STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

In the Matter of Remedial Action by:	AGREED ORDER
Port of Tacoma	No. DE 15816

TO: Rob Healy
Senior Manager, Environmental Programs
Port of Tacoma
1 Sitcum Plaza
Tacoma, Washington 98421-3000

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I. INTRODUCTION

The mutual objective of the State of Washington, Department of Ecology (Ecology) and Port of Tacoma under this Agreed Order (Order) is to provide for remedial action at a facility where there has been a release or threatened release of hazardous substances. This Order requires Port of Tacoma to implement a cleanup action plan. Ecology believes the actions required by this Order are in the public interest.

II. JURISDICTION

This Agreed Order is issued pursuant to the Model Toxics Control Act (MTCA), RCW 70.105D.050(1).

III. PARTIES BOUND

This Agreed Order shall apply to and be binding upon the Parties to this Order, their successors and assigns. The undersigned representative of each party hereby certifies that he or she is fully authorized to enter into this Order and to execute and legally bind such party to comply with this Order. Port of Tacoma agrees to undertake all actions required by the terms and conditions of this Order. No change in ownership or corporate status shall alter Port of Tacoma's responsibility under this Order. Port of Tacoma shall provide a copy of this Order to all agents, contractors, and subcontractors retained to perform work required by this Order, and shall ensure that all work undertaken by such agents, contractors, and subcontractors complies with this Order.

IV. DEFINITIONS

Unless otherwise specified herein, the definitions set forth in RCW 70.105D and WAC 173-340 shall control the meanings of the terms in this Order.

A. Site: The Site is referred to as Portac Site. The Site constitutes a facility under RCW 70.105D.020(8). The Site is defined by 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. Based upon factors currently known to Ecology, the Site is generally located at 4215 SR 509 E. Frontage Rd., Tacoma, WA 98421-3998 as shown on the Site Location Diagram (Exhibit A).

B. Parties: Refers to the State of Washington, Department of Ecology and Port of Tacoma.

C. Potentially Liable Persons (PLP(s)): Refers to Port of Tacoma.

D. Subject PLP(s): Refers to PLP(s) subject to this Order. Port of Tacoma.

E. Agreed Order or Order: Refers to this Order and each of the exhibits to this Order. All exhibits are integral and enforceable parts of this Order.

V. FINDINGS OF FACT

Ecology makes the following findings of fact, without any express or implied admissions of such facts by Port of Tacoma:

A. The Site consists of a 30-acre paved former log yard, and an adjacent former sawmill area adjoining Wapato Creek in the Commencement Bay tide flats area. At the former log yard, slag from the former Asarco smelter was used as ballast to form road beds. An investigation of the former log yard conducted by the State of Washington under authority of RCW 90.48 in the early 1980s showed that bark/slag surficial fill materials were releasing chemicals that were migrating into surface waters. The principal contaminants migrating from ballast materials were heavy metals, including: Arsenic, Copper, Lead, and Zinc. Analysis of soils and ballast materials indicated the presence, at that time, of these contaminants at concentrations that would exceed current MTCA cleanup levels. Portac, Inc. and/or its predecessor(s) in interest, operated the former log yard and sawmill at the Site during the time of the release. The Port of Tacoma owned the Site during the time of the release, and has maintained ownership.

B. Pursuant to a 1988 Order on Consent under RCW 90.48, the PLPs agreed to cap the former log yard to abate metals contamination of surface water runoff to Wapato Creek and Blair Waterway.

C. Although the primary purpose for capping the former log yard was to mitigate surface water metals contamination, the action was also expected to protect against groundwater contamination by preventing surface water infiltration and associated mobilization of metals. Site

groundwater is hydraulically connected with, and flows into, Wapato Creek. Wapato Creek in turn flows into the Blair Waterway of Commencement Bay in Puget Sound.

D. In addition to capping the former log yard, the PLPs also agreed to conduct groundwater monitoring twice a year for three years after paving to verify that metals concentrations in the groundwater did not worsen as a result of capping. A report prepared by Hart-Crowser for the Port of Tacoma in June 1992 entitled, "Final Report, Groundwater Quality Monitoring Program, Portac Log Sort Yard Remediation, Tacoma, Washington" indicated levels of arsenic in groundwater did not increase as a result of capping. However, groundwater concentrations measured at that time exceeded current MTCA cleanup levels at a standard point of compliance. Thus, the 1992 groundwater monitoring data showed that hazardous substances had been released to groundwater at concentrations in excess of current MTCA groundwater cleanup levels.

E. A restrictive (environmental) covenant is not currently in place to ensure the maintenance of the pavement cap at the Site. In addition, groundwater monitoring under the RCW 90.48 Order on Consent did not confirm that current MTCA cleanup levels were met at a conditional point of compliance, as would be required under current MTCA rules. Current MTCA rules require confirmational monitoring and institutional controls.

F. In 2009, Portac, Inc. entered into Ecology's Voluntary Cleanup Program (VCP) to address the release of toxic substances (pentachlorophenol into the soil and groundwater) within the former sawmill area. A number of Ecology's concerns regarding the former sawmill were addressed as a part of this VCP process; however, the Whitman Environmental Sciences (WES) report entitled "Log Yard Ramp Demolition" of January 16, 2009 indicates that contaminated slag and soils were detected in the area of the ramp connecting the sawmill area to the log yard area. The contaminated slag and soils encountered during excavation were properly excavated and disposed of, but some slag remained. The WES Groundwater Monitoring reports also indicated the presence of pentachlorophenol above current cleanup standards in one well. As a result of this

information, Ecology determined that the Site encompassed the former log yard, former saw mill, and any adjacent areas that may be affected by chemicals of concern related to those two areas.

G. In 2016, Portac, Inc. and the Port of Tacoma entered into Agreed Order No. DE 11237 to perform a Remedial Investigation and Feasibility Study. That work was completed and preliminary approval given by Ecology on March 6, 2018.

H. On March 28, 2018, Portac, Inc. and the Port of Tacoma entered into a Settlement Agreement and Full Site Release, releasing Portac, Inc. from liability of the environmental responsibilities at the Portac site.

I. On August 8, 2018, an amendment to Agreed Order No. DE 11237 was signed between Ecology and the Port of Tacoma for removal of Portac, Inc. as a responsible party to the order and the addition of a draft Cleanup Action Plan (dCAP).

VI. ECOLOGY DETERMINATIONS

Ecology makes the following determinations, without any express or implied admissions of such determinations (and underlying facts) by Port of Tacoma.

A. Each PLP is an "owner or operator" as defined in RCW 70.105D.020(22) of a "facility" as defined in RCW 70.105D.020(8).

B. Based upon all factors known to Ecology, a "release" or "threatened release" of "hazardous substance(s)" as defined in RCW 70.105D.020(32) and (13), respectively, has occurred at the Site.

C. Based upon credible evidence, Ecology issued a PLP status letter to Portac, Inc. dated June 27, 2013, pursuant to RCW 70.105D.040, .020(26), and WAC 173-340-500. After providing for notice and opportunity for comment, reviewing any comments submitted, and concluding that credible evidence supported a finding of potential liability, Ecology issued a determination that Portac, Inc. is a PLP under RCW 70.105D.040 and notified Portac, Inc. of this determination by letter dated September 12, 2013.

D. Based upon credible evidence, Ecology issued a PLP status letter to Port of Tacoma dated June 27, 2013, pursuant to RCW 70.105D.040, .020(26), and WAC 173-340-500. After providing for notice and opportunity for comment, reviewing any comments submitted, and concluding that credible evidence supported a finding of potential liability, Ecology issued a determination that Port of Tacoma is a PLP under RCW 70.105D.040 and notified Port of Tacoma of this determination by letter dated September 12, 2013.

VII. WORK TO BE PERFORMED

Based on the Findings of Fact and Ecology Determinations, it is hereby ordered that Port of Tacoma take the following remedial actions at the Site and that these remedial actions must be conducted in accordance with WAC 173-340 unless otherwise specifically provided for herein:

A. The Scope of Work required by this Order consists of the following tasks and is to be consistent with the Phase 1 Cleanup work presented in the finalized Cleanup Action Plan (Exhibit D) for the Site and in accordance with the Schedule (Exhibit C):

ONGOING: Compliance Monitoring - implement monitoring of site groundwater at the Point of Compliance Well in the Sawmill Area and Conditional Point of Compliance Wells in the Log Yard Area as described in the Cleanup Action Plan, and other monitor wells on site in accordance with the Compliance Monitoring Plan and Contingency Response Plan to be prepared under the Scope of Work for this Agreed Order.

Cap Maintenance - periodic inspection and maintenance of the current Log Yard cap to limit stormwater infiltration.

YEAR 1: Preparation of an Engineering Design Report, Compliance Monitoring Plan and Contingency Response Plan that describe the methods by which the remedial actions required by the CAP will be implemented.

YEAR 2. Conveyance System Improvements including removal of significant accumulated debris in the site stormwater system that discharges at outfalls OF-2 and OF-3 and installation of tide gates at outfalls OF-2 and OF-3.

YEAR 3. Conveyance System Improvements: for outfalls OF-2 and OF-3, removal of the spill containment vaults and slip lining the conveyance pipes (or other trenchless pipe repair) between Wapato Creek and the removed vaults. A section of pipe or stormwater vault will be installed in place of each of the existing vaults.

YEAR 4. Permeable Reactive Barrier: construct a Permeable Reactive Barrier (PRB) parallel to Wapato Creek along the westernmost boundary of the Log Yard cap and along a portion of the northwestern boundary. The PRB will extend to below the streambed of Wapato Creek and will be expected to key into the underlying low permeability silts. It will be backfilled with reactive media to treat dissolved arsenic in the groundwater passing through the PRB. A low-permeability material to inhibit surface water infiltration and provide structural strength would be placed atop the reactive media to restore the grade to pre-excavation conditions. The PRB performance will be monitored and evaluated to determine effectiveness and the reactive media replenishment schedule. Monitoring wells will be installed within and downgradient of the PRB during its construction and will be used to assess the effectiveness of the PRB.

YEAR 9. Contingent Perched Zone Groundwater Treatment: this contingent element of the remedy would be implemented based on a trend analysis of water quality conditions in response to the previously implemented remedy components. This component of the remedy would be implemented if water quality concentrations are measured as a sustained flat or increasing trend in groundwater measured in wells on the site. This element includes collecting perched water with a French Drain type system. The collected perched water would be treated in situ in vaults that infiltrate downward into a more permeable layer. Overflow from the vaults would flow to a trench in the Sawmill Area where it would be treated in situ and infiltrated. Treatment

would be provided by a reactive media to meet cleanup levels at a designated Point of Compliance.

YEAR 9. Contingent Additional Conveyance System Improvements: this contingent element of the remedy would be implemented if base flow discharges from the conveyance system with continuing arsenic concentrations above the CULs. This element includes additional sections of stormwater conveyance pipes being slip lined or sealed via other trenchless pipe technologies upstream of the removed vaults.

The Phase 2 Cleanup work presented in the finalized Cleanup Action Plan for the Site, which includes construction of a future low-permeability cap, will be implemented under a separate future AO Amendment or Consent Decree. The Phase 2 Cleanup work will be implemented as part of future development of the site.

B. If Subject PLP(s) learns of a significant change in conditions at the Site, including but not limited to a statistically significant increase in contaminant and/or chemical concentrations in soil, groundwater, surface water, air, and/or sediments, Subject PLP(s), within seven (7) days of learning of the change in condition, shall notify Ecology in writing of said change and provide Ecology with any reports or records (including laboratory analyses, sampling results) relating to the change in conditions.

C. Port of Tacoma shall submit to Ecology written annual Progress Reports that describe the actions taken during the previous year to implement the requirements of this Order. All Progress Reports shall be submitted within thirty (30) days of the anniversary date of the entry of this Order. Unless otherwise specified by Ecology, Progress Reports and any other documents submitted pursuant to this Order shall be sent by email to Ecology's project coordinator. The Progress Reports shall include the following:

1. A list of on-site activities that have taken place during the quarter.
2. Detailed description of any deviations from required tasks not otherwise documented in project plans or amendment requests.

3. Description of all deviations from the Scope of Work and Schedule during the current year and any planned deviations in the upcoming year.
4. For any deviations in schedule, a plan for recovering lost time and maintaining compliance with the schedule.
5. All raw data (including laboratory analyses) received during the previous year (if not previously submitted to Ecology), together with a detailed description of the underlying samples collected.

D. A list of deliverables for the upcoming year if different from the schedule. Pursuant to WAC 173-340-440(11), Port of Tacoma shall maintain sufficient and adequate financial assurance mechanisms to cover all costs associated with the operation and maintenance of the remedial action at the Site, including institutional controls, compliance monitoring, and corrective measures.

1. Within one hundred and eighty (180) days of the effective date of this Order, Port of Tacoma shall submit to Ecology for review and approval an estimate of the costs under this Order for operation and maintenance of the remedial actions at the Site, including institutional controls, compliance monitoring and corrective measures. Within sixty (60) days after Ecology approves the aforementioned cost estimate, Port of Tacoma shall provide proof of financial assurances sufficient to cover all such costs in a form acceptable to Ecology.
2. Port of Tacoma shall adjust the financial assurance coverage and provide Ecology's project coordinator with documentation of the updated financial assurance for:
    i. Inflation, annually, within thirty (30) days of the anniversary date of the entry of this Order; or if applicable, the modified anniversary date established in accordance with this section, or if applicable, ninety (90) days after the close of Port of Tacoma's fiscal year if the financial test or corporate guarantee is used.

ii. Changes in cost estimates, within thirty (30) days of issuance of Ecology's approval of a modification or revision to the cleanup action plan (CAP) that result in increases to the cost or expected duration of remedial actions. Any adjustments for inflation since the most recent preceding anniversary date shall be made concurrent with adjustments for changes in cost estimates. The issuance of Ecology's approval of a revised or modified CAP will revise the anniversary date established under this section to become the date of issuance of such revised or modified CAP.

E. As detailed in the Cleanup Action Plan, institutional controls are required at the Site. Environmental (Restrictive) Covenants will be used to implement the institutional controls.

