

Technical Memorandum

TO: Sam Meng and Andy Kallus, Washington State Department of Ecology
FROM: Kathryn F. Hartley and Stephanie Renando
DATE: June 8, 2016
RE: First Quarter 2016 Compliance Monitoring Results
North Marina Bayside ABW
Everett, Washington
Project No. 147037.030.037

SITE NAME *Bayside ABW*
FSID 9286485
SIT 3.10

Introduction

This technical memorandum summarizes the field activities and analytical results for the first quarter 2016 groundwater quality monitoring event at the North Marina Bayside ABW site (Site) in Everett, Washington. Cleanup at the Site was completed through the Washington State Department of Ecology (Ecology) Voluntary Cleanup Program (VCP) and Ecology issued a no further action (NFA) determination in October 2015 (Ecology 2015). The NFA and associated environmental covenant require confirmational groundwater monitoring for a period of 5 years in order to demonstrate that concentrations of arsenic in groundwater are above the Model Toxics Control Act (MTCA) Method A cleanup level only where reducing conditions are present, and that concentrations of arsenic in groundwater meet the cleanup level at the downgradient point of compliance (monitoring well P-27). The four monitoring wells identified for groundwater monitoring consist of wells HWA-MW1, HWA-MW2, P-26, and P-27. Monitoring well P-27 was inadvertently paved over during construction activities associated with the adjacent Everett Shipyard Site. With approval from Ecology, monitoring well P-27 was replaced with P-27B, which was installed in mid-March 2016 in the immediate vicinity of monitoring well P-27. The well locations are shown on Figure 1.

Sample Collection and Analysis

The groundwater samples were collected on March 29, 2016 with a peristaltic pump using low-flow groundwater sampling procedures. Prior to collecting samples, depth to groundwater was measured at each location. The wells were then purged and field parameters (temperature [°C], conductivity [microsiemen per centimeter { $\mu\text{S}/\text{cm}$ }], dissolved oxygen [milligrams per liter {mg/L}], pH, and ORP [millivolts {mV}]) were recorded every 3 minutes until stabilization goals were achieved. Field measurements for ferrous iron (mg/L) were also recorded at each monitoring well prior to collecting samples for laboratory analysis.

In accordance with the Confirmational Monitoring Plan (Ecology 2015), samples were collected and analyzed for dissolved arsenic, nitrate, sulfate, and methane at each monitoring well. Samples were submitted to ALS Environmental laboratory in Everett, Washington on the same day as collection. A

summary of the analyses for groundwater samples collected at each well and the analytical methods is provided in Table 1.

Quality Assurance

Field and laboratory control samples were used to evaluate data precision, accuracy, representativeness, completeness, and comparability of the analytical results. The quality control samples included collection and analysis of one field duplicate for each analysis performed and analysis of a laboratory duplicate. The field duplicate was collected from monitoring well HWA-MW1 and identified on the chain-of-custody as DUP.

Validation of the analytical data was performed by Landau Associates following the guidelines in the appropriate sections of the US Environmental Protection Agency (EPA) Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review (EPA 1999; 2004) and included evaluation of the following:

- Chain-of-Custody records
- Holding times
- Laboratory method blanks
- Blank spikes/laboratory control samples
- Field duplicate results
- Completeness
- Overall assessment of data quality.

Based on the validation, all of the data were determined to be acceptable for use; therefore, no qualification of the data was necessary.

Results

The analytical results are summarized in Table 1 and the laboratory analytical report is attached (Attachment 1). Groundwater was analyzed for dissolved arsenic at all sample locations. Arsenic was detected in each of the samples at concentrations ranging from 1.2 micrograms per liter ($\mu\text{g/L}$; P-27B) to 22 $\mu\text{g/L}$ (HWA-MW1). Consistent with Site groundwater monitoring data for 2014 and 2015, detected concentrations of arsenic exceeded the cleanup level (5 $\mu\text{g/L}$) in the samples from monitoring wells HWA-MW1, HWA-MW2, and P-26 and were below the cleanup level at the point of compliance (downgradient well P-27B).

Also consistent with previous Site data, the first quarter 2016 groundwater data indicate that conditions are naturally reduced at the Site. Conditions that are at least iron-reducing will release arsenic due to reduction (solubilization) of iron-arsenic (FeAs) complexes. Site data indicate that Site conditions are not only iron-reducing, based on the detection of ferrous iron at all sample locations,

but also indicate sulfate reduction (i.e., conditions are more strongly reducing than required for solubilization of FeAs), based on the low detected concentrations of sulfate (less than 0.26 mg/L to 17 mg/L). In addition, methane is detected at all locations indicating that conditions are also methanogenic (methane producing), which is also indicative of highly reducing conditions.

The lowest detected ferrous iron concentrations and the highest sulfate concentrations were present at sampling location P-27B. These data, considered in conjunction with the low arsenic concentration at P-27B supports the conclusion that elevated arsenic concentrations at the Site are associated with reducing conditions, and reducing conditions sufficiently dissipate by the time groundwater migrates to the P-27B vicinity for groundwater to achieve the Site cleanup standard for arsenic.

For reference, groundwater monitoring data for 2014 and 2015, as presented in the 2015 Cleanup Report (LAI 2015), are attached (Attachment 2).

Conclusions

Detected concentrations of arsenic in groundwater at the Site are consistent with previous sampling data and consistent with the source of elevated arsenic conditions being reducing conditions unrelated to Site releases. Arsenic concentrations at the downgradient well (P-27/P-27B) continue to be below the cleanup level (5µg/L) and have decreased slightly since the March 2015 monitoring event. Site groundwater does not pose a threat to human health and the environment.

Because groundwater at the Site is not used as drinking water, the pathway of concern is a release to marine surface water. Arsenic has not been detected at concentrations greater than the cleanup level in any of the six groundwater samples collected from the downgradient monitoring well P-27/P-27B between March of 2014 and March of 2016, indicating that there is no complete pathway to surface water.

In accordance with the NFA and environmental covenant, quarterly compliance monitoring will continue for three additional quarters (June, September and December) in 2016. After 2016, compliance monitoring and reporting will be conducted on an annual basis until 2020.

Limitations


This document has been prepared for the exclusive use of the Port of Everett and Ecology for specific application to the North Marina Bayside ABW Project. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of the Port and Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by the Port and Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been

provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

LANDAU ASSOCIATES, INC.



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cc: Elise Gronewald, Port of Everett

Attachments:

Figure 1	Compliance Monitoring Well Locations
Table 1	Quarterly Groundwater Monitoring Results
Attachment 1	Laboratory Analytical Report
Attachment 2	Groundwater Monitoring Data 2014-2015

References

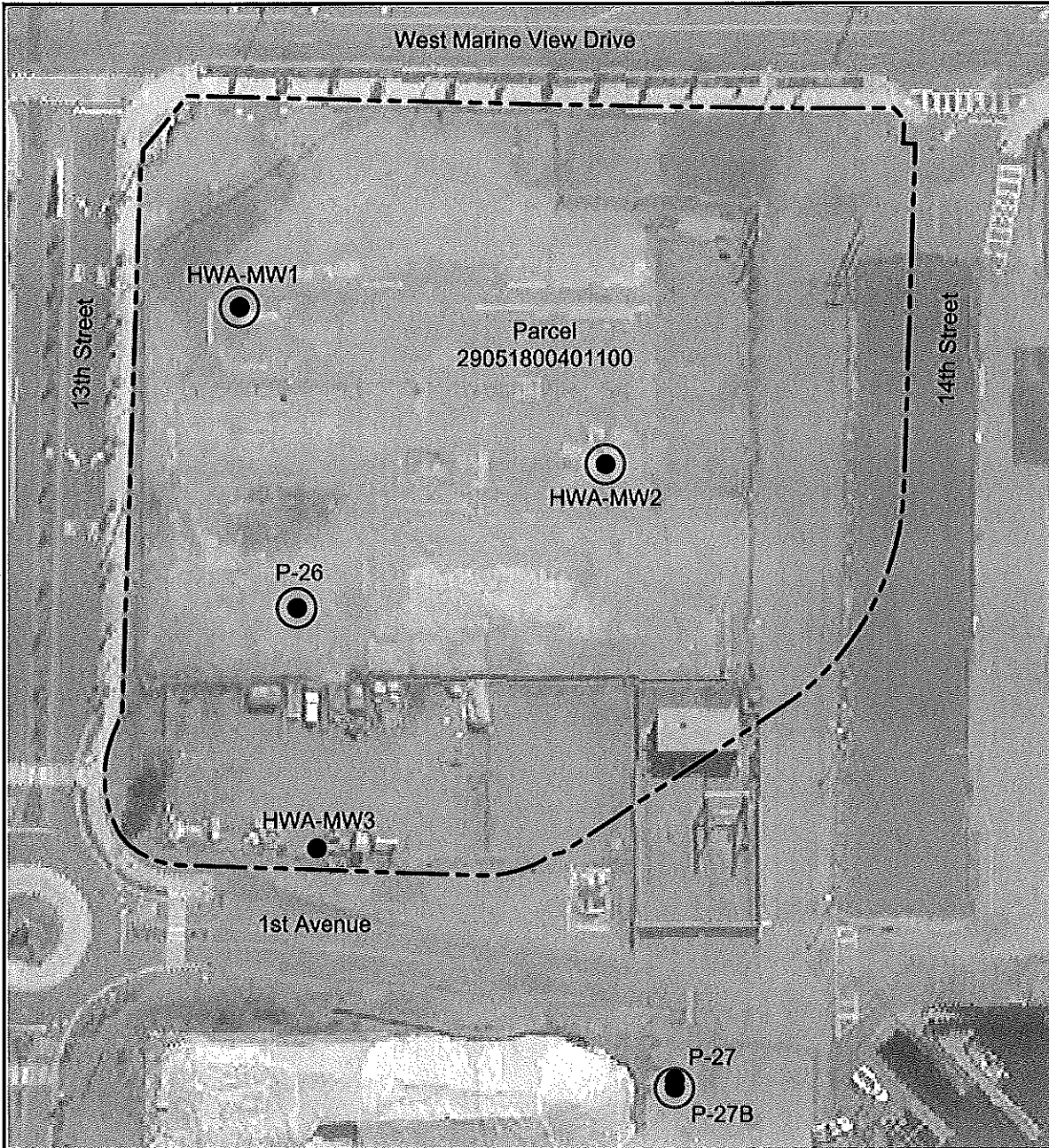
Ecology. 2015. Letter: Re: No Further Action at the following Site: North Marina Bayside ABW, 1332 West Marine View Drive, Everett, WA 98201. From Washington State Department of Ecology, to Elise Gronewald, Port of Everett. October 1.

EPA. 1999. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. edited by Office of Emergency and Remedial Response. Washington, DC: US Environmental Protection Agency.

EPA. 2004. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. edited by Office of Superfund Remediation and Technology Innovation: US Environmental Protection Agency.

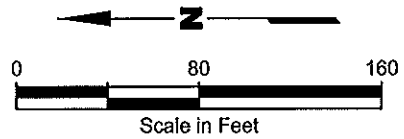
LAI. 2015. Environmental Investigation and Cleanup Documentation, American Boiler Works/Bayside Marine Site, Everett, Washington. Landau Associates, Inc. April 27.

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Legend

- Monitoring Well Location
- Monitoring Well to be Included in Monitoring Network (P-27B replaced P-27)
- - - - - Snohomish County Parcel Line / Area of Groundwater Use Restriction



Source: ©Bing Imagery, 2015; Snohomish County GIS (parcel data);



North Marina
ABW/Bayside Marine VCP Site
Port of Everett, Washington

**Compliance Monitoring
Well Locations**

Figure
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