart, the installation costs decrease, but the treatment costs and injection volumes increase.

The horizontal injection well spacing design will be detailed in the GW CPS.

Injection Well Design

The following design parameters will be considered in the design of the EISB injection wells:

- Drilling Method – Consider the geologic environment to minimize formation disturbance and allow cost-effective installation;
- Well Casing – The well casing diameter should be sized so that the velocity of water does not exceed 1.5 meters per second (m/s) (Payne et al, 2008);
- Well Screen – Optimal well-screen designs maximize the flow and communication with the formation in the target interval by balancing screen slot-size to minimize conveyance of fines while maximizing flow area per linear foot of screen. The well-screen area design will aim to limit entrance velocities across the screen of 1.5 centimeters per second (cm/s) during the EISB injections (Payne et al, 2008);
- Annular Seal – The strength of the annular seal is critical to avoid failure and short-circuiting; and
- Filter Pack – The purpose of the filter pack is to prevent the conveyance of fine particles from the formation into the well screen and to provide a permeable hydraulic connection to the formation.

The design of the EISB injection wells will be detailed in the GW CPS.

It is proposed that the groundwater remedy be implemented in two phases. Phase I would be implemented on a small scale to field test the design proposed herein and detailed in the GW CPS. Information gathered during Phase I implementation would be utilized to refine full-scale implementation under Phase II.

4.2 MONITORED NATURAL ATTENUATION

4.2.1 Process Description

Natural attenuation refers to the natural physical, chemical, and/or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, or concentration of contaminants. These natural processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants. MNA implements careful monitoring and analysis of Site constituents and/or conditions to verify that natural attenuation is occurring.

When MNA is selected to achieve remediation objectives, Ecology has the following expectations, as stated in WAC 173-340-370:

- Source control (including removal and/or treatment of hazardous substances) has been conducted to the maximum extent practicable;
- Leaving contaminants on-site during the restoration timeframe does not pose an unacceptable threat to human health or the environment;
- There is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the Site; and
- Appropriate monitoring requirements are conducted to demonstrate that the natural attenuation process is taking place and that human health and the environment are protected.

Source Control

Source control at the Site has focused on the nitrogen compounds present including nitrate, nitrite, and ammonia. The first phase of source control was completed during the shallow soil excavation conducted at the BJS and WGL parcels in 2014, which addressed soil exceeding the soil CULs for nitrate and ammonia. Soil source removal extended to a maximum depth of approximately 11 feet bgs. With the exception of source soils that may be present under existing structures or that are located outside of the parcel boundaries, source soils above the groundwater table have been removed.

The EISB proposed for the groundwater IHSs at the Site will provide additional source control at the Site below the groundwater table. However, logistically, EISB will not be able to be applied across the entire plume. Bioremediation injection wells will be installed in treatment zones, and limited to locations where the interference with property owner activities can be limited and where property access is reasonably attainable. In addition, the EISB design selected will not provide source control for each of the IHSs to an equal extent. The approach was selected to target nitrogen-containing compounds (nitrate, nitrite, ammonia, and dinoseb), and may also remediate several IHSs to a lesser extent (1,2-dichloropropane, benzene, chlorobenzene, and 2,4-D). The EISB design will, however, likely increase the concentrations of the dissolved metal IHSs (iron, manganese, and arsenic), at least in the short term. As a result, MNA will be utilized in conjunction with the EISB implementation to verify the remediation objectives are achieved for IHSs throughout the identified POC.

Risk to Human Health and the Environment

Soil source removal has addressed the risk to human health and the environment identified by the CAP in shallow soil located on the BJS and WGL parcels. Risks associated with the groundwater at the Site are limited by the following conditions:

- Groundwater impacts are limited to the shallow aquifer defined by a clay layer located approximately 30 feet bgs;

- No water wells are currently installed within the shallow aquifer Site groundwater plume(s);
- Municipal water is available throughout the City limits which includes all parcels affected by the Site groundwater plume(s); and
- ICs will be implemented to protect against the future use of groundwater through the groundwater plume until Site CULs are met.

Existing Natural Attenuation

Site groundwater sampling results from both of the 2015 semi-annual events were examined for exceedances of the Site CULs for any of the IHSs. Where exceedances were found, a statistical analysis of the concentration trend for the applicable IHS and monitoring well location were performed over the monitoring history from 2003 to present. Concentration trends for each IHS at each monitoring well location were analyzed using the Mann-Kendall non-parametric test for the linear trend analysis of data over time.

The Mann-Kendall test neither requires a specific statistical distribution of the data, nor is the test sensitive to the sampling interval over which the monitoring data are collected. The outcome of the procedure depends on the ranking of individual data points and not the overall magnitude of the data points. Therefore, the Mann-Kendall procedure can be used for data sets that include irregular sampling intervals, data below the detection limit, and trace or missing data. The approach is particularly advantageous in cases where outliers in the data could produce biased estimates using parametric trend analysis. The method may be applied to track data trends for purpose of groundwater compliance monitoring, site assessment, and monitoring of the performance of groundwater corrective actions (USEPA, 2009).

The Mann-Kendall test for trend analysis utilized for this report relies on three statistical metrics, as follows:

- The "S" Statistic which indicates whether concentration trend versus time is generally decreasing (negative S value) or increasing (positive S value);
- The Confidence Factor which modifies the S Statistic calculation to indicate the degree of confidence in the trend result to define "Decreasing" versus "Probably Decreasing" and "Increasing" versus "Probably Increasing". Additionally, if the Confidence Factor is low, it is used to apply a preliminary "No Trend" classification, pending consideration of the Coefficient of Variation; and
- The Coefficient of Variation which is used to distinguish between a "No Trend" result (significant scatter in concentration over time) and a "Stable" result (limited variability in concentration over time) for data with no significant increasing or decreasing trend.

Mann-Kendall results are summarized in **Table 5.**

Nitrate

Nitrate has exceeded the CUL in 10 Site monitoring wells in at least one of the 2015 sampling events. Nitrate concentrations were analyzed for each of these 10 monitoring wells over their sampling history to assess the natural attenuation process for nitrate across the current plume. Six of the 10 monitoring wells (MW-4R, MW-5R, MW-8, MW-9, MW-12R, and MW-13) indicate a decreasing trend in nitrate concentrations over their monitoring history. Three of the 10 monitoring wells (MW-3, MW-6, and MW-16) indicate a stable trend in nitrate concentration over their monitoring history. One of the 10 monitoring wells (MW-19) indicated no nitrate concentration trend over its monitoring history; however, MW-19 was installed in August 2013 and there is a limited data set.

These nitrate data collectively indicate the Site nitrate plume is undergoing natural attenuation and the plume is relatively stable as concentrations do not appear to be increasing at down-gradient monitoring wells.

Nitrite

Nitrite has exceeded the Site CUL in two monitoring wells (MW-3 and MW-5R) in at least one of the 2015 sampling events. Nitrite concentration trends were analyzed for each of these two locations over their sampling history to assess the natural attenuation process for nitrite across the current Site plume. The analysis indicated a stable nitrite concentration trend at MW-3 and no nitrite concentration trend at MW-5R.

Nitrite concentrations have been highly variable at these locations as indicated by the elevated coefficient of variation results. Both ammonia and nitrate concentrations have been elevated at MW-3 and MW-5R, and variations in the nitrite concentrations may be a result of the incomplete nitrification or denitrification of these compounds. As described previously, the EISB design is effective in the remediation of nitrite in groundwater, and both MW-3 and MW-5R are located near an area where EISB wells are planned.

1,2-Dichloropropane

1,2-Dichloropropane has exceeded the Site CUL in five Site monitoring wells (MW-4R, MW-9, MW-12R, MW-16, and MW-19) in both of the 2015 sampling events. 1,2-Dichloropropane concentrations were analyzed for each of these five monitoring wells over their history to assess the concentration trend for 1,2-dichloropropane across the current plume. Three of the five monitoring wells (MW-4R, MW-9, and MW-16) indicate a decreasing trend in 1,2-dichloropropane concentration over their monitoring history. Two of the five monitoring wells (MW-12R and MW-19) indicate no 1,2-dichloropropane concentration trend.

The data indicate that there is some natural attenuation of 1,2-dichloropropane across its existing plume. Research indicates that 1,2-dichloropropane can be remediated by bacteria under anaerobic groundwater conditions similar to those proposed for the Site under the EISB system. However, the bench-scale and pilot testing conducted on the Site groundwater have not conclusively shown the proposed EISB system to be effective in remediating 1,2-

dichloropropane. Concentrations of 1,2-dichloropropane will warrant close attention as part of the compliance monitoring, especially at locations MW-12R and MW-19.

2,4-D

2,4-D has exceeded the Site CUL in MW-12R in at least one of the 2015 sampling events. Historic 2,4-D concentrations were analyzed at this monitoring well to assess the concentration trend. The analysis did not indicate a concentration trend over the monitoring history.

Natural attenuation of 2,4-D could not be confirmed in MW-12R. However, MW-12R is located near an area where EISB injection wells are planned. The concentration trend of 2,4-D in MW-12R will warrant close attention as part of the Site compliance monitoring to confirm that the EISB design implemented is effective in remediating this IHS in Site groundwater.

Arsenic

Arsenic has exceeded the CUL in nine Site monitoring wells (MW-3, MW-6, MW-10, MW-11, MW-12R, MW-15, MW-18, MW-19, and MW-20) in both of the 2015 sampling events. Arsenic concentrations were analyzed for each of these monitoring wells over their sampling history to assess the natural attenuation process for arsenic across the existing plume. Two of the nine monitoring wells (MW-6 and MW-12R) indicate an increasing trend in arsenic concentrations over their monitoring history. One monitoring well (MW-3) indicates a decreasing trend in arsenic concentration over its monitoring history. The remaining six monitoring wells (MW-10, MW-11, MW-15, MW-18, MW-19, and MW-20) indicate either a stable trend or no trend in arsenic concentration over their monitoring history.

The arsenic concentration trends do not indicate natural attenuation of arsenic across the Site groundwater, and as detailed in Section 3.4.2, do not appear to correlate with the Site source areas or other IHS groundwater plumes. Elevated arsenic concentrations may be the result of both historic releases of arsenic containing compounds and reducing conditions associated with the Site. In addition, arsenic concentrations are expected to increase temporarily following implementation of the EISB injection system outlined in this report. As a result, arsenic will be an important component of the Site compliance monitoring program.

As detailed in Section 3.4.2, a groundwater arsenic RL has been proposed for the Site by Ecology. Groundwater arsenic concentrations exceeding the Site CUL but below the Site RL will require continued MNA sampling and protection under ICs, but will not require active remediation approaches.

Benzene

Benzene has exceeded the Site CUL in MW-12R in both of the 2015 sampling events. Historic benzene concentrations were analyzed at this monitoring well to assess the concentration trend. The benzene concentration at MW-12R shows an increasing trend over the monitoring history.

Benzene concentrations above the Site CUL are limited to the area in and around MW-12R and the increasing trend may be a result of migration or dilution from a nearby area of higher

concentration that has not been sampled. Research indicates that benzene can be remediated by bacteria under anaerobic groundwater conditions similar to those proposed for the Site under the EISB system. However, the bench-scale testing conducted on the Site groundwater has not conclusively shown the proposed EISB system to be effective in remediating benzene. MW-12R is located near an area where EISB injection wells are planned. The concentration trend of benzene in MW-12R will warrant close attention as part of the compliance monitoring to confirm that the EISB design implemented is effective in remediating this IHS in Site groundwater.

Chlorobenzene

Similar to benzene, chlorobenzene has exceeded the Site CUL only in MW-12R in at least one of the two 2015 sampling events. Historic chlorobenzene concentrations were analyzed at this monitoring well to assess the concentration trend. The chlorobenzene concentration at MW-12R shows an increasing trend over the monitoring history.

Similar to benzene, the chlorobenzene concentrations above the Site CUL are limited to the area in and around MW-12R and the increasing trend may be a result of migration or dilution from a nearby area of higher concentration that has not been sampled. Research indicates that chlorobenzene can be remediated by bacteria under anaerobic groundwater conditions similar to those proposed for the Site under the EISB system. However, the bench-scale testing conducted on the Site groundwater has not conclusively shown the proposed EISB system to be effective in remediating chlorobenzene. MW-12R is located near an area where EISB injection wells are planned. The concentration trend of chlorobenzene in MW-12R will warrant close attention as part of the compliance monitoring to confirm that the EISB design implemented is effective in remediating this IHS in Site groundwater.

Dinoseb

Dinoseb has exceeded the Site CUL in five monitoring wells (MW-4R, MW-9, MW-12R, MW-13, and MW-16) in at least one of the 2015 sampling events. Historic dinoseb concentrations were analyzed at these monitoring wells to assess the concentration trend. Three of the five monitoring well locations (MW-9, MW-12R, and MW-13) indicate an increasing or probably increasing dinoseb concentration trend. The concentration data at MW-16 shows a stable concentration trend. The dinoseb concentration data at MW-4R indicates no trend.

The dinoseb concentration trends do not indicate that natural attenuation is occurring across much of the plume area. The EISB design to be implemented has shown the ability to remediate dinoseb in bench-scale and field pilot testing. Monitoring well locations MW-4R, MW-12R, and MW-16 are located near areas where EISB injection wells are planned. The concentration trends at MW-9 and MW-13 will warrant close attention as part of the Site compliance monitoring to confirm that the EISB design implemented is effective in remediating this IHS in Site groundwater in those locations down-gradient of the planned injection well locations.

Iron

Iron exceeded the Site CUL in monitoring well MW-19 in one of the 2015 sampling events. Historic iron concentrations were analyzed at this monitoring well and the data indicated a decreasing concentration trend over the monitoring history.

The concentration trend indicates natural attenuation of iron is occurring at MW-19; however, the sampling history is relatively brief and there is a high degree of variation in the data. Regardless of the attenuation status of iron in Site groundwater, iron concentrations are expected to temporarily increase following any implementation of the EISB design outlined in this report. As a result, iron will be an important component of the Site compliance monitoring program.

4.2.2 Monitored Natural Attenuation Design Basis

There are limitations of the EISB design to be implemented at the Site and treatment in some areas will likely rely on the natural groundwater hydraulic gradient; therefore, MNA will be utilized within the existing monitoring well system for the Site to aid in meeting groundwater CULs at the POCs within a reasonable timeframe and to demonstrate that there is not an unacceptable risk to human health or the environment during the groundwater cleanup action. Monitored natural attenuation will be implemented as part of the required compliance monitoring plan for the Site groundwater remedy. Monitoring will be conducted to evaluate natural attenuation in the Site groundwater plume using the following criteria:

- Monitor the transformation of nitrogen and document the rate of transformation;
- Identify and monitor potential products (dissolved metals) resulting from biodegradation;
- Document changes in the groundwater plume geometry;
- Monitor for decreasing IHS concentration trends;
- Demonstrate the effectiveness of ICs in protecting potential receptors;
- Detect changes in environmental conditions which may adversely affect the efficacy of the natural attenuation process; and
- Verify that the groundwater CULs have been met or can be achieved within a reasonable timeframe.

4.3 INSTITUTIONAL CONTROLS

4.3.1 Process Description

ICs are administrative and/or legal controls that minimize exposure to the public by limiting the use of land and its resources. The Consent Decree and CAP require a good faith effort to

implement ICs in the form of restrictive covenants (i.e., a deed restriction) with the owners of the affected parcels to be recorded with the office of the Yakima County Auditor. The purpose of a restrictive covenant is to prohibit activities that may interfere with a cleanup action or other measures necessary to assure the integrity of the cleanup action and to protect human health and the environment.

In 2007, Washington enacted the Uniform Environmental Covenants Act (UECA) which establishes environmental covenants for sites in Washington that are remediated under Ecology or USEPA. Environmental covenants created under UECA contain activity or land use restrictions on real property that legally stay with the land, regardless of changes of ownership. The covenants are based on traditional property law principles and are recorded in local land records, thereby binding successive owners of the property. The purpose of the UECA is to ensure that environmental covenants created for a particular site are not invalidated by conflicts or misunderstandings with other local, state, or federal regulations. The UECA provides clear rights for Ecology or USEPA to create, record, monitor, enforce, modify and terminate environmental covenants and thereby ensure with greater certainty the protection of human health and the environment throughout the life of the environmental covenant, including during real estate transactions or legal actions. The most recent Environmental Covenant Instructions and Template for MTCA Sites prepared by Ecology is provided in **Appendix B**.

4.3.2 Institutional Control Implementation

The Consent Decree, CAP, and this report strive to mitigate current conditions within the shallow aquifer Site groundwater plume from potentially exposing the public to an unacceptable level of risk. Furthermore, it should be noted that households and businesses within the plume area use municipal water. In addition, the CAP defined the reasonable restoration timeframe for the groundwater remedy at the Site to be 30 to 40 years. As a result, CEMC and ARC will attempt to establish ICs in accordance with WAC 173-340-440 to protect the public from a potential unacceptable risk during the implementation of the EISB and MNA portions of the groundwater remedy.

WAC 173-340-440 sets separate requirements for those properties owned by a person who has been named as a potentially liable person (PLP) or who meets the criteria in Revised Code of Washington (RCW) 70.105D.040 for being named a PLP, and those properties not owned by a PLP that have been affected by the release. Parcels owned by PLPs must have ICs described in a restrictive covenant for the parcel(s). For those parcels not owned by a PLP, a good faith effort must be made to obtain a restrictive covenant on the parcel prior to using other legal or administrative ICs. The parcels owned by PLPs are limited to the BJS and WGL parcels (22102522014 and 22102522015).

In addition to the required ICs detailed in WAC 173-340-440(9), the following particular ICs are planned to be implemented within a restrictive covenant for the BJS and WGL parcels:

- A restriction on the construction or relocation of buildings within the parcels that would prevent proper monitoring of soil and groundwater or result in unacceptable risks from inhalation of vapors;

- A restriction on installing municipal or domestic drinking water wells in the shallow aquifer while nitrate concentrations exceed the MCL of 10 mg/L; and

- A requirement that the parcel owner notify future parcel owners of the presence of subsurface contamination prior to the parcel transfer.

A good faith effort will be made to implement the following IC within restrictive covenants for down-gradient parcels impacted by the nitrate groundwater plume attributable to the Site:

- A restriction on installing municipal or domestic drinking water wells in the shallow aquifer at the Site while nitrate concentrations exceed the MCL of 10 mg/L.

If a good faith effort to obtain a restrictive covenant for one or more down-gradient parcels impacted by the Site groundwater plume fails, an educational mailing communicating the most recent groundwater monitoring and treatment progress will be provided to those parcel owners.

5.0 Compliance Monitoring

Compliance monitoring will be implemented pursuant to the provisions of WAC 173-340-410. The objectives of compliance monitoring are to:

1) Monitor for potential adverse effects in order to protect human health and the environment during cleanup actions;

2) Verify the Site-specific criteria have been achieved during cleanup actions; and

3) Confirm the long-term effectiveness of the cleanup actions.

5.1 PROTECTION MONITORING

Protection monitoring refers to monitoring enacted during the implementation of the groundwater remedy in order to adequately protect human health and the environment.

The implementation of the groundwater remedy is anticipated to be executed in two phases:

- The installation of the groundwater remediation injection wells; and
- The injection of the carbon source and nutrients, which may occur over several separate events.

All of the entities in this project consider health and safety to be the most important aspect of this work. All entities are committed to ensuring the protection of the workers, as well as the public and environment. All field activities for this project are conducted under a Site-specific Health and Safety Plan (HASP) and Stantec's policy to complete the work without any type of injury, illness, impact to the environment, or impact to property and equipment. The purpose of the HASP is to proactively aid the project personnel in: identifying and understanding the risks and hazards they are likely to encounter at the Site; and mitigating those risks and hazards.

Prior to starting the scope of work detailed in this report, Stantec will develop a comprehensive HASP which will be prepared specifically for the tasks required to complete the implementation of the groundwater remediation and for the hazards associated with this specific Site. The HASP will be submitted to Ecology prior to the implementation of the groundwater remedy as required by WAC 173-340-810, the Consent Decree, and the updated schedule.

5.2 PERFORMANCE MONITORING

Performance monitoring refers to sampling conducted to confirm that the groundwater remedy is operating as designed and progressing towards attaining the Site-specific cleanup criteria at the POCs identified in the CAP and adhering to performance standards such as construction quality control measurements, permit conditions, access agreements, or requirements of other laws.

5.2.1 Injection Well Installation Performance Monitoring

The EISB injection wells to be installed as part of this groundwater remediation system are considered Class V injection wells within the underground injection control program (UIC) and must meet the requirements of WAC 173-218 and WAC 173-200. Prior to operating UIC wells, they must be registered and either rule authorized or receive a state waste discharge permit from Ecology. Per WAC 173-218-060, if these EISB wells are authorized in accordance with the MTCA conducting a cleanup under a MTCA consent decree, then the EISB wells will only need to be registered with the UIC program and will not require a permit.

Specifications for the installation of the EISB wells will be established in the GW CPS. Performance monitoring measures will be taken so the installed remediation system meets the requirements of the GW CPS.

The collection of performance monitoring data during EISB well installation will include, but is not limited to, the following methods:

- Soil boring/well construction logs;
- Field survey data collected by licensed surveyors;
- Well development field logs; and
- UIC Well Registration Form for Class V UIC wells that automatically meet the non-endangerment standard.

This performance monitoring data will be submitted to Ecology as part of the *Groundwater Remedy As-Built Report*.

5.2.2 Groundwater Remedy Performance Monitoring

Groundwater remedy performance monitoring will be implemented to measure the effectiveness of both the EISB and MNA process implementation at the Site. Two monitoring and sampling programs will be used to conduct performance monitoring during the groundwater remedy:

- The existing semi-annual groundwater monitoring and sampling program; and
- A quarterly groundwater monitoring and sampling program to be implemented for four events following an EISB injection event.

The existing semi-annual groundwater monitoring and sampling program will continue throughout the groundwater remedy, and data from this program will be incorporated into the performance monitoring.

The quarterly groundwater remedy performance monitoring will be implemented at a combination of EISB injection wells and existing groundwater monitoring wells within the applicable EISB treatment zone. The quarterly performance monitoring events will be scheduled so they are conducted approximately 1, 3, 6, and 9 months (+/- 1 month) after completion of an EISB injection event. The parameters measured during the quarterly performance monitoring events will be defined in the *Groundwater Remedy Compliance Monitoring Plan* (GW CMP).

When monitoring or sampling parameters for the two programs are redundant at a particular time and location, a single sample may be collected and used for both programs. A more detailed description of the groundwater remediation performance monitoring will be provided in the GW CMP. In addition, contingencies if the groundwater remedy causes concentrations of IHSs to increase will be provided in the GW CMP.

5.2.3 Institutional Controls Performance Monitoring

Performance monitoring will be conducted to verify that the ICs implemented for the Site parcels are effectively protecting the public throughout the groundwater remedy duration. Performance monitoring of the ICs will include the following items:

- The ongoing semi-annual groundwater monitoring and sampling events will be used to:
    - Verify that no buildings have been constructed or moved to locations on the BJS and WGL parcels that would prevent proper monitoring of soil and groundwater or result in unacceptable risks from inhalation of vapors; and
    - Verify that no Site owner activities have interfered with the groundwater remedy implementation or compliance monitoring.
- Conduct a well survey every 5 years using the Ecology searchable well log database for any water wells installed into the shallow aquifer that is impacted by the Site groundwater plume.

A more detailed description of the ICs performance monitoring will be provided in the GW CMP.

5.3 CONFIRMATIONAL MONITORING

Once performance monitoring has indicated that the groundwater remedy has attained the cleanup standards within the defined POC, confirmational monitoring will be implemented to verify the long-term effectiveness of the groundwater remedy. The confirmation monitoring program may differ from the performance monitoring program in the following ways:

- Utilize a less frequent sampling interval; and
- Eliminate monitoring wells or chemical constituents from the sampling plan.

The focus of confirmational monitoring may also be to collect additional data to apply in statistical analyses supporting the long-term groundwater remedy effectiveness and closure of the cleanup action as defined in the Site Consent Decree and CAP.

A more detailed description of the groundwater remediation confirmational monitoring will be provided in the GW CMP.

6.0 Project Schedule

An implementation schedule was developed as required in the CAP, and submitted to Ecology on August 5, 2013. The schedule was updated and submitted to Ecology on September 12, 2014, and approved in a letter dated January 6, 2015. Due to the delay in approval of the design report and determination of the path forward for the Site, and the recommendation to implement the groundwater remedy in two phases, the implementation schedule has been revised. The proposed implementation schedule is included as **Figure 9**, and key activities pertaining to the groundwater remedy are summarized below:

- Ecology Review and Approval of *Groundwater Remedy Engineering Design Report* – estimated by November 18, 2016.
- Submit *Groundwater Remedy Construction Plans and Specifications* – December 22, 2016.
- Submit *Groundwater Remedy Compliance Monitoring Plan* – December 22, 2016.
- Ecology Review and Approval of *Groundwater Remedy Construction Plans and Specifications* and *Groundwater Remedy Compliance Monitoring Plan* – estimated by February 15, 2017.
- Obtain Additional Access Agreements for Groundwater Remedy – between January 4 and April 27, 2017.
- Submit *Groundwater Remedy Health and Safety Plan* – April 13, 2017.
- Estimated Window for Phase I Groundwater Remedy Implementation – between May 26 and November 9, 2017 (Final Schedule to be Determined).
- Estimated Window for Phase II Groundwater Remedy Implementation – between January 11 and September 19, 2018 (Final Schedule to be Determined).
- Submit *Groundwater Remedy As-Built Report* – estimated on December 19, 2018 (Dependent upon Final Schedule for Groundwater Remedy Implementation).