1. In consultation with Port of Tacoma, Ecology will prepare the Environmental (Restrictive) Covenants consistent with WAC 173-340-440, RCW 64.70, and any policies or procedures specified by Ecology. The Environmental (Restrictive) Covenants shall restrict future activities and uses of the Site as agreed to by Ecology and Port of Tacoma.
2. After approval by Ecology, Port of Tacoma shall record the Environmental (Restrictive) Covenant for affected properties it owns with the office of the Pierce County Auditor as detailed in the Schedule and Deliverables (Exhibit C). Port of Tacoma shall provide Ecology with the original recorded Environmental (Restrictive) Covenants within thirty (30) days of the recording date.

F. All plans or other deliverables submitted by Port of Tacoma for Ecology's review and approval under the Scope of Work and Schedule and Deliverables (Exhibit C) shall, upon Ecology's approval, become integral and enforceable parts of this Order.

G. If the Parties agree on an interim action under Section VI.E, Port of Tacoma shall prepare and submit to Ecology an Interim Action Work Plan, including a scope of work and schedule, by the date determined by Ecology. Ecology will provide public notice and opportunity to comment on the Interim Action Work Plan in accordance with WAC 173-340-600(16). The Port

of Tacoma shall not conduct the interim action until Ecology approves the Interim Action Work Plan. Upon approval by Ecology, the Interim Action Work Plan becomes an integral and enforceable part of this Order, and Port of Tacoma is required to conduct the interim action in accordance with the approved Interim Action Work Plan.

H. If Ecology determines that Port of Tacoma has failed to make sufficient progress or failed to implement the remedial action, in whole or in part, Ecology may, after notice to Port of Tacoma, perform any or all portions of the remedial action or at Ecology's discretion allow the Port of Tacoma opportunity to correct. In an emergency, Ecology is not required to provide notice to Port of Tacoma, or an opportunity for dispute resolution. Port of Tacoma shall reimburse Ecology for the costs of doing such work in accordance with Section VIII.A (Remedial Action Costs). Ecology reserves the right to enforce requirements of this Order under Section X (Enforcement).

I. Except where necessary to abate an emergency situation or where required by law, the Port of Tacoma shall not perform any remedial actions at the Site outside those remedial actions required by this Order to address the contamination that is the subject of this Order, unless Ecology concurs, in writing, with such additional remedial actions pursuant to Section VIII.J. (Amendment of Order). In the event of an emergency, or where actions are taken as required by law, Port of Tacoma must notify Ecology in writing of the event and remedial action(s) planned or taken as soon as practical but no later than within twenty-four (24) hours of the discovery of the event.

J. Ecology hereby incorporates into this Order the previous remedial actions described in Section V, Findings of Fact. Reimbursement for specific project tasks under a grant agreement with Ecology is contingent upon a determination by Ecology's Toxics Cleanup Program that the retroactive costs are eligible under WAC 173-332A-320(6), the work performed complies with the substantive requirements of WAC 173-340, and the work is consistent with the remedial actions required under this Order. The costs associated with Ecology's determination on the past independent remedial actions described in Section V, Findings of Fact, are recoverable under this Order.

VIII. TERMS AND CONDITIONS

A. Payment of Remedial Action Costs

Port of Tacoma shall pay to Ecology costs incurred by Ecology pursuant to this Order and consistent with WAC 173-340-550(2). These costs shall include work performed by Ecology or its contractors for, or on, the Site under RCW 70.105D, including remedial actions and Order preparation, negotiation, oversight, and administration. These costs shall include work performed both prior to and subsequent to the issuance of this Order. Ecology's costs shall include costs of direct activities and support costs of direct activities as defined in WAC 173-340-550(2). For all Ecology costs incurred, Port of Tacoma shall pay the required amount within thirty (30) days of receiving from Ecology an itemized statement of costs that includes a summary of costs incurred, an identification of involved staff, and the amount of time spent by involved staff members on the project. A general statement of work performed will be provided upon request. Itemized statements shall be prepared quarterly. Pursuant to WAC 173-340-550(4), failure to pay Ecology's costs within ninety (90) days of receipt of the itemized statement of costs will result in interest charges at the rate of twelve percent (12%) per annum, compounded monthly.

In addition to other available relief, pursuant to RCW 19.16.500, Ecology may utilize a collection agency and/or, pursuant to RCW 70.105D.055, file a lien against real property subject to the remedial actions to recover unreimbursed remedial action costs.

B. Designated Project Coordinators

The project coordinator for Ecology is:

Andrew Smith
Department of Ecology
Southwest Regional Office
PO Box 47775
Olympia, WA 98504-7775
360-407-6316
Andrew.Smith@ecy.wa.gov

The project coordinator for Port of Tacoma is:

Robert Healy
Port of Tacoma,

1 Sitcum Way, Tacoma WA
253-428-8643
rhealy@portoftacoma.com

Each project coordinator shall be responsible for overseeing the implementation of this Order. Ecology's project coordinator will be Ecology's designated representative for the Site. To the maximum extent possible, communications between Ecology and Port of Tacoma, and all documents, including reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Order shall be directed through the project coordinators. The project coordinators may designate, in writing, working level staff contacts for all or portions of the implementation of the work to be performed required by this Order.

Any party may change its respective project coordinator. Written notification shall be given to the other party at least ten (10) calendar days prior to the change.

C. Performance

All geologic and hydrogeologic work performed pursuant to this Order shall be under the supervision and direction of a geologist or hydrogeologist licensed by the State of Washington or under the direct supervision of an engineer registered by the State of Washington, except as otherwise provided for by RCW 18.43 and 18.220.

All engineering work performed pursuant to this Order shall be under the direct supervision of a professional engineer registered by the State of Washington, except as otherwise provided for by RCW 18.43.130.

All construction work performed pursuant to this Order shall be under the direct supervision of a professional engineer or a qualified technician under the direct supervision of a professional engineer. The professional engineer must be registered by the State of Washington, except as otherwise provided for by RCW 18.43.130.

Any documents submitted containing geologic, hydrogeologic, or engineering work shall be under the seal of an appropriately licensed professional as required by RCW 18.43 and 18.220.

Port of Tacoma shall notify Ecology in writing of the identity of any engineer(s) and geologist(s), contractor(s) and subcontractor(s), and others to be used in carrying out the terms of this Order, in advance of their involvement at the Site.

D. Access

Ecology or any Ecology authorized representative shall have access to enter and freely move about all property at the Site that Port of Tacoma either owns, controls, or has access rights to at all reasonable times for the purposes of, *inter alia*: inspecting records, operation logs, and contracts related to the work being performed pursuant to this Order; reviewing Port of Tacoma's progress in carrying out the terms of this Order; conducting such tests or collecting such samples as Ecology may deem necessary; using a camera, sound recording, or other documentary type equipment to record work done pursuant to this Order; and verifying the data submitted to Ecology by Port of Tacoma. Port of Tacoma shall make all reasonable efforts to secure access rights for those properties within the Site not owned or controlled by Port of Tacoma where remedial activities or investigations will be performed pursuant to this Order. Ecology or any Ecology authorized representative shall give reasonable notice before entering any Site property owned or controlled by Port of Tacoma unless an emergency prevents such notice. All persons who access the Site pursuant to this section shall comply with any applicable health and safety plan(s) and Port restricted access requirements. Ecology employees and their representatives shall not be required to sign any liability release or waiver as a condition of Site property access.

E. Sampling, Data Submittal, and Availability

With respect to the implementation of this Order, Port of Tacoma shall make the results of all sampling, laboratory reports, and/or test results generated by it or on its behalf available to Ecology. Pursuant to WAC 173-340-840(5), all sampling data shall be submitted to Ecology in both printed and electronic formats in accordance with Section VII (Work to be Performed), Ecology's Toxics Cleanup Program Policy 840 (Data Submittal Requirements), and/or any subsequent procedures specified by Ecology for data submittal.

If requested by Ecology, Port of Tacoma shall allow Ecology and/or its authorized representative to take split or duplicate samples of any samples collected by Port of Tacoma pursuant to implementation of this Order. Port of Tacoma shall notify Ecology seven (7) days in advance of any sample collection or work activity at the Site. Ecology shall, upon request, allow Port of Tacoma and/or its authorized representative to take split or duplicate samples of any samples collected by Ecology pursuant to the implementation of this Order, provided that doing so does not interfere with Ecology's sampling. Without limitation on Ecology's rights under Section VIII.E (Access), Ecology shall notify Port of Tacoma prior to any sample collection activity unless an emergency prevents such notice.

In accordance with WAC 173-340-830(2)(a), all hazardous substance analyses shall be conducted by a laboratory accredited under WAC 173-50 for the specific analyses to be conducted, unless otherwise approved by Ecology.

F. Public Participation

Ecology shall maintain the responsibility for public participation at the Site. However, Port of Tacoma shall cooperate with Ecology, and shall:

1. If agreed to by Ecology, develop appropriate mailing lists and prepare drafts of public notices and fact sheets at important stages of the remedial action, such as the submission of work plans, remedial investigation/feasibility study reports, cleanup action plans, and engineering design reports. As appropriate, Ecology will edit, finalize, and distribute such fact sheets and prepare and distribute public notices of Ecology's presentations and meetings.

2. Notify Ecology's project coordinator prior to the preparation of all press releases and fact sheets, and before meetings related to remedial action work to be performed at the Site with the interested public and/or local governments. Likewise, Ecology shall notify Port of Tacoma prior to the issuance of all press releases and fact sheets related to the Site, and before meetings related to the Site with the interested public and local governments. For all press releases, fact sheets, meetings, and other outreach

efforts by Port of Tacoma that do not receive prior Ecology approval, Port of Tacoma shall clearly indicate to its audience that the press release, fact sheet, meeting, or other outreach effort was not sponsored or endorsed by Ecology.

3. When requested by Ecology, participate in public presentations on the progress of the remedial action at the Site. Participation may be through attendance at public meetings to assist in answering questions or as a presenter.

4. When requested by Ecology, arrange and/or continue information repositories to be located at the following location:

a. **Tacoma Public Library**
1102 Tacoma Avenue South
Tacoma, WA 98402
(253) 292-2001

b. **Citizens for a Healthy Bay**
535 Dock Street, Suite 213
Tacoma, WA 98402
(253) 383-2429

c. **Ecology's Southwest Regional Office**
300 Desmond Dr SE
Lacey, 98503-1274
(360) 407-6045

At a minimum, copies of all public notices, fact sheets, and documents relating to public comment periods shall be promptly placed in these repositories. A copy of all documents related to this Site shall be maintained in the repository at Ecology's Southwest Regional Office in Lacey, Washington.

G. Retention of Records

During the pendency of this Order, and for ten (10) years from the date of completion of work performed pursuant to this Order, Port of Tacoma shall preserve all records, reports, documents, and underlying data in its possession relevant to the implementation of this Order and shall insert a similar record retention requirement into all contracts with project contractors and subcontractors. Upon request of Ecology, Port of Tacoma shall make all records available to Ecology and allow access for review within a reasonable time.

Nothing in this Order is intended to waive any right Port of Tacoma may have under applicable law to limit disclosure of documents protected by the attorney work-product privilege and/or the attorney-client privilege. If Port of Tacoma withholds any requested records based on an assertion of privilege, Port of Tacoma shall provide Ecology with a privilege log specifying the records withheld and the applicable privilege. No Site-related data collected pursuant to this Order shall be considered privileged.

H. Resolution of Disputes

1. In the event that Port of Tacoma elects to invoke dispute resolution Port of Tacoma must utilize the procedure set forth below.

a. Upon the triggering event (receipt of Ecology's project coordinator's written decision or an itemized billing statement), Port of Tacoma has fourteen (14) calendar days within which to notify Ecology's project coordinator in writing of its dispute (Informal Dispute Notice).

b. The Parties' project coordinators shall then confer in an effort to resolve the dispute informally. The parties shall informally confer for up to fourteen (14) calendar days from receipt of the Informal Dispute Notice. If the project coordinators cannot resolve the dispute within those 14 calendar days, then within seven (7) calendar days Ecology's project coordinator shall issue a written decision (Informal Dispute Decision) stating: the nature of the dispute; the Port of Tacoma's position with regards to the dispute; Ecology's position with regards to the dispute; and the extent of resolution reached by informal discussion.

c. Port of Tacoma may then request regional management review of the dispute. This request (Formal Dispute Notice) must be submitted in writing to the Southwest Region Toxics Cleanup Section Manager within seven (7) calendar days of receipt of Ecology's Informal Dispute Decision. The Formal Dispute Notice shall include a written statement of dispute setting forth: the nature of the dispute; the disputing Party's position with respect to the dispute; and the information relied upon to support its position.

d. The Section Manager shall conduct a review of the dispute and shall issue a written decision regarding the dispute (Decision on Dispute) within thirty (30) calendar days of receipt of the Formal Dispute Notice. The Decision on Dispute shall be Ecology's final decision on the disputed matter.

2. The Parties agree to only utilize the dispute resolution process in good faith and agree to expedite, to the extent possible, the dispute resolution process whenever it is used.

3. Implementation of these dispute resolution procedures shall not provide a basis for delay of any activities required in this Order, unless Ecology agrees in writing to a schedule extension.

4. In case of a dispute, failure to either proceed with the work required by this Order or timely invoke dispute resolution may result in Ecology's determination that insufficient progress is being made in preparation of a deliverable, and may result in Ecology undertaking the work under Section VII.E (Work to be Performed) or initiating enforcement under Section X (Enforcement).

I. Extension of Schedule

1. Port of Tacoma request for an extension of schedule shall be granted only when a request for an extension is submitted in a timely fashion, generally at least thirty (30) days prior to expiration of the deadline for which the extension is requested, and good cause exists for granting the extension. All extensions shall be requested in writing. The request shall specify:

a. The deadline that is sought to be extended.

b. The length of the extension sought.

c. The reason(s) for the extension.

d. Any related deadline or schedule that would be affected if the extension were granted.

2. The burden shall be on Port of Tacoma to demonstrate to the satisfaction of Ecology that the request for such extension has been submitted in a timely fashion and that good cause exists for granting the extension. Good cause may include, but may not be limited to:

a. Circumstances beyond the reasonable control and despite the due diligence of Port of Tacoma including delays caused by unrelated third parties or Ecology, such as (but not limited to) delays by Ecology in reviewing, approving, or modifying documents submitted by Port of Tacoma.

b. Acts of God, including fire, flood, blizzard, extreme temperatures, storm, or other unavoidable casualty.

c. Endangerment as described in Section VIII.K (Endangerment).

