

January 31, 2019

## Technical Memorandum

To: Rory Galloway, Dan Hatch, Russ Shropshire  
cc: Eric Hetrick  
From: Mr. Dale Myers, Washington State Department of Ecology  
Subject: Ecology Review Summary: Boeing Field Chevron, G-Logics Draft Feasibility Study Pilot Test Workplan, Dated 29 August 2018.

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The Washington State Department of Ecology (Ecology) with the assistance of Kennedy/Jenks Consultants is issuing its final edits and comments for the Boeing Field Chevron Feasibility Study Pilot Test Workplan. In the Spirit of moving this project along, only the red-line edits in the draft Workplan will be required. Therefore, it is Ecology's expectation that the comments provided below in this Technical Memorandum (Tech Memo) will be fully addressed in either the Pilot Study Report and/or the Feasibility Study Report (after the completion of Pilot Test).

Whereas the Draft Workplan will not be uploaded to the Boeing Field Chevron website, this Technical Memorandum will be uploaded. Boeing Field Chevron website:  
<https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=7030> .

This Tech Memo provides a summary of review comments for the Draft Feasibility Study Pilot Test Workplan (FSPTWP) prepared by G-Logics, Inc., dated 29 August 2018, and submitted to the Ecology for the Boeing Field Chevron site (Site) located in Tukwila, Washington. Ecology's primary comments are summarized in this Technical Memorandum and additional comments are included in the attached annotated version of the FSPTWP text (MS Word format, attached).

The 29 August 2018 FSPTWP is an update to the previous draft FSPTWP, dated 30 April 2018. Ecology provided comments to the potentially liable parties (PLPs) for previous draft FSPTWP on 14 May 2018. We understand that the scope of the Pilot Test is based, in part, on findings reported in the Draft Remedial Investigation (RI), Ecology's comment for the previous FSPTWP, and on discussions between the PLPs and Ecology, including a meeting to discuss the previous FSPTWP on 24 May 2018.

Ecology understands that the Pilot Study is being performed to evaluate the efficacy of implementing soil vapor extraction (SVE) and air sparging (AS) technologies for possible use at the Site, and that the results of the Pilot Study will be used to facilitate evaluation of potential Site cleanup alternatives in the upcoming Feasibility Study (FS), and that summary of the Pilot Study findings will be submitted to Ecology for review and comment prior to submittal of a combined RI/FS report for the Site.

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Ecology's primary comments for the 29 August 2018 Draft FSPTWP are summarized below and are identified by general category and numbered sequentially. Each category includes one or more comments followed by a summary of the supporting information (as appropriate), including references to the applicable section(s) in the FSPTWP text, and specific questions and requests for additional information from Ecology.

Additional comments and suggested edits are included in the attached FSPTWP text file.

**Remedial Design and Site-Wide Applicability [Section 1.0, page 2, last paragraph; Section 2.2, page 3]**

1. Ecology understands that the Pilot Study Report will include a discussion regarding the applicability of the Pilot Test findings to the larger Site based on lithologic variation in the shallow zone and the silty confining layer. Please discuss how the applicability of the results at the Pilot Test location be evaluated for the Site as a whole, considering the variations in lithology (differing types/depths of shallow fill, native soils, local sand lenses, excavation backfill, confining layer thickness, etc.).

*The soil types encountered in the shallow zone (i.e., above the silty confining interval) are variable across the Site. Previous Site investigations, as described in the December 2017 Draft RI Report, identified both native soils and fill materials in the shallow zone. Fill materials occur in the upper part of the shallow zone, within previous excavation areas, and within utility corridors, and were placed at the Site at various times (including initial and subsequent development phases and previous remedial excavations). Native soils are also present in the shallow zone, and generally include silty sand materials with local thin silt layers/lenses and interbedded sand layers/lenses. The interrelationship between the different shallow zone soil types varies across the Site and, consequently, the nature, stratigraphy, and lateral continuity of the particular soil materials present in the Pilot Test area are not necessarily representative of conditions at other areas of the Site.*