Please note that the deadlines are dependent on Ecology review and approval, and a delay in review and approval of a document will likely result in delay of the subsequent tasks that may be dependent on that document.

7.0 References

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TABLES

Table 1
Cumulative Groundwater Elevations
Bee-Jay Scales Site, Sunnyside, Washington

Well ID	Quarter/ Half[1]	Date	TOC Elevation (feet above MSL)	Depth to GW (feet below TOC)	GW Elevation (feet above MSL)
MW-1	3Q05	09/28/05	745.86	11.67	734.19
	4Q05	01/11/06	745.86	10.74	735.12
	1Q06	03/28/06	745.86	11.12	734.74
	2Q06	06/26/06	745.86	11.29	734.57
	3Q06	09/18/06	745.86	11.87	733.99
	4Q06	12/18/06	745.86	11.39	734.47
	1Q07	03/19/07	745.86	11.35	734.51
	2Q07	06/25/07	745.86	11.68	734.18
	3Q07	09/18/07	745.86	11.81	734.05
	4Q07	12/17/07	745.86	11.18	734.68
	1Q08	03/11/08	745.86	11.30	734.56
	2Q08	06/16/08	745.86	11.70	734.16
	3Q08	09/08/08	745.86	11.94	733.92
	1H09	03/10/09	745.86	11.47	734.39
	2H09	09/14/09	745.86	12.25	733.61
	1H10	03/09/10	745.86	11.04	734.82
	2H10	08/30/10	745.86	11.78	734.08
	1H11	03/08/11	745.86	11.21	734.65
	2H11	09/12/11	745.86	11.75	734.11
	1H12	03/12/12	745.86	11.24	734.62
	2H12	08/29/12	745.86	11.67	734.19
	1H13	03/04/13	745.86	11.41	734.45
	3Q13	08/22/13	745.86	12.98	732.88
	4Q13	12/02/13	745.86	11.65	734.21
	1Q14	03/10/14	745.86	11.23	734.63
	2Q14	05/19/14	745.86	11.36	734.50
	2H14	09/08/14	745.86	11.80	734.06
	1H15	02/13/15	745.86	11.05	734.81
	2H15	08/11/15	745.86	11.85	734.01
MW-3	3Q05	09/28/05	740.92	7.23	733.69
	4Q05	01/11/06	740.92	5.31	735.61
	1Q06	03/28/06	740.92	6.68	734.24
	2Q06	06/26/06	740.92	6.72	734.20
	3Q06	09/18/06	740.92	7.50	733.42
	4Q06	12/18/06	740.92	6.40	734.52
	1Q07	03/19/07	740.92	6.93	733.99
	2Q07	06/25/07	740.92	7.18	733.74
	3Q07	09/18/07	740.92	7.35	733.57
	4Q07	12/17/07	740.92	6.49	734.43
	1Q08	03/11/08	740.92	6.85	734.07
	2Q08	06/16/08	740.92	7.11	733.81
	3Q08	09/08/08	740.92	7.60	733.32
	1H09	03/10/09	740.92	6.71	734.21
	2H09	09/14/09	740.92	7.86	733.06
	1H10	03/09/10	740.92	6.52	734.40
	2H10	08/30/10	740.92	7.40	733.52
	1H11	03/08/11	740.92	6.78	734.14
	2H11	09/12/11	740.92	7.30	733.62
	1H12	03/12/12	740.92	6.79	734.13
	2H12	08/29/12	740.92	7.20	733.72
	1H13	03/04/13	740.92	7.01	733.91
	3Q13	08/22/13	740.92	7.72	733.20
	4Q13	12/02/13	740.92	7.15	733.77
	1Q14	03/10/14	740.92	6.48	734.44
	2Q14	05/19/14	740.92	6.82	734.10
	2H14	09/08/14	740.92	7.35	733.57
	1H15	02/13/15	740.92	6.49	734.43
	2H15	08/11/15	740.92	7.32	733.60

Table 1
Cumulative Groundwater Elevations
Bee-Jay Scales Site, Sunnyside, Washington

Well ID	Quarter/ Half[1]	Date	TOC Elevation (feet above MSL)	Depth to GW (feet below TOC)	GW Elevation (feet above MSL)
MW-4	3Q05	09/28/05	741.88	8.30	733.58
	4Q05	01/11/06	741.88	7.03	734.85
	1Q06	03/28/06	741.88	7.83	734.05
	2Q06	06/26/06	741.88	9.15	732.73
	3Q06	09/18/06	741.88	8.52	733.36
	4Q06	12/18/06	741.88	7.80	734.08
	1Q07	03/19/07	741.88	8.07	733.81
	2Q07	06/25/07	741.88	8.31	733.57
	3Q07	09/18/07	741.88	8.45	733.43
	4Q07	12/17/07	741.88	7.68	734.20
	1Q08	03/11/08	741.88	8.04	733.84
	2Q08	06/16/08	741.88	8.32	733.56
	3Q08	09/08/08	741.88	8.82	733.06
	1H09	03/10/09	741.88	8.04	733.84
	2H09	09/14/09	741.88	8.96	732.92
	1H10	03/09/10	741.88	7.71	734.17
	2H10	08/30/10	741.88	8.54	733.34
	1H11	03/08/11	741.88	7.94	733.94
	2H11	09/12/11	741.88	8.45	733.43
	1H12	03/12/12	741.88	7.90	733.98
	2H12	08/29/12	741.88	8.30	733.58
	1H13	03/04/13	741.88	8.13	733.75
	3Q13	08/22/13	741.88	8.46	733.42
	4Q13	12/02/13	741.88	8.27	733.61
	1Q14	03/10/14	741.88	7.68	734.20
	2Q14	05/19/14	741.88	7.98	733.90
	Well Destroyed in June 2014				
MW-4R	1H15	02/13/15	741.90	7.68	734.22
	2H15	08/11/15	741.90	8.47	733.43
MW-5	3Q05	09/28/05	741.93	7.82	734.11
	4Q05	01/11/06	741.93	6.50	735.43
	1Q06	03/28/06	741.93	7.36	734.57
	2Q06	06/26/06	741.93	7.46	734.47
	3Q06	09/18/06	741.93	8.03	733.90
	4Q06	12/18/06	741.93	7.34	734.59
	1Q07	03/19/07	741.93	7.62	734.31
	2Q07	06/25/07	741.93	7.99	733.94
	3Q07	09/18/07	741.93	7.97	733.96
	4Q07	12/17/07	741.93	7.21	734.72
	1Q08	03/11/08	741.93	7.67	734.26
	2Q08	06/16/08	741.93	7.90	734.03
	3Q08	09/08/08	741.93	8.15	733.78
	1H09	03/10/09	741.93	7.70	734.23
	2H09	09/14/09	741.93	8.45	733.48
	1H10	03/09/10	741.93	7.30	734.63
	2H10	08/30/10	741.93	8.04	733.89
	1H11	03/08/11	741.93	7.50	734.43
	2H11[7]	09/12/11	741.93	NA	NA
	1H12	03/12/12	741.93	7.41	734.52
	2H12	08/29/12	741.93	7.75	734.18
	1H13	03/04/13	741.93	7.67	734.26
	3Q13	08/22/13	741.93	8.01	733.92
	4Q13	12/02/13	741.93	7.76	734.17
	1Q14	03/10/14	741.93	7.26	734.67
	2Q14	05/19/14	741.93	7.50	734.43
	Well Destroyed in June 2014				
MW-5R	1H15	02/13/15	741.85	7.29	734.56
	2H15	08/11/15	741.85	8.03	733.82

Table 1
Cumulative Groundwater Elevations
Bee-Jay Scales Site, Sunnyside, Washington

Well ID	Quarter/ Half[1]	Date	TOC Elevation (feet above MSL)	Depth to GW (feet below TOC)	GW Elevation (feet above MSL)
MW-6	3Q05	09/28/05	741.73	6.71	735.02
	4Q05	01/11/06	741.73	5.51	736.22
	1Q06	03/28/06	741.73	6.37	735.36
	2Q06	06/26/06	741.73	6.51	735.22
	3Q06	09/18/06	741.73	6.95	734.78
	4Q06	12/18/06	741.73	6.26	735.47
	1Q07	03/19/07	741.73	6.62	735.11
	2Q07	06/25/07	741.73	7.60	734.13
	3Q07	09/18/07	741.73	6.90	734.83
	4Q07	12/17/07	741.73	6.18	735.55
	1Q08	03/11/08	741.73	6.76	734.97
	2Q08	06/16/08	741.73	6.98	734.75
	3Q08	09/08/08	741.73	7.15	734.58
	1H09	03/10/09	741.73	6.85	734.88
	2H09	09/14/09	741.73	7.48	734.25
	1H10	03/09/10	741.73	6.32	735.41
	2H10	08/30/10	741.73	6.95	734.78
	1H11	03/08/11	741.73	6.48	735.25
	2H11	09/12/11	741.73	6.81	734.92
	1H12	03/12/12	741.73	6.35	735.38
	2H12	08/29/12	741.73	6.57	735.16
	1H13	03/04/13	741.73	6.64	735.09
	3Q13	08/22/13	741.73	6.90	734.83
	4Q13	12/02/13	741.73	6.70	735.03
	1Q14	03/10/14	741.73	6.35	735.38
	2Q14	05/19/14	741.73	6.50	735.23
	2H14	09/08/14	741.73	6.74	734.99
	1H15	02/13/15	741.73	6.12	735.61
	2H15	08/11/15	741.73	6.82	734.91
MW-7	3Q05	09/28/05	744.68	10.65	734.03
	4Q05	01/11/06	744.68	9.76	734.92
	1Q06	03/28/06	744.68	10.22	734.46
	2Q06	06/26/06	744.68	10.39	734.29
	3Q06	09/18/06	744.68	10.85	733.83
	4Q06	12/18/06	744.68	10.45	734.23
	1Q07	03/19/07	744.68	10.39	734.29
	2Q07	06/25/07	744.68	10.69	733.99
	3Q07	09/18/07	744.68	10.79	733.89
	4Q07	12/17/07	744.68	10.22	734.46
	1Q08	03/11/08	744.68	10.42	734.26
	2Q08	06/16/08	744.68	10.75	733.93
	3Q08	09/08/08	744.68	10.91	733.77
	1H09	03/10/09	744.68	10.50	734.18
	2H09	09/14/09	744.68	11.25	733.43
	1H10	03/09/10	744.68	10.15	734.53
	2H10	08/30/10	744.68	10.78	733.90
	1H11	03/08/11	744.68	10.30	734.38
	2H11	09/12/11	744.68	10.78	733.90
	1H12	03/12/12	744.68	10.30	734.38
	2H12	08/29/12	744.68	10.60	734.08
	1H13	03/04/13	744.68	10.45	734.23
	3Q13	08/22/13	744.68	11.01	733.67
	4Q13	12/02/13	744.68	10.68	734.00
	1Q14	03/10/14	744.68	10.41	734.27
	2Q14	05/19/14	744.68	10.45	734.23
	2H14	09/08/14	744.68	10.82	733.86
	1H15	02/13/15	744.68	10.11	734.57
	2H15	08/11/15	744.68	10.93	733.75

Table 1
Cumulative Groundwater Elevations
Bee-Jay Scales Site, Sunnyside, Washington

Well ID	Quarter/ Half[1]	Date	TOC Elevation (feet above MSL)	Depth to GW (feet below TOC)	GW Elevation (feet above MSL)
MW-8	3Q05	09/28/05	741.32	7.04	734.28
	4Q05	01/11/06	741.32	5.58	735.74
	1Q06	03/28/06	741.32	6.48	734.84
	2Q06	06/26/06	741.32	6.59	734.73
	3Q06	09/18/06	741.32	7.28	734.04
	4Q06	12/18/06	741.32	6.38	734.94
	1Q07	03/19/07	741.32	6.67	734.65
	2Q07	06/25/07	741.32	7.03	734.29
	3Q07	09/18/07	741.32	7.15	734.17
	4Q07	12/17/07	741.32	6.28	735.04
	1Q08	03/11/08	741.32	6.65	734.67
	2Q08	06/16/08	741.32	7.01	734.31
	3Q08	09/08/08	741.32	7.39	733.93
	1H09	03/10/09	741.32	6.61	734.71
	2H09	09/14/09	741.32	7.79	733.53
	1H10	03/09/10	741.32	6.45	734.87
	2H10	08/30/10	741.32	7.20	734.12
	1H11	03/08/11	741.32	6.52	734.80
	2H11	09/12/11	741.32	7.18	734.14
	1H12	03/12/12	741.32	6.57	734.75
	2H12	08/29/12	741.32	7.05	734.27
	1H13	03/04/13	741.32	6.75	734.57
	3Q13	08/22/13	741.32	7.31	734.01
	4Q13	12/02/13	741.32	7.00	734.32
	1Q14	03/10/14	741.32	6.39	734.93
	2Q14	05/19/14	741.32	6.68	734.64
	2H14	09/08/14	741.32	7.13	734.19
	1H15	02/13/15	741.32	6.30	735.02
	2H15	08/11/15	741.32	7.09	734.23
MW-9	3Q05	09/28/05	741.09	8.31	732.78
	4Q05	01/11/06	741.09	7.04	734.05
	1Q06	03/28/06	741.09	7.91	733.18
	2Q06	06/26/06	741.09	8.45	732.64
	3Q06	09/18/06	741.09	8.45	732.64
	4Q06	12/18/06	741.09	7.86	733.23
	1Q07	03/19/07	741.09	8.15	732.94
	2Q07	06/25/07	741.09	8.65	732.44
	3Q07	09/18/07	741.09	8.40	732.69
	4Q07	12/17/07	741.09	7.78	733.31
	1Q08	03/11/08	741.09	8.11	732.98
	2Q08	06/16/08	741.09	8.34	732.75
	3Q08[3]	09/10/08	741.09	8.61	732.48
	1H09[5]	03/12/09	741.09	8.15	732.94
	2H09	09/14/09	741.09	8.74	732.35
	1H10	03/09/10	741.09	7.75	733.34
	2H10	08/30/10	741.09	8.50	732.59
	1H11	03/08/11	741.09	8.00	733.09
	2H11	09/12/11	741.09	8.34	732.75
	1H12	03/12/12	741.09	8.00	733.09
	2H12	08/29/12	741.09	8.24	732.85
	1H13	03/04/13	741.09	8.23	732.86
	3Q13	08/22/13	741.09	8.49	732.60
	4Q13	12/02/13	741.09	8.17	732.92
	1Q14	03/10/14	741.09	7.80	733.29
	2Q14	05/19/14	741.09	8.12	732.97
	2H14	09/08/14	741.09	8.27	732.82
	1H15	02/13/15	741.09	7.72	733.37
	2H15	08/11/15	741.09	8.40	732.69

Table 1
Cumulative Groundwater Elevations
Bee-Jay Scales Site, Sunnyside, Washington

Well ID	Quarter/ Half[1]	Date	TOC Elevation (feet above MSL)	Depth to GW (feet below TOC)	GW Elevation (feet above MSL)
MW-10	3Q05	09/28/05	742.38	6.48	735.90
	4Q05	01/11/06	742.38	5.46	736.92
	1Q06	03/28/06	742.38	6.21	736.17
	2Q06	06/26/06	742.38	6.35	736.03
	3Q06	09/18/06	742.38	6.75	735.63
	4Q06	12/18/06	742.38	6.45	735.93
	1Q07	03/19/07	742.38	6.43	735.95
	2Q07	06/25/07	742.38	6.88	735.50
	3Q07	09/18/07	742.38	6.70	735.68
	4Q07	12/17/07	742.38	6.06	736.32
	1Q08	03/11/08	742.38	6.59	735.79
	2Q08	06/16/08	742.38	6.81	735.57
	3Q08	09/08/08	742.38	6.95	735.43
	1H09	03/10/09	742.38	6.72	735.66
	2H09	09/14/09	742.38	7.30	735.08
	1H10	03/09/10	742.38	6.09	736.29
	2H10	08/30/10	742.38	6.74	735.64
	1H11	03/08/11	742.38	6.31	736.07
	2H11	09/12/11	742.38	6.54	735.84
	1H12	03/12/12	742.38	6.16	736.22
	2H12	08/29/12	742.38	6.30	736.08
	1H13	03/04/13	742.38	6.42	735.96
	3Q13	08/22/13	742.38	6.72	735.66
	4Q13	12/02/13	742.38	6.50	735.88
	1Q14	03/10/14	742.38	6.36	736.02
	2Q14	05/19/14	742.38	6.29	736.09
	2H14	09/08/14	742.38	6.59	735.79
	1H15	02/13/15	742.38	5.91	736.47
	2H15	08/11/15	742.38	6.58	735.80
MW-11	3Q05	09/28/05	742.10	6.01	736.09
	4Q05	01/11/06	742.10	5.03	737.07
	1Q06	03/28/06	742.10	5.85	736.25
	2Q06	06/26/06	742.10	5.99	736.11
	3Q06	09/18/06	742.10	6.30	735.80
	4Q06	12/18/06	742.10	5.72	736.38
	1Q07	03/19/07	742.10	6.07	736.03
	2Q07	06/25/07	742.10	6.50	735.60
	3Q07	09/18/07	742.10	6.21	735.89
	4Q07	12/17/07	742.10	5.71	736.39
	1Q08	03/11/08	742.10	6.29	735.81
	2Q08	06/16/08	742.10	6.41	735.69
	3Q08	09/08/08	742.10	6.47	735.63
	1H09	03/10/09	742.10	6.40	735.70
	2H09	09/14/09	742.10	6.80	735.30
	1H10	03/09/10	742.10	5.83	736.27
	2H10	08/30/10	742.10	6.20	735.90
	1H11	03/08/11	742.10	5.95	736.15
	2H11	09/12/11	742.10	6.05	736.05
	1H12	03/12/12	742.10	5.82	736.28
	2H12	08/29/12	742.10	5.82	736.28
	1H13	03/04/13	742.10	6.05	736.05
	3Q13	08/22/13	742.10	6.20	735.90
	4Q13	12/02/13	742.10	6.08	736.02
	1Q14	03/10/14	742.10	5.87	736.23
	2Q14	05/19/14	742.10	5.91	736.19
	2H14	09/08/14	742.10	6.24	735.86
	1H15	02/13/15	742.10	5.57	736.53
	2H15	08/11/15	742.10	6.05	736.05

Table 1
Cumulative Groundwater Elevations
Bee-Jay Scales Site, Sunnyside, Washington

Well ID	Quarter/ Half[1]	Date	TOC Elevation (feet above MSL)	Depth to GW (feet below TOC)	GW Elevation (feet above MSL)
MW-12	3Q05	09/28/05	741.82	8.85	732.97
	4Q05	01/11/06	741.82	7.55	734.27
	1Q06	03/28/06	741.82	8.36	733.46
	2Q06	06/26/06	741.82	8.36	733.46
	3Q06	09/18/06	741.82	9.05	732.77
	4Q06[2]	12/18/06	741.82	8.45	733.37
	1Q07	03/19/07	741.82	8.59	733.23
	2Q07	06/25/07	741.82	8.80	733.02
	3Q07	09/18/07	741.82	8.95	732.87
	4Q07	12/17/07	741.82	8.27	733.55
	1Q08	03/11/08	741.82	8.49	733.33
	2Q08	06/16/08	741.82	8.78	733.04
	3Q08	09/08/08	741.82	9.09	732.73
	1H09	03/10/09	741.82	8.54	733.28
	2H09	09/14/09	741.82	9.32	732.50
	1H10	03/09/10	741.82	8.21	733.61
	2H10	08/30/10	741.82	8.98	732.84
	1H11	03/08/11	741.82	8.50	733.32
	2H11	09/12/11	741.82	8.85	732.97
	1H12	03/12/12	741.82	8.45	733.37
	2H12	08/29/12	741.82	8.75	733.07
	1H13	03/04/13	741.82	8.65	733.17
	3Q13	08/22/13	741.82	8.94	732.88
	4Q13	12/02/13	741.82	8.81	733.01
	1Q14	03/10/14	741.82	8.25	733.57
	2Q14	05/19/14	741.82	8.46	733.36
	Well Destroyed in June 2014				
MW-12R	1H15	02/13/15	741.48	7.85	733.63
	2H15	08/11/15	741.48	8.58	732.90
MW-13	2Q07	06/25/07	742.20	9.89	732.31
	3Q07	09/18/07	742.20	9.85	732.35
	4Q07	12/17/07	742.20	9.48	732.72
	1Q08	03/11/08	742.20	9.61	732.59
	2Q08	06/16/08	742.20	9.80	732.40
	3Q08[4]	09/08/08	742.20	NA	NA
	1H09[6]	03/12/09	742.20	9.76	732.44
	2H09[6]	09/17/09	742.20	10.10	732.10
	1H10	03/09/10	742.20	9.51	732.69
	2H10	08/30/10	742.20	9.85	732.35
	1H11	03/08/11	742.20	9.61	732.59
	2H11	09/12/11	742.20	9.76	732.44
	1H12	03/12/12	742.20	9.53	732.67
	2H12	08/29/12	742.20	9.73	732.47
	1H13	03/04/13	742.20	9.68	732.52
	3Q13	08/22/13	742.20	9.84	732.36
	4Q13	12/02/13	742.20	9.75	732.45
	1Q14	03/10/14	742.20	9.46	732.74
	2Q14	05/19/14	742.20	9.58	732.62
	2H14	09/08/14	742.20	9.68	732.52
	1H15	02/13/15	742.20	9.40	732.80
	2H15	08/11/15	742.20	9.77	732.43
MW-14	3Q13	08/22/13	741.37	8.04	733.33
	4Q13	12/02/13	741.37	7.89	733.48
	1Q14	03/10/14	741.37	7.69	733.68
	2Q14	05/19/14	741.37	7.72	733.65
	2H14[9]	09/10/14	741.37	7.94	733.43
	1H15	02/13/15	741.37	7.38	733.99
	2H15	08/11/15	741.37	7.99	733.38

Table 1
Cumulative Groundwater Elevations
Bee-Jay Scales Site, Sunnyside, Washington

Well ID	Quarter/ Half[1]	Date	TOC Elevation (feet above MSL)	Depth to GW (feet below TOC)	GW Elevation (feet above MSL)
MW-15	3Q13	08/22/13	742.72	11.73	730.99
	4Q13	12/02/13	742.72	11.71	731.01
	1Q14	03/10/14	742.72	11.30	731.42
	2Q14	05/19/14	742.72	11.39	731.33
	2H14	09/08/14	742.72	11.70	731.02
	1H15	02/13/15	742.72	11.24	731.48
	2H15	08/11/15	742.72	11.72	731.00
MW-16	3Q13	08/22/13	741.26	9.33	731.93
	4Q13	12/02/13	741.26	9.21	732.05
	1Q14	03/10/14	741.26	8.86	732.40
	2Q14[8]	05/21/14	741.26	9.02	732.24
	2H14	09/08/14	741.26	9.17	732.09
	1H15	02/13/15	741.26	8.77	732.49
	2H15	08/11/15	741.26	9.30	731.96
MW-17	3Q13	08/22/13	741.82	10.97	730.85
	4Q13	12/02/13	741.82	10.88	730.94
	1Q14	03/10/14	741.82	10.83	730.99
	2Q14	05/19/14	741.82	10.56	731.26
	2H14	09/08/14	741.82	10.87	730.95
	1H15	02/13/15	741.82	10.38	731.44
	2H15	08/11/15	741.82	10.93	730.89
MW-18	3Q13	08/22/13	741.30	13.51	727.79
	4Q13	12/02/13	741.30	13.57	727.73
	1Q14	03/10/14	741.30	13.54	727.76
	2Q14	05/19/14	741.30	13.52	727.78
	2H14	09/08/14	741.30	13.60	727.70
	1H15	02/13/15	741.30	13.52	727.78
	2H15	08/11/15	741.30	13.63	727.67
MW-19	3Q13	08/22/13	739.46	8.60	730.86
	4Q13	12/02/13	739.46	8.48	730.98
	1Q14	03/10/14	739.46	8.13	731.33
	2Q14	05/19/14	739.46	8.31	731.15
	2H14	09/08/14	739.46	8.31	731.15
	1H15	02/13/15	739.46	8.05	731.41
	2H15	08/11/15	739.46	8.56	730.90
MW-20	3Q13	08/22/13	740.51	12.79	727.72
	4Q13	12/02/13	740.51	12.82	727.69
	1Q14	03/10/14	740.51	12.65	727.86
	2Q14	05/19/14	740.51	12.70	727.81
	2H14	09/08/14	740.51	12.78	727.73
	1H15	02/13/15	740.51	12.65	727.86
	2H15	08/11/15	740.51	12.80	727.71

Notes: GW = groundwater NA = not accessible
MSL = mean sea level TOC = top of casing

[1] Sampling frequency reduced from quarterly to semi-annually following the 3Q08 event, increased from semi-annually to quarterly following the 1H13 event, then reduced from quarterly to semi-annually following the 2Q14 event.
[2] Depth to GW during 4Q06 taken just prior to sampling because well was covered by a drum during gauging.
[3] Depth to GW during 3Q08 taken just prior to sampling because well was covered by boxes during gauging.
[4] Depth to GW during 3Q08 not measured because well could not be opened.
[5] Depth to GW during 1H09 taken just prior to sampling because well was covered by boxes during gauging.
[6] Depth to GW during 1H09 and 2H09 taken just prior to sampling because well could not be opened during gauging.
[7] Depth to GW during 2H11 not measured because there was biological hazard (wasp nest) adjacent to well.
[8] Depth to GW during 2Q14 taken just prior to sampling because well was covered by pallets during gauging.
[9] Depth to GW during 2H14 taken just prior to sampling because well was covered by truck during gauging.