However, neither increased costs of performance of the terms of this Order nor changed economic circumstances shall be considered circumstances beyond the reasonable control of Port of Tacoma.

3. Ecology shall act upon any Port of Tacoma's written request for extension in a timely fashion. Ecology shall give Port of Tacoma written notification of any extensions granted pursuant to this Order. A requested extension shall not be effective until approved by Ecology. Unless the extension is a substantial change, it shall not be necessary to amend this Order pursuant to Section VIII.J (Amendment of Order) when a schedule extension is granted.

4. At Port of Tacoma's request, an extension shall only be granted for such period of time as Ecology determines is reasonable under the circumstances. Ecology may grant schedule extensions exceeding ninety (90) days only as a result of one of the following:

a. Delays in the issuance of a necessary permit which was applied for in a timely manner.

b. Other circumstances deemed exceptional or extraordinary by Ecology.

c. Endangerment as described in Section VIII.K (Endangerment).

J. Amendment of Order

The project coordinators may verbally agree to minor changes to the work to be performed without formally amending this Order. Minor changes will be documented in writing by Ecology within seven (7) days of verbal agreement.

Except as provided in Section VIII.L (Reservation of Rights), substantial changes to the work to be performed shall require formal amendment of this Order. This Order may only be

formally amended by the written consent of both Ecology and Port of Tacoma. Ecology will provide its written consent to a formal amendment only after public notice and opportunity to comment on the formal amendment.

When requesting a change to the Order, Port of Tacoma shall submit a written request to Ecology for approval. Ecology shall indicate its approval or disapproval in writing and in a timely manner after the written request is received. If Ecology determines that the change is substantial, then the Order must be formally amended. Reasons for the disapproval of a proposed change to this Order shall be stated in writing. If Ecology does not agree to a proposed change, the disagreement may be addressed through the dispute resolution procedures described in Section VIII.H (Resolution of Disputes).

K. Endangerment

In the event Ecology determines that any activity being performed at the Site under this Order is creating or has the potential to create a danger to human health or the environment on or surrounding the Site, Ecology may direct Port of Tacoma to cease such activities for such period of time as it deems necessary to abate the danger. Port of Tacoma shall immediately comply with such direction.

In the event Port of Tacoma determines that any activity being performed at the Site under this Order is creating or has the potential to create a danger to human health or the environment, Port of Tacoma may cease such activities. Port of Tacoma shall notify Ecology's project coordinator as soon as possible, but no later than twenty-four (24) hours after making such determination or ceasing such activities. Upon Ecology's direction, Port of Tacoma shall provide Ecology with documentation of the basis for the determination or cessation of such activities. If Ecology disagrees with Port of Tacoma's cessation of activities, it may direct Port of Tacoma to resume such activities.

If Ecology concurs with or orders a work stoppage pursuant to this section, Port of Tacoma's obligations with respect to the ceased activities shall be suspended until Ecology determines the danger is abated, and the time for performance of such activities, as well as the time

for any other work dependent upon such activities, shall be extended in accordance with Section VIII.I (Extension of Schedule) for such period of time as Ecology determines is reasonable under the circumstances.

Nothing in this Order shall limit the authority of Ecology, its employees, agents, or contractors to take or require appropriate action in the event of an emergency.

L. Reservation of Rights

This Order is not a settlement under RCW 70.105D. Ecology's signature on this Order in no way constitutes a covenant not to sue or a compromise of any of Ecology's rights or authority. Ecology will not, however, bring an action against Port of Tacoma to recover remedial action costs paid to and received by Ecology under this Order. In addition, Ecology will not take additional enforcement actions against Port of Tacoma regarding remedial actions required by this Order, provided Port of Tacoma complies with this Order.

Ecology nevertheless reserves its rights under RCW 70.105D, including the right to require additional or different remedial actions at the Site should it deem such actions necessary to protect human health or the environment, and to issue orders requiring such remedial actions. Ecology also reserves all rights regarding the injury to, destruction of, or loss of natural resources resulting from the release or threatened release of hazardous substances at the Site.

By entering into this Order, Port of Tacoma does not admit to any liability for the Site. Although Port of Tacoma is committing to conducting the work required by this Order under the terms of this Order, Port of Tacoma expressly reserves all rights available under law, including but not limited to the right to seek cost recovery or contribution against third parties, and the right to assert any defenses to liability in the event of enforcement.

M. Transfer of Interest in Property

No voluntary conveyance or relinquishment of title, easement, leasehold, or other interest in any portion of the Site shall be consummated by Port of Tacoma without provision for continued implementation of all requirements of this Order and implementation of any remedial actions found to be necessary as a result of this Order.

Prior to Port of Tacoma's transfer of any interest in all or any portion of the Site, and during the effective period of this Order, Port of Tacoma shall provide a copy of this Order to any prospective purchaser, lessee, transferee, assignee, or other successor in said interest; and, at least thirty (30) days prior to any transfer, Port of Tacoma shall notify Ecology of said transfer. Upon transfer of any interest, Port of Tacoma shall notify all transferees of the restrictions on the activities and uses of the property under this Order and incorporate any such use restrictions into the transfer documents.

N. Compliance with Applicable Laws

1. *Applicable Laws.* All actions carried out by Port of Tacoma pursuant to this Order shall be done in accordance with all applicable federal, state, and local requirements, including requirements to obtain necessary permits or approvals, except as provided in RCW 70.105D.090. At this time, no federal, state, or local requirements have been identified as being applicable to the actions required by this Order. Port of Tacoma has a continuing obligation to identify additional applicable federal, state, and local requirements which apply to actions carried out pursuant to this Order, and to comply with those requirements. As additional federal, state, and local requirements are identified by Ecology or Port of Tacoma, Ecology will document in writing if they are applicable to actions carried out pursuant to this Order, and Port of Tacoma must implement those requirements.

2. *Relevant and Appropriate Requirements.* All actions carried out by Port of Tacoma pursuant to this Order shall be done in accordance with relevant and appropriate requirements identified by Ecology. At this time, no relevant and appropriate requirements have been identified as being applicable to the actions required by this Order. If additional relevant and appropriate requirements are identified by Ecology or Port of Tacoma, Ecology will document in writing if they are applicable to actions carried out pursuant to this Order and Port of Tacoma must implement those requirements.

3. Pursuant to RCW 70.105D.090(1), Port of Tacoma may be exempt from the procedural requirements of RCW 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 and of any laws

requiring or authorizing local government permits or approvals. However, Port of Tacoma shall comply with the substantive requirements of such permits or approvals. For permits and approvals covered under RCW 70.105D.090(1) that have been issued by local government, the Parties agree that Ecology has the non-exclusive ability under this Order to enforce those local government permits and/or approvals. At this time, no state or local permits or approvals have been identified as being applicable but procedurally exempt under this section.

4. Port of Tacoma has a continuing obligation to determine whether additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order. In the event either Ecology or Port of Tacoma determines that additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order, it shall promptly notify the other party of its determination. Ecology shall determine whether Ecology or Port of Tacoma shall be responsible to contact the appropriate state and/or local agencies. If Ecology so requires, Port of Tacoma shall promptly consult with the appropriate state and/or local agencies and provide Ecology with written documentation from those agencies of the substantive requirements those agencies believe are applicable to the remedial action. Ecology shall make the final determination on the additional substantive requirements that must be met by Port of Tacoma and on how Port of Tacoma must meet those requirements. Ecology shall inform Port of Tacoma in writing of these requirements. Once established by Ecology, the additional requirements shall be enforceable requirements of this Order. Port of Tacoma shall not begin or continue the remedial action potentially subject to the additional requirements until Ecology makes its final determination.

Pursuant to RCW 70.105D.090(2), in the event Ecology determines that the exemption from complying with the procedural requirements of the laws referenced in RCW 70.105D.090(1) would result in the loss of approval from a federal agency that is necessary for the state to administer any federal law, the exemption shall not apply and Port of Tacoma shall comply with both the procedural and substantive requirements of the laws referenced in RCW 70.105D.090(1), including any requirements to obtain permits or approvals.

O. Periodic Review

So long as remedial action continues at the Site, the Parties agree to review the progress of remedial action at the Site, and to review the data accumulated as a result of monitoring the Site as often as is necessary and appropriate under the circumstances. Unless otherwise agreed to by Ecology, at least every five (5) years after the initiation of cleanup action at the Site the Parties shall confer regarding the status of the Site and the need, if any, for further remedial action at the Site. At least ninety (90) days prior to each periodic review, Port of Tacoma shall submit a report to Ecology that documents whether human health and the environment are being protected based on the factors set forth in WAC 173-340-420(4). Ecology reserves the right to require further remedial action at the Site under appropriate circumstances. This provision shall remain in effect for the duration of this Order.

P. Indemnification

Port of Tacoma agrees to indemnify and save and hold the State of Washington, its employees, and agents harmless from any and all claims or causes of action (1) for death or injuries to persons, or (2) for loss or damage to property, to the extent arising from or on account of acts or omissions of Port of Tacoma, its officers, employees, agents, or contractors in entering into and implementing this Order. However, Port of Tacoma shall not indemnify the State of Washington nor save nor hold its employees and agents harmless from any claims or causes of action to the extent arising out of the negligent acts or omissions of the State of Washington, or the employees or agents of the State, in entering into or implementing this Order.

IX. SATISFACTION OF ORDER

The provisions of this Order shall be deemed satisfied upon Port of Tacoma's receipt of written notification from Ecology that Port of Tacoma has completed the remedial activity required by this Order, as amended by any modifications, and that Port of Tacoma has complied with all other provisions of this Agreed Order.

X. ENFORCEMENT

Pursuant to RCW 70.105D.050, this Order may be enforced as follows:

A. The Attorney General may bring an action to enforce this Order in a state or federal court.

B. The Attorney General may seek, by filing an action, if necessary, to recover amounts spent by Ecology for investigative and remedial actions and orders related to the Site.

C. A liable party who refuses, without sufficient cause, to comply with any term of this Order will be liable for:

1. Up to three (3) times the amount of any costs incurred by the State of Washington as a result of its refusal to comply.

2. Civil penalties of up to twenty-five thousand dollars ($25,000) per day for each day it refuses to comply.

D. This Order is not appealable to the Washington Pollution Control Hearings Board. This Order may be reviewed only as provided under RCW 70.105D.060.

Effective date of this Order: June 23, 2021

Port of Tacoma

Eric Johnson
Executive Director
1 Sitcum Way, Tacoma WA
253-428-8633

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Rebecca S. Lawson, P.E., LHG
Section Manager
Toxics Cleanup Program
Southwest Regional Office
360-407-6241

EXHIBIT A
Site Location Diagram

FIGURE 1-1

Vicinity Map

Remedial Investigation Report
Parcel 15
Tacoma, WA

LEGEND

- Site Boundary
- Watercourse
- Waterbody

N

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Feet

Date: May 11, 2017
Data Sources: PORTAC, Aerial photo taken in July of 2013 by the USDA

GSI Water Solutions, Inc.

Document Path: P:\Portland\603-Port of Tacoma\GIS\Project_mxds\RI\Figure1-1_Vicinity_Map.mxd

EXHIBIT B
Remedial Action Location Map

Site Map
Cleanup Action Plan
Parcel 15

Blair Waterway

MARSHALL AVE

4TH ST E

LOG YARD AREA

SAWMILL AREA

E ALEXANDER AVE

Wapato Creek

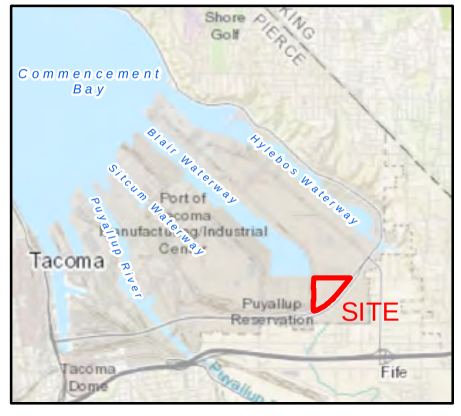
SR 509 N FRONTAGE RD

SR 509 S FRONTAGE RD

E 8TH ST

Legend

- Site Boundary
- Former Dip Tank
- Fill Containing Slag
- Railroad
- Watercourse
- Waterbody



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Data Source: Imagery from NearMap (dated May 2020).
Streams from Department of Natural Resources.
Roads from City of Tacoma.

Port of Tacoma

DISCLAIMER: The information included on this map has been compiled by Port of Tacoma staff from a variety of sources and is subject to change without notice.These data are intended for informational purposes and should not be considered authoritative for engineering, navigational, legal and other site-specific uses.The Port of Tacoma makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information.