*Previous Site findings also indicate that the silty confining is not uniform across the Site, with variations in lithology (particularly local sandy interbeds/lenses) and thickness. Variations in thickness may be due, in part, to the local removal of the upper portion of the silty layer at previous excavation areas. Consequently, the Pilot Study findings for the lower saturated zone, including potential interconnectivity with the upper zone and/or evaluation of lateral continuity of the silty layer, may not be applicable to other areas of the Site.*

2. Ecology will not require a Modification to the FSPTWP text in Section 2.2 to indicate that remedial technologies other than those identified in your preliminary evaluation may also be applicable for the Site, however Ecology expects that the Feasibility Study Report will address this (see the attached FSPTWP text file for suggested edits).

*The intent of any FS is to screen process options and technologies to develop a range of remedial alternatives to address site conditions (all potential exposure pathways). Since*

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*this has not been performed yet, potentially applicable remedial alternatives to address conditions at the Site cannot be limited to the preliminary alternatives identified in the FSPTWP. Multiple other remedial technologies may be applicable for the conditions present at this site. It is premature to define which alternatives will be evaluated in the FS at this time.*

**Nature and Extent of Contamination [Section 2.1, page 2]**

Ecology understands that a discussion will be included in the Pilot Study Report regarding the following

3. Indicate that potential connectivity between the two saturated zones has not been fully characterized, and interconnections are likely present due to the heterogeneity of subsurface conditions (potentially via interconnected sand layers, at locations where silty materials have been previously removed during excavation or are relatively thin, or at previous well/borings where the silty interval was breached).
4. Indicate that the confining layer varies in thickness across the Site, including locations where it may be fairly thin (logs for the 2008 extraction wells show only a 1-2 foot thickness). Also indicate that the silty layer was not encountered at all previous locations.
5. Identify the lateral and vertical hydraulic gradients based on the existing water level data, and discuss water levels relative to the silty confining layer including seasonal variation.

*Based on existing water level and lithologic data, the potentiometric surface in the lower saturated zone may also be above the bottom of the confining layer at low tide at some locations (the thickness and elevations of the top/bottom of the confining layer are variable across the Site), and also above the top of the confining layer at some locations at high tide (at least seasonally).*

**Pilot Test Site-Wide Applicability and AS Well Locations [Section 3.0, page 4]**

6. Identify the lithologic conditions (for both saturated zones and the silty interval) encountered in the Pilot Test area as well as a discussion the extent to which these conditions may or may not be representative of other areas of the Site.

*The proposed locations for the AS wells are near potentially thin spots in the confining layer, and near former excavation areas. Therefore pilot test conditions may not be representative of the Site as a whole. The proposed well placements could produce biased results applicable only for those specific locations, which must be considered in evaluation of the pilot test data.*

**Pilot Test Parameters and Site-Wide Applicability [Section 4.3, page 10]**

7. Ecology understands that a discussion will be included in the Pilot Study Report regarding the relevance of the location-specific SVE parameters (peak flow, vacuum, ROI, etc.) to

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other Site areas where AS/ASVE implementation may be considered based on Pilot Test results.

**Screen Intervals and Water Levels in Observation Wells [Section 4.3.1, page 11]**

8. Ecology understands that the Pilot Study Report will contain a record of the status of screen intervals (i.e. length of available or unsubmerged screen interval at the time of testing) in the observation wells used during the Pilot Test and a discussion of how those test conditions have been considered during evaluation of the Pilot Test results.

*The tops of the screen intervals for the existing wells to be used as observation wells are very close to seasonal high water levels. Depending on when the pilot test is performed, seasonal water level variations may limit the usefulness of these wells for SVE observation purposes.*

**Upper Zone AS/SVE Testing [Section 4.4, page 13 and 14]**

9. Ecology understands that a discussion will be included in the Pilot Study Report regarding shallow zone soil heterogeneity and its possible effect on the fracture pressure (and other test parameters).

*Silty sand is common in the upper zone, but other soil types (such as coarser excavation backfill and sand layers/lenses) are also present in the study area. How will the AS/SVE Pilot Test parameters be evaluated and interpreted to account for variable Site lithology?*

10. Ecology understands that a discussion will be included in the Pilot Study Report regarding how formational fracturing was evaluated and/or identified during the Pilot Test.

**Lower Zone AS/SVE Test Methods [Section 4.5, page 16 and 17]**

11. Ecology understands that a discussion will be included in the Pilot Study Report regarding the evaluation of interconnectivity of the upper and lower saturated zones. Include discussion of applicability of Pilot Test results for the lower saturated zone to other areas of the Site.

*As noted above, this test (as designed) may not evaluate the variability in vapor transmissivity due to heterogeneity in the formation.*

*Also, a significant concern of Ecology's for full scale implementation of this technology is based on the potential for sparged hydrocarbon vapors to migrate off property and impact nearby populations. Ecology may not approve this technology for full-scale implementation if the concern over potential off-property vapor migration cannot be adequately addressed.*

12. Ecology understands that a discussion will be included in the Pilot Study Report regarding how vapor transmissivity will be evaluated for the Pilot Test location (i.e., what are the

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criteria for determining if transmissivity is sufficient to implement AS part of the remedial action?). Also include a discussion of how the transmissivity results for the Pilot Test location may be applied to other Site areas given the variability in the silty layer thickness and lithology.

*Ecology has previously expressed concerns regarding the applicability of AS/SVE technology at the Site, including those related to Site lithologic (as described in the previous comment) and hydrogeologic conditions. As such, the findings of the study will need to be carefully evaluated, and field parameters carefully monitored during each phase of the test.*

*It may be difficult to discern between specific pathways of vapor migration, particularly from the lower zone across the silty layer but also in the shallow zone. For example, if the test results suggest that vapor migration from the lower zone has occurred, it may be very difficult to identify the particular migration pathway, i.e. whether migration was through interconnected sand layers, a breach in the silty layer, or some other pathway. Also, lateral migration of air injected into the lower zone (toward preferential pathways) may occur, so the actual migration pathway may be difficult to ascertain. Consequently, if the analytical results indicate that contaminants were extracted during the Pilot Test, it may be difficult to identify the specific location and interval from which they originated.*

*Ecology has previously expressed concerns regarding potential off-Site vapor migration related to the use of AS/SVE at the Site, and this will need to be fully evaluated before Ecology will accept implementation of AS/SVE as a component of the remedial design for the Site.*

#### **Conditions and Criteria for Terminating the Pilot Test [Section 4.6]**

- 13. Ecology understands that a discussion will be included in the Pilot Study Report regarding a summary section of field conditions, observations, and criteria for which the Pilot Test was terminated (or modified) for each phase of the study.**

*Given the nature of the subsurface at the Site (utility corridors, previous excavation areas, variation in fill materials, etc.), the potential for short-circuiting (i.e., vapor migration along preferential pathways rather than through the formation) exists at the Site. Ecology has previously expressed concerns that short-circuiting could provide an inaccurate assessment of the overall SVE system performance; therefore, ensuring this does not occur is critical to the success of the pilot study.*

#### **Vapor Sample Collection and Analysis [Section 4.7, page 22]**

- 14. Ecology understands that a discussion will be included in the Pilot Study Report regarding a summary of how many vapor samples were submitted for laboratory analysis for each phase of the Pilot Study and conditions under which additional samples were submitted for laboratory analysis.**

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*Estimates of contaminant removal need to be based on the results of laboratory analysis of vapor samples. Although useful for screening purposes, field PID measurements are not suitable for remedial design purposes. Consequently, the laboratory analyses need to fully support the stated goals of the Pilot Test.*

Attachment: Draft Feasibility Pilot Study Work Plan - Text with Edits and Comments