Table 2
Comparison of Second Half 2015 Detected Groundwater Concentrations to Cleanup Levels
Bee-Jay Scales Site, Sunnyside, Washington

Location ID	Date	Analyte	Analytical Results*	Units	MDL**	Qualifier	Cleanup Level
MW-01	08/12/15	Nitrate Nitrogen	5.2	mg/L	0.2		10
MW-03	08/12/15	Ammonia-Nitrogen	114	mg/L	1.3		NA
MW-03	08/12/15	Arsenic	**0.0486**	mg/L	0.007		0.01
MW-03	08/12/15	Nitrate Nitrogen	**37.3**	mg/L	0.4		10
MW-03	08/12/15	Nitrite Nitrogen	**1.1**	mg/L	0.075		1
MW-04R	08/12/15	1,2,3-Trichloropropane	**0.016**	mg/L	0.00025		0.00001
MW-04R	08/12/15	1,2-Dichloropropane	**0.019**	mg/L	0.0005		0.005
MW-04R	08/12/15	2,4,5-T	0.000076	mg/L	0.000014	P	0.16
MW-04R	08/12/15	2,4-D	0.00072	mg/L	0.00015		0.07
MW-04R	08/12/15	2,4-DB	0.00085	mg/L	0.00029	JP	0.128
MW-04R	08/12/15	Ammonia-Nitrogen	544	mg/L	5		NA
MW-04R	08/12/15	Chlorobenzene	0.001	mg/L	0.0005		0.1
MW-04R	08/12/15	Dicamba	0.00041	mg/L	0.000076		0.48
MW-04R	08/12/15	Dinoseb	**0.47**	mg/L	0.0057		0.007
MW-04R	08/12/15	Nitrate Nitrogen	**535**	mg/L	10		10
MW-04R	08/12/15	Pentachlorophenol	0.00012	mg/L	0.000026	P	0.001
MW-04R	08/12/15	pH	7.7	Std. Units	0.01		NA
MW-04R	08/12/15	Sulfate	169	mg/L	7.5		NA
MW-04R	08/12/15	Total Alkalinity to pH 4.5	319	mg/L as CaCO3	0.7		NA
MW-05R	08/12/15	Ammonia-Nitrogen	73.4	mg/L	0.5		NA
MW-05R	08/12/15	Nitrate Nitrogen	**208**	mg/L	4		10
MW-05R	08/12/15	Nitrite Nitrogen	**6.9**	mg/L	0.15		1
MW-05R	08/12/15	pH	7.4	Std. Units	0.01		NA
MW-05R	08/12/15	Sulfate	221	mg/L	15		NA
MW-05R	08/12/15	Total Alkalinity to pH 4.5	358	mg/L as CaCO3	0.7		NA
MW-06	08/12/15	Arsenic	**0.0243**	mg/L	0.007		0.01
MW-06	08/12/15	Nitrate Nitrogen	4.1	mg/L	0.4		10
MW-07	08/12/15	Nitrate Nitrogen	3.3	mg/L	0.04		10
MW-08	08/12/15	Nitrate Nitrogen	**77.2**	mg/L	4		10
MW-08	08/12/15	Sulfate	96.3	mg/L	7.5		NA
MW-09	08/13/15	1,2,3-Trichloropropane	**0.012**	mg/L	0.00025		0.00001
MW-09	08/13/15	1,2-Dichloropropane	**0.043**	mg/L	0.0005		0.005
MW-09	08/13/15	2,4,5-T	0.000074	mg/L	0.000014		0.16
MW-09	08/13/15	2,4-D	0.00092	mg/L	0.00015		0.07
MW-09	08/13/15	2,4-DB	0.072	mg/L	0.028	J	0.128
MW-09	08/13/15	Ammonia-Nitrogen	214	mg/L	2.5		NA
MW-09	08/13/15	Chlorobenzene	0.001	mg/L	0.0005		0.1
MW-09	08/13/15	Dicamba	0.00095	mg/L	0.000076		0.48
MW-09	08/13/15	Dinoseb	**0.67**	mg/L	0.011		0.007
MW-09	08/13/15	Nitrate Nitrogen	**344**	mg/L	10		10
MW-09	08/13/15	Pentachlorophenol	0.000053	mg/L	0.000026		0.001
MW-09	08/13/15	pH	7.5	Std. Units	0.01		NA
MW-09	08/13/15	Sulfate	169	mg/L	15		NA
MW-09	08/13/15	Total Alkalinity to pH 4.5	435	mg/L as CaCO3	0.7		NA
MW-10	08/11/15	Arsenic	**0.0189**	mg/L	0.007	J	0.01
MW-10	08/11/15	Nitrate Nitrogen	3.7	mg/L	0.04		10
MW-11	08/11/15	Arsenic	**0.0419**	mg/L	0.007		0.01
MW-11	08/11/15	Nitrate Nitrogen	5.5	mg/L	0.2		10
MW-12R	08/12/15	1,2,3-Trichloropropane	**0.09**	mg/L	0.001		0.00001
MW-12R	08/12/15	1,2-Dichloroethane	0.003	mg/L	0.001		NA
MW-12R	08/12/15	1,2-Dichloropropane	**1.1**	mg/L	0.01		0.005
MW-12R	08/12/15	2,4,5-T	0.00089	mg/L	0.00014		0.16
MW-12R	08/12/15	2,4-D	**0.16**	mg/L	0.015		0.07
MW-12R	08/12/15	Ammonia-Nitrogen	251	mg/L	2.5		NA
MW-12R	08/12/15	Arsenic	**0.0608**	mg/L	0.007		0.01
MW-12R	08/12/15	Benzene	**0.011**	mg/L	0.001		0.005
MW-12R	08/12/15	Chlorobenzene	**0.21**	mg/L	0.001		0.1
MW-12R	08/12/15	Dicamba	0.01	mg/L	0.00076		0.48
MW-12R	08/12/15	Dinoseb	**2.9**	mg/L	0.11		0.007
MW-12R	08/12/15	m+p-Xylene	0.001	mg/l	0.001	J	10

Table 2
Comparison of Second Half 2015 Detected Groundwater Concentrations to Cleanup Levels
Bee-Jay Scales Site, Sunnyside, Washington

Location ID	Date	Analyte	Analytical Results*	Units	MDL**	Qualifier	Cleanup Level
MW-12R	08/12/15	Nitrate Nitrogen	**333**	mg/L	10		10
MW-12R	08/12/15	Nitrite Nitrogen	0.061	mg/L	0.015		1
MW-12R	08/12/15	o-Xylene	0.001	mg/L	0.001	J	10
MW-12R	08/12/15	pH	7.5	Std. Units	0.01		NA
MW-12R	08/12/15	Sulfate	373	mg/L	15		NA
MW-12R	08/12/15	Total Alkalinity to pH 4.5	556	mg/L as CaCO3	0.7		NA
MW-13	08/13/15	Dinoseb	0.0067	mg/L	0.00012		0.007
MW-13	08/13/15	Nitrate Nitrogen	**46.1**	mg/L	1		10
MW-13	08/13/15	pH	7.8	Std. Units	0.01		NA
MW-13	08/13/15	Sulfate	147	mg/L	7.5		NA
MW-13	08/13/15	Total Alkalinity to pH 4.5	247	mg/L as CaCO3	0.7		NA
MW-14	08/11/15	Nitrate Nitrogen	1.7	mg/L	0.04		10
MW-15	08/11/15	Ammonia-Nitrogen	0.34	mg/L	0.05		NA
MW-15	08/11/15	Arsenic	**0.0141**	mg/L	0.007	J	0.01
MW-15	08/11/15	Nitrate Nitrogen	3.3	mg/L	0.04		10
MW-15	08/11/15	pH	7.9	Std. Units	0.01		NA
MW-15	08/11/15	Total Alkalinity to pH 4.5	166	mg/L as CaCO3	0.7		NA
MW-16	08/13/15	1,2,3-Trichloropropane	**0.025**	mg/L	0.0005		0.00001
MW-16	08/13/15	1,2-Dichloropropane	**0.23**	mg/L	0.005		0.005
MW-16	08/13/15	2,4,5-T	0.00013	mg/L	0.000015		0.16
MW-16	08/13/15	2,4-DB	0.00091	mg/L	0.00029	JP	0.128
MW-16	08/13/15	2-Butanone	5.5	mg/L	0.03		NA
MW-16	08/13/15	Acetone	0.1	mg/L	0.06	J	NA
MW-16	08/13/15	Ammonia-Nitrogen	4.8	mg/L	0.5		NA
MW-16	08/13/15	Nitrite Nitrogen	0.20	mg/L	0.015		1
MW-16	08/13/15	pH	6.5	Std. Units	0.01		NA
MW-16	08/13/15	Total Alkalinity to pH 4.5	2,090	mg/L as CaCO3	0.7		NA
MW-17	08/11/15	Nitrate Nitrogen	3.2	mg/L	0.04		10
MW-18	08/11/15	Arsenic	**0.0134**	mg/L	0.007	J	0.01
MW-18	08/11/15	Nitrate Nitrogen	2.9	mg/L	0.04		10
MW-19	08/13/15	1,2,3-Trichloropropane	**0.023**	mg/L	0.00025		0.00001
MW-19	08/13/15	1,2-Dichloroethane	0.0009	mg/L	0.0005	J	NA
MW-19	08/13/15	1,2-Dichloropropane	**0.23**	mg/L	0.0005		0.005
MW-19	08/13/15	Arsenic	**0.0272**	mg/L	0.007		0.01
MW-19	08/13/15	Chloride	111	mg/L	5		NA
MW-19	08/13/15	Iron	4.43	mg/L	0.0333		11.2
MW-19	08/13/15	Nitrate Nitrogen	**26.4**	mg/L	0.4		10
MW-19	08/13/15	Nitrite Nitrogen	0.72	mg/L	0.015		1
MW-19	08/13/15	pH	7.9	Std. Units	0.01		NA
MW-19	08/13/15	Sulfate	127	mg/L	7.5		NA
MW-19	08/13/15	Total Alkalinity to pH 4.5	260	mg/L as CaCO3	0.7		NA
MW-20	08/13/15	Arsenic	**0.0150**	mg/L	0.007	J	0.01
MW-20	08/13/15	Nitrate Nitrogen	3.7	mg/L	0.04		10

Notes:
*Results in **bold** exceed Cleanup Levels (CULs).
**MDLs for 1,2,3-trichloropropane elevated in samples with detections. Non-detect samples achieved MDL of 0.0000005 mg/L.
J = estimated value (the result is ≥ the MDL and < the LOQ)
P = Concentration difference between the primary and confirmation column >40%. The lower result is reported.
LOQ = limit of quantitation
MDL = method detection limit
mg/L = milligrams per liter
mg/L as CaCO3 = milligrams per liter as calcium carbonate
NA = not applicable; no CUL designated
2,4,5-T = 2,4,5-Trichlorophenoxyacetic acid
2,4-D = 2,4-Dichlorophenoxyacetic acid
2,4-DB = 4-(2,4-Dichlorophenoxy)butyric acid

Table 3
Groundwater Cleanup Levels
Bee-Jay Scales Site
Sunnyside, Washington

Analyte	Groundwater Cleanup Level (mg/L)	Source
1,2,3-Trichloropropane	0.00001	Modified MTCA Method B
1,2,4-Trimethylbenzene	0.4	Modified MTCA Method B
1,2-Dichloropropane	0.005	Primary MCL
1,3,5-Trimethylbenzene	0.4	Modified MTCA Method B
2-Methylnaphthalene	0.032	Modified MTCA Method B
2,4,5-T	0.16	Modified MTCA Method B
2,4,5-TP	0.05	Primary MCL
2,4-D	0.07	Primary MCL
2,4-DB	0.128	Modified MTCA Method B
Arsenic	0.01	Primary MCL
Benzene	0.005	Primary MCL
Chlorobenzene	0.1	Primary MCL
Dicamba	0.48	Modified MTCA Method B
Dinoseb	0.007	Primary MCL
Ethylbenzene	0.7	Primary MCL
Iron	11.2	Modified MTCA Method B
Manganese	2.2	Standard MTCA Method B
Naphthalene	0.16	Modified MTCA Method B
Nitrate Nitrogen	10	Primary MCL
Nitrite Nitrogen	1	Primary MCL
Pentachlorophenol	0.001	Primary MCL
Toluene	1	Primary MCL
TPH-Gx	0.8	Standard MTCA Method A
Xylenes	10	Primary MCL

Notes:
2,4,5-T = 2,4,5-Trichlorophenoxyacetic acid
2,4,5-TP = 2(2,4,5-Trichlorophenoxy)propionic acid
2,4-D = 2,4-Dichlorophenoxyacetic acid
2,4-DB = 4-(2,4-Dichlorophenoxy)butyric acid
TPH-Gx = Total petroleum hydrocarbons in the gasoline range
mg/L = milligrams per liter
MCL = Maximum Contaminant Level
MTCA = Model Toxics Control Act
Bold analytes are indicator hazardous substances (IHSs).

Table 4
Summary of Groundwater Remedy Applicable or Relevant and Appropriate Requirements
Bee-Jay Scales Site
Sunnyside, Washington

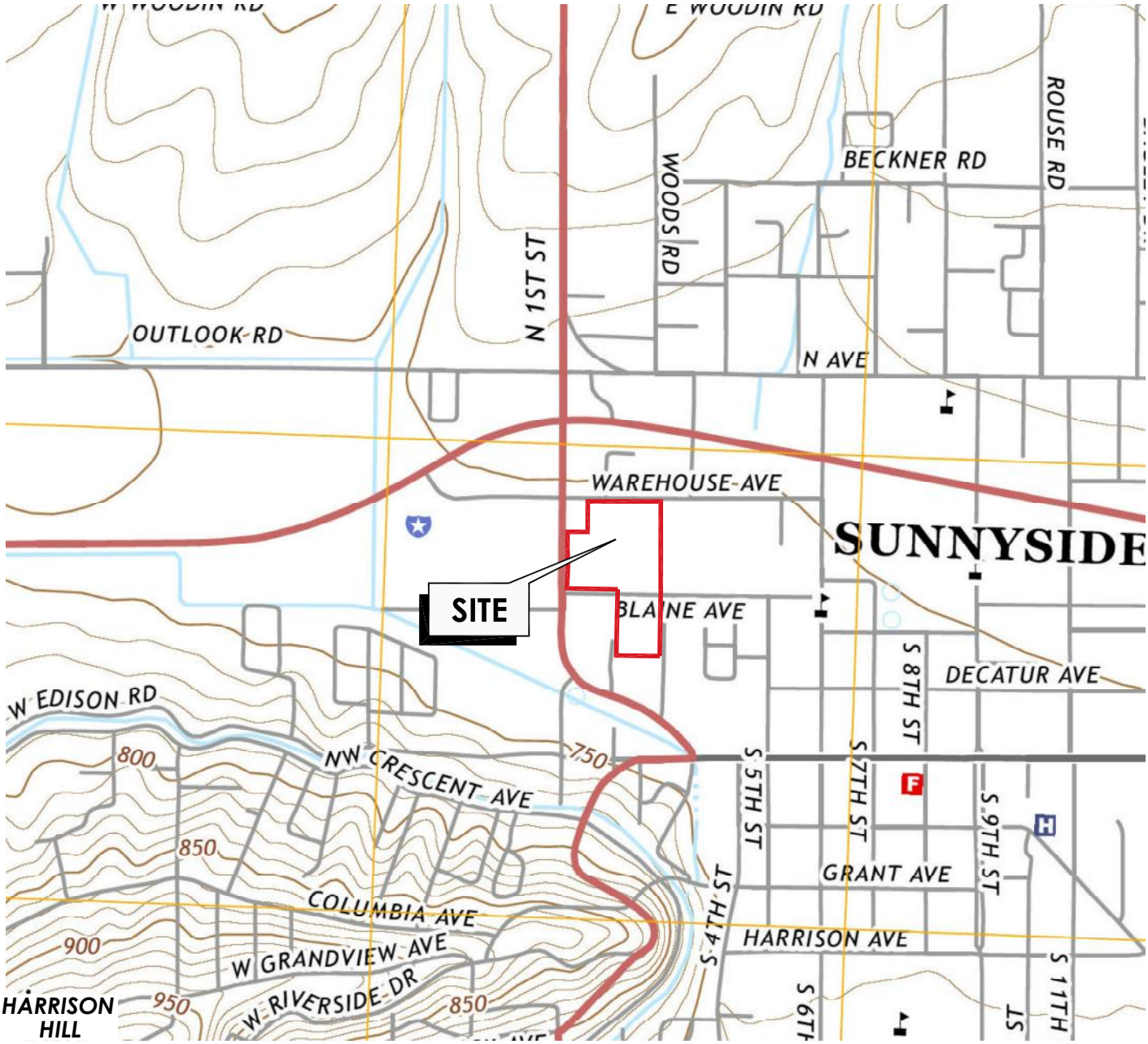
REGULATION	CODE	TYPE	SUMMARY	ADMINISTERING AGENCY	ANALYSIS
PUBLIC WATER SUPPLY STATUTES AND REGULATIONS					
Safe Drinking Water Act	40 CFR 141.11-141.16	Chemical Specific	MCLs are enforceable maximum permissible levels of a contaminant that is delivered to any user of a public water system. Applicable MCLs are based on MCLGs, best available technology, best treatment techniques, and cost.	USEPA Office of Water	Relevant and appropriate. Groundwater cleanup level of 10 mg/L based on this ARAR.
Washington MTCA Groundwater Cleanup Standards	WAC 173-340-720	Chemical Specific	Establishes standards for groundwater covered under MTCA. MTCA standards are applicable at sites where hazardous substances have been found.	Washington Department of Ecology	Applicable.
Washington Underground Injection Control Program	WAC 173-218	Action Specific	An example of Class V injection wells that are allowed in Washington are those used for remediation wells receiving fluids intended to cleanup, treat, or prevent subsurface contamination. The wells must be registered and rule authorized (WAC 173-218-070)	Washington Department of Ecology	Applicable for enhanced in-situ bioremediation.
COMPLIANCE MONITORING STATUTES AND REGULATIONS					
Washington MTCA Compliance Monitoring Requirements	WAC 173-340-410	Action Specific	Compliance monitoring includes protection monitoring (to confirm protection of human health and the environment during cleanup), performance monitoring (to confirm cleanup has attained cleanup standards), and confirmational monitoring (to confirm long-term effectiveness of the cleanup)	Washington Department of Ecology	Applicable. Remedial alternatives must be able to incorporate these types of compliance monitoring.
INSTITUTIONAL CONTROLS STATUTES AND REGULATIONS					
Washington MTCA Institutional Controls Regulation	WAC 173-340-440	Action Specific	Provides guidance on institutional controls used to prohibit activities that may interfere with the integrity of an interim action or cleanup action or that may result in exposure to hazardous substances at a site.	Washington Department of Ecology	Applicable for remedial alternatives that utilize institutional controls.
WORKER SAFETY STATUTES AND REGULATIONS					
Occupational Safety and Health Act	29 CFR 1910	Action Specific	Establishes general safety procedures and general construction safety standards applicable to workers during cleanup actions.	OSHA	Applicable.
Washington Industrial Safety and Health Act	WAC 296, Chapters 06-17A, 24, 62-63, 155, 200A, 800-809, 817, 839-843, 863, 874, 876 and WAC 173-340-810	Action Specific	Establishes safety and health rules that apply to most workplaces and workers in the State of Washington.	Washington Department of Labor and Industries	Applicable.
OVERALL ENVIRONMENT STATUTES AND REGULATIONS					
State Environmental Policy Act	43.21C RCW	Action Specific	Enacted in 1971, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. A SEPA checklist must be prepared with any new proposal to provide information to help the agency identify environmental impacts from the proposal, and to help the agency decide whether and EIS is required.	Washington Department of Ecology	Applicable.

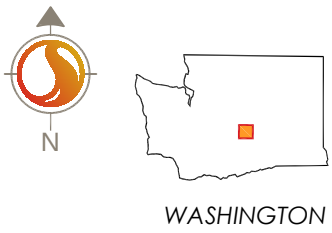
Notes:
CFR = Code of Federal Regulations
EIS = Environmental Impact Statement
MCLs = Maximum Contaminant Levels
MCLGs = Maximum Contaminant Level Goals
mg/L = milligrams per liter
MTCA = Model Toxics Control Act
OSHA = Occupational Safety and Health Administration
RCW = Revised Code of Washington
SEPA = State Environmental Policy Act
USEPA = United States Environmental Protection Agency
WAC = Washington Administrative Code

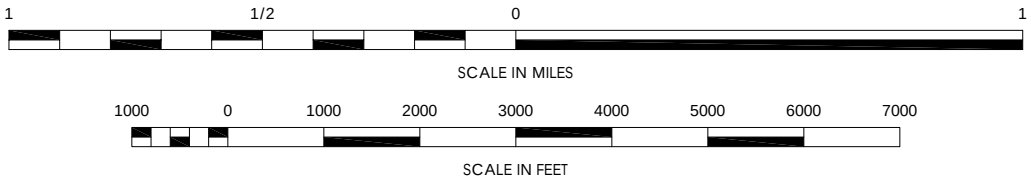
Table 5
Mann-Kendall Evaluation Results
Bee-Jay Scales Site, Sunnyside, Washington

Analyte	Location	Mann-Kendall Statistic (S)	Confidence Factor	Coefficient of Variation	Concentration Trend
Nitrate	MW-3	-46	79.90%	0.53	Stable
	MW-4(R)	-136	99.90%	0.25	Decreasing
	MW-5(R)	-202	>99.9%	0.7	Decreasing
	MW-6	-42	77.70%	0.75	Stable
	MW-8	-327	>99.9%	0.96	Decreasing
	MW-9	-123	98.60%	0.35	Decreasing
	MW-12(R)	-178	>99.9%	0.33	Decreasing
	MW-13	-182	>99.9%	0.51	Decreasing
	MW-16	-7	86.40%	0.41	Stable
	MW-19	5	71.90%	0.57	No Trend
Nitrite	MW-3	-69	89.80%	0.99	Stable
	MW-5(R)	35	75.90%	3.55	No Trend
1,2-Dichloropropane	MW-4(R)	-243	>99.9%	0.73	Decreasing
	MW-9	-98	96.60%	0.84	Decreasing
	MW-12(R)	64	89.20%	0.62	No Trend
	MW-16	-13	96.50%	0.46	Decreasing
	MW-19	9	88.10%	0.49	No Trend
2,4-D	MW-12(R)	-42	77.70%	1.17	No Trend
Arsenic	MW-3	-309	>99.9%	0.51	Decreasing
	MW-6	141	98.60%	0.15	Increasing
	MW-10	-53	82.20%	0.17	Stable
	MW-11	49	80.20%	0.1	No Trend
	MW-12(R)	122	98.90%	0.17	Increasing
	MW-15	9	88.10%	0.17	No Trend
	MW-18	2	55.70%	0.22	No Trend
	MW-19	3	61.40%	1.05	No Trend
	MW-20	0	37.90%	0.2	Stable
Benzene	MW-12(R)	96	97.00%	0.62	Increasing
Chlorobenzene	MW-12(R)	224	>99.9%	0.53	Increasing
Dinoseb	MW-4(R)	48	89.10%	0.69	No Trend
	MW-9	243	>99.9%	0.89	Increasing
	MW-12(R)	71	91.60%	0.55	Probably Increasing
	MW-13	103	99.90%	0.91	Increasing
	MW-16	-8	84.50%	0.31	Stable
Iron	MW-19	-25	97.00%	1.94	Decreasing

FIGURES







REFERENCE: USGS 7.5 MINUTE QUADRANGLE; SUNNYSIDE, WASHINGTON; 2013

Stantec
2321 Club Meridian Drive, Suite E
Okemos, MI 48864
PHONE: (517)349-9499 FAX: (517)349-6863

FOR:			FIGURE:
BEE-JAY SCALES SITE SUNNYSIDE, WASHINGTON		SITE LOCATION MAP	1

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213202156/213202157	JRO	MRK/EJB	ASM	08/18/16

FILEPATH:V:\2132\active\213202156\05_report_deliv\dwgs_design\cad_figures\dwg_213202156_gwr_2016.dwg | jopalekopsahl | Nov 15, 2016 at 12:46 | Layout: fig1_slm

WAREHOUSE AVENUE

N. 1ST STREET

S. 3RD STREET

BLAINE AVENUE

#22503

CARPORT

#22496

BLDG.

MW-7

MW-1

AREA 5- NORTH AREA

#22014

AREA 4 - SUSPECTED HISTORIC WASHDOWN AREA

BLDG.

AREA 2 - DRY FERTILIZER AREA

MW-8

AREA 1 - LIQUID FERTILIZER PLANT AND TRUCK WASH AREA

#22015

AREA 6- HICKENBOTTOM PROPERTY

#22016

BUILDING

MW-3

MW-10

AREA 3 - DRUM STORAGE AREA

FORMER FERTILIZER BUILDING

FORMER LAGOON

MW-11

MW-6

MW-5

MW-5R

MW-4

MW-4R

MW-12

MW-12R

CENTER OF NORTH RAIL FOR RAILROAD SIDE TRACK

MW-15

#22902

MW-9

#22903

MW-14

BUILDING

#22555

MW-16

BUILDING

MW-17

#22502

MW-13

MW-18

#23447

#23443

#23902

BUILDING

#23901

BUILDING

#23441

#23416

#23417

#23903

#23440

#23418

#23419

#23439

#23442

MW-19

#23438

#23420

MW-20

#23446

#23437

#23421

#23444

#23436

#23422

#23423

N

0 80 160

APPROXIMATE SCALE IN FEET

LEGEND

- PARCEL BOUNDARY (APPROXIMATE)
- #22503 PARCEL ID NUMBER
- #22014 SITE PARCEL ID NUMBER
- BUILDING
- BUILDING OVERHANG
- CHAIN LINK FENCE
- RAILROAD
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL
- SITE GROUNDWATER PLUME EXTENT (EXCLUDING ARSENIC)

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FOR: BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON

SITE PLAN

FIGURE: 2

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213202156/213202157	JRO	MRK/EJB	ASM	08/18/16

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WAREHOUSE AVENUE

N. 1ST STREET

S. 3RD STREET

BLAINE AVENUE

#22503

#22496
BLDG.

CARPORT

#22014

#22015

#22016

BUILDING

#22902

#22903

#22555

#22502

#23447

#23443

#23902
BUILDING

#23901
BUILDING

#23441

#23416

#23417

#23440

#23418

#23419

#23439

#23442

#23438

#23420

#23437

#23421

#23436

#23422

#23423

AREA 1 - LIQUID FERTILIZER PLANT AND TRUCK WASH AREA

AREA 2 - DRY FERTILIZER AREA

AREA 3 - DRUM STORAGE AREA

AREA 4 - SUSPECTED HISTORIC WASHDOWN AREA

AREA 5- NORTH AREA

AREA 6- HICKENBOTTOM PROPERTY

FORMER FERTILIZER BUILDING

FORMER LAGOON

CENTER OF NORTH RAIL FOR RAILROAD SIDE TRACK

MW-1 (734.01)
MW-3 (733.60)
MW-4R (733.43)
MW-5 (DECOMMISSIONED)
MW-5R (733.82)
MW-6 (734.91)
MW-7 (733.75)
MW-8 (734.23)
MW-9 (732.69)
MW-10 (735.80)
MW-11 (736.05)
MW-12R (732.90)
MW-13 (732.43)
MW-14 (733.38)
MW-15 (731.00)
MW-16 (731.96)
MW-17 (730.89)
MW-18 (727.67)
MW-19 (730.90)
MW-20 (727.71)

734.00
735.00
736.00
733.00
732.00
731.00
730.00
729.00
728.00

LEGEND

- PARCEL BOUNDARY (APPROXIMATE)
- #22503 — PARCEL ID NUMBER
- #22014 — SITE PARCEL ID NUMBER
- BUILDING
- BUILDING OVERHANG
- CHAIN LINK FENCE
- RAILROAD
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL
- INFERRED GROUNDWATER FLOW DIRECTION
- (734.01) — GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL); DASHED WHERE INFERRED

N

0 80 160

APPROXIMATE SCALE IN FEET

NOTES

GROUNDWATER ELEVATION DATA WERE COLLECTED ON AUGUST 11, 2015.

GROUNDWATER CONTOURS WERE CREATED USING SURFER VERSION 11.6

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Okemos, MI 48864
PHONE: (517)349-9499 FAX: (517)349-6863

FOR: BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON

GROUNDWATER ELEVATION CONTOUR MAP - SECOND HALF 2015

FIGURE: 3

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213202156/213202157	JRO	MRK/EJB	ASM	08/18/16

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WAREHOUSE AVENUE

	2Q14	2H14	1H15	2H15
NO3	3.4*	3.5*	3.4*	3.3*

MW-7

	2Q14	2H14	1H15	2H15
NO3	5.1*	5.2*	5.3*	5.2*

MW-1

#22503

CARPORT

AREA 5- NORTH AREA

	2Q14	2H14	1H15	2H15
NH3	57.7**	76.7**	79.0**	114**
As	0.0272	0.0567	0.0351	0.0486
NO3	10.4	39.7	17.9	37.3
NO2	ND	0.9*	ND	1.1

#22014

#22015

#22496

BLDG.

AREA 4 - SUSPECTED HISTORIC WASHDOWN AREA

	2Q14	2H14	1H15	2H15
NO3	89.3	96.0	83.6	77.2
SO4	163**	145**	157**	96.3**

MW-8

AREA 6- HICKENBOTTOM PROPERTY

#22016

BLDG.

	2Q14	2H14	1H15	2H15
As	0.0207	0.0307	0.0199J	0.0189J
NO3	3.1*	3.4*	3.2*	3.7*

AREA 1 - LIQUID FERTILIZER PLANT AND TRUCK WASH AREA

	1H15	2H15
NH3	107**	73.4**
NO3	284	208
NO2	3.9	6.9
SO4	392**	221**

MW-3

	1H15	2H15
2,4-D	ND	0.16
NH3	302**	251**
As	0.0299	0.0608
BNZ	0.006	0.011
CB	0.16	0.21
DCP	0.55	1.1
Dnsb	0.73	2.9
NO3	279	333
SO4	285**	373**
TCP	0.029	0.09

BUILDING

N. 1ST STREET

MW-10

AREA 3 - DRUM STORAGE AREA

FORMER FERTILIZER BUILDING

	1H15	2H15
NH3	577**	544**
DCP	0.029	0.019
Dnsb	0.13	0.47
NO3	612	535
NO2	0.031J*	ND
SO4	168**	169**
TCP	0.009	0.016

FORMER LAGOON

MW-5

MW-5R

MW-4R

MW-12

MW-12R

MW-11

MW-6

	2Q14	2H14	1H15	2H15
As	0.0524	0.0543	0.0437	0.0419
NO3	5.5*	5.4*	5.3*	5.5*

	2Q14	2H14	1H15	2H15
As	0.0222	0.0272	0.0236	0.0243
NO3	6.8*	4.2*	10.4	4.1*

CENTER OF NORTH RAIL FOR RAILROAD SIDE TRACK

MW-15

	2Q14	2H14	1H15	2H15
NH3	ND	ND	ND	0.34**
As	0.0142J	0.0188J	0.0177J	0.0141J
NO3	3.5*	3.6*	3.4*	3.3*

MW-9

	2Q14	2H14	1H15	2H15
As	0.0085J*	0.0113J	0.0083J*	ND
NO3	1.8*	1.8*	3.3*	1.7*

#22903

MW-14

	2Q14	2H14	1H15	2H15
NH3	249**	501**	222**	214**
DCP	0.028	0.036	0.02	0.043
Dnsb	0.8	0.79	0.33	0.67
NO3	348	486	262	344
SO4	171**	177**	127**	169**
TCP	0.012	0.016	0.0068	0.012

MW-17

	2Q14	2H14	1H15	2H15
NO3	3.3*	3.2*	3.4*	3.2*

BUILDING

#22555

MW-16

	2Q14	2H14	1H15	2H15
NH3	0.070J**	0.34**	ND	4.8**
DCP	0.34	0.27	0.26	0.23
Dnsb	0.089	0.066	0.035	ND
NO3	241	282	207	ND
SO4	347**	353**	506**	ND
TCP	0.093	0.078	0.071	0.025

BUILDING

#22502

	2Q14	2H14	1H15	2H15
As	0.0196J	0.0236	0.0234	0.0134J
NO3	3.0*	3.0*	3.0*	2.9*

MW-13

MW-18

	2Q14	2H14	1H15	2H15
Dnsb	0.0078	0.012	0.0081	0.0067*
NO3	40.0	44.8	45.0	46.1
SO4	138**	128**	122**	147**

#23447

#23443

#23902

BUILDING

#23903

#23441

	2Q14	2H14	1H15	2H15
NH3	0.22**	0.29**	0.050J**	ND
As	0.0500	0.0161J	0.0457	0.0272
Cl	76.7**	284**	175**	111**
DCP	0.14	0.22	0.15	0.23
Fe	14.0	0.922*	21.8	4.43*
NO3	7.0*	14.3	18.5	26.4
NO2	0.13*	2.5	ND	0.72*
SO4	56.6**	107**	99.4**	127**
TCP	0.01	0.018	0.015	0.023

#23416

#23417

	2Q14	2H14	1H15	2H15
As	0.0160J	0.0197J	0.0150J	0.0150J
NO3	3.7*	3.4*	3.7*	3.7*

S. 3RD STREET

#23418

#23419

MW-20

MW-19

#23420

#23421

LEGEND

- PARCEL BOUNDARY (APPROXIMATE)
- #22503 PARCEL ID NUMBER
- #22014 SITE PARCEL ID NUMBER
- BUILDING
- BUILDING OVERHANG
- CHAIN LINK FENCE
- RAILROAD
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL

	2Q14	2H14	1H15	2H15
NO3	40.0	44.8	45.0	46.1

EVENT DATES

CONSTITUENT AND DETECTED GROUNDWATER CONCENTRATIONS

NOTES

ALL CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/L)

*DETECTED, BUT BELOW THE CLEANUP LEVEL

**NO CLEANUP LEVELS ARE ESTABLISHED FOR AMMONIA, CHLORIDE, AND SULFATE. ALL DETECTED CONCENTRATIONS ARE SHOWN.

ND = NOT DETECTED

J = ESTIMATED VALUE

CLEANUP LEVELS IN PARENTHESES BELOW:

2,4-D: 2,4-DICHLOROPHENOXYACETIC ACID (0.07 mg/L)
NH3: AMMONIA-N (NONE)
As: ARSENIC (0.01 mg/L)
BNZ: BENZENE (0.005 mg/L)
Cl: CHLORIDE (NONE)
CB: CHLOROBENZENE (0.1 mg/L)
DCP: 1,2-DICHLOROPROPANE (0.005 mg/L)
Dnsb: DINOSEB (0.007 mg/L)
Fe: IRON (11.2 mg/L)
NO3: NITRATE-N (10 mg/L)
NO2: NITRITE-N (1 mg/L)
SO4: SULFATE (NONE)
TCP: 1,2,3-TRICHLOROPROPANE (0.00001 mg/L)

N

0 80 160

APPROXIMATE SCALE IN FEET

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2321 Club Meridian Drive, Suite E
Okemos, MI 48864
PHONE: (517)349-9499 FAX: (517)349-6863

FOR: BEE-JAY SCALES SITE SUNNYSIDE, WASHINGTON

DETECTED GROUNDWATER CONCENTRATIONS ABOVE CLEANUP LEVELS - SECOND HALF 2015

FIGURE: 4

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213202156/213202157	JRO	MRK/EJB	ASM	08/18/16

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WAREHOUSE AVENUE

N. 1ST STREET

MW-7 (3.3)

MW-1 (5.2)

AREA 5- NORTH AREA

#22503

CARPORT

#22014

#22015

#22496

BLDG.

AREA 4 - SUSPECTED HISTORIC WASHDOWN AREA

AREA 6- HICKENBOTTOM PROPERTY

#22016

BLDG.

MW-8 (77.2)

AREA 1 - LIQUID FERTILIZER PLANT AND TRUCK WASH AREA

10

100

BUILDING

AREA 2 - DRY FERTILIZER AREA

MW-3 (37.3)

MW-10 (3.7)

AREA 3 - DRUM STORAGE AREA

FORMER FERTILIZER BUILDING

FORMER LAGOON

MW-5

MW-11 (5.5)

MW-6 (4.1)

(208) MW-5R

(535) MW-4R

MW-4

MW-12

(333) MW-12R

CENTER OF NORTH RAIL FOR RAILROAD SIDE TRACK

MW-15 (3.3)

#22902

MW-9 (344)

#22903

MW-14 (1.7)

MW-17 (3.2)

BUILDING

#22555

MW-16 (<0.04)*

BUILDING

100

#22502

BLAINE AVENUE

MW-13 (46.1)

MW-18 (2.9)

#23447

#23443

#23902

BUILDING

#23901

BUILDING

#23441

#23416

#23417

#23440

#23418

#23419

#23439

#23442

MW-19 (26.4)

10

#23438

#23420

#23437

#23421

#23436

#23903

S. 3RD STREET

MW-20 (3.7)

N

0 80 160

APPROXIMATE SCALE IN FEET

LEGEND

- PARCEL BOUNDARY (APPROXIMATE)
- #22503 PARCEL ID NUMBER
- #22014 SITE PARCEL ID NUMBER
- BUILDING
- BUILDING OVERHANG
- CHAIN LINK FENCE
- RAILROAD
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL
- INFERRED GROUNDWATER FLOW DIRECTION (2H15)
- (5.2) NITRATE CONCENTRATION (2H15)
- * THE NON-DETECT NITRATE CONCENTRATION IN WELL MW-16 WAS ANOMALOUS; THEREFORE THIS WELL WAS INCLUDED WITHIN THE 100 mg/L CONTOUR BASED ON HISTORICAL DATA. THE PLUME CONFIGURATION AROUND WELL MW-16 WILL BE FURTHER EVALUATED DURING THE NEXT SAMPLING EVENT.
- CONTOURS FOR SITE-SPECIFIC NITRATE PLUME; DASHED WHERE INFERRED

NOTE

ALL CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/L)

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FOR: BEE-JAY SCALES SITE SUNNYSIDE, WASHINGTON

NITRATE ISOCONCENTRATION MAP - SECOND HALF 2015

FIGURE: 5

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
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WAREHOUSE AVENUE

N. 1ST STREET

S. 3RD STREET

BLAINE AVENUE

#22503

CARPORT

#22496

BLDG.

MW-7 (NA)

MW-1 (NA)

AREA 5- NORTH AREA

#22014

#22015

AREA 6- HICKENBOTTOM PROPERTY

#22016

AREA 4 - SUSPECTED HISTORIC WASHDOWN AREA

BLDG.

MW-8 (NA)

AREA 1 - LIQUID FERTILIZER PLANT AND TRUCK WASH AREA

AREA 2 - DRY FERTILIZER AREA

BUILDING

MW-3 (NA)

MW-10 (NA)

AREA 3 - DRUM STORAGE AREA

FORMER FERTILIZER BUILDING

FORMER LAGOON

0.005

0.05

0.50

(0.019)

(1.1)

MW-5

MW-5R (NA)

MW-11 (NA)

MW-6 (NA)

MW-4

MW-4R

MW-12

MW-12R

CENTER OF NORTH RAIL FOR RAILROAD SIDE TRACK

MW-15 (NA)

#22902

MW-9 (0.043)

#22903

MW-14 (NA)

BUILDING

MW-17 (NA)

0.05

#22555

MW-16 (0.23)

BUILDING

#22502

MW-13 (NA)

MW-18 (NA)

#23447

#23443

#23902

BUILDING

#23901

BUILDING

#23441

#23416

#23417

#23440

#23418

#23903

#23439

#23419

MW-20 (NA)

#23442

MW-19 (0.23)

#23438

#23420

#23437

#23421

#23436

N

0 80 160

APPROXIMATE SCALE IN FEET

LEGEND

- PARCEL BOUNDARY (APPROXIMATE)
- #22503 PARCEL ID NUMBER
- #22014 SITE PARCEL ID NUMBER
- BUILDING
- BUILDING OVERHANG
- CHAIN LINK FENCE
- RAILROAD
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL
- INFERRED GROUNDWATER FLOW DIRECTION (2H15)
- (0.019) 1,2-DICHLOROPROPANE CONCENTRATION (2H15)
- (NA) NOT ANALYZED
- CONTOURS FOR SITE-SPECIFIC 1,2-DICHLOROPROPANE PLUME; DASHED WHERE INFERRED

NOTE

ALL CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/L)

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Okemos, MI 48864
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FOR: BEE-JAY SCALES SITE SUNNYSIDE, WASHINGTON

1,2-DICHLOROPROPANE ISOCONCENTRATION MAP - SECOND HALF 2015

FIGURE: 6

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213202156/213202157	JRO	MRK/EJB	ASM	08/18/16

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WAREHOUSE AVENUE

N. 1ST STREET

BLAINE AVENUE

S. 3RD STREET

#22503

CARPORT

#22496

BLDG.

MW-7
(NA)

MW-1
(NA)

AREA 5-
NORTH AREA

#22014

#22015

AREA 6-
HICKENBOTTOM
PROPERTY

#22016

BUILDING

AREA 4 - SUSPECTED
HISTORIC
WASHDOWN AREA

BLDG.

MW-8
(NA)

AREA 1 - LIQUID
FERTILIZER PLANT AND
TRUCK WASH AREA

AREA 2 - DRY
FERTILIZER AREA

MW-3
(NA)

FORMER
LAGOON

MW-10
(NA)

AREA 3 - DRUM
STORAGE AREA

FORMER FERTILIZER BUILDING

MW-5

(NA)
MW-11

MW-6
(NA)

MW-5R
(NA)

(0.47)
MW-4R

MW-12

(2.9)
MW-12R

CENTER OF NORTH RAIL
FOR RAILROAD SIDE TRACK

MW-15
(NA)

#22902

0.70

0.07

0.007

MW-9
(0.67)

#22903

MW-14
(NA)

BUILDING

MW-17
(NA)

#22555

MW-16
(ND)*

BUILDING

#22502

MW-13
(0.0067)**

MW-18
(NA)

#23447

#23443

#23902

BUILDING

#23901

BUILDING

#23441

#23416

#23417

#23440

#23418

#23419

#23439

#23442

MW-19
(NA)

#23438

#23420

#23437

#23421

#23436

MW-20
(NA)

N

0 80 160

APPROXIMATE SCALE IN FEET

LEGEND

- PARCEL BOUNDARY (APPROXIMATE)
- #22503 PARCEL ID NUMBER
- #22014 SITE PARCEL ID NUMBER
- BUILDING
- BUILDING OVERHANG
- CHAIN LINK FENCE
- RAILROAD
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL
- INFERRED GROUNDWATER FLOW DIRECTION (2H15)
- (0.47) DINOSEB CONCENTRATION (2H15)
- (NA) NOT ANALYZED
- (ND) NOT DETECTED
- * THE NON-DETECT DINOSEB CONCENTRATION IN WELL MW-16 WAS ANOMALOUS; THEREFORE THIS WELL WAS INCLUDED WITHIN THE 0.007 MG/L CONTOUR BASED ON HISTORICAL DATA. THE PLUME CONFIGURATION AROUND WELL MW-16 WILL BE FURTHER EVALUATED DURING THE NEXT SAMPLING EVENT.
- ** DETECTED, BUT BELOW CLEANUP LEVEL.
- CONTOURS FOR SITE-SPECIFIC DINOSEB PLUME; DASHED WHERE INFERRED

NOTE

ALL CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/L)

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Okemos, MI 48864
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FOR: BEE-JAY SCALES SITE
SUNNYSIDE, WASHINGTON

DINOSEB ISOCONCENTRATION MAP - SECOND HALF 2015

FIGURE: 7

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213202156/213202157	JRO	MRK/EJB	ASM	08/18/16

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WAREHOUSE AVENUE

N. 1ST STREET

MW-7 (3.3)

MW-1 (5.2)

AREA 5- NORTH AREA

#22503

CARPORT

#22014

#22015

#22496 BLDG.

AREA 4 - SUSPECTED HISTORIC WASHDOWN AREA

AREA 6- HICKENBOTTOM PROPERTY

#22016

BLDG.

MW-8 (77.2)

AREA 1 - LIQUID FERTILIZER PLANT AND TRUCK WASH AREA

10

100

BUILDING

AREA 2 - DRY FERTILIZER AREA

MW-3 (37.3)

MW-10 (3.7)

AREA 3 - DRUM STORAGE AREA

FORMER FERTILIZER BUILDING

FORMER LAGOON

MW-5

MW-11 (5.5)

MW-6 (4.1)

(208) MW-5R

(535) MW-4R

MW-4

MW-12

(333) MW-12R

CENTER OF NORTH RAIL FOR RAILROAD SIDE TRACK

MW-15 (3.3)

#22902

MW-9 (344)

#22903

MW-14 (1.7)

MW-17 (3.2)

BUILDING

#22555

MW-16 (<0.04)*

BUILDING

100

#22502

BLAINE AVENUE

MW-13 (46.1)

MW-18 (2.9)

#23447

#23443

#23902 BUILDING

#23901 BUILDING

#23441

#23416

#23417

#23440

#23418

#23419

#23439

#23442

MW-19 (26.4)

10

#23438

#23420

#23437

#23421

#23436

S. 3RD STREET

MW-20 (3.7)

N

0 80 160

APPROXIMATE SCALE IN FEET

LEGEND

- PARCEL BOUNDARY (APPROXIMATE)
- #22503 PARCEL ID NUMBER
- #22014 SITE PARCEL ID NUMBER
- BUILDING
- BUILDING OVERHANG
- CHAIN LINK FENCE
- RAILROAD
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL
- INFERRED GROUNDWATER FLOW DIRECTION (2H15)
- (5.2) NITRATE CONCENTRATION (2H15)
- * THE NON-DETECT NITRATE CONCENTRATION IN WELL MW-16 WAS ANOMALOUS; THEREFORE THIS WELL WAS INCLUDED WITHIN THE 100 MG/L CONTOUR BASED ON HISTORICAL DATA. THE PLUME CONFIGURATION AROUND WELL MW-16 WILL BE FURTHER EVALUATED DURING THE NEXT SAMPLING EVENT.
- CONTOURS FOR SITE-SPECIFIC NITRATE PLUME; DASHED WHERE INFERRED
- PROPOSED LOCATION OF ENHANCED IN-SITU BIOREMEDIATION (EISB) INJECTION WELL LINE

NOTE

ALL CONCENTRATIONS IN MILLIGRAMS PER LITER (mg/L)

Stantec
2321 Club Meridian Drive, Suite E
Okemos, MI 48864
PHONE: (517)349-9499 FAX: (517)349-6863

FOR: BEE-JAY SCALES SITE SUNNYSIDE, WASHINGTON

PROPOSED INJECTION WELL LINE LOCATIONS

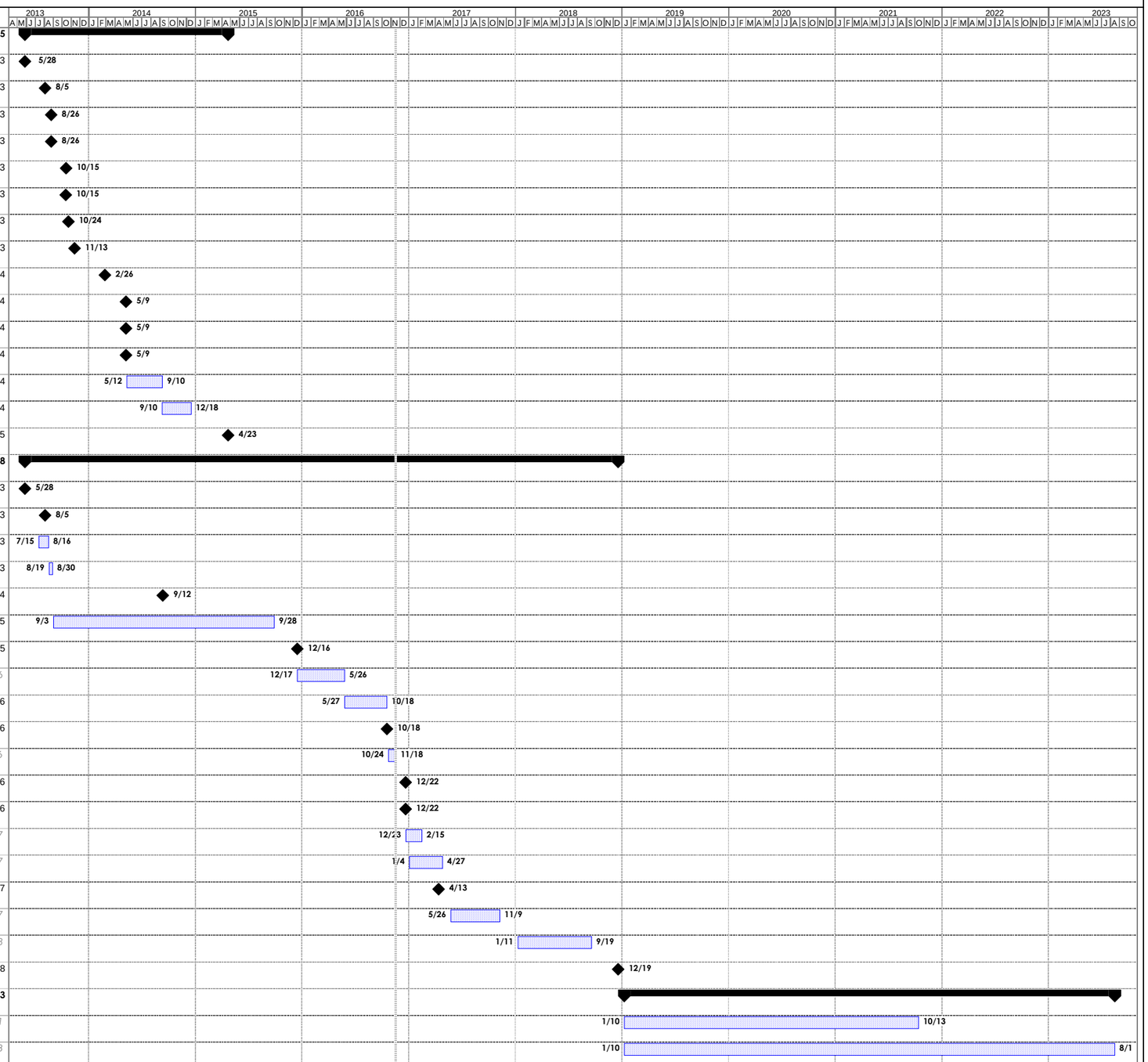
FIGURE: 8

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
213202156/213202157	JRO	MRK/EJB	ASM	08/18/16

FILEPATH:V:\2132\active\213202156\05_report_deliv\dwgs_design\cad_figures\dwg_213202156_gwr_2016.dwg | jopalekopsahl | Nov 15, 2016 at 13:36 | Layout: fig8_propInj

Figure 9: Proposed Revised Implementation Schedule
Bee-Jay Scales Site

ID	Task Name	Duration	Start	Finish
1	**Shallow Soil Excavation Implementation Schedule**	**479 days**	**Tue 5/28/13**	**Thu 4/23/15**
2	Consent Decree Signed	0 days	Tue 5/28/13	Tue 5/28/13
3	Submit Implementation Schedule	0 days	Mon 8/5/13	Mon 8/5/13
4	Submit Draft Shallow Soil Excavation Engineering Design Report	0 days	Mon 8/26/13	Mon 8/26/13
5	Submit Draft Shallow Soil Excavation Construction Plans and Specifications	0 days	Mon 8/26/13	Mon 8/26/13
6	Ecology Review and Approval of Shallow Soil Excavation Engineering Design Report	0 days	Tue 10/15/13	Tue 10/15/13
7	Ecology Review and Approval of Shallow Soil Excavation Construction Plans and Specifications	0 days	Tue 10/15/13	Tue 10/15/13
8	Submit Revised Implementation Schedule	0 days	Thu 10/24/13	Thu 10/24/13
9	Submit Shallow Soil Excavation Compliance Monitoring Plan	0 days	Wed 11/13/13	Wed 11/13/13
10	Submit Request for Extension and Proposed Revised Implementation Schedule	0 days	Wed 2/26/14	Wed 2/26/14
11	Submit Revised Shallow Soil Excavation Construction Plans and Specifications	0 days	Fri 5/9/14	Fri 5/9/14
12	Submit Revised Shallow Soil Excavation Compliance Monitoring Plan	0 days	Fri 5/9/14	Fri 5/9/14
13	Submit Shallow Soil Excavation Health and Safety Plan	0 days	Fri 5/9/14	Fri 5/9/14
14	Planning and Procurement for Shallow Soil Excavation Activities	85 days	Mon 5/12/14	Wed 9/10/14
15	Estimated Duration of Shallow Soil Excavation Activities	70 days	Wed 9/10/14	Thu 12/18/14
16	Submit Shallow Soil Excavation As-built Report	0 days	Thu 4/23/15	Thu 4/23/15
17	**Groundwater Remedy Implementation Schedule**	**1415 days?**	**Tue 5/28/13**	**Wed 12/19/18**
18	Consent Decree Signed	0 days	Tue 5/28/13	Tue 5/28/13
19	Submit Implementation Schedule	0 days	Mon 8/5/13	Mon 8/5/13
20	Obtain Access Agreements for Off-Property Groundwater Investigation	25 days	Mon 7/15/13	Fri 8/16/13
21	Perform Off-Property Groundwater Investigation	10 days	Mon 8/19/13	Fri 8/30/13
22	Submit Revised Implementation Schedule	0 days	Fri 9/12/14	Fri 9/12/14
23	Timeframe for Groundwater Monitoring to Define Nitrate Plume	26 mons	Tue 9/3/13	Mon 9/28/15
24	Submit Draft Groundwater Remedy Engineering Design Report	0 days	Wed 12/16/15	Wed 12/16/15
25	*Ecology Review and Approval of Groundwater Remedy Engineering Design Report*	*5.55 mons*	*Thu 12/17/15*	*Thu 5/26/16*
26	Revise Groundwater Remedy Engineering Design Report based on Ecology Comments	100 days	Fri 5/27/16	Tue 10/18/16
27	Submit Final Groundwater Remedy Engineering Design Report	0 days	Tue 10/18/16	Tue 10/18/16
28	*Ecology Review and Approval of Final Groundwater Remedy Engineering Design Report*	*1 mon?*	*Mon 10/24/16*	*Fri 11/18/16*
29	Submit Draft Groundwater Remedy Construction Plans and Specifications	0 days	Thu 12/22/16	Thu 12/22/16
30	Submit Draft Groundwater Remedy Compliance Monitoring Plan	0 days	Thu 12/22/16	Thu 12/22/16
31	*Ecology Review and Approval of Groundwater Remedy Construction Plans and Specifications*	*36 days?*	*Fri 12/23/16*	*Wed 2/15/17*
32	*Obtain Access Agreements for Groundwater Remedy*	*4 mons?*	*Wed 1/4/17*	*Thu 4/27/17*
33	Submit Groundwater Remedy Health and Safety Plan	0 days	Thu 4/13/17	Thu 4/13/17
34	*Estimated Window for Phase I Groundwater Remedy Implementation - Final Timeframe TBD*	*6 mons?*	*Fri 5/26/17*	*Thu 11/9/17*
35	*Estimated Window for Phase II Groundwater Remedy Implementation - Final Timeframe TBD*	*9 mons?*	*Thu 1/11/18*	*Wed 9/19/18*
36	Submit Groundwater Remedy As-built Report	0 days	Wed 12/19/18	Wed 12/19/18
37	**Long-Term Groundwater Remedy Monitoring Schedule**	**1200 days?**	**Thu 1/10/19**	**Wed 8/16/23**
38	*Estimated Performance of Long-Term Groundwater Monitoring for Groundwater Remedy*	*36 mons?*	*Thu 1/10/19*	*Wed 10/13/21*
39	*Estimated Performance of Long-Term IC Monitoring for Groundwater Remedy*	*60 mons?*	*Thu 1/10/19*	*Wed 8/16/23*



Project: Proposed Revised Implementation Schedule
Date: 10/18/16

Task | Milestone | Rolled Up Task | Rolled Up Progress | External Tasks | Group By Summary
Progress | Summary | Rolled Up Milestone | Split | Project Summary | Deadline

APPENDIX A

Ecology Comments on Groundwater Remedy Engineering Design Report and Arsenic Background Technical Memorandum

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1250 W Alder St • Union Gap, WA 98903-0009 • (509) 575-2490

May 26, 2016

Marisa Kaffenberger, P.E.
Senior Engineer
Stantec Consulting Services, Inc.
2321 Club Meridian Drive, Suite E
Okemos, Michigan 48864

Re: Ecology Comments on *Groundwater Remedy Engineering Design Report* for

Site Name:	Bee Jay Scales
Site Address:	116 N 1st Street, Sunnyside
Facility/Site ID No.:	504
Cleanup Site ID No.:	3641

Dear Ms. Kaffenberger,

The Washington State Department of Ecology (Ecology) has reviewed the *Groundwater Remedy Engineering Design Report* that was submitted for the Bee Jay Scales Site on December 16, 2015, and has the following comments:

General
The Model Toxic Control Act (MTCA) defines a "Site" as "...any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publically owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, vessel, or aircraft; or any site or area where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located." The Bee Jay Scales **Site** includes all soils and groundwater that have been impacted by operations on the Bee Jay Scales *property*, and is not bounded by the railroad tracks or defined by property boundaries. There are numerous instances throughout the *Groundwater Remedy Engineering Design Report* where the terms Site and Property are used interchangeably, implying that any off-property contamination is not within the Site. Please reconcile all, to accurately reflect the MTCA definition.

Determination of background Arsenic concentrations in groundwater
According to WAC 173-340-709, for purposes of defining background concentrations, samples shall be collected from areas that have the same basic characteristics as the medium of concern at the site and have not been influenced by releases from the site. The *Groundwater Area Background Concentration for Arsenic Memorandum* used data from impacted wells within the contaminant plume to determine a background arsenic concentration. If you would like to calculate a background concentration for arsenic in groundwater, data must come from wells that have NOT been impacted by Site operations.

Additional Contaminants of Concern

The contaminants 1,2-dichloropropane and 1,2,3-trichloropropane have been consistently detected in Site groundwater for over 10 years, at concentrations exceeding our current cleanup levels. Under the current Consent Decree (CD), these contaminants are not addressed as part of the current cleanup action. Given current monitoring data, these constituents will likely not degrade to meet cleanup levels within the restoration timeframe established in the CAP. Further, we are aware of private wells established within a mile of the Site, presenting a potential exposure pathway. Given these circumstances, we can anticipate now that unless these constituents are also addressed as part of the remedy, the remedy will likely not be deemed protective of human health and the environment at the time of the first periodic (five year) review under the Section XXVI of the CD. Since the CAP remedy is still in the design phase, implementation of cleanup options for 1,2,3-trichloropropane and 1,2-dichloropropane can still be accomplished as part of the remedy, reducing the potential for having to implement additional remedial actions in the future. If you are amenable to this approach, we can work with you to amend the current Consent Decree and CAP.

Ecology will provide additional comments regarding compliance monitoring after these comments have been addressed.

Please feel free to contact me with any questions about these comments.

Regards,

Mary Monahan
Site Manager
Washington State Department of Ecology
1250 West Alder Street
Union Gap, WA 98903

cc: Ms. Caryl Weekley, Chevron Environmental Management Company
Mr. Kyle Christie, Atlantic Richfield Company

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1250 W Alder St • Union Gap, WA 98903-0009 • (509) 575-2490

July 12, 2016

Marisa Kaffenberger, P.E.
Senior Engineer
Stantec Consulting Services, Inc.
2321 Club Meridian Drive, Suite E
Okemos, MI 48864

Re: Comments on revised Groundwater Remedy Engineering Design Report for

Site Name:	Bee Jay Scales
Site Address:	116 N 1st Street, Sunnyside
Facility/Site ID No.:	504
Cleanup Site ID No.:	3641

Dear Ms. Kaffenberger,

The Washington State Department of Ecology (Ecology) has conducted a technical assessment in response to the *Groundwater Area Background Concentration for Arsenic Memorandum.* The results of the technical assessment found that the proposed background arsenic level is based on samples collected from observation wells located within the current and historical groundwater nitrate plume. The data collected from these wells does not meet the definition of "area background", and will not be accepted by Ecology. I am attaching a copy of the technical assessment for your information.

Ecology has recently completed an investigation of natural arsenic in groundwater concentrations for the Yakima Basin area, and determined natural background arsenic concentrations are approximately 0.006 mg/L. If this level is not acceptable to you, groundwater data from locations outside of the Bee-Jay Scales footprint must be collected and statistically analyzed (at least 10 observations) in order to derive an arsenic in groundwater background concentration.

Please call me at (509) 454-7840 if you have questions concerning the site. My e-mail address is mary.monahan@ecy.wa.gov.

Regards,

Valerie Bound for

Mary Monahan
Site Manager
Toxics Cleanup Program

cc: Mr. Kyle Christie, Atlantic Richfield Company
Caryl Weekley, Chevron Environmental Management Company

By Certified Mail [7010 0290 0000 7128 1107]

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Lacey HQ • 300 Desmond Dr. • Lacey, Washington 98503 • (360) 407-6000

June 30th, 2016

TO: Mary Monahan, Env. Eng., TCP Central Regional Office (CRO)

FROM: Charles San Juan, LHG, TCP-HQ Policy Section *Charles San Juan*

SUBJECT: Bee Jay Scales Site Groundwater Area Background Arsenic.

State of Washington Hydrogeologist 566 Licensed Geologist
Charles F. San Juan

Summary

Per request, a technical assessment of the proposed area background groundwater arsenic level, for the subject facility, is provided in this transmittal. Historical operations, from a liquid fertilizer mixing area, has resulted in a groundwater nitrate (NO_3-) dissolved phase footprint (up to 600 mg/L). Ammonium nitrate (fertilizer) is highly water soluble and is also a strong oxidizing agent. This has resulted in geochemically reduced groundwater (ORP of roughly 50 to 150 mV). This geochemically reduced groundwater has resulted in higher groundwater arsenic levels (alkaline groundwater reacting with iron oxides). Also, as part of the on-going remedial work (denitrification), site groundwater has been injected (as part of a pilot test) with an agent (sodium acetate and disodium phosphate). This will result in higher groundwater arsenic levels. Briefly, the results of this technical analysis found that the proposed area background arsenic level (40 ug/L) is based on samples collected from observation wells that are located within the current (and historical) groundwater nitrate footprint. Therefore, this groundwater arsenic data does not meet the definition of "area background" and should not be accepted.

Methods

The proposed groundwater arsenic area background level (40 ug/L) is based on measurements from site observation wells. Thus, the spatial alignment of these wells, in relation to the existing groundwater nitrate footprint was checked. The key issue here is whether the groundwater arsenic levels are the result of historical site releases (i.e. Bee-Jay liquid fertilizer / ammonium nitrate). To check the observation well alignment, average groundwater elevations, for each of the 19 site wells, were calculated (Stantec, May 1, 2015). A potentiometric surface map, with average groundwater elevation contours, was then constructed.

Next, groundwater nitrate-nitrogen levels (Stantec, May 1, 2015), were spatially mapped. A filled contour map of the nitrate footprint was then constructed (kriging methods). This data was used to predict or estimate groundwater nitrate levels to 10 mg/L (current EPA drinking water MCL). The spatial orientation of the proposed area background wells, in relation to this 10 mg/L groundwater nitrate footprint, was then checked.

Site groundwater arsenic levels were also compared to geochemical parameters. Specifically, groundwater arsenic data from the February 15, 2015, monitoring event (Stantec, May 1st, 2015) was reviewed. A scatter plot of groundwater oxidation-reduction potential (ORP) v. groundwater arsenic levels was constructed.

The proposed area background groundwater arsenic levels (Stantec, December 16th, 2015) were compared to Yakima Basin natural background groundwater arsenic levels (Ecology, 2016). Specifically, a probability plot, of arsenic levels and 90th percentile reference lines, was constructed.

Lastly, all of the historical groundwater arsenic data (up through Feb-2015), including both "site" and "area" background, was spatially mapped (graduated symbol). The groundwater 10 mg/L nitrate map was included for reference. This map is based on groundwater arsenic data from the Phase II RIFS (SECOR, 2005) and the more recent Stantec (May 1st, 2015) groundwater monitoring report.

Results

Average groundwater elevations, for 19 site observations wells (364 records, 2005-15), are provided in Table 1. A potentiometric surface map is provided in Figure 1. The predominant groundwater flow direction is southeast. There is also a significant gradient to the southeast (8 ft change in head over about 1,000 ft). Southeast of Bee-Jay, the shallow water table flow vectors converge on a low elevation area along Blaine Ave (MWs 18 & 20). This appears to be either a storm drain line or some other subsurface utility corridor.

A filled contour map of the groundwater nitrate-nitrogen footprint (from Table 2 data) is provided in Figure 2. The highest nitrate levels (up to 600 mg/L) are observed in MW-4R (Area 1 liquid fertilizer plant and truck wash). The spatial nature of this nitrate footprint appears to be oriented more to the south. Specifically, the highest nitrate levels (200 to 600 mg/L) were observed in MWs 4R, 9 and 16. All three of these wells align along a north-south axis.

The spatial alignment of the proposed area background observation wells, in relation to the predicted groundwater nitrate footprint (to 10 mg/L) is provided in Figure 3. Overall, 7 of the 8 area background wells are within 100 ft of this > 10 mg/L nitrate footprint.

Groundwater oxidation-reduction potential (ORP) and arsenic levels (Stantec, May 1st, 2015) are provided in Table 3. A plot of groundwater ORP v. arsenic is provided in Figure 4. Although there was not a strong correlation, higher arsenic levels did tend to correspond with lower ORP values.

A probability plot (with 90th percentile reference lines), of Bee-Jay and Yakima Basin natural background groundwater arsenic levels, is provided in Figure 5. If you compare 90th percentile arsenic values (lognormal distribution) from this probability plot, then the Bee-Jay groundwater arsenic (34 ug/L) is about seven times higher than Yakima Basin natural background (5 ug/L).

Lastly, a map all the historical groundwater arsenic data (both site and area background; Table 4 data) is provided in Figure 6. What you observe in Figure 6 is high groundwater arsenic levels (up to about 100 ug/L) throughout much of the Bee-Jay parcel. As discussed, the proposed area background arsenic data points are located along the edges of the groundwater nitrate footprint.

Discussion

The proposed area background arsenic level (40 ug/L) is largely an artifact of one location (MW-11) with high arsenic levels. The average MW-11 arsenic concentration is nearly 50 ug/L (9 observations, 2004-07). MW-11 is an upgradient well (average elevation of about 736 ft). Therefore, you could, as proposed,

contend that the arsenic levels are representative of this “area”. However, as discussed, MW-11 is also close to the upgradient edge of the groundwater nitrate footprint. What this, therefore, suggests, again, is that the MW-11 arsenic levels are an artifact of the groundwater nitrate plume. For example, the MW-11 ORP level (Feb-2015) was 100 mV. Geochemically reduced groundwater typically has ORP levels of < 50 mV (Whitlock and Kelly, 2010). Likewise, from the graduated symbol plot of all historical groundwater arsenic data (Figure 6), it appears that there may have been some westward spreading of groundwater nitrates (and arsenic). Specifically, both MWs 6 and 10, which are about 130 ft east of MW-11, had fairly high arsenic levels (~ 20-25 ug/L). It may be that over time, there was some runoff (to the west) from the liquid fertilizer operations (e.g. storm drains, sewer, and other utility corridors, etc.) Thus, based on the weight of evidence, it would appear that MW-11 groundwater has been impacted by Bee-Jay site releases.

More importantly, the impact of nitrates, from various sources (e.g. agriculture, etc.) on groundwater quality, has been well documented (Rivett et al., 2008; see also Figure 7). In this particular case, the groundwater nitrate footprint is upwards of 600 mg/L, which is well above typical background levels. For example, Panno et al. (2006) report typical background or “threshold" groundwater nitrate concentrations of roughly 0.1 to 4 mg/L. What this again infers is the Bee-Jay fertilizer releases have significantly altered groundwater geochemistry, which has, in turn, resulted in higher arsenic levels.

Conclusion

The proposed area background arsenic level, based on the limited evidence presented, does not meet the definition of “area background” (MTCA Section 200). Specifically, the groundwater arsenic data was collected from areas that have been impacted by historical liquid fertilizer operations. Consequently, Ecology should not accept the proposed area background groundwater arsenic value.

Legal Framework

Both area and natural background are defined in Section 200 of the MTCA regulations; however, they are not the same. Specifically, “natural background” is defined as not impacted by human activity. However, “area background” is a level common to an area that has not been impacted by “site” releases.

Recommendations

- Use the Yakima Basin natural background groundwater arsenic level (6 ug/L; Ecology, 2016). If that is not acceptable, then groundwater arsenic data, from locations outside of the Bee-Jay groundwater nitrate footprint, will need to be collected and statistically analyzed (at least 10 observations).

- Use the EPA ProUCL statistical software to calculate "background threshold values" or "BTVs". The reason for this is because ProUCL has more robust and updated methods for non-detects. The Ecology MTCAStat software assumes ½ ND, which is more of an outdated approach.

- Check the Blaine Ave. storm drains (or other utility corridors) for nitrate enriched Bee-Jay groundwater. Special emphasis should be given to potential storm drain discharges to surface water (e.g. lakes, creeks, streams, etc.).

- Check for potential off-site migration of the groundwater nitrate plume to sensitive receptors. For example, the City of Sunnyside Well #10 is located about 2,000 ft southeast (in the direction of groundwater flow).

- Collect and maintain a database of standard groundwater monitored natural attenuation (MNA) parameters (e.g. pH, DO, ORP, etc.). Some of this information is in the various reports (e.g. field worksheets, etc.), however, it has not been tabulated. Use this information to assess changes in groundwater geochemistry over time.

References

Ecology (2016). Natural Background Groundwater Arsenic Concentrations in Washington State. Ecology Publication No. 14-09-044 (Draft).

EPA Pro UCL software (Version 5.0).

Panno et al. Estimating Background and Threshold Nitrate Concentrations Using Probability Graphs. Vol. 44, No. 5—GROUND WATER—September–October 2006 (pages 697–709).

Rivett et al. (2008). Nitrate attenuation in groundwater: A review of biogeochemical controlling processes. Water Research 42 (2008), pp. 4215– 4232

SECOR (May 17th, 2005). Phase II Remedial Investigation Report for the Bee-Jay Scales Site.

Stantec (May 1st, 2015). First Half 2015 Semi-Annual Groundwater Monitoring and Replacement Well Installation Report.

Stantec (December 16th, 2015). Groundwater Area Background Concentrations for Arsenic Memorandum, Bee-Jay Scales Site, Sunnyside, WA (16-Dec-2015).

Whitlock, I.A. and Kelly, T.M. (2010). Relationship Between Subsurface Landfill Gas and Arsenic Mobilization into Groundwater Ground Water Monitoring & Remediation 30, no. 2/ Spring 2010/pages 86–96.

Table 1 – Bee-Jay Average Groundwater Elevations (2005-15).

Well	X_E (a)	Y_N (a)	TOC_Ft	Avg_GWE_Ft
MW-1	1,762,010.32	363,305.17	745.86	734.33
MW-3	1,762,174.54	363,095.82	740.92	733.96
MW-4	1,762,127.85	363,024.99	741.88	733.70
MW-5	1,761,964.70	363,039.90	741.93	734.28
MW-6	1,761,817.89	363,019.03	741.73	735.08
MW-7	1,761,919.78	363,309.79	744.68	734.14
MW-8	1,762,045.37	363,118.13	741.32	734.52
MW-9	1,762,129.16	362,929.93	741.09	732.93
MW-10	1,761,783.17	363,076.57	742.38	735.91
MW-11	1,761,682.86	363,023.60	742.1	736.05
MW-12	1,762,210.50	363,028.98	741.82	733.19
MW-13	1,762,022.83	362,706.46	742.2	732.51
MW-14	1,761,871.17	362,888.54	741.37	733.59
MW-15	1,762,360.75	362,989.06	742.72	731.21
MW-16	1,762,097.90	362,784.86	741.26	732.20
MW-17	1,762,374.64	362,867.50	741.82	731.07
MW-18	1,762,331.24	362,697.36	741.3	727.76
MW-19	1,762,187.49	362,492.85	739.46	731.15
MW-20	1,762,354.15	362,516.11	740.51	727.78

(a) NAD83 HARN Washington State Plane South (Ft)

Table 2 – Groundwater Nitrates (Stantec, May-2015).

Well	X_E (a)	Y_N (a)	Date	Nitrate_N_mg/L
MW-1	1,762,010.32	363,305.17	2/19/2015	5.3
MW-3	1,762,174.54	363,095.82	2/19/2015	17.9
MW-4R	1,762,127.85	363,024.99	2/19/2015	612
MW-5R	1,761,964.70	363,039.90	2/19/2015	143.95
MW-6	1,761,817.89	363,019.03	2/19/2015	10.4
MW-7	1,761,919.78	363,309.79	2/19/2015	3.4
MW-8	1,762,045.37	363,118.13	2/19/2015	83.6
MW-9	1,762,129.16	362,929.93	2/19/2015	262
MW-10	1,761,783.17	363,076.57	2/19/2015	3.2
MW-11	1,761,682.86	363,023.60	2/19/2015	5.3
MW-12R	1,762,210.50	363,028.98	2/19/2015	279
MW-13	1,762,022.83	362,706.46	2/19/2015	45
MW-14	1,761,871.17	362,888.54	2/19/2015	3.3
MW-15	1,762,360.75	362,989.06	2/19/2015	3.4
MW-16	1,762,097.90	362,784.86	2/19/2015	207
MW-17	1,762,374.64	362,867.50	2/19/2015	3.4
MW-18	1,762,331.24	362,697.36	2/19/2015	3
MW-19	1,762,187.49	362,492.85	2/19/2015	18.5
MW-20	1,762,354.15	362,516.11	2/19/2015	3.7

(a) NAD83 HARN Washington State Plane South (Ft)

Table 3 – Groundwater Geochemistry (Stantec, May-2015).

Well	X_E (a)	Y_N (a)	Date	ORP_mV (b)	As ug/L (c)
MW-1	1,762,010.32	363,305.17	2/19/2015	91.4	10.1
MW-10	1,761,783.17	363,076.57	2/19/2015	95.4	19.9
MW-11	1,761,682.86	363,023.60	2/19/2015	102.2	43.7
MW-12R	1,762,210.50	363,028.98	2/19/2015	102.8	29.9
MW-14	1,761,871.17	362,888.54	2/19/2015	107.8	8.3
MW-15	1,762,360.75	362,989.06	2/19/2015	107.2	17.7
MW-18	1,762,331.24	362,697.36	2/19/2015	109.5	23.4
MW-19	1,762,187.49	362,492.85	2/19/2015	68.2	45.7
MW-20	1,762,354.15	362,516.11	2/19/2015	90.3	15.0
MW-3	1,762,174.54	363,095.82	2/19/2015	90.2	35.1
MW-4R	1,762,127.85	363,024.99	2/19/2015	96.1	8.9
MW-6	1,761,817.89	363,019.03	2/19/2015	62.9	23.6
MW-7	1,761,919.78	363,309.79	2/19/2015	127.3	10.2

a) NAD83 HARN Washington State Plane South (Ft)
b) ORP = oxidation-reduction potential (mV)

Table 4 – Groundwater Arsenic (All Historical Data).

Location	Date	X_E	Y_N	As_ppb
A1-VP-001	5/20/2004	1,762,117.82	363,144.50	15.0
	5/20/2004	1,762,117.82	363,144.50	17.0
A1-VP-003	5/21/2004	1,762,099.74	363,060.68	47.0
	5/21/2004	1,762,099.74	363,060.68	47.0
	5/21/2004	1,762,099.74	363,060.68	57.0
	5/21/2004	1,762,099.74	363,060.68	59.0
A1-VP-004	5/21/2004	1,762,044.02	363,023.53	42.0
	5/21/2004	1,762,044.02	363,023.53	11.0
A1-VP-005	5/21/2004	1,762,007.12	363,060.68	24.0
	5/21/2004	1,762,007.12	363,060.68	15.0
A1-VP-007	5/20/2004	1,761,974.37	363,116.40	18.0
	5/20/2004	1,761,974.37	363,116.40	16.0
	5/20/2004	1,761,974.37	363,116.40	17.0
	5/20/2004	1,761,974.37	363,116.40	20.0
A5-VP-001	5/20/2004	1,762,035.96	363,276.17	17.0
A5-VP-002	5/19/2004	1,762,071.88	363,244.89	12.0
	5/20/2004	1,762,071.88	363,244.89	18.0
A5-VP-003	5/19/2004	1,762,028.38	363,188.20	4.0
	5/20/2004	1,762,028.38	363,188.20	14.0
A5-VP-004	5/19/2004	1,761,974.62	363,183.31	17.0
	5/19/2004	1,761,974.62	363,183.31	18.0
	5/19/2004	1,761,974.62	363,183.31	43.0
	5/19/2004	1,761,974.62	363,183.31	48.0
A5-VP-005	5/19/2004	1,761,908.15	363,182.33	49.0
	5/19/2004	1,761,908.15	363,182.33	34.0
A5-VP-006	5/19/2004	1,761,949.94	363,222.41	13.0
	5/19/2004	1,761,949.94	363,222.41	33.0
A5-VP-007	5/19/2004	1,761,973.64	363,254.42	20.0
A5-VP-008	5/20/2004	1,762,018.61	363,286.83	28.0
A5-VP-009	5/20/2004	1,762,147.54	363,188.24	22.0
A6-VP-001	5/24/2004	1,762,178.53	363,137.66	27.0
	5/24/2004	1,762,178.53	363,137.66	18.0
A6-VP-002	5/24/2004	1,762,211.08	363,104.59	25.0
A6-VP-003	5/24/2004	1,762,178.01	363,057.98	18.0
	5/24/2004	1,762,178.01	363,057.98	87.0
A6-VP-004	5/24/2004	1,762,206.66	363,034.49	34.0
MW-01	7/29/2003	1,762,010.32	363,305.17	11.0
	10/27/2003	1,762,010.32	363,305.17	11.0
	1/28/2004	1,762,010.32	363,305.17	11.0
	6/1/2004	1,762,010.32	363,305.17	10.0
	9/28/2005	1,762,010.32	363,305.17	9.3

Location	Date	X_E	Y_N	As_ppb
	1/12/2006	1,762,010.32	363,305.17	9.3
	3/29/2006	1,762,010.32	363,305.17	9.3
	6/27/2006	1,762,010.32	363,305.17	10.0
	9/19/2006	1,762,010.32	363,305.17	10.0
	12/19/2006	1,762,010.32	363,305.17	10.0
	3/20/2007	1,762,010.32	363,305.17	10.0
	6/26/2007	1,762,010.32	363,305.17	10.0
	2/19/2015	1,762,010.32	363,305.17	10.1
MW-03	2/19/2015	1,762,174.54	363,095.82	35.1
MW-4R	2/19/2015	1,762,127.85	363,024.99	8.9
MW-06	2/19/2015	1,761,817.89	363,019.03	23.6
MW-07	7/29/2003	1,761,919.78	363,309.79	11.0
	10/27/2003	1,761,919.78	363,309.79	11.0
	1/28/2004	1,761,919.78	363,309.79	12.0
	6/1/2004	1,761,919.78	363,309.79	11.0
	9/29/2005	1,761,919.78	363,309.79	9.3
	1/12/2006	1,761,919.78	363,309.79	9.3
	3/29/2006	1,761,919.78	363,309.79	9.3
	6/27/2006	1,761,919.78	363,309.79	10.0
	9/19/2006	1,761,919.78	363,309.79	10.0
	12/19/2006	1,761,919.78	363,309.79	10.0
	3/20/2007	1,761,919.78	363,309.79	10.0
	6/26/2007	1,761,919.78	363,309.79	10.0
	2/19/2015	1,761,919.78	363,309.79	10.2
MW-10	2/19/2015	1,761,783.17	363,076.57	19.9
MW-11	10/25/2004	1,761,682.86	363,023.60	42.0
	9/29/2005	1,761,682.86	363,023.60	59.9
	1/12/2006	1,761,682.86	363,023.60	43.4
	3/29/2006	1,761,682.86	363,023.60	51.2
	6/27/2006	1,761,682.86	363,023.60	46.2
	9/19/2006	1,761,682.86	363,023.60	47.9
	12/19/2006	1,761,682.86	363,023.60	47.8
	3/20/2007	1,761,682.86	363,023.60	52.8
	6/26/2007	1,761,682.86	363,023.60	52.2
	2/19/2015	1,761,682.86	363,023.60	43.7
MW-12R	2/19/2015	1,762,210.50	363,028.98	29.9
MW-14	8/28/2013	1,761,871.17	362,888.54	6.8
	12/3/2013	1,761,871.17	362,888.54	6.8
	2/19/2015	1,761,871.17	362,888.54	8.3
MW-15	8/28/2013	1,762,360.75	362,989.06	6.8
	12/4/2013	1,762,360.75	362,989.06	6.8
	2/19/2015	1,762,360.75	362,989.06	17.7

Location	Date	X_E	Y_N	As_ppb
MW-17	8/28/2013	1,762,374.64	362,867.50	3.4
MW-18	8/27/2013	1,762,331.24	362,697.36	6.8
	12/3/2013	1,762,331.24	362,697.36	20.5
	2/19/2015	1,762,331.24	362,697.36	23.4
MW-19	2/19/2015	1,762,187.49	362,492.85	45.7
MW-20	8/28/2013	1,762,354.15	362,516.11	6.8
	12/3/2013	1,762,354.15	362,516.11	6.8
	12/3/2013	1,762,354.15	362,516.11	3.4
	2/19/2015	1,762,354.15	362,516.11	15.0

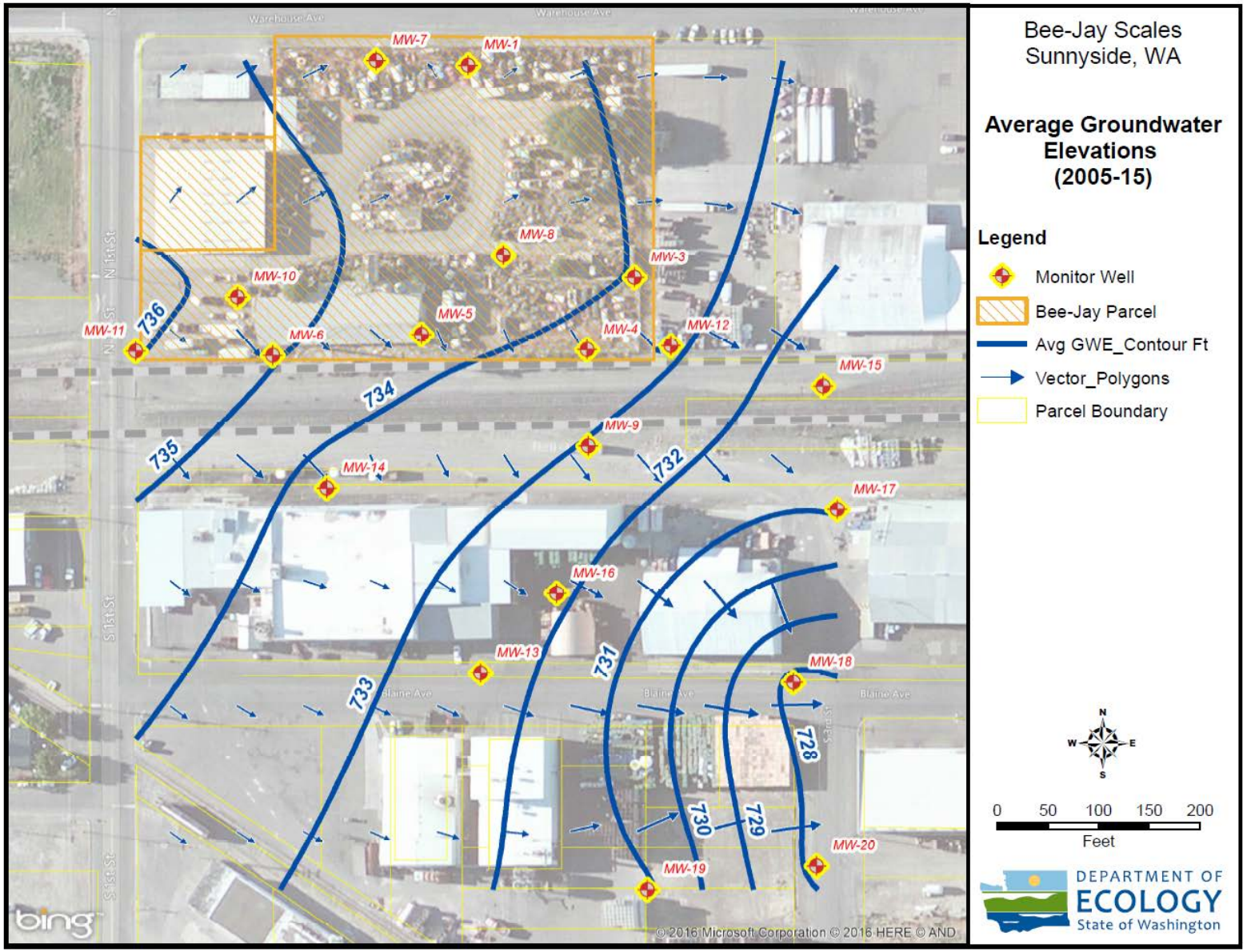


Figure 1 – Average Groundwater Elevations.

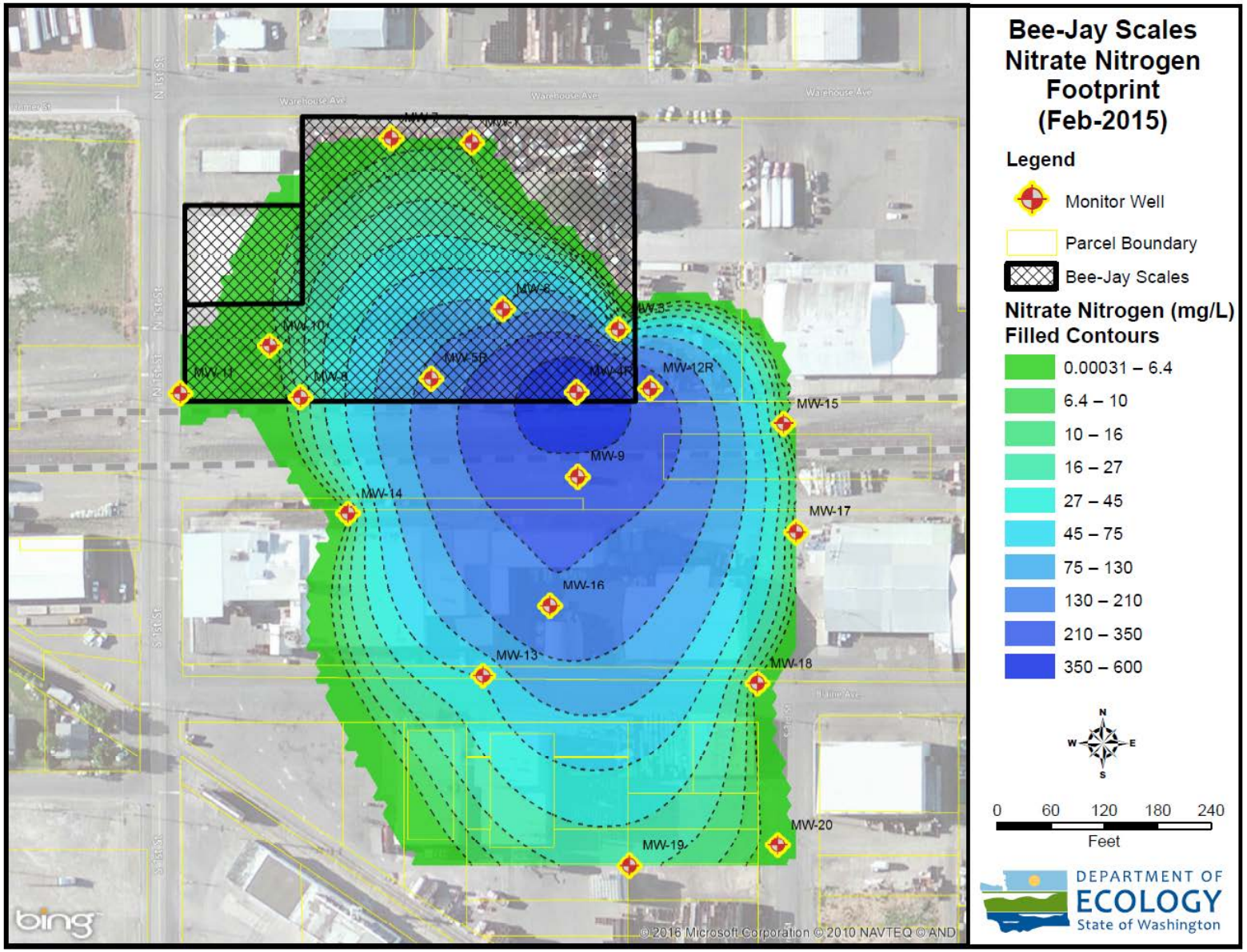


Figure 2 – Groundwater Nitrate Nitrogen Footprint.

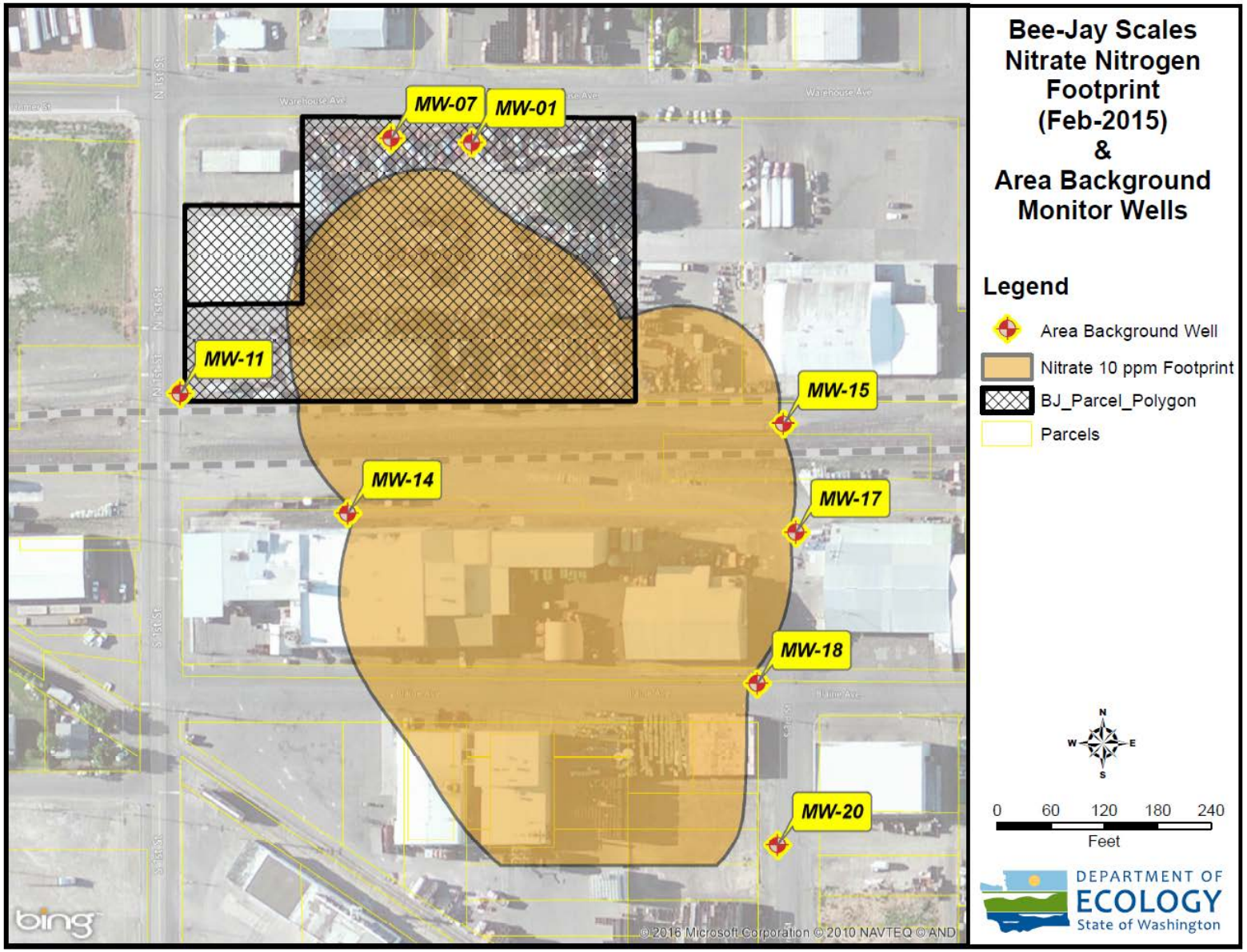


Figure 3 – Groundwater Nitrate Footprint and Area Background Well Locations.

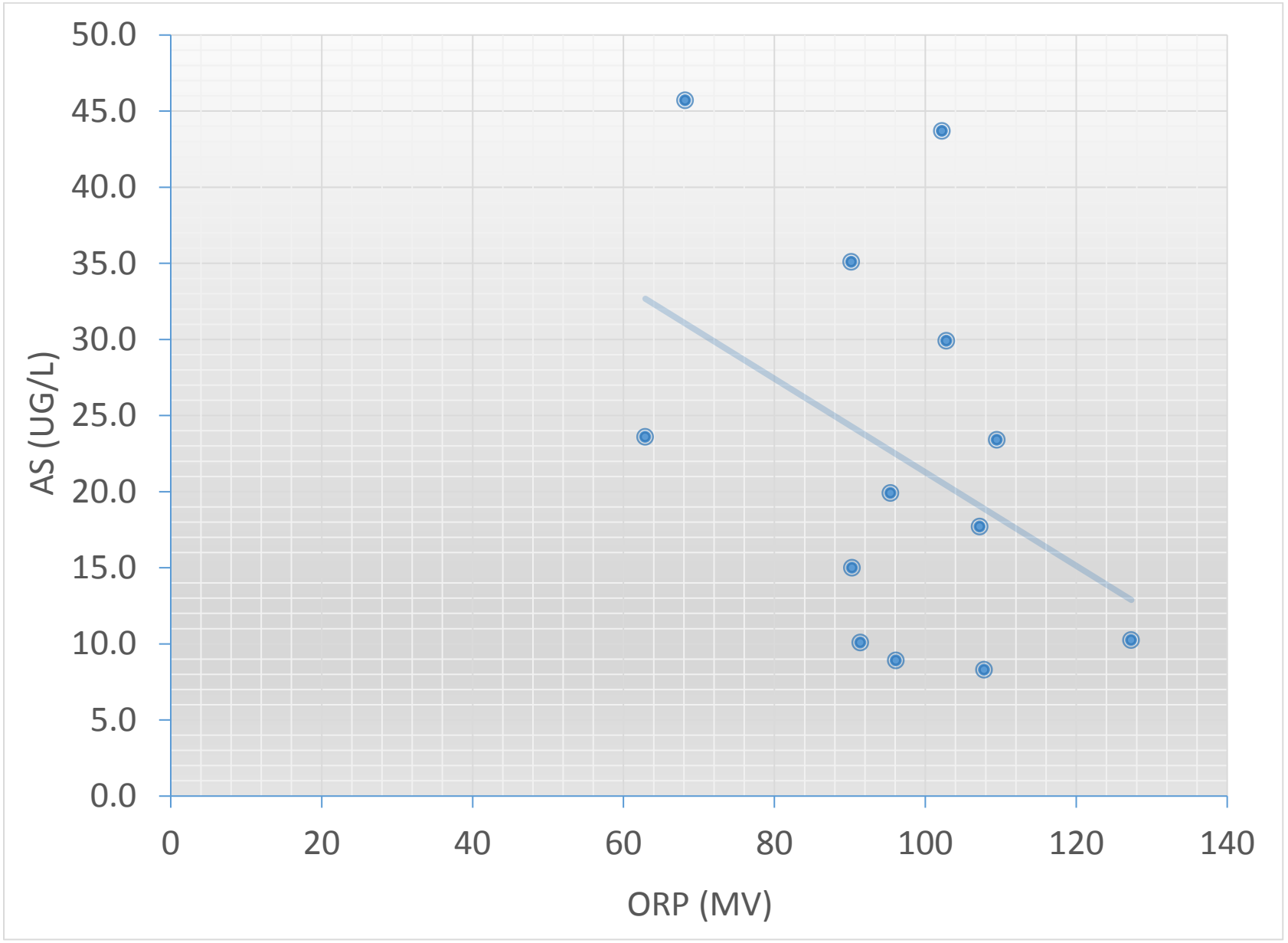


Figure 4 – Groundwater ORP v. Arsenic.

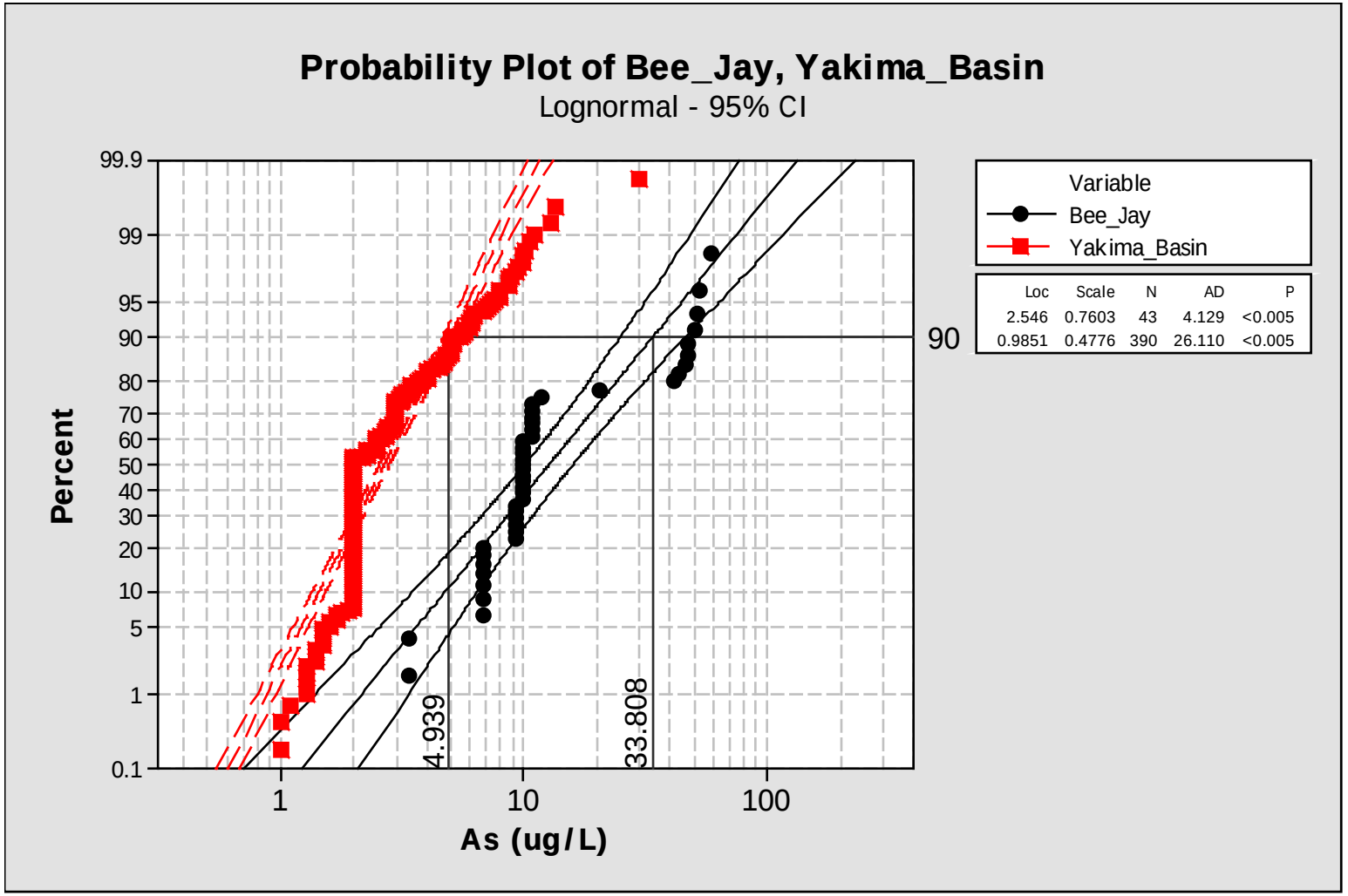


Figure 5 – Groundwater Arsenic Probability Plot.

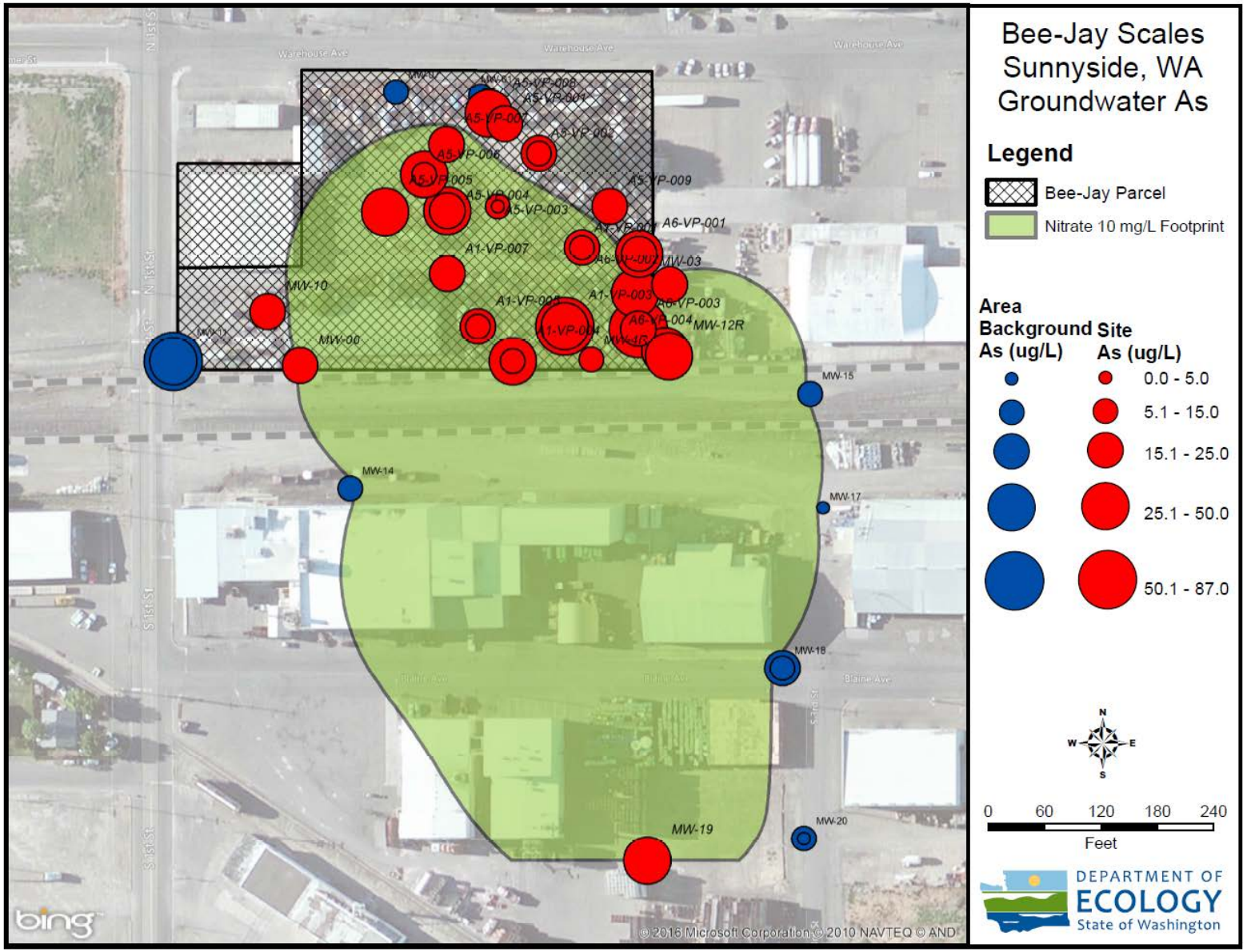


Figure 6 – Area Background and Site Groundwater Arsenic.

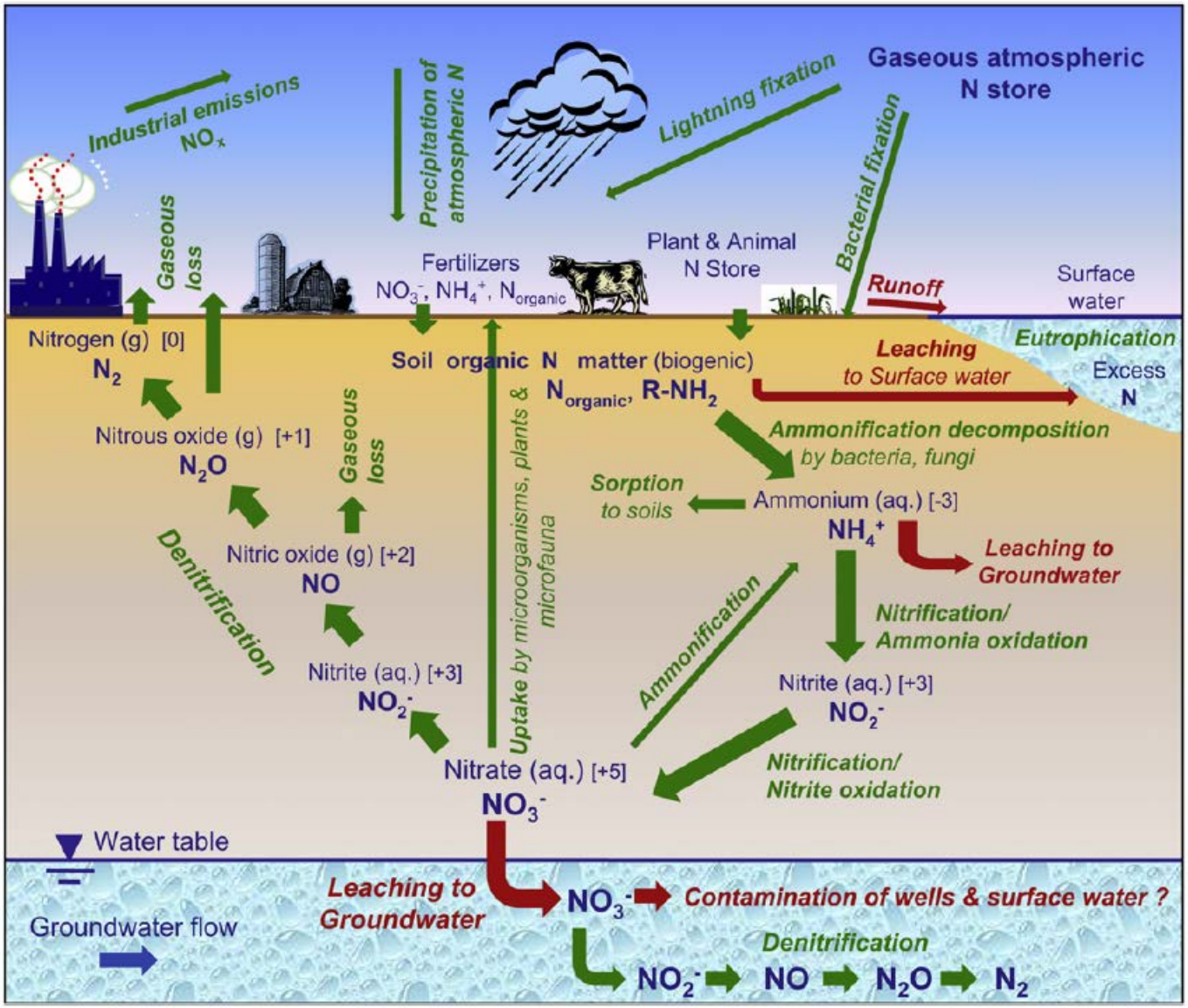


Figure 7 – Nitrogen Cycle (adapted from Rivett et al, 2008).

APPENDIX B

Environmental Covenant for MTCA Sites: Instructions for Use and Covenant Template

DEPARTMENT OF ECOLOGY
State of Washington

Environmental Covenant for MTCA Sites: Instructions for Use and Covenant Template

To: Interested Persons

From: James. J. Pendowski, Program Manager
Toxics Cleanup Program

Date: August 20, 2015

For additional instructions on the use of this Covenant, see Toxics Cleanup Program's ***Procedure 440A: Establishing Environmental Covenants under the Model Toxics Control Act,*** *publication no. 15-09-054.*

Instructions for Use

The following steps provide guidance on how to develop an environmental covenant using the enclosed template. While the exact sequence of steps, as well as who conducts the work (Ecology, potentially liable person (PLP) or Voluntary Cleanup Program (VCP) customer), may vary from site to site, all of the elements identified here must be addressed. When requesting a Covenant, Ecology should identify which steps are the responsibilities of the PLP or VCP customer at the site. Questions about specific provisions in the Covenant template should be directed to the Ecology Cleanup Project Manager assigned to the site. If no Cleanup Project Manager has been assigned, contact Ecology's Toxics Cleanup Program at (360) 407-7170 and ask for advice from the Toxics Cleanup Program (TCP) Policy Unit.

Step 1: Identify the Parcels Subject to the Covenant

Using the County Assessors Tax records, identify the parcels subject to the Covenant. Even though the site (or part of the site subject to the Covenant) may be owned by one entity, it may actually encompass more than one parcel of real property as shown on the County's property (and tax) records.

Step 2: Identify the Specific Activity and Use Restrictions for the Property

Create a conceptual list of specific prohibited activities (e.g., don't drill wells on the property) and prohibited uses (e.g., property can't be used for residential uses).

Work with the PLP/VCP customer, the property owner, and owners of other property interests (if different) to refine the language implementing these restrictions.

Step 3: Consult with the Local Government Land Use Planning Authority

The Uniform Environmental Covenants Act (UECA) and Model Toxics Control Act (MTCA) require Ecology to "consult" with the local government land use planning authority on the terms of the Covenant. While technically the Mayor/Executive is this authority, this guidance recommends contacting the staff that who work with land use issues. However, if the jurisdiction prefers the contact be through the local elected executive, work through the Mayor/Executive instead.

Ideally, before drafting the Covenant, Ecology staff should discuss the proposed restrictions with the local government staff by phone or email. **Once the Covenant has been drafted, the full covenant should be sent to the local government for review.** This consultation should be done by Ecology, but may be delegated to the PLP or VCP customer, upon agreement by Ecology.

The purpose of this consultation is to identify provisions in the Covenant that might conflict with current or future land use plans and development regulations for the property. For example, a provision requiring the land to remain in industrial use won't hold up in the long term if the comprehensive plans for the area call for future mixed residential and commercial use development. Similarly, a provision prohibiting infiltration of stormwater anywhere on the property may conflict with local development regulations requiring all stormwater to be retained and infiltrated on the property. If there is a conflict, see if it's possible to apply the restriction to only part of the property where the exposure pathway is of concern.

Use the following table as a guide for whom to contact:

Jurisdiction	Department
City or Town	City or Town Planning Department
Unincorporated Areas	County Planning Department
Urban Growth Areas not Annexed to City or Town[1]	Both City or Town Planning Department and County Planning Department

Note: In larger communities, planning staff who work on zoning and comprehensive plan issues are typically different than those who review development proposals. *Make sure you are talking to the right staff.*

[1] City limits and urban growth area should be identified in the City's and County's comprehensive plans. They can typically be found on the local jurisdiction's website. If not, call the jurisdiction's staff to obtain a copy.

Step 4: Confirm the Recorded Interests in the Property

To determine who owns the property and any relevant property interests that may need to be superseded by the Covenant, a title search must be conducted to identify all recorded interests in the Property. The title search should be the responsibility of the PLP (or VCP customer) and conducted by a title company. **The results of this search, typically called a title report or plat certificate, must be included with any request asking Ecology to sign a Covenant.** An uninsured title report is sufficient for this purpose.

In general, the title search should be no more than six months old to ensure it reflects the current status of the property. However, under some circumstances, Ecology may accept an older title search, such as that completed during the PLP identification process. Accepting older title searches should be done only if Ecology has been closely involved with the site during the intervening time period since the last title search, and there is no reason to suspect the owner has changed or an easement or other interest in the property has been granted. Examples of changes that would trigger the need for a new title search are:

- Establishment of a new business on the property;
- Change in the name of the business currently on the property;
- Subdivision of the property;
- Construction of new utilities or roads across the property;
- Foreclosure on the property;
- Change in the status of the persons owning the property (death, divorce or marriage); and
- Bankruptcy of the site owner or operator.

Step 5: Determine Who Needs to Sign the Covenant

Real property interests are prioritized according to the date on which they were recorded with the land record authority. Such interests include not only ownership of the property, but may also include mortgages; tax or mechanics' liens; utility easements; surface land rights; and judgments. If a senior mortgage holder forecloses on the property, for instance, it may be able to dispose of all other interests, including Ecology's Covenant. For this reason, to ensure the restrictions in a Covenant are enforceable, the Covenant must supersede these pre-existing property interests.

Grantors or signatories to a Covenant not only are granting access to Ecology and agreeing to adhere to the restrictions on future activities or uses of the property, they are also agreeing to be responsible for any "affirmative obligations" described in the Covenant, such as maintaining the remedy and monitoring.

Signing a subordination agreement means the person holding a senior property interest is agreeing that the Covenant takes precedent over their interest, including providing Ecology with access, and consenting to the restrictions on future uses and activities on the property. However, they are not necessarily agreeing to the affirmative obligations in the Covenant.

Use the following as a guide to determine who must sign the Covenant as a grantor or subordinate their interests:

a) Persons holding fee simple title to the property (i.e., landowners).

The landowner must always sign the Covenant as a Grantor.

b) Persons holding other property interests (such as easements, right-of-ways, water & mineral rights).

In general, if a person holds a title to:

a) An easement or right-of-way,

b) Water rights (if groundwater use is restricted); or

c) Mineral rights,

…that is located within the area of activity or use restrictions, and compliance with those restrictions could be overridden by the person exercising their rights, then the person holding the title should either:

a) Sign the covenant as a Grantor, or

b) Subordinate their interests by signing a subordination agreement.

However, if a current contact cannot be located, or if the holder's interest is not critical to the success of the Covenant, it is probably not necessary to expend a lot of effort to track them down and obtain a signature. For example, many properties, especially in eastern Washington State, have underlying mineral rights that are controlled by someone different than the owner. In most urban areas it is unlikely those rights would be exercised to the detriment of the remedy, and so there would be no reason to pursue a signature.

Similarly, the holder of an easement or right-of-way for overhead power lines that is unlikely to affect the performance of the remedy does not need to be pursued.

However, if a cap is part of the remedy, and the easement or right-of-way grants the holder the right to conduct activities that could compromise the integrity of the cap (such as installation and maintenance of road or an underground utility), these holders should be required to sign the Covenant as a Grantor or subordinate their interests.

c) Persons holding encumbrances on the property (such as lien and mortgage holders).

In general, persons holding a lien have merely a monetary interest (lien imposed because of lack of payment of a bill) and do not need to sign the Covenant or subordinate their interests. However, if the lien holder is claiming a right that could affect the performance of the remedy, such as control over future sale and development of the property, then they should be required to subordinate their interest.

Mortgage holders such as banks usually hold the title to the property until the property owner pays off the loan for purchase of the property. Should they foreclose on a property, they may be able to extinguish all subsequent interests, including Ecology's Covenant. As such, they should be required to sign a subordination agreement.

A Covenant or subordination agreement must be voluntarily granted. There may be circumstances where the holder of an interest or encumbrance on the property (other than the property owner) refuses to grant a Covenant or subordinate their interests, can't be located, or are not responsive. In these cases, the Ecology Cleanup Project Manager should, in consultation with the Assistant Attorney General assigned to the site, consider the success of the remedy without their signature. If it is deemed necessary to secure their signature and they refuse to sign, then a more complete cleanup will be required.

In cases where there is minimal risk to the success of the remedy and it is decided to proceed without their signature, a letter should be sent to the holder of this interest or encumbrance notifying them that, should they do anything on the property that affects the integrity of the remedial action or results in a release of a hazardous substance, they could trigger liability under MTCA. If the holder of this interest is unresponsive or cannot be located, work with the Assistant Attorney General assigned to the site on an appropriate notification procedure.

Step 6: Prepare the Covenant

Use the attached Ecology template to prepare the Covenant.

A precise legal description of the Property and any interests in the Property (such as an easement) is essential to know where the Covenant applies. A map must also be developed to provide a visual representation of where the restrictions apply on the Property.

- If the restrictions apply to the entire Property, the legal description in the Property deed and a map of the Property should be sufficient.
- If the restrictions apply to only part of the Property, a new legal description and map will need to be developed, and boundary markers or reference monuments will need to be established on the Property by a licensed surveyor.

If the Property includes more than one parcel of real property, the legal description and map should cover all of the parcels. This will enable recording of the same covenant on each parcel instead of creating and recording a different covenant for each parcel.

There are specific formatting requirements that apply to recorded Covenants. For example, there must be a three inch margin on the top of the first page and a one inch margin on the bottom and sides. See Chapter 65.04.045 RCW for additional format requirements.

Step 7: Public Involvement

In general, there is no requirement for a public notice and comment period on a Covenant, other than the requirement for local government consultation discussed above. However, because a Covenant can affect future uses of a property and potentially impact future development in the area, any public notice issued for the cleanup action plan or order or decree governing the cleanup should highlight the fact that there will be restrictions on future activities or uses of the property.

For sites with a high level of public interest or controversy, it may be appropriate to provide a separate opportunity for public comment. The Ecology Cleanup Project Manager should consult with the public involvement specialist assigned to the site regarding the appropriate level of public involvement.

Step 8: Sign the Covenant

The Ecology Cleanup Project Manager must ensure all appropriate persons sign the Covenant and that each of those signatures is notarized. This responsibility can be delegated to the PLP (or VCP applicant) but Ecology staff must verify this step has been completed.

Ecology's representative should sign the Covenant only after all other parties to the Covenant have signed.

Step 9: Record the Covenant

The Covenant must be recorded on the title of each parcel of real property subject to the Covenant. Recording is done by the County Auditor. If the area covered by the Covenant extends across a County boundary, the Covenant will have to be recorded in both Counties.

Step 10: Send the Recorded Covenant to Ecology and Others per RCW 64.70.070

a. Send the original recorded Covenant to Ecology's contact for the site. [2]

b. Send a legible copy of the recorded Covenant, with the recording number evident, to the following persons (per RCW 64.70.070):

- Each person who signed the Covenant.
- Each person holding a recorded interest in the real property subject to the Covenant (including each person who subordinated their interests to Ecology's Covenant).
- Each person in possession of the real property subject to the Covenant at the time the Covenant is executed (such as renters).
- The local government planning authority in which the real property subject to the Covenant is located.
- Any other person to whom the Covenant expressly grants the power to enforce the Covenant.
- Any other persons required by Ecology.

Note: These instructions and attached template are intended solely for the guidance of Ecology staff. They are not intended, and cannot be relied on, to create rights, substantive or procedural, enforceable by any party in litigation with the state of Washington. Ecology may act at variance with these instructions and the attached template depending on site-specific circumstances, or modify or withdraw these documents at any time.

[2] Some Counties retain the original. If that is the case, make sure Ecology receives a legible copy of the recorded Covenant with all the signatures and with recorded notation.

Environmental Covenant for MTCA Sites: Covenant Template

*See Toxics Cleanup Program's **Procedure 440A** for additional instructions on the use of this Covenant.*

Text highlighted by yellow are instructions/comments and options.
Those instructions and related footnotes should be removed from the Covenant.

After Recording Return
Original Signed Covenant to: [1]
[ECOLOGY SITE MANAGER]
Toxics Cleanup Program
Department of Ecology
[ECOLOGY OFFICE ADDRESS]

NOTE: This Covenant is not valid without Ecology's approval and signature.

Environmental Covenant

(For MTCA Sites – August 20, 2015 Version)

Grantor: [NAME OF THE LANDOWNER OR OTHER GRANTOR] [2]
Grantee: State of Washington, Department of Ecology (hereafter "Ecology")
Brief Legal Description: [BRIEF LEGAL DESCRIPTION]
Tax Parcel Nos.: [INSERT TAX PARCEL NUMBERS]
Cross Reference: [SEE BOX]

- **If superseding or amending an existing Covenant, insert one of the following:**
  "Original Covenant #____(superseding)" OR "Original Covenant #____(amending)"
- **Insert a reference to any subordination agreements, if separately recorded**
- **Insert a list of other related documents such as consent decree, order, or NFA opinion**
- **Otherwise, delete**

RECITALS [3]

a. This document is an environmental (restrictive) covenant (hereafter "Covenant") executed pursuant to the Model Toxics Control Act ("MTCA"), chapter 70.105D RCW, and Uniform Environmental Covenants Act ("UECA"), chapter 64.70 RCW.

b. The Property that is the subject of this Covenant is part or all of a site commonly known as [ECOLOGY SITE NAME AND FACILITY ID]. The Property is legally described in Exhibit A, and illustrated in Exhibit B, both of which are attached (hereafter "Property"). If there are differences between these two Exhibits, the legal description in Exhibit A shall prevail.

c. The Property is the subject of remedial action conducted under MTCA. This Covenant is required because residual contamination remains on the Property after completion of remedial actions. Specifically, the following principal contaminants remain on the Property: [4]

[1] Some counties keep the original Covenant, others don't. If the signed original is available, it must be sent to Ecology. If the signed original is not available, send a legible copy to Ecology.
[2] The Grantor of a Covenant typically is the fee simple land owner of the property. The Grantor may also include holders of other property interests such as a holder of an easement, right-of-way, mineral right, lien, or mortgage.
[3] This section is primarily used to describe this document and its purpose. It should not be used for substantive binding provisions.
[4] List the contaminants for the associated media. If more than a few are present, list the top three to five for each medium.

Medium	Principal Contaminants Present
Soil	
Groundwater	
Surface Water/Sediment	

d. It is the purpose of this Covenant to restrict certain activities and uses of the Property to protect human health and the environment and the integrity of remedial actions conducted at the site. Records describing the extent of residual contamination and remedial actions conducted are available through Ecology. **[*Optional--This includes the following documents: (list key documents such as RI/FS, Cleanup Action Plan, Voluntary Cleanup Report(s), As-built report)*].**

e. This Covenant grants Ecology certain rights under UECA and as specified in this Covenant. As a Holder of this Covenant under UECA, Ecology has an interest in real property, however, this is not an ownership interest which equates to liability under MTCA or the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601 *et seq*. The rights of Ecology as an "agency" under UECA, other than its' right as a holder, are not an interest in real property.

f. **[*Include the following statement if this Covenant is superseding another environmental covenant.*]** This Covenant supersedes and replaces the existing Environmental (Restrictive) Covenant, which is recorded with [_____] County as [# OF ORIGINAL COVENANT].

COVENANT

[[NAME OF LANDOWNER OR OTHER GRANTOR]**]**, as Grantor [5] and [FEE SIMPLE, EASEMENT OR OTHER] owner of the Property hereby grants to the Washington State Department of Ecology, and its successors and assignees, the following covenants. Furthermore, it is the intent of the Grantor that such covenants shall supersede any prior interests the GRANTOR has in the property and run with the land and be binding on all current and future owners of any portion of, or interest in, the Property.

Section 1. General Restrictions and Requirements.

The following general restrictions and requirements shall apply to the Property:

a. **Interference with Remedial Action**. The Grantor shall not engage in any activity on the Property that may impact or interfere with the remedial action and any operation, maintenance, inspection or monitoring of that remedial action without prior written approval from Ecology.

b. **Protection of Human Health and the Environment**. The Grantor shall not engage in any activity on the Property that may threaten continued protection of human health or the environment without prior written approval from Ecology. This includes, but is not limited to, any activity that results in the release of residual contamination that was contained as a part of the remedial action or that exacerbates or creates a new exposure to residual contamination remaining on the Property.

[5] If there is more than one Grantor, use the term "Grantors" here and throughout this document.

c. Continued Compliance Required. Grantor shall not convey any interest in any portion of the Property without providing for the continued adequate and complete operation, maintenance and monitoring of remedial actions and continued compliance with this Covenant.

d. Leases. Grantor shall restrict any lease for any portion of the Property to uses and activities consistent with this Covenant and notify all lessees of the restrictions on the use of the Property.

e. Preservation of Reference Monuments. Grantor shall make a good faith effort to preserve any reference monuments and boundary markers used to define the areal extent of coverage of this Covenant. Should a monument or marker be damaged or destroyed, Grantor shall have it replaced by a licensed professional surveyor within 30 days of discovery of the damage or destruction.

Section 2. Specific Prohibitions and Requirements.

In addition to the general restrictions in Section 1 of this Covenant, the following additional specific restrictions and requirements shall apply to the Property.

[See Appendix 1 for example restrictions.]

Select from the restrictions in Appendix 1 as appropriate, based on site-specific circumstances. Most sites will have only some of these restrictions. Options are provided to illustrate the range of potential restrictions. In some cases, the options are mutually exclusive (pick one or the other, but not both). In other cases, several options may need to be combined to cover the range of conditions at the site. This is not intended to be an all-inclusive list. In circumstances where none of the categories or suggested options fit the site conditions, adjust the language as appropriate to fit the situation.

a. Land use.
b. Containment of soil/waste materials.
c. Stormwater facilities.
d. Vapor/gas controls.
e. Groundwater use.
f. Sediments.
g. Monitoring.
h. Other.

Section 3. Access.

a. The Grantor shall maintain clear access to all remedial action components necessary to construct, operate, inspect, monitor and maintain the remedial action.

b. The Grantor freely and voluntarily grants Ecology and its authorized representatives, upon reasonable notice, the right to enter the Property at reasonable times to evaluate the effectiveness of this Covenant and associated remedial actions, and enforce compliance with this Covenant and those actions, including the right to take samples, inspect any remedial actions conducted on the Property, and to inspect related records.

c. No right of access or use by a third party to any portion of the Property is conveyed by this instrument.

Section 4. Notice Requirements.

a. Conveyance of Any Interest. The Grantor, when conveying any interest **[**IN ANY PART OF THE PROPERTY**]** ***OR*** **[**WITHIN THE AREA OF THE PROPERTY DESCRIBED AND ILLUSTRATED IN EXHIBITS B AND C**]**, including but not limited to title, easement, leases, and security or other interests, must:

i. Provide written notice to Ecology of the intended conveyance at least thirty (30) days in advance of the conveyance.[6]

ii. Include in the conveying document a notice in substantially the following form, as well as a complete copy of this Covenant:

NOTICE: THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL COVENANT GRANTED TO THE WASHINGTON STATE DEPARTMENT OF ECOLOGY ON [DATE] AND RECORDED WITH THE [COUNTY] COUNTY AUDITOR UNDER RECORDING NUMBER [RECORDING NUMBER]. USES AND ACTIVITIES ON THIS PROPERTY MUST COMPLY WITH THAT COVENANT, A COMPLETE COPY OF WHICH IS ATTACHED TO THIS DOCUMENT.

iii. Unless otherwise agreed to in writing by Ecology, provide Ecology with a complete copy of the executed document within thirty (30) days of the date of execution of such document.

b. Reporting Violations. Should the Grantor become aware of any violation of this Covenant, Grantor shall promptly report such violation in writing to Ecology.

c. Emergencies. For any emergency or significant change in site conditions due to Acts of Nature (for example, flood or fire) resulting in a violation of this Covenant, the Grantor is authorized to respond to such an event in accordance with state and federal law. The Grantor must notify Ecology in writing of the event and response actions planned or taken as soon as practical but no later than within 24 hours of the discovery of the event.

d. Notification procedure. Any required written notice, approval, reporting or other communication shall be personally delivered or sent by first class mail to the following persons. Any change in this contact information shall be submitted in writing to all parties to this Covenant. Upon mutual agreement of the parties to this Covenant, an alternative to personal delivery or first class mail, such as e-mail or other electronic means, may be used for these communications.

[6] Ecology may waive this notice provision for some units at a Property where the anticipated use is a multi-tenant/owner building where some owners or tenants are unlikely to be exposed to residual contamination. For example: upper story apartments or condominiums, or commercial tenants in a strip mall, with limited rights to use the grounds under and around the building (such as for parking).

If Ecology agrees to such a waiver, the circumstances of the waiver must be detailed in paragraph 4.a.i. In addition to the specific circumstances, this provision must include the following statement: "Waiver of this advance notice to Ecology for these transactions does not constitute waiver of this notice for the entire Property nor a waiver of the requirement in Section 4.a.ii. to include this notice in any document conveying interest in the Property."

[insert contact name, address, phone number and e-mail for Grantor]	Environmental Covenants Coordinator Washington State Department of Ecology Toxics Cleanup Program P.O. Box 47600 Olympia, WA 98504 – 7600 (360) 407-6000 ToxicsCleanupProgramHQ@ecy.wa.gov

Section 5. Modification or Termination.

a. Grantor must provide written notice and obtain approval from Ecology at least sixty (60) days in advance of any proposed activity or use of the Property in a manner that is inconsistent with this Covenant. [7] For any proposal that is inconsistent with this Covenant and permanently modifies an activity or use restriction at the site: [8]

i. Ecology must issue a public notice and provide an opportunity for the public to comment on the proposal; and

ii. If Ecology approves of the proposal, the Covenant must be amended to reflect the change before the activity or use can proceed.

b. If the conditions at the site requiring a Covenant have changed or no longer exist, then the Grantor may submit a request to Ecology that this Covenant be amended or terminated. Any amendment or termination of this Covenant must follow the procedures in MTCA and UECA and any rules promulgated under these chapters.

c. ***[Optional]*** By signing this agreement, per RCW 64.70.100, the original signatories to this agreement, other than Ecology, agree to waive all rights to sign amendments to and termination of this Covenant. [9]

Section 6. Enforcement and Construction.

a. This Covenant is being freely and voluntarily granted by the Grantor.

b. Within ten (10) days of execution of this Covenant, Grantor shall provide Ecology with an original signed Covenant and proof of recording and a copy of the Covenant and proof of recording to others required by RCW 64.70.070.

c. Ecology shall be entitled to enforce the terms of this Covenant by resort to specific performance or legal process. All remedies available in this Covenant shall be in addition to any

[7] Example of inconsistent uses are using the Property for a use not allowed under the covenant (i.e. mixed residential and commercial use on a property restricted to industrial uses), OR drilling a water supply well when use of the groundwater for water supply is prohibited by the covenant.

[8] An example of an activity that is unlikely to be considered a permanent modification is a proposal to disturb a cap to repair an existing underground utility that passes through the site. However, installing a new underground utility within a capped area would be a permanent change.

[9] As time passes, the original grantor and other signers of the Covenant may no longer exist as viable entities. This provision is intended to allow future amendments or termination of the Covenant without Ecology having to seek court authorization, as provided by RCW 64.70.100.

and all remedies at law or in equity, including MTCA and UECA. Enforcement of the terms of this Covenant shall be at the discretion of Ecology, and any forbearance, delay or omission to exercise its rights under this Covenant in the event of a breach of any term of this Covenant is not a waiver by Ecology of that term or of any subsequent breach of that term, or any other term in this Covenant, or of any rights of Ecology under this Covenant.

d. The Grantor shall be responsible for all costs associated with implementation of this Covenant. Furthermore, the Grantor, upon request by Ecology, shall be obligated to pay for Ecology's costs to process a request for any modification or termination of this Covenant and any approval required by this Covenant.

e. This Covenant shall be liberally construed to meet the intent of MTCA and UECA.

f. The provisions of this Covenant shall be severable. If any provision in this Covenant or its application to any person or circumstance is held invalid, the remainder of this Covenant or its application to any person or circumstance is not affected and shall continue in full force and effect as though such void provision had not been contained herein.

g. A heading used at the beginning of any section or paragraph or exhibit of this Covenant may be used to aid in the interpretation of that section or paragraph or exhibit but does not override the specific requirements in that section or paragraph.

[GRANTOR'S SIGNATURE BLOCK FOR ORIGINAL COVENANTS]

Each person who signs must have a separate signature block and applicable notary acknowledgment. Repeat as many times as necessary.

Holders of other property interests must either sign the amended Covenant as a GRANTOR or sign the subordination agreement in Exhibit D.

The undersigned Grantor warrants he/she holds the title **[to the Property] OR [to an (Easement/Right of Way/etc.) on the Property]** and has authority to execute this Covenant.

EXECUTED this _____ day of _____, 20___.

_____ [SIGNATURE] _____

by: _____ [PRINTED NAME] _____

Title: _____

Insert one of the following, as applicable after each signature. See example format on page after next:

INDIVIDUAL ACKNOWLEDGMENT
CORPORATE ACKNOWLEDGMENT
REPRESENTATIVE ACKNOWLEDGEMENT

[GRANTOR'S SIGNATURE BLOCK FOR AMENDED COVENANTS]

Each person who signs must have a separate signature block and applicable notary acknowledgment. Repeat as many times as necessary.

When amending a Covenant, each GRANTOR of the existing Covenant must sign the amended Covenant unless the GRANTOR waived its rights under Section 5(b) of the Covenant.

Holders of other property interests must either sign the amended Covenant as a GRANTOR or sign the subordination agreement in Exhibit D.

The undersigned Grantor warrants he/she holds the title **[to the Property] OR [to an (Easement/Right of Way/etc.) on the Property]** and has authority to execute this Covenant.

EXECUTED this _____ day of _____, 20___.

The undersigned further acknowledges [Environmental or Restrictive] Covenant [# OF THE ORIGINAL COVENANT] filed in **[_____]** County, is hereby terminated and replaced with the above Environmental Covenant.

_____ [SIGNATURE] _____

by: _____ [PRINTED NAME] _____

Title: _____

Insert one of the following, as applicable. See example format on next page:

INDIVIDUAL ACKNOWLEDGMENT
CORPORATE ACKNOWLEDGMENT
REPRESENTATIVE ACKNOWLEDGEMENT

INDIVIDUAL ACKNOWLEDGMENT

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** is the individual described herein and who executed the within and foregoing instrument and signed the same at **his/her** free and voluntary act and deed for the uses and purposes therein mentioned.

_____
Notary Public in and for the State of Washington [10]
Residing at _____
My appointment expires _____

CORPORATE ACKNOWLEDGMENT

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** is the _____ of the corporation that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said corporation.

_____
Notary Public in and for the State of Washington [15]
Residing at _____
My appointment expires _____

REPRESENTATIVE ACKNOWLEDGEMENT

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** signed this instrument, on oath stated that **he/she** was authorized to execute this instrument, and acknowledged it as the _____ [TYPE OF AUTHORITY] of _____ [NAME OF PARTY BEING REPRESENTED] to be the free and voluntary act and deed of such party for the uses and purposes mentioned in the instrument.

_____
Notary Public in and for the State of Washington [15]
Residing at _____
My appointment expires _____

[10] Where landowner is located out of state, replace with appropriate out-of-state title and location.

[ECOLOGY'S SIGNATURE BLOCK]

The Department of Ecology**,** hereby accepts the status as GRANTEE and HOLDER of the above Environmental Covenant.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

_____ [SIGNATURE] _____

by: _____ [PRINTED NAME] _____

Title: _____

Dated: _____

STATE ACKNOWLEDGMENT

STATE OF _____

COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** is the _____ of the state agency that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said state agency.

_____
Notary Public in and for the State of Washington

Residing at _____

My appointment expires _____

Exhibit A

LEGAL DESCRIPTION

(Required)

Exhibit B

PROPERTY MAP

(Required)

Exhibit C

MAP ILLUSTRATING LOCATION OF RESTRICTIONS

While a map illustrating the location of the restrictions is required, the grantor has the option of creating a separate map or including this information in Exhibit B.

More than one map may be necessary to illustrate the area subject to restrictions. For example, the area encompassing a soil cap may be different than the area where vapor or groundwater contamination is a concern.

The area subject to the restrictions, if less than the entire property, should be a contiguous area with even boundaries that follow physical features on the site so the boundary can be easily discerned in the field.

Exhibit D

SUBORDINATION AGREEMENT

KNOW ALL PERSONS, That __ [HOLDER'S NAME] __, the owner and holder of that certain __[INSTRUMENT – E.G. EASEMENT/ROW/MORTGAGE/ETC.]__ bearing the date the _____ day of __[MONTH]__, __ [YEAR] __, executed by __[NAME OF PERSON THAT GRANTED THE INTEREST BEING SUBORDINATED] __, __[LEGAL STATUS OF ORIGINAL GRANTOR – E.G. LANDOWNER, CORPORATE OFFICER, ETC.]__, and recorded in the office of the County Auditor of __[COUNTY]__ County, State of Washington, on __[DATE]__, under Auditor's File Number _____, does hereby agree that said Instrument shall be subordinate to the interest of the State of Washington, Department of Ecology, under the environmental (restrictive) covenant dated __[DATE]__, executed by __[NAME OF PERSON SIGNING THIS SUBORDINATION AGREEMENT]__, and recorded in __[COUNTY]__ County, Washington under Auditor's File Number _____.

_____ [SIGNATURE] _____

by: _____ [PRINTED NAME] _____

Title: _____

Dated: _____

Insert one of the following, as applicable. See example format on next page:

INDIVIDUAL ACKNOWLEDGMENT
CORPORATE ACKNOWLEDGMENT
REPRESENTATIVE ACKNOWLEDGEMENT

INDIVIDUAL ACKNOWLEDGMENT

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** is the individual described herein and who executed the within and foregoing instrument and signed the same at **his/her** free and voluntary act and deed for the uses and purposes therein mentioned.

_____
Notary Public in and for the State of Washington [11]
Residing at _____
My appointment expires _____

CORPORATE ACKNOWLEDGMENT

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** is the _____ of the corporation that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said corporation.

_____
Notary Public in and for the State of Washington [16]
Residing at _____
My appointment expires _____

REPRESENTATIVE ACKNOWLEDGEMENT

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** signed this instrument, on oath stated that **he/she** was authorized to execute this instrument, and acknowledged it as the _____ [TYPE OF AUTHORITY] of _____ [NAME OF PARTY BEING REPRESENTED] to be the free and voluntary act and deed of such party for the uses and purposes mentioned in the instrument.

_____
Notary Public in and for the State of Washington [16]
Residing at _____
My appointment expires _____

[11] Where landowner is located out of state, replace with appropriate out-of-state title and location.

APPENDIX 1

EXAMPLE SITE-SPECIFIC COVENANT PROVISIONS

a. Land Use. [12]

Option 1 Industrial Land Use: The remedial action for the Property is based on a cleanup designed for industrial property. As such, the Property shall be used in perpetuity only for industrial uses, as that term is defined in the rules promulgated under Chapter 70.105D RCW. Prohibited uses on the Property include but are not limited to residential uses, childcare facilities, K-12 public or private schools, parks, grazing of animals, growing of food crops, and non-industrial commercial uses.

Option 2 Commercial Land Use: The remedial action for the Property is based on a cleanup designed for commercial property. As such, the Property shall be used in perpetuity only for commercial land uses as that term is defined in the rules promulgated under Chapter 70.105D RCW. Prohibited uses on the Property include but are not limited to residential uses, childcare facilities, K-12 public or private schools, parks, grazing of animals, and growing of food crops.

Option 3 Park: The remedial action for the Property is based on a cleanup designed for a public park. As such, the Property shall be used in perpetuity only for a public park. Prohibited uses on the Property include but are not limited to residential uses, childcare facilities, K-12 public or private schools, grazing of animals, and growing of food crops.

Option 4 [Specify other land use limitations as appropriate.]

b. Containment of Soil/Waste Materials. [13]

[Use where contaminated soil or solid or hazardous waste remains on the property.]

The remedial action for the Property is based on containing contaminated soil **[and waste materials]** under a cap consisting of **[Insert a description of the cap]** [14] and located as illustrated in **[Exhibit B/C]** [15]. The primary purpose of this cap is to **[Insert purpose of cap].** [16] As such, the following restrictions shall apply within the area illustrated in **[Exhibit B/C]** [17]:

Option 1 [Use where a cap is required.] Any activity on the Property that will compromise the integrity of the cap including: drilling; digging; piercing the cap with sampling device, post, stake or similar device; grading; excavation; installation of underground utilities; removal of the cap; or, application of loads in excess of the cap load bearing capacity, is prohibited without prior written approval by Ecology. The Grantor shall report to Ecology within forty-eight (48) hours of the discovery of any damage to the cap. Unless an alternative plan has been approved by Ecology in writing, the Grantor shall promptly repair the damage and submit a report documenting this work to Ecology within thirty (30) days of completing the repairs.

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[12] Use one of these restrictions only if the underlying zoning allows the use.

[13] Waste materials means solid wastes as defined in Chapter 70.95 RCW or hazardous wastes as defined in Chapter 70.105 RCW and the rules promulgated under these statutes.

[14] Such as: an X foot thick layer of clean soil; an engineered cap consisting of X inches of clean soil overlying a X mil thick geomembrane and/or clay layer; asphalt pavement; an X square foot building, etc.]

[15] Be very clear in describing or diagramming where the contamination is located relative to a legally defined benchmark such as a property line or survey monument; or use a legal description.

[16] Such as: minimize the potential for contact with contaminated soil; minimize leaching of contaminants to groundwater and surface water; prevent runoff from contacting contaminated soil; minimize airborne contaminants. A cap may have multiple purposes.

[17] NOTE: More than one exhibit may be necessary to illustrate the area restricted by this and other limitations.

Option 2 [Use when contamination is left behind under a building.]

The Grantor shall not alter or remove the existing structures on the Property in any manner that would expose contaminated soil **[and waste materials]**, result in a release to the environment of contaminants, or create a new exposure pathway, without prior written approval of Ecology. Should the Grantor propose to remove all or a portion of the existing structures illustrated in **[Exhibit B/C]** so that access to the underlying contamination is feasible, Ecology may require treatment or removal of the underlying contaminated soil **[and waste materials]**.

Option 3: [Use when periodic inspections of a cap/building are included.]

The Grantor covenants and agrees that it shall annually, or at another time as approved in writing by Ecology, inspect the **[cap/building]** and report within thirty (30) days of the inspection the condition of the **[cap/building]** and any changes to the **[cap/building]** that would impair its performance.

c. Stormwater facilities. [Use when infiltration needs to be controlled to minimize leaching from soil or waste materials, or spreading of groundwater contamination.]

To minimize the potential for mobilization of contaminants remaining in the **[soil/waste materials/groundwater]** on the Property, no stormwater infiltration facilities or ponds shall be constructed **[on the Property] OR [within the area of the Property illustrated in Exhibit B/C]**. All stormwater catch basins, conveyance systems, and other appurtenances located within this area shall be of water-tight construction.[18]

d. Vapor/gas controls. [Use when vapors or methane gas are a concern.]

The residual contamination on the Property includes **[volatile chemicals that may generate harmful vapors] AND/OR [biodegradable wastes/chemicals that may generate methane, a combustible gas]**. As such, the following restrictions shall apply **[on the Property] OR [within the area of the Property illustrated in Exhibit B/C]** to minimize the potential for exposure to these vapors:

Option 1 No building or other enclosed structure shall be constructed **[on the Property/within this area]**.

Option 2 Any building or other enclosed structure constructed **[on the Property/within this area]** shall be constructed with a sealed foundation and with a **[vapor/gas]** control system installed and maintained to prevent the migration of **[vapors/gas]** into the building or structure.

e. Groundwater Use. [Use when groundwater use restrictions are required.]

The groundwater beneath **[the Property] OR [within the area of the Property illustrated in Exhibit B/C]** remains contaminated and shall not be extracted for any purpose other than temporary construction dewatering, investigation, monitoring or remediation. Drilling of a well for any water supply purpose is strictly prohibited. Groundwater extracted **[from the Property/within this area]** for any purpose shall be considered potentially contaminated and any discharge of this water shall be done in accordance with state and federal law.

[18] NOTE: Most local ordinances require on-site infiltration of runoff. If redevelopment of the Property is anticipated, the cleanup plan should reserve an area for this infiltration to occur without exacerbating leaching of residual soil contamination or enhancing movement of contaminants within the groundwater.

f. Sediments. [Use for sediment cleanup sites.] [19]

The residual contamination on the Property includes contaminated sediments. As such, the following restrictions shall apply to minimize potential disturbance of these sediments **[on the Property] OR [within the area of the Property illustrated in Exhibit B/C]**:

Option 1 [Use where a cap is required.] Any activity **[on the Property/within this area]** that will compromise the integrity of the cap including: drilling; digging; piercing the cap with sampling device, post, stake or similar device; excavation; installation of buried utilities; removal of the cap; or, application of loads in excess of the cap load bearing capacity, is prohibited without prior written approval by Ecology. The Grantor shall report to Ecology within forty-eight (48) hours of the discovery of any damage to the cap. Unless an alternative plan has been approved by Ecology in writing, the Grantor shall promptly repair the damage and submit a report documenting this work to Ecology within thirty (30) days of completing the repairs.

Option 2 No docks or other structures shall be constructed **[on the Property/within this area]** without prior written approval of Ecology.

Option 3 No dredging shall be allowed **[on the Property/within this area]** without prior written approval of Ecology.

Option 4 No ships or boats shall be allowed to anchor or use side thrusters **[on the Property/within this area]**. A no wake zone shall be enforced and ships and boats shall be limited to a draft depth of **[XX]** feet **[on the Property/within this area]**.

Option 5 No digging for clams, setting of crab pots or fishing nets, anchoring of mooring buoys or channel markers, or similar activities that could disturb the surface of the sediment shall be allowed **[on the Property/within this area]** without prior written approval of Ecology.

g. Monitoring. [Use for long-term protection of monitoring devices.]

Several **[groundwater monitoring wells, vapor probes, etc.]** are located on the Property to monitor the performance of the remedial action. The Grantor shall maintain clear access to these devices and protect them from damage. The Grantor shall report to Ecology within forty-eight (48) hours of the discovery of any damage to any monitoring device. Unless Ecology approves of an alternative plan in writing, the Grantor shall promptly repair the damage and submit a report documenting this work to Ecology within thirty (30) days of completing the repairs.

h. Other.

[Add other property-specific use or activity restrictions and affirmative obligations that are necessary but not identified above. Examples include special remedy-specific requirements such as restrictions on structures over leachate/groundwater collection systems, or protection requirements for cut-off walls or sheet piling.]

[19] NOTE: Sediment restrictions are currently evolving. Additional guidance can be found in Ecology's Sediment Cleanup Users Manual II (SCUM II), Publication No. 12-09-057, located at: https://fortress.wa.gov/ecy/publications/SummaryPages/1209057.html