Document Path: H:\Environmental\SHS\Portac\Parcel 15_Portac_SiteMap.mxd Date Revised: 8/25/2020 by ktauhi

EXHIBIT C
Schedule and Deliverables

Exhibit C
Agreed Order No. DE 15816
SCHEDULE AND DELIVERABLES
Parcel 15 (Former Portac Site)
Port of Tacoma

Deliverable	Schedule
Engineering Design Report[1]	The Engineering Design Report shall be submitted 280 calendar days following the effective date of the Agreed Order
Initiate Phase 1 Cleanup Actions	
Log Yard Conveyance System Improvements	Storm water conveyance system improvements shall be completed during the dry season (between May and September) following Ecology's approval of the Engineering Design Report
Permeable Reactive Barrier	The Permeable Reactive Barrier shall be installed within two years of completion of the Log Yard Conveyance System Improvments
Contingent - Conveyance System Improvements	Contingent conveyance system improvements would be implemented based on performance monitoring results of water quality conditions of base flow discharges from the storm water conveyance system
Contingent - Perched Zone Drainage and Treatment System Installation	Contingent perched zone drainage and treatment system installation would be implemented based on a trend analysis of performance monitoring results of the permeable reactive barrier
Conduct Long-term Monitoring	Semi-annual groundwater monitoring and annual cap inspections will be initiated upon the effective date of the Agreed Order
Implement Institutional Controls (Adopt CMCRP and CMMP) except for Environmental Convenant	Institutional controls will be implemented within 30 days of Ecology's approval of the Engineering Design Report
File Environmental Covenant	To be filed within 60 days of completion of the permeable reactive barrier and Ecology's approval of the covenant lanaguage

1) Includes Compliance Monitoring and Contingency Response Plan (CMCRP) and Contaminated Media Management Plan (CMMP)

EXHIBIT D
Cleanup Action Plan

Draft Cleanup Action Plan

Parcel 15 (Portac) - Port of Tacoma

June 9, 2020

Prepared by:

Washington State Department of Ecology

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Contents

Tables

Figures

Appendix

Abbreviations and Acronyms

µg/L	microgram per liter
ARAR	applicable, relevant and appropriate requirement
bgs	below ground surface
CAP	Cleanup Action Plan
CMCRP	Compliance Monitoring and Contingency Response Plan
CMMP	contaminated media management plan
CUL	cleanup levels
CWA	Clean Water Act
DCA	disproportionate cost analysis
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FRTR	Federal Remediation Technologies Roundtable
FS	feasibility study
GCL	geosynthetic clay liner
GSI	GSI Water Solutions, Inc.
HMA	hot mix asphalt
IC	institutional control
LEL	lower explosive limit
LLC	limited liability company
Log Yard	former log yard area at the Site
mg/kg	milligram per kilogram
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
NPV	net present value
OMMP	operations maintenance and monitoring plan
Order	Agreed Order
PCP	pentachlorophenol
pH	negative log of the hydrogen ion concentration in solution
POC	point of compliance
Port	Port of Tacoma
Portac	Portac, LLC
PQL	practical quantification limits
PRB	permeable reactive barrier
RCC	roller-compacted concrete
RCW	Revised Code of Washington
REL	remediation level
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
Sawmill	former sawmill area at the Site
Site	Parcel 15 – Former Portac sawmill and log yard
SR	State Route
SVOC	semivolatile organic compound
VCP	Voluntary Cleanup Program
VOC	volatile organic compound
WAC	Washington Administrative Code
ZVI	zero valent iron

Executive Summary

This document presents the Cleanup Action Plan (CAP) for the Port of Tacoma (Port) Parcel 15 Site (Site) near Tacoma, Washington. The CAP, prepared by the Washington State Department of Ecology (Ecology) in collaboration with the Port, meets the requirements of the Model Toxics Control Cleanup Act (MTCA) and implementing regulations Chapter 70.105D RCW; WAC Chapter 173-340WAC. The CAP describes Ecology's proposed cleanup action for this site and sets forth the requirements for the cleanup.

Background: The Site is an approximately 52-acre triangular parcel near the Blair Waterway owned by the Port of Tacoma. Figure 1 shows the location of the Site. The Site consists of two functionally distinct historical use areas: the former sawmill area (Sawmill) in the southwestern part of the property; and the former log yard area (Log Yard) occupying the remainder of the Site, as shown on Figure 1.

- **Log Yard:** Slag from the former ASARCO smelter was used as a road base to stabilize surface soils in the Log Yard. Studies showed that metals (e.g., arsenic, copper, lead, and zinc) were leaching from the slag and being discharged into Wapato Creek in surface water and groundwater. The Log Yard was capped in 1988 to prevent runoff of contaminated surface water from flowing into Wapato Creek. Groundwater monitoring and maintenance of the cap has been conducted over the ensuing years.
- **Sawmill:** The sawmill operated from 1974 to 2009 and used pentachlorophenol (PCP) to prevent sap staining on the cut wood. Contaminated soil was removed from the sawmill area in the early 2000s. Groundwater contaminated with PCP remains at one location near Wapato Creek.

Evaluation of Alternatives: A comprehensive remedial investigation (RI) and feasibility study (FS) were initiated in 2016. The RI documented current environmental conditions throughout the Site, assessed contaminant fate and transport properties, and provided the information needed to develop the FS. The FS defined applicable Site cleanup standards, screened potentially viable cleanup technologies, and evaluated a range of cleanup alternatives. Five cleanup alternatives were evaluated for the Log Yard, and three were evaluated for the Sawmill. A sixth cleanup alternative was later evaluated for the Log Yard in an FS Addendum. Preferred cleanup alternatives were identified after evaluation against MTCA threshold criteria, evaluation of restoration time frame and completion of a disproportionate cost analysis.

Ecology's Cleanup Decision: The FS and FS Addendum identified **Alternative 3A** for the Log Yard and **Alternative 1** for the Sawmill as preferred remedial alternatives. Ecology concurs with the findings of the alternatives evaluation as contained in those documents, and has selected these two cleanup alternatives for implementation at the Site. These alternatives comply with MTCA remedy selection criteria, and also comply with Ecology's expectations for cleanup remedies as defined in WAC 173-340-370.

The selected cleanup remedies include the following components:

- **Log Yard Remedy:** The selected Log Yard remedy uses a two-phased approach. The first phase of cleanup (Figure 6) will be implemented following finalization of this CAP and will include maintenance of the existing cap, improvements to the stormwater conveyance system, installation and operation of a permeable reactive barrier (PRB) along Wapato Creek, environmental monitoring, and implementation of institutional controls (ICs). The second phase of cleanup will be implemented following completion of land use planning and in parallel with future Site redevelopment. The second phase (Figure 6) includes replacement of the existing cap with a low-permeability geosynthetic clay liner (GCL) cap or an alternate cap achieving the same or better infiltration control performance. The remedy also includes contingent remedial actions to be used in the event that Site remediation levels are not met.
- **Sawmill Remedy:** The selected remedy for the Sawmill uses natural attenuation processes to treat residual PCP in groundwater, within the former dip tank area. The remedy incorporates natural attenuation monitoring, institutional controls, and contingent remedial actions.

The cleanup will be implemented in two phases. Compliance monitoring will ensure that cleanup standards are met.

SECTION 1

Introduction

1.1 Purpose

This document presents the Cleanup Action Plan (CAP) for the Port of Tacoma (Port) Parcel 15 Site (Site) near Tacoma, Washington. Site details are shown in Figure 1. A CAP is required as part of the site cleanup process under Washington Administrative Code (WAC) Chapter 173-340. The CAP identifies the proposed cleanup action for the Site and provides an explanatory document for public review. More specifically, this plan:

- Describes the Site
- Summarizes current Site conditions
- Identifies site-specific cleanup levels and points of compliance for each hazardous substance and medium of concern for the proposed cleanup action
- Summarizes the cleanup action alternatives considered during the feasibility study (FS) and the remedy selection process
- Describes the cleanup action selected by Washington State Department of Ecology (Ecology) for the Site and the basis for remedy selection
- Summarizes the compliance monitoring framework for the site;
- Identifies applicable state and federal laws for the proposed cleanup action
- Identifies residual contamination remaining on the site after cleanup
- Presents the schedule for implementing the CAP

Ecology has made a preliminary determination that a cleanup conducted in conformance with this CAP will comply with the requirements for selection of a remedy under WAC 173-340-360.

1.2 Previous Studies

A comprehensive summary of previous environmental investigations prior to the remedial investigation (RI) (GSI 2017) is provided in the RI. Table 1 provides a summary of documents representing the primary investigations and evaluations.

RI activities were conducted during 2016 and 2017 consistent with an Ecology-approved RI Work Plan (GSI, 2016; Ecology, 2016). The investigation approach for the RI entailed testing for arsenic concentrations and redox chemistry across the Site, with additional testing near Wapato Creek for geochemical conditions affecting arsenic mobility and attenuation. Additional constituents, such as pentachlorophenol (PCP), were analyzed in historical source areas in the Sawmill. Data collection included groundwater sampling, soil sampling,

test pit explorations, porewater sampling, surface water sampling, outfall discharge sampling, sediment sampling, and a tidal study in the adjacent Wapato Creek. In addition, the following Ecology-approved activities were conducted beyond the scope of work described in the RI work plan:

- Conducted a video survey of stormwater lines.
- Visually inspected and surveyed the invert elevations in the spill containment vaults located adjacent to Manholes #1 and #6.
- Installed transducers to evaluate water level fluctuations in response to precipitation seepage through the cap.
- Abandoned monitoring well HC-1 to prevent it from acting as a potential conduit for rainwater to migrate into the underlying fill containing slag.

Post-RI studies conducted have included the following:

- Preparing a MTCA feasibility study (FS) (GSI, 2018) that screened potentially viable remedial technologies; considered potential effects of climate change; analyzed different remedial alternatives, including five for the Log Yard and three for the Sawmill; and identified preferred remedial alternatives for each area following completion of a disproportionate cost analysis.
- Preparing a FS addendum (GSI, 2019a) that evaluated a refined remedial alternative for the Log Yard.
- Performing additional groundwater monitoring in February 2019 (GSI 2019b), with a second event in August 2019.

1.3 Regulatory Framework

The proposed cleanup action complies with the MTCA provisions for selecting a cleanup action as listed in WAC 173-340-360. Specifically, the proposed cleanup action will:

1. Protect human health and the environment. The cleanup action will mitigate potential risks associated with impacted groundwater at the Site, which will protect human or ecological receptors where groundwater discharges to surface water.

2. Comply with cleanup standards. Groundwater cleanup standards are established to address all potential exposure pathways. The cleanup action will meet those cleanup standards, or a series of contingency measures will be implemented until standards are achieved at points of compliance.

3. Comply with applicable state and federal laws. The cleanup action will comply with requirements of the state cleanup regulation (MTCA), as well as other applicable laws and regulations. All required permits will be obtained during cleanup implementation.

4. Provide for compliance monitoring. A performance groundwater quality monitoring plan will be developed to document performance monitoring and evaluation, and

attainment of groundwater cleanup standards. Contingent remedial actions are included and will be implemented if cleanup levels (CULs) established by MTCA are not met and remediation levels (RELs) are exceeded.

5. Use permanent solutions to the maximum extent practicable. The proposed cleanup action was evaluated in the FS and FS Addendum and was determined to be permanent to the maximum extent practicable. The selected remedy includes source control measures (capping and drainage system improvements within the Log Yard) to limit contaminant leaching and transport, uses treatment measures (including a permeable reactive barrier [PRB] within the Log Yard and biological degradation of contaminants in the Sawmill) to control groundwater contaminants, and incorporates applicable institutional controls.

6. Provide for a reasonable restoration time frame. The proposed cleanup action provides for a reasonable restoration time frame, with contingency actions included, as necessary, to achieve cleanup goals.

7. Consider public concerns. Ecology is making the draft CAP available for public review during a formal public comment period in accordance with the Amendment to Agreed Order No. DE-11237. Ecology will respond to public comments and concerns on the draft CAP received during the public comment period, prior to preparing the final CAP.

SECTION 2

Site Description

2.1 Site Location

Parcel 15 consists of an approximately triangular parcel of about 52 acres of land owned by the Port. The Site is located at 4215 State Route (SR) 509 – North Frontage Road in an industrial area between Interstate 5 and Commencement Bay, in Tacoma, Washington, as shown in Figure 1. The Site is bounded by East 4th Street (northern boundary), Alexander Avenue East (western boundary), and North Frontage Road (SR 509) (southeastern boundary). Wapato Creek is situated between Alexander Avenue East and the western edge of the property, and empties into the Blair Waterway through a culvert under East 4th Street. The Blair Waterway is in the southern portion of Commencement Bay, one of multiple industrial waterways developed in the 1900s to support international commerce.

2.2 Site History

Portac, LLC (Portac) and its predecessors leased the Site from the Port beginning in 1974 and vacated the Site in 2009. The Site consists of two functionally distinct historical use areas: the former sawmill area (Sawmill) in the southwestern part of the property, and the former log yard (Log Yard) occupying the remainder of the Site.

Historical industrial activities conducted on the Site adversely impacted upland soil, groundwater, and surface water in the adjacent Wapato Creek. Environmental investigations and cleanup under Ecology oversight have been ongoing since the late 1980s.

Like other milling and log storage operations in the Tacoma area, slag from the former ASARCO smelter was used as road base to stabilize surface soil in the Log Yard. During Log Yard operations the slag was pulverized by operating equipment and mixed with wood waste, which produced a slightly acidic and reduced environment that leached heavy metals, principally arsenic, from the slag. Historical analysis of upland soil and fill containing slag indicated that metals (i.e., arsenic) were present at concentrations that would exceed current MTCA soil cleanup levels (CULs).

Pursuant to the 1988 Order on Consent, State of Washington Department of Ecology Docket No. DE 88-S326 under RCW 90.48 (Order on Consent), Portac and the Port agreed to cap the Log Yard to abate metals contamination of surface water runoff discharging to the adjacent Wapato Creek. Although the primary purpose for capping the Log Yard was to mitigate surface water impacts, the action also was expected to mitigate groundwater contamination by preventing stormwater infiltration through the slag/wood waste fill, which was linked to leaching of metals. The Site was capped between late 1988 and early 1989, and inspection and maintenance of the cap have been ongoing under the 1988 Order on Consent, Section VI (4).

In 2009, Portac entered into Ecology's Voluntary Cleanup Program (VCP) to address the presence of contaminants (e.g., PCP) in soil and groundwater in the Sawmill. As described in the RI report, Portac implemented soil removal to address areas of identified contaminants. Approximately 4,950 tons of soil were removed as part of the combined VCP soil cleanup activities.

The Port and the former site tenant initiated a site-wide RI/FS in 2016 under Agreed Order No. DE 11237 with Ecology. That work resulted in production of site-wide RI and FS reports, and an FS addendum as described in Section 1.2.

2.3 Human Health and Environmental Concerns

Currently, the Log Yard is capped with roller-compacted concrete (RCC), installed as part of a remedial action, with two subsurface stormwater conveyance lines serving as Log Yard stormwater drainage (Figure 1). Currently, the Sawmill is partially paved; however, the particular area of interest (the area near the former dip tank, as shown in Figure 1) remains unpaved.

2.3.1 Log Yard

Before installation of the cap, infiltration or precipitation through the fill containing slag, and subsequent discharge of stormwater to Wapato Creek (via the former central drainage ditch, subsurface drains, and direct overland flow), served as a direct pathway for metals migration to surface water and potentially groundwater. The cap in the Log Yard was installed between late 1988 and early 1989 with the intention of cutting off surficial and shallow subsurface stormwater drainage through the fill containing slag. However, observations of ongoing perched water in a number of wells confirmed that there are portions of the Site where fill containing slag is still saturated, and thus leaching of metals from the slag still serves as an ongoing source of arsenic to groundwater (Figure 2). Although the cap significantly reduced infiltration and groundwater flux to the creek, seepage of ponded stormwater through the cap appears to be the primary source of the ongoing perched water.

Arsenic in groundwater has the potential to be transported toward Wapato Creek via either the groundwater-to-porewater-to-surface water pathway, or through infiltration into the storm drain system. Because the Log Yard has been capped, surface soil migration through water and wind erosion is not a significant release mechanism in the Log Yard portion of the Site. Further details on these pathway mechanisms are provided in the RI report (GSI, 2017).

Methane, a naturally occurring gas, is present below the Log Yard cap as a result of decomposition of the wood waste associated with the fill containing slag.

2.3.2 Sawmill

PCP was used historically at the former sawmill to prevent sap stain, applied in a water-based solution using spray booths and a dip tank. In previous remedial actions, PCP sources and contaminated soil were removed. Some PCP contamination persists in groundwater in

the immediate vicinity of the former dip tank (Figure 3), although it has not migrated to porewater or surface water at concentrations above screening levels. Decreases in PCP concentration have been observed over time due to natural degradation. However, elevated pH values in groundwater have been observed at the same well as the highest PCP detections (well MW-2R). The alkaline conditions in groundwater in the former dip tank excavation area are likely the result of the recycled concrete aggregate that was used for backfill (University of Wisconsin-Madison, 2012). The alkaline groundwater conditions are considered to be localized in the concrete aggregate backfill, given that a high pH was not observed in the three wells (MW-1, MW-3, and MW-4) located adjacent to the former dip tank excavation area.

Alkaline groundwater conditions can inhibit biological activity and reduce the adsorptive capacity of PCP, resulting in a localized increase in PCP mobility. However, PCP concentrations have continued to naturally attenuate over time, as shown in the trend plot in Appendix A.

In addition, two wells north of the former dip tank area (MW-1 and MW-3) have arsenic concentrations above the natural background concentrations. Groundwater arsenic concentrations in this range are likely caused by arsenic desorption from naturally occurring minerals, a process promoted under the reducing geochemical conditions and the nearby alkaline conditions in the former dip tank area (see the RI report for further details). Methane gas is also present in those wells.

2.4. Contaminants of Concern

The site-associated contaminants identified for cleanup are arsenic and PCP, with arsenic the primary driver in the Log Yard, and PCP the primary driver in the Sawmill. In addition, methane gas is identified as a site-associated contaminant in the Log Yard and portions of the Sawmill that will be managed through institutional controls (IC)s.

2.5 Cleanup Standards

Cleanup standards include cleanup levels, points of compliance (POCs), and remediation levels (RELs).

2.5.1 Cleanup Levels

MTCA's CULs are risk-based concentrations that are protective of generic exposure scenarios for a given site use. The RI report (GSI, 2017) summarizes potentially relevant human health and ecological screening criteria by medium. These screening criteria were derived from a variety of pertinent sources. The CUL for each medium is selected as the most stringent of the MTCA or applicable or relevant and appropriate requirement (ARAR) concentration, unless the natural background concentration is higher than that criterion. Because MTCA states that CULs should not be lower than natural background concentrations, CULs default up to the natural background concentration (or analytical testing limitations defined by the practical quantitation limit [PQL] where background

concentrations are not available). CULs and the associated protection basis are provided in Table 2 and described below

Soil

The lowest screening level for soil was selected as the CUL for the two site-associated contaminants as follows:

- **Arsenic CUL = 20 milligrams per kilogram (mg/kg),** based on the MTCA Method A industrial cleanup level. Note that the MTCA Method A criterion of 20 mg/kg was developed to be protective of groundwater at a concentration of 5 micrograms per liter (µg/L), which is based on natural background levels in groundwater.
- **PCP CUL = 328 mg/kg,** based on the MTCA Method C cancer screening value.

Groundwater and Surface Water

As discussed in the RI report, groundwater at the Site is nonpotable, and current and future Site use will be industrial. The highest beneficial use of groundwater at the Site is discharge to marine waters:

- **Arsenic CUL = 5 µg/L,** based on the MTCA Method A groundwater cleanup level, which in turn is based on the natural background level of arsenic in groundwater.
- **PCP CUL = 1 µg/L,** based on the PQL.

Air

Methane gas in soil at the Site poses a potential risk for indoor air quality for potential future use scenarios at the Site. As such, the MTCA Air Quality Guidance (WAC 173-340) sets a standard of 10 percent of the lower explosive limit (LEL) for all volatile organic compounds (VOCs). Therefore, the CUL for methane is:

- **Methane CUL = 0.5 percent by volume,** based on an LEL of 5 percent.

2.5.2 Points of Compliance

The POCs also are included in Table 2 for each media and Site area. POCs are the locations within the site where the cleanup standards must be met. Site POCs are discussed further in Section 4.3.

2.5.3 Remediation Levels

RELs are also shown in Table 2 where applicable. The RELs are used to determine when contingent remedial actions must be implemented. Site RELs are discussed further in Section 4.3.

SECTION 3

Evaluation of Cleanup Alternatives

This section provides a summary of key information provided in the FS and FS Addendum (GSI, 2018 and GSI, 2019a), including a detailed screening of remedial technologies, evaluation of cleanup alternatives, and identification of preferred remedial alternatives for each Site area. These technology screening and alternatives evaluation steps were conducted separately for each Site area, because the occurrence of the two primary site-associated contaminants (PCP and arsenic) differed for each portion of the Site.

3.1 Initial Screening of Technologies

3.1.1 Screening Approach

Potentially applicable remedial technologies were identified and screened employing available published resources and industry common practice. Two primary contaminants of interest are considered throughout this evaluation, PCP and arsenic; the treatment of both focuses on contamination in soil and water. The following sources of information were used to screen these technologies relative to the pertinent media:

- The Federal Remediation Technologies Roundtable (FRTR) screening matrix (http://www.frtr.gov)
- Federal (U.S. Environmental Protection Agency [EPA], U.S. Navy, U.S. Air Force, and U.S. Army Corps of Engineers) documents available online (https://cluin.org/databases/#67; http://www.epa.gov/remedytech/publicationsremediation-technologies-cleaning-contaminated-sites)
- Regional industry common practices for soil and water treatment

3.1.2 Preliminary Identification of Technologies

The FRTR screening matrix provides an overall rating of a technology group or process (e.g., In Situ Biological Treatment) with respect to broad chemical types such as "Inorganics." "Inorganics" is understood to include metals, such as arsenic, and "Halogenated SVOCs" (semivolatile organic compounds) is understood to include PCP. The FRTR rating system is structured as "Above Average," "Average," or "Below Average." As a result, the preliminary identification was performed in the following steps:

- All technologies rated "Above Average" for "Inorganics" or "Halogenated SVOCs" were determined to be applicable.
- Technologies that were rated "Average," "Below Average," or "Site Dependent" for "Inorganics" and "Halogenated SVOCs," but were known to be applicable, were added to the list of identified technologies.

The results of the preliminary technology identification screening for PCP and arsenic in soil are provided in the FS and FS Addendum.

3.1.3 Technology Evaluation

Available information in literature was reviewed to determine site-specific applicability of each technology identified in the preliminary screening. Each technology was screened for effectiveness and implementability. Technologies determined to be effective and implementable were retained for further consideration. Technologies deemed ineffective or not implementable at the Site were eliminated from further consideration.

3.1.4 Development of Remedial Alternatives

Six remedial alternatives for the Log Yard were assembled from the remedial technologies presented in the FS and FS Addendum. Table 3 summarizes the components of the remedial alternatives considered.

Three remedial alternatives for the Sawmill were assembled from the remedial technologies presented in the FS. Table 4 summarizes the components of the remedial alternatives considered.

3.2 Detailed Evaluation of Alternatives

This section summarizes the evaluations of remedial alternatives as conducted during the FS and FS Addendum.

3.2.1 Threshold Requirements

Remedial actions performed under MTCA must meet a set of minimum requirements or threshold requirements. Per WAC 173-340-360(2)(a), alternatives that do not meet the threshold requirements are not considered viable remedial alternatives under MTCA. Each of the six evaluated Log Yard alternatives and the three Sawmill alternatives were determined to comply with threshold requirements, which are to:

- Protect human health and environment
- Comply with cleanup standards
- Comply with applicable state and federal laws
- Provide for compliance monitoring

3.2.2 Other MTCA Requirements

A preferred remedial alternative for each Site area was defined after evaluating other MTCA requirements. These additional requirements included the following:

- Use permanent solutions to the maximum extent possible
- Provide for a reasonable restoration time frame

- Consider public concerns

3.2.3 Restoration Time Frame

The restoration time for each alternative was evaluated during the FS and FS Addendum. A summary of those evaluations is provided below:

Log Yard

All evaluated remedial alternatives in the Log Yard are expected to achieve cleanup objectives within a similar time frame. That time varies as described below:

- **Groundwater restoration time frame:** Residual groundwater contamination is expected to remain within the Site under all Log Yard alternatives. Following remedial actions (capping or soil removal), residual groundwater contamination is expected to attenuate as a result of ongoing geochemical processes that sequester arsenic. However, this is expected to require many decades under all alternatives. No practicable alternatives were defined that could result in a more rapid groundwater restoration time frame. Given the extended restoration time frames for Site groundwater, all FS and FS Addendum cleanup alternatives include contingent remedial actions for arsenic in groundwater. The schedule for installation of a PRB along Wapato Creek is expedited in Alternative 3A to optimize groundwater restoration time frames. Remediation levels will be used to determine whether contingent remedial actions should be undertaken at the Site.

- **Restoration time frame for benthic receptors, sediments and surface water:** Despite the extended groundwater restoration time frame, RI monitoring documented that concentrations of arsenic in Wapato Creek surface water were below levels protective of aquatic organisms and groundwater background levels, the levels in sediments were below natural background, and arsenic concentrations in porewater were below those protective of benthic organisms. Therefore, aquatic and benthic receptors are expected to remain protected throughout the groundwater restoration time frame.

- **Termination of stormwater migration pathway:** Groundwater infiltration to the stormwater system currently serves as a preferential pathway for arsenic migration to Wapato Creek. Stormwater conveyance system repair or replacement is proposed in all Log Yard remedial alternatives and is considered to be a priority action. Implementation of stormwater system repair is expected to occur in year one following regulatory approval. Reduction of seepage in the stormwater conveyance system is expected to occur immediately following system repair.

Sawmill

As evaluated in the FS, all three remedial alternatives in the Sawmill are expected to achieve cleanup objectives within a reasonable time frame. Ongoing natural attenuation of the primary contaminant, PCP, is an element of all three alternatives and is the primary

treatment in Alternative 1. Based on existing data, residual PCP in the Sawmill is expected to achieve cleanup standards through natural attenuation within approximately 12 to 16 years. The baseline alternative, Alternative 3, which proposes excavation, offsite disposal, temporary groundwater treatment, and monitored natural attenuation (MNA), anticipates a shorter restoration time frame of 4 to 6 years with performance monitoring. Alternative 2, an enhanced MNA or biodegradation alternative, anticipates an enhanced restoration time frame of 6 to 8 years with performance monitoring.

3.2.4 Disproportionate Cost Analysis

The MTCA disproportionate cost analysis (DCA) is used to determine which alternative is permanent to the maximum extent practicable. The DCA does this by comparing the relative costs and benefits of the different alternatives.

The evaluation criteria for the DCA are specified at WAC 173-340-360((3)(e), and include protectiveness, permanence, cost, long-term effectiveness, management of short-term risks, implementability, and consideration of public concerns.

In the FS and FS Addendum and Cleanup Action Plan, the individual criterion scores were weighted to emphasize protectiveness, permanence, and long-term effectiveness. The weighting factors used in the evaluation of Sawmill and Log Yard alternatives are as follows:

- Protectiveness: 25 percent
- Permanence: 20 percent
- Long-term effectiveness: 20 percent
- Management of short-term risks: 15 percent
- Technical and administrative implementability: 10 percent
- Consideration of public concerns: 10 percent

For each criterion, the benefits of the alternative were scored on a scale of 1 to 10 based on the degree to which the alternative meets that criterion. A score of 1 indicates that the alternative poorly meets the criterion and a score of 10 indicates that the alternative provides the highest benefit for that criterion. Overall benefits of the alternative are represented by the sum of the individual benefits scores, multiplied by the weighting factors. Tables 5 and 6 show this overall score in the "Environmental Benefit Score" column.

The preferred alternative for each Site area was identified by evaluating which alternatives were the most permanent without triggering disproportionate costs. As specified at WAC 173-340-360(3)(e), the alternatives were ranked from most permanent to least permanent using the benefits scores and the MTCA definition of permanent solution. Then the alternatives were evaluated to determine the relationship between remedy benefits and incremental costs of each alternative. As defined in MTCA, "costs are disproportionate to benefits if the incremental costs of the alternative over that of a lower-cost alternative exceed

the incremental degree of benefits achieved by the alternative over that of the other lower-cost alternative."

Log Yard DCA

A DCA was performed for five Log Yard alternatives in the FS. It was then updated for a sixth alternative (Alternative 3A) in the FS Addendum. The findings of the Log Yard DCA as presented in the FS Addendum are summarized below and in Table 5:

- **Protectiveness:** All proposed remedial alternatives meet the protectiveness threshold criteria and would be protective of human health and environment. However, significant differences in protectiveness were identified among the alternatives. Alternative 3 and 3A were the highest-ranked capping alternatives because both use a low-permeability cap expected to protectively address the source of perched water and reduce groundwater flux to Wapato Creek. The cap also separates the infiltration-control layer from the working surface, providing better protection of cap performance over the long term in comparison to other alternatives. Alternative 3 addresses the stormwater pathway through raising and replacing the stormwater system and Alternative 3A addresses the stormwater pathway through a combination of draining the perched water zone and stormwater system repairs. Because the replacement of the stormwater system in Alternative 3 occurs earlier than in Alternative 3A, Alternative 3 provides a more robust barrier to the stormwater pathway earlier than the stormwater system repairs of Alternative 3A. However, the contingent placement of the drainage system in Alternative 3A within the perched water zone provides more direct source reduction. Consequently, each alternative was awarded the same ranking score for protectiveness.

- **Permanence:** Scores for remedy permanence generally follow those for protectiveness. Among the capping alternatives, Alternatives 3 and 3A both received the highest score for permanence because of their use of the low-permeability cap, separation of the cap working surface from the infiltration-control layer, and stormwater system replacement.

- **Long-Term Effectiveness:** Scores for long-term effectiveness were highest for those alternatives expected to require the least active maintenance to protect remedy performance for the long term. Among the capping alternatives, long-term effectiveness scores were highest for Alternative 3 and 3A. Initial investments in a low-permeability cap under Alternative 3 or the perched groundwater treatment and PRB in Alternative 3A are expected to control the high-arsenic concentrations in perched groundwater and reduce arsenic flux toward Wapato Creek most effectively, enhancing the performance of natural attenuation processes. The separation of the cap working surface from the infiltration-control layer enhances the long-term performance of the cap and makes the remedy less dependent on active cap inspections and maintenance in comparison to Alternatives 1, 2, and 4. The remedies for Alternatives 3 and 3A do not require long-term active groundwater extraction, treatment, and monitoring, as required under Alternative 4. Alternative 5 received a high score for long-term effectiveness because of its use of offsite disposal in a commercial landfill for management of contaminated soils, rather than onsite containment beneath a cap.

- **Management of Short-Term Risks:** Scores for short-term risk-management varied significantly among the alternatives. Those alternatives that require the greatest exposure of contaminated materials during remedy implementation (i.e., Alternatives 4 and 5) received the lowest scores. Alternatives 1, 2, and 3 received higher scores because those alternatives require little or no exposure of contaminated soils or groundwater during remedy implementation. Alternative 3A received the same score ad Alternative 4, a higher score than Alternatives 5 but lower than other alternatives as it requires more direct exposure to contaminated soils via the early implementation of the perched groundwater treatment and PRB, but less exposure than Alternatives 4 and 5.

- **Technical and Administrative Implementability:** All Log Yard alternatives are considered to be sufficiently implementable to be evaluated in the FS. However, the complexity of implementation requirements varies significantly among the alternatives. Alternative 3A is considered to be the highly implementable because the primary remedial technologies, the perched groundwater treatment and PRB, can be implemented most easily with current facility use. Alternatives 1 and 2 are considered the most implementable because these alternatives use relatively simple construction methods not requiring exposure of contaminated soils or groundwater, and do not require additional permitting as do Alternatives 3, 4, or 5. Alternatives 3 and 3A require more regrading of the Site during cap construction, and will require issuance of a construction stormwater permit not required under Alternatives 1 and 2 because of the rubblization of the RCC cap. Implementation requirements for Alternatives 4 and 5 are much greater, resulting in lower scores for implementability. To be protective, Alternative 4 requires the use of short-term and long-term management methods for extracted groundwater. This would include development and maintenance of an individual NPDES permit, and performance of active groundwater treatment, monitoring, and reporting throughout the life cycle of the remedy. Alternative 5 requires implementation of the largest construction effort, use of management practices to prevent contaminant releases via stormwater, and implementation of measures to ensure safety during offsite transportation and disposal of contaminated soils removed from the Site.

- **Consideration of Public Concerns:** Public concerns will be evaluated after the public comment period, and alternative scoring will be altered as appropriate.

- **Environmental Benefit Score:** The derivation of this score is described above in Section 3.2.4. See Table 5 for the score for each alternative.

- **Probable Cost:** Cost estimates for each alternative are provided in Appendix A of the FS Addendum. The costs were evaluated on a 100-year timescale to fully capture the expected long-term care costs of the proposed remedies. Because of the areal extent of the Site and quantity of contaminated media present, remedies are material sensitive. Alternative 5, which proposes Site-wide excavation and offsite disposal, was estimated to have the highest cost (approximately $31 million). Alternatives 1 through 4 vary in initial construction cost, driven primarily by cap material quantities and significance of existing cap alteration. In terms of net present value

(NPV), Alternatives 1 through 4 have similar overall cost, ranging from $9.5 to $12.2 million.

DCA results are presented in Figure 4 for the Log Yard. Environmental benefit scores rank in the following order: Alternative 1 (lowest), 4, 2, 3, 3A, and 5 (highest). The incremental benefit increases in rough proportion with cost from Alternatives 1 through 3A. However, a large (more than twofold) cost increase occurs between Alternatives 3A and 5 without a corresponding increase in environmental benefits. Environmental benefits increase only 6 percent in contrast to a 190 percent increase in costs. Based on the disproportionate increase in costs for Alternative 5, Alternative 3A is identified as the preferred remedial alternative. Alternative 3A is permanent to the maximum extent practicable.

Sawmill DCA

Comparative analysis used to determine the benefit scoring and overall ranking of proposed remedial alternatives in the Sawmill are detailed below. The individual benefit scores and rankings are provided in Table 6.

- **Protectiveness:** The three Sawmill alternatives were evaluated for protectiveness relative to the expected timeline to reach CULs in all Site wells. Scores for Alternatives 3 and 2 were higher than for Alternative 1, given the longer restoration time frame for that alternative. However, all alternatives are expected to achieve compliance with Site CULs and protect human health and the environment.

- **Permanence:** All alternatives propose permanent remedies that would result in permanent reduction of contaminant mass and toxicity. PCP degrades naturally in aerobic and anaerobic groundwater conditions, ultimately to innocuous by-products. Differences among the alternatives were associated with the expected time to reach CULs in all Site wells. Alternative 3 had the highest score and Alternative 1 had the lowest score.

- **Long-Term Effectiveness:** All alternatives propose permanent remedies that would result in permanent reduction of contaminant mass and toxicity. PCP degrades naturally in aerobic and anaerobic groundwater conditions, ultimately to innocuous by-products. Alternative 1 scored lower than Alternatives 2 and 3 because of the longer time frame required to reach CULs in all wells, and the longer time frame required for implementation of interim environmental covenants at the Site.

- **Management of Short-Term Risks:** Each alternative was ranked relative to the significance of expected interaction and handling of contaminated media during implementation of the respective remedy. Alternative 3, which proposes excavation and temporary groundwater treatment, received the lowest relative ranking because it poses the greatest short-term exposure risks to workers during material removal and offsite transportation and disposal.

- **Technical and Administrative Implementability:** All Sawmill alternatives use commercially available construction methods. Alternative 3 received the lowest score because of its greater relative complexity in handling excavated materials and

coordinating offsite disposal. Alternative 1 received the highest implementability score because the treatment mechanism is ongoing and requires minimal infrastructure changes for long-term monitoring.

- **Consideration of Public Concerns:** Public concerns will be evaluated after the conclusion of the public comment period, and alternative scoring will be altered as appropriate.

- **Environmental Benefit Score:** The derivation of this score is described above in Section 3.2.4. See Table 6 for the score for each alternative.

- **Cost:** Each alternative includes provisions for compliance and confirmation monitoring, and cost estimates for the monitoring program are included in each alternative. Alternative 3, which proposes excavation and offsite disposal with temporary groundwater treatment, poses the greatest cost at an NPV of approximately $740,000; landfill disposal fees represent the greatest unit cost. Alternatives 1 and 2 had a similar NPV cost of approximately $500,000 to $540,000, despite initial capital expenditures in Alternative 2, because of expected savings in long-term monitoring costs.

Benefits and costs of remediation alternatives for the Sawmill are presented in Figure 5. Environmental benefit scores increase from Alternatives 1 to 2, but decrease between Alternatives 2 and 3. Remedy costs increase slightly between Alternatives 1 and 2. However, they increase substantially between Alternatives 2 and 3, without a corresponding increase in environmental benefit. Based on the disproportionate increase in costs for Alternative 3, Alternative 2 is identified as the preferred remedial alternative. Alternative 2 is permanent to the maximum extent practicable.

3.3 Optimization and Modification of Alternatives

3.3.1 Log Yard Alternative 3A Optimization

Additional evaluations were completed for the alternative that scored highest in the DCA for the Log Yard, Alternative 3A, to optimize the environmental benefit score versus probable cost. Based on these evaluations, sequencing of the elements of the alternative were revised as follows:

- Installation of the PRB earlier in the implementation of the remedy, in conjunction with the conveyance system improvements. The DCA evaluation called for the PRB installation later in the remedial action implementation, after conveyance system improvements and perched groundwater treatment actions were completed.

- Installation of the perched groundwater treatment system will be contingent on the performance of the PRB and conveyance system improvements, and would occur later in the implementation of the remedy. The DCA evaluation included the perched groundwater treatment system installation early in the remedial action implementation, before the PRB installation.

The probable cost, and environmental benefit score were recalculated based on these changes in sequencing. The revised tables and DCA figure from the FS Addendum are provided in Appendix B. Installing the PRB earlier and delaying the installation of the perched groundwater treatment system increases the probably cost from $11.4 million to $11.5 million while also increasing the environmental benefit score from 7.0 to 7.3. This revises the environmental benefit to probable cost ratio from 0.61 of 0.63. Alternative 3A is identified as the preferred remedial alternative. Alternative 3A is permanent to the maximum extent practicable.

3.3.2 Sawmill Alternative Modification

Additional evaluation of the source of alkalinity in groundwater in the former dip tank area was conducted following approval of the FS and FS addendum. It was determined that alkaline conditions are likely the result of the recycled concrete aggregate that was used for backfill (University of Wisconsin-Madison, 2012). The alkaline groundwater conditions are localized in the concrete aggregate backfill, given that a high pH was not observed in the three wells (MW-1, MW-3, and MW-4) located adjacent to the former dip tank excavation area. Alkaline groundwater conditions can inhibit biological activity and reduce the adsorptive capacity of PCP, resulting in a localized increase in PCP mobility. However, PCP concentrations have continued to naturally attenuate over time, as shown in the trend plot in Appendix A. Alternative 2 was selected in the FS based on the assumption that the pH could be modified by injecting amendments to enhance biodegradation. Given that the excavation in the dip tank area is backfilled with concrete aggregate, it is expected that injection of amendments would not provide the pH adjustment needed to enhance biodegradation.

The environmental benefit scores were recalculated based on these considerations. The revised DCA evaluation table and DCA figure from the FS are provided in Appendix C. This revises the environmental benefit to probable cost ratio for Alternative 2 from 1.34 to 1.09. Based on these revisions, Alternative 1 has the highest environmental benefit to cost ratio and Alternative 1 is selected as the preferred remedial alternative. Alternative 1 is permanent to the maximum extent practicable.

SECTION 4

Description of Selected Remedy

4.1 Basis for Remedy Selection

Ecology has selected the proposed remedy for the Site based on the alternatives evaluation conducted in the FS Report and the FS Addendum, and as described in Sections 3.2 and 3.3 of this CAP:

- **Alternative 3A** was selected as the preferred remedial alternative for the **Log Yard** and
- **Alternative 1** was selected as the preferred remedial alternative for the **Sawmill**.

These alternatives meet all of the threshold requirements under MTCA and provide a reasonable restoration time frame (see Section 3.2.3), and have been determined to be permanent to the maximum extent practicable as defined in WAC 173-340-360(3)(e) following completion of a disproportionate cost analysis (see Section 3.2.4). These alternatives also comply with Ecology's expectations for cleanup remedies as defined in WAC 173-340-370.

4.2 Description of the Cleanup Action

4.2.1 Log Yard

The selected alternative (Alternative 3A) is illustrated in Figures 6 and 7. Figure 8 details the implementation phasing for remedial actions and includes a time frame for completion. The remedy includes the following components, with planned remedial actions to be implemented in two discrete phases of construction (Phase 1 and Phase 2):

Planned Remedial Actions

- **Conveyance System Improvements (Phase 1):** Elements of the conveyance system improvements include the installation of tide gates, removal of the spill containment vaults, and installation of slip lining or other trenchless pipe. The goal of these actions are to eliminate preferential pathways between site groundwater and Wapato Creek. This work will include the following actions:
    - Tide gates will be installed at outfalls OF-2 and OF-3 to prevent tidal backflow from Wapato Creek.
    - Significant accumulated debris in the stormwater system will be removed.
    - Removal of the spill containment vaults and slip lining the conveyance pipes (or other trenchless pipe repair) between Wapato Creek and the

removed vaults will be completed. A section of pipe or stormwater vault would then be installed in place of each of the existing vaults.

- Performance monitoring will then be conducted for conveyance system improvements.

- **Permeable Reactive Barrier (Phase 1):** The PRB will be installed in conjunction with the conveyance system improvements to serve as the primary remedy. The goal of the PRB is to control and reduce the concentration of the arsenic in groundwater at the downgradient side of the PRB. The PRB will be installed parallel to Wapato Creek along the westernmost boundary of the cap and along a portion of the northwestern boundary (Figure 6). The PRB will extend to below the streambed of Wapato Creek. It will be backfilled with reactive media (e.g., iron filing or zero valent iron) to treat dissolved arsenic in the groundwater passing through the PRB. Based on preliminary analysis (to be confirmed with a design study), the PRB will extend to a depth of approximately 25 feet below ground surface (bgs), with reactive media placed between the interval of 10 and 25 feet bgs to intercept impacted groundwater (Figure 7). A low-permeability material to inhibit surface water infiltration and provide structural strength, such as a low-strength concrete, will be placed atop the reactive media to restore the grade to pre-excavation conditions. The PRB performance will be monitored to assess whether the PRB is achieving its goals. Monitoring wells installed downgradient of the PRB will be used to assess the effectiveness of the PRB.

- **Enhanced (Low-Permeability) Cap (Rubblize RCC and Install Clay Liner; Phase 2):** During Phase 2 of Site cleanup, a low-permeability GCL or cap of equivalent infiltration-control performance, will be constructed within the Log Yard at the time the Site undergoes redevelopment. The goal for this component of the cleanup is to (1) significantly reduce vertical seepage of stormwater through the cap and underlying fill containing slag, (2) significantly reduce seepage with elevated arsenic concentrations into the conveyance system, and (3) lower the perched groundwater level in the vicinity of monitoring wells HC-2, MW-10, and MW-13 to below the fill containing slag. The timing of the construction of the low-permeability cap will be determined by completion of land use planning efforts for the site and the timing for development at the site. This coordination of remediation and land use planning efforts is required to optimize cap and associated drainage performance. The conceptual implementation approach for the cap is as follows:

  - The RCC cap will be rubblized and the underlying gravel course removed to install a low-permeability GCL atop the fill containing slag. The cap will be sloped to subsurface drain structures.

  - A working surface will be constructed atop the GCL and the Site will be restored for ongoing uses. The working surface is expected to be composed sequentially of a geogrid, gravel, and standard hot mix asphalt surface. A schematic is shown in the inset in Figure 6.

  - In parallel with capping, the existing stormwater conveyance system will be abandoned and a replacement system installed at the same or higher grade with watertight seals and joints. The existing system will be abandoned by either complete removal or plugging with low-permeability material (e.g., low-strength concrete) at multiple stations throughout the system.

- **Remedy Maintenance Activities:**

  - The remedy includes planned maintenance activities for the PRB, the existing RCC cap, and the future low-permeability cap (following its installation). These activities will be defined for each phase of remedial action in operations maintenance and monitoring plans (OMMPs) to be prepared during remedial design. The first OMMP will address maintenance of the PRB and RCC cap. The second OMMP will address maintenance of the low-permeability cap.

  - The remedy also includes development of a contaminated media management plan (CMMP). The CMMP will define the method to be used to manage contaminated soil or groundwater that may be generated in the future during remedy maintenance or site development activities. The CMMP will be developed during remedial design.

- **Environmental Monitoring:** The planned remedy includes a comprehensive environmental monitoring program to document that cleanup standards are met and determine whether contingent remedial actions must be implemented. The details of the environmental monitoring program will be defined in a Compliance Monitoring and Contingency Response Plan (CMCRP). That document will be prepared during environmental design for the first phase of remedy implementation. Additional details regarding monitoring activities are described in Section 4.3.

- **Institutional Controls:** A restrictive covenant will be placed on the property to restrict the land use at the site to industrial uses, prohibit consumptive use of site groundwater, restrict activities that would compromise the remedial actions, and require a contingent soil gas evaluation should enclosed structures be constructed in the Log Yard.

Contingent Remedial Actions

Groundwater monitoring will be performed as described in the CMCRP to document compliance with cleanup standards. In the event that remediation levels are not met following implementation of the remedial action and environmental monitoring, contingent remedial actions will be implemented to ensure protection of human health and the environment. The remedy includes one defined contingent remedial action for groundwater and one for soil vapors as contemplated during development of the FS and this CAP:

- **Contingent Conveyance System Improvements:** If performance monitoring indicates that base flow discharges from the Log Yard outfalls with elevated arsenic concentrations continue after the Log Yard conveyance system

improvements described above, then additional sections of pipe will be slip lined or sealed via other trenchless pipe technologies upstream of the removed vaults.

- **Contingent Perched Groundwater Treatment:** Groundwater evaluations performed during the FS demonstrated that elevated arsenic levels in perched groundwater within the Log Yard can be reduced rapidly by treating the water with zero valent iron. If remediation levels for groundwater are not met downgradient of the PRB or arsenic concentrations in discharges from the Log Yard outfalls are not reduced, collection and treatment of perched groundwater may be implemented to reduce the flux of arsenic toward the PRB and into the stormwater conveyance system. This contingent treatment remedy would capture perched water with a French drain type collection system (see Figure 9). Perched water would be treated in situ (i.e., in collector vaults) and then re-infiltrated within the groundwater plume area at or upgradient of the PRB.
- **Contingent Management of Soil Vapors:** The RI confirmed that methane levels in soil gas are elevated within the Log Yard and portions of the Sawmill. These soil vapors are primarily associated with decomposition of wood waste present in the Log Yard area. There may also be contributions from natural organic matter deposits in site soils. Under current land uses, no management controls are required. However, in the event that buildings or other enclosed structures are constructed at the Site, an evaluation will be required to define soil gas management methods to prevent gas accumulation in the new structures.

4.2.2 Sawmill

The selected remedy for the Sawmill is Alternative 1 (Figure 10), with revisions as described below. The alternative includes the following components:

- **Natural Attenuation:** The PCP concentration in groundwater within the former dip tank area has been decreasing over time, confirming that natural attenuation of the PCP is occurring (Appendix A). This alternative will employ natural attenuation and monitoring in the former dip tank area to achieve compliance with groundwater cleanup standards. PCP concentrations in nearby wells (MW-1, MW-3, and MW-4) are already below site CULs.
- **Environmental Monitoring:** Groundwater monitoring will be performed to verify that natural attenuation of the remaining PCP contamination achieves groundwater cleanup standards. The groundwater program will be defined in the site CMCRP, which is to be developed during remedial design. Current monitoring expectations are described in Section 4.3.
- **Institutional Controls:** A restrictive covenant will be recorded for the Sawmill to document the cleanup as performed, restrict land uses to industrial use, restrict consumptive use of site groundwater in the former dip tank area pending compliance with cleanup standards, and require a contingent soil gas evaluation should enclosed structures be constructed in the Sawmill.
- **Contingent Management of Soil Vapors:** The RI confirmed that methane levels in soil gas are elevated within the Log Yard and portions of the Sawmill. These

soil vapors are primarily associated with decomposition of wood waste present in the Log Yard. There may also be contributions from natural organic matter deposits in site soils. Under current land uses, no management controls are required. However, in the event that buildings or other enclosed structures are constructed at the Site, an evaluation will be required to define soil gas management methods to prevent gas accumulation in the new structures.

4.3 Compliance Monitoring Framework

This section describes the compliance monitoring framework considered by Ecology during selection of the remedy.

Compliance monitoring activities associated with the cleanup include three types of monitoring:

- **Protection monitoring:** Includes monitoring during implementation of an active remedy to ensure continued protection of remediation workers and the environment. Projection monitoring requirements will be defined during remedial design for each phase of remedy construction.
- **Performance monitoring:** Includes monitoring activities to confirm that the cleanup action has attained cleanup standards and other performance requirements.
    - Performance monitoring requirements for soil capping activities will be defined during remedial design.
    - Performance monitoring requirements for groundwater monitoring will be defined in the CMCRP.
- **Confirmational monitoring:** Includes monitoring activities to confirm the long-term effectiveness of the cleanup action once performance standards have been attained. Confirmational monitoring requirements for groundwater monitoring will be defined in the CMCRP.

4.3.1 Groundwater POCs and RELs

The groundwater monitoring framework assumes the use of both conditional (arsenic) and standard (PCP) POCs, and the use of RELs for arsenic.

Arsenic Conditional POC

The remedial actions for the Log Yard include a conditional POC located along the shoreline of Wapato Creek. This POC meets the tests for a conditional point of compliance as defined in WAC 173-340-720(8)(c), including requirements for providing a reasonable restoration time frame (see Section 3.2.3) and for providing all practicable methods of treatment (i.e., inclusion of the PRB and contingent perched water treatment).

Arsenic concentrations throughout the Log Yard exceed the CUL, with the highest concentrations observed within and below the perched water zone located in the central

portion of the Log Yard. As described in the FS and RI Reports, arsenic transport is limited by the fine-grained nature of the native alluvial deposits, and by the groundwater and soil conditions that promote arsenic precipitation and adsorption.

None of the Log Yard FS alternatives evaluated potentially could achieve groundwater CULs at the standard POC within a relatively short time frame. Integral to the selected remedy is the use of a conditional POC established along the eastern shoreline of Wapato Creek, as shown in Figure 11. Conditional POC wells in this location are located as close as practicable downgradient from the source areas and before discharge to surface water, in accordance with WAC 173-340-720(8)(c). Wells in this location will be located downgradient of containment (capping) and treatment structures (i.e., PRB and contingent perched groundwater treatment structures if required) installed as part of the remedy, and upgradient of Wapato Creek.

Additional sentinel wells or piezometers may be included in the groundwater monitoring framework to monitor groundwater elevations or groundwater quality within the Log Yard and upgradient of the POC. Evaluation against CULs will not be performed at such sentinel wells.

Arsenic RELs

The compliance monitoring framework for the Log Yard includes the use of arsenic RELs. These arsenic RELs will be used to trigger additional contingent remedy evaluations in the event that groundwater remedial actions do not perform as anticipated. Compliance with RELs will be evaluated at the conditional POC wells and supplemented with additional PRB groundwater monitoring points.

The combination of cap maintenance/replacement and PRB installation is expected to control and ultimately reduce groundwater arsenic concentrations at the POC wells in comparison to baseline groundwater quality at these locations. Baseline groundwater quality will be defined for each well during the first eight groundwater monitoring events (including existing data available from the RI/FS and post-FS sampling events where applicable).

A REL exceedance is defined as a sustained flat or increasing trend in groundwater arsenic concentrations measured at one or more POC wells that is not associated with recent construction activities (e.g., soil disturbance during PRB installation) Trend analysis will be performed periodically on each well using the Theil-Sen trend analysis method or similar statistical methods to be defined in the CMCRP. The Theil-Sen trend method is capable of differentiating between increasing and decreasing trends and random water quality variation.

If a REL exceedance is noted, a contingent remedy evaluation will be initiated. That evaluation may include additional groundwater, surface water, or porewater testing as necessary to assess the significance of the groundwater quality changes. An evaluation report will be prepared documenting the conclusions of the evaluation and recommending a contingent remedial action if necessary.

PCP POC

PCP is consistently elevated only in a single well in the Sawmill (MW-2R), which sits within the former dip tank excavation. Two other wells (MW-5R and MW-6R) in the Sawmill have had intermittent exceedances of the PCP PQL but are located approximately 550 feet from Wapato Creek. Wells nearest to Wapato Creek in the Sawmill (MW-1, MW-3 and MW-4) exhibit PCP concentrations consistently below the PCP CUL.

A standard POC (i.e., site-wide) for groundwater will be applied to PCP in the Sawmill.

Groundwater monitoring activities at the Sawmill are expected to include periodic monitoring of wells MW-2R, MW-5R, and MW-6R (see Figure 11) until PCP cleanup levels are consistently maintained.

4.3.2 Soil POC

Soil cleanup levels at the Log Yard and Sawmill are applied at the standard MTCA POC, throughout the site and between 0 and 15 feet below ground surface.

Ongoing soil testing is not anticipated following implementation of the remedy, unless the cap is disturbed (e.g., during cap maintenance or redevelopment activities).

4.3.3 Surface Water POC

Compliance with surface water will be measured using a standard POC located within the surface water discharging from Log Yard outfalls (OF-2 and OF-3) into of Wapato Creek.

Log Yard outfall monitoring is anticipated during cleanup implementation to verify protectiveness of the Log Yard conveyance system upgrades. Log Yard outfall monitoring is anticipated following implementation of the remedy. Log Yard outfall monitoring may also be performed as part of contingent remedy evaluations where appropriate.

Sediment porewater is not surface water. Porewater monitoring provides an indication of contaminant transport and attenuation processes occurring between the groundwater POC and the surface water POC. Porewater monitoring may be performed as part of contingent remedy evaluations but is not anticipated as a regular part of the compliance monitoring program for the Site.

4.3.4 Groundwater Monitoring Expectations

This section describes groundwater monitoring expectations for the selected remedy. The detailed expectations will be defined in the CMCRP, to be developed during remedial design.

Log Yard Monitoring

Log Yard monitoring activities are to include periodic monitoring of POC wells, as well as periodic monitoring of selected sentinel wells and piezometers located within the Log Yard.

- Monitoring is to be performed on a semi-annual basis during the year preceding (Year 0) and the five years following (Year 1 through Year 5) Phase 1

construction (construction of the PRB and completion of the storm drain upgrades).

- Provided that groundwater RELs are met, the frequency may then be reduced to annual measurements (Year 6 forward).
- Following five years of annual monitoring (Year 6 through Year 10), and provided that groundwater RELs have not been exceeded, the frequency of monitoring may be reduced to 2.5-year intervals for long-term monitoring. Statistical evaluations over the long term may be conducted to determine if five year monitoring intervals will adequately characterize groundwater conditions.

Sawmill Monitoring

Sawmill monitoring will include periodic monitoring of the three wells that have had detectable PCP (MW-2R, MW-5R, and MW-6R). Monitoring will be performed semi-annually during the first two years, unless cleanup levels have been met (in which case groundwater monitoring will terminate at that well). Groundwater cleanup levels will be considered to have been met when the results in a given well remain below the PCP cleanup level for four consecutive monitoring events.

After two years, and assuming there is not an upward trend in groundwater PCP concentrations, the frequency of monitoring may be reduced to annual.

Soil Gas Monitoring

Routine soil gas monitoring is not warranted. Soil gas monitoring will be performed as part of contingent evaluations should construction of enclosed or occupied spaces be proposed at the Site. These data would be used to determine what types of controls may be necessary to protect indoor air quality.

4.4 Compliance with ARARs

In accordance with WAC 173-340-710, applicable, relevant and appropriate requirements (ARARs) were considered during development of corrective actions and proposed CULs. Although a cleanup action performed under formal MTCA authorities (e.g., a consent decree) would be exempt from the procedural requirements of certain state and local environmental laws, the action nevertheless must comply with the substantive requirements of such laws (RCW 70.105D.090; WAC 173-340-710).

Potentially applicable federal laws and regulations that may impact the implementation of remedial actions at the Site are shown in Table 7. The list of applicable ARARs may be refined during remedial design.

4.5 Schedule for Implementation

The final remedy will be implemented in two discrete phases.

- **Phase 1 Cleanup:** Phase 1 implementation will be initiated following finalization of the CAP and execution of an Agreed Order (AO). This work will include the following:
    - Development of an engineering design report, including supporting plans (CMCRP, CMMP, and an OMMP for the existing cap)
    - Design and permitting for the Phase 1 cleanup
    - Construction of the Phase 1 cleanup, including construction of the PRB and storm drain improvements
    - Development of a Completion Report for Phase 1 construction
    - Implementation of ongoing cap maintenance activities as defined in the OMMP
    - Groundwater monitoring and data evaluation as defined in the CMCRP (including, if applicable, the implementation of a contingent remedy [conveyance system improvements and perched groundwater treatment]).
- **Phase 2 Cleanup:** Construction of the future low-permeability cap requires verification of land use planning assumptions and coordination with future redevelopment activities. This work will be implemented under a separate future AO Amendment or Consent Decree, and will include the following:
    - Development of a Phase 2 engineering design report, including supporting plans (Phase 2 OMMP for the upgraded cap)
    - Design and permitting for the Phase 2 cleanup
    - Construction of the Phase 2 cleanup, including construction of the low-permeability cap
    - Development of a Completion Report for Phase 2 construction
    - Implementation of cap maintenance activities as defined in the Phase 2 OMMP
    - Ongoing groundwater monitoring and data evaluation as defined in the CMCRP

SECTION 5

References

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GSI. 2016. Final Remedial Investigation Work Plan, Parcel 15 (Portac) Investigation, Ecology Facility Site No. 1215/Cleanup Site No. 3642. GSI Water Solutions, Inc. April 2016.

GSI. 2017. Final Remedial Investigation Report, Parcel 15 (Portac) Investigation, Ecology Facility Site No. 1215/Cleanup Site No. 3642. GSI Water Solutions, Inc. November 2017.

GSI. 2018. Public Review Draft Feasibility Study, Parcel 15 (Portac) Investigation, Ecology Facility Site No. 1215/Cleanup Site No. 3642. GSI Water Solutions, Inc. February 2018.

GSI. 2019a. Feasibility Study Addendum, Parcel 15 (Portac) Investigation, Ecology Facility Site No. 1215/Cleanup Site No. 3642. GSI Water Solutions, Inc. February 2019.

GSI. 2019b. Technical Memorandum RE: Event 5 Groundwater Data Report, Parcel 15 (Portac) Investigation, Ecology Facility Site No. 1215/Cleanup Site No. 3642. May 9, 2019.

University of Wisconsin-Madison. 2012. Leaching Characteristics of Recycled Aggregate used as Road Base. Edil, T. B., and J. M. Tinjum. May 2012.

Tables

Year	Author	Document Title
1976	Hart Crowser, Inc.	Geology Study of the Port of Tacoma
1988	Rittenhouse-Zeman & Associates, Inc.	Memorandum by Rittenhouse-Zeman & Associates, Inc., for Portac, Inc., to C.C. Pittman. Regarding Results of Soil Sampling and Analytical Results Following Partial Soil Removal in the Central Ditch Area of the Portac Site. August 23, 1988.
1988	Hart Crowser, Inc.	Portac Log Sort Yard Remediation Plan, Volume I and II Appendices.
1988	Rittenhouse-Zeman & Associates, Inc.	Letter by Daniel Whitman, Rittenhouse-Zeman & Associates, Inc., to C. Pittman, Portac, Inc. Subject: Wapato Creek Sediment Sampling and Analytical Results. September 8, 1988.
1988	Rittenhouse-Zeman & Associates, Inc.	Memorandum by Rittenhouse-Zeman & Associates, Inc., for Portac, Inc., to C.C. Pittman. Regarding Results of Soil Sampling and Analytical Results following Soil Removal in the Central Ditch Area of the Portac Site. September 23, 1988.
1989	PTI Environmental Services	Background Concentrations of Selected Chemicals in Water, Soil, Sediments, and Air of Washington State
1992	Hart Crowser, Inc.	Final Report Groundwater Quality Monitoring Program Portac Log Sort Yard Remediation
2009	Whitman Environmental Services	Log Yard Ramp Demolition - Portac, Inc. - 4215 N. Frontage Road, Tacoma, WA. (Draft)
2009	Whitman Environmental Services	Lumber Mill Demolition - Environmental Cleanup and Testing Report - Former Portac Inc. Site - Tacoma, WA. July 6, 2009. Prepared by Whitman Environmental Services for Portac, Inc.
2010	GeoEngineers	Site Investigation, Port of Tacoma Parcel 14. December 6, 2010. Tacoma, WA. Prepared for Grette Associates, LLC, and Port of Tacoma.
2012	Hart Crowser, Inc.	Technical Memorandum by Will Abercrombie and Roger McGinnis, Hart Crowser, October 24, 2012. Regarding Evaluation of 2011 Summary Groundwater Monitoring Reports by Whitman Environmental Services - Former Portac, Inc. Site. Prepared for Bill Evans, Port of Tacoma.
2014	Anchor QEA	Log Yard Soil Testing Report, Former Portac, Inc., Site. Tacoma, WA. Prepared by Anchor QE for Portac, Inc., and Port of Tacoma.
2015	GSI Water Solutions, Inc.	Draft Data Gaps Memorandum. Prepared by GSI Water Solutions, Inc., and S.S. Papadopulos & Associates, Inc.November 2015. Parcel 15 (Portac) Investigation. Ecology Facility Site No. 1215/Cleanup Site No. 3642. Prepared for the Port of Tacoma and Portac, Inc.
2016	GSI Water Solutions, Inc.	Final Remedial Investigation Work Plan. Parcel 15 (Portac) Investigation. Ecology Facility Site No. 1215/Cleanup Site No. 3642. April 2016. Prepared by GSI Water Solutions, Inc., and S.S. Papadopulos & Associates, Inc. Prepared for the Port of Tacoma and Portac, Inc.
2017	Windward Environmental, LLC, nd Landau Associates	Environmental Cap Inspection Report, Former Portac Facility. March 30, 2017. Order on Consent DE 88-S326 (September 22, 1988), Washington Department of Ecology Facility ID #1215, Inspection Date: February 8, 2017. Prepared for Port of Tacoma. Prepared by Windward Environmental, LLC, and Landau Associates.
2018	GSI Water Solutions, Inc.	Public Review Draft Feasibility Study, Parcel 15 (Portac) Investigation. Ecology Facility Site No. 1215/Cleanup Site No. 3642. February 2018. Prepared by GSI Water Solutions, Inc. Prepared for the Port of Tacoma and Portac, Inc.
2018	GSI Water Solutions, Inc.	2018 Parcel 15 Interim Action Cap Maintenance - Summary of Work. December 12, 2018. Prepared by GSI Water Solutions, Inc.
2019	GSI Water Solutions, Inc.	Feasibility Study Addendum, Parcel 15 (Portac) Investigation. February 2019. Ecology Facility Site No. 1215/Cleanup Site No. 3642. Prepared by GSI Water Solutions, Inc. Prepared for the Port of Tacoma.
2019	GSI Water Solutions, Inc.	Technical Memorandum by Randy Pratt and Josh Bale, GSI Water Solutions, Inc. May 9, 2019. Regarding Event 5 Groundwater Data Report, Parcel 15 (Portac) Investigation, Ecology Facility Site No. 1215/Cleanup Site No. 3642. To Andrew Smith, Washington Department of Ecology, cc: Rob Healy, Port of Tacoma.

Site-Associated Contaminant	Cleanup Level (CUL)	CUL Units	Protection Basis	Point of Compliance or Measuring Point	Remediation Level (REL)	Nature and Extent and Remedial Action Summary
Soil						
Arsenic	20	mg/kg	MTCA Method A (Industrial)	Site-wide soil (to 15 ft bgs)		Soils in and below the fill containing slag exceed the MTCA A CUL throughout much of the capped Log Yard area. One exceedance in a shallow fill sample from the former dip tank excavation (Sawmill) was observed but no active remediation is anticipated in that area.
Pentachlorophenol	328	mg/kg	MTCA Method C (Cancer)	Site-wide soil (to 15 ft bgs)		No exceedances of CULs (see RI Report for further details). No active remediation or monitoring anticipated.
Methane (as vapor)	0.5	% by Volume	MTCA Air Quality Guidance	Site-wide soil (to the water table)		Present at concentrations above CULs throughout the capped Log Yard and in the area around the former dip tank on the Sawmill.
Groundwater						
Arsenic	5.0	µg/L	MTCA Method A, Adjusted for Background	Conditional POC in nearshore groundwater monitoring wells	A REL exceedance is defined as a sustained flat or increasing trend in groundwater arsenic concentrations measured at POC wells that is not associated with recent construction activities (e.g., soil disturbance during PRB installation)	Groundwater throughout most of the Log Yard and a portion of the Sawmill exceeds the CUL for arsenic. Because none of the FS alternatives could achieve groundwater CULs at the standard POC within a relatively short time frame, a conditional POC is proposed at nearshore groundwater monitoring wells located at the top of the bank, in accordance with WAC 173-340-720(8)(c).
Pentachlorophenol	1.0	µg/L	PQL	Well MW-2R to be used as POC at dip tank area		All groundwater from top of bank monitoring wells had PCP concentrations that were below CULs. Consistent exceedances of CULs were observed only at MW-2R, within the former dip tank excavation area. Concentrations are decreasing over time.

Notes

µg/L = micrograms per liter
bgs = below ground surface
CAP = corrective action plan
CUL = cleanup level
FS = feasibility study
ft = feet or foot
mg/kg = miilligrams per kilogram
MTCA = Model Toxics Control Act
MW = monitoring well
N/A = not applicable
PCP = pentachlorophenol
POC = point of compliance
PQL = practical quantitation limit
REL = remediation level
RI = remedial investigation
WAC = Washington Administrative Code

Table 3. Log Yard Remedial Alternatives

Remedial Technology	Alternative 1	Alternative 2	Alternative 3	Alternative 3A	Alternative 4	Alternative 5	Remedy Detail
Log Yard Cap/Soil							
Existing Cap Maintenance and Monitoring	X			X	X		Maintenance activities includes regular inspections and periodic crack repair and resurfacing using a suitable overlay.
Cap Enhancement (Geogrid and Gravel)		X					Cap enhancement includes cap upgrades to reduce (1) the effects of cracking and (2) effective cap permeability to precipitation. The infiltration-control layer is considered to be the asphalt concrete working surface. On-going monitoring and maintenance of the cap will also be required and includes regular inspections and periodic repair and maintenance of infiltration control layer.
Cap Enhancement (Low Permeability)			X	X			Includes the rubbilization of the existing roller-compacted concrete (RCC) cap and installation of a low-permeability infiltration-control layer that is separate from the working surface. For costing purposes, the preliminary design used included a geosynthetic clay liner (GCL) that would be installed atop the rubbilized RCC, with subsequent layers of recycled gravel base coarse, geogrid, new gravel base coarse, and a asphalt concrete working surface. The asphalt concrete working surface is considered separate from maintenance and monitoring following installation as the infiltration control layer would subsequently be separate. Ongoing monitoring and maintenance of the GCL will be required and will include regular inspections and periodic repair and maintenance.
Source Removal (Excavation and Disposal)						X	Fill containing slag will be removed and disposed offsite. RCC and cap subgrade materials overlaying the source material are assumed to be clean and will be stockpiled on-site during removal for subsequent use as fill material. Existing stormwater conveyance system reconstruction and usable surface restoration will be required.
Institutional Controls	X	X	X	X	X		Periodic inspection and/or repair of the engineered system or barrier while contamination remains. A notification of potential exposure for workers handling impacted soils will be attached to the property deed.
Stormwater							
Conveyance System Interim Repair			X			X	This remedy is the same approach as conveyance system repair detailed below; however, this remedy does not include slip lining. This remedy is considered to be an interim action to reduce groundwater seepage prior to a full conveyance system replacement.
Conveyance System Repair	X	X		X	X		Conveyance system repair incorporates slip lining the existing system (pipes, manholes, and spill-containment vessels) to significantly reduce leakage where joints and cracks are observed, as well as slip lining sections at the lowest elevations. It is assumed that an investigation and incremental repair approach will be adopted. Installation of tide gates at outfalls OF 2 and OF 3 is part of this work. Slip lining is assumed to extend from OF 2 and OF 3 to the respective spill containment vessels, approximately 300 ft upstream. Replacement of vaults is assumed for Alternative 3A. Periodic maintenance, monitoring, and repair of the improved conveyance system will be conducted to prevent groundwater seepage.
Conveyance System Replacement			X	X		X	A replacement system will incorporate the abandonment of the existing system and construction of a shallower, watertight system. Portions of the abandoned system will be removed and replaced with low permeability backfill to limit perched water and groundwater migration along the pipe and bedding. This alternative would require periodic monitoring, maintenance, and repair of the improved conveyance system will be needed to prevent groundwater infiltration.
Institutional Controls	X	X	X	X	X		Periodic inspection and/or repair of engineered system or barrier while contamination remains. A notification of potential exposure for workers handling stormwater with site-related contaminants will be attached to the property deed.
Groundwater							
Monitored Natural Attenuation	X	X	X	X	X	X	Periodic monitoring will be conducted to ensure cleanup goals are met.
Permeable Reactive Barrier	X	X	X	X	X	X	A permeable reactive barrier will be installed parallel to Wapato Creek inside the fence line and running along the full extent of the westernmost boundary of the cap and along the northwestern boundary near identified perched water areas. The barrier will extend to below the streambed of Wapato Creek and be backfilled with reactive media (such as iron filings or zero-valent iron [ZVI]) to treat dissolved arsenic in the groundwater flux.
Perched Groundwater Treatment				X			A French drain or similar groundwater collection system will be designed to remove accumulated water in perched groundwater zones. The system will likely require the use of several laterals spanning the north/south extent of the Log Yard. Accumulating perched water will be treated in situ in the collector vaults that infiltrate water downward into a more permeable layer. Overflow from the collector vaults will flow to a trench in the Sawmill Area where it will be treated in situ and infiltrated. Treatment will be provided by a reactive medium (e.g., ZVI).
Extraction and Ex Situ Treatment					X		Areas of perched groundwater will be extracted via sumps, shallow wells, or French drains to minimized areas of perched groundwater in contact with the fill containing slag. Ex-situ treatment may include precipitation and separation media (e.g., filters, iron reactive media). Separated arsenic will be disposed offsite and the treated groundwater will be discharged to surface water.
Institutional Controls	X	X	X	X	X	X	Periodic inspection and/or repair of engineered system or barrier while contamination remains. A notification of potential exposure for workers handling impacted groundwater will be attached to the property deed.
Soil Gas							
Institutional Controls	X	X	X	X	X	X	Methane gas does not present an imminent hazard under existing site conditions. A notification of potential hazardous conditions for trench workers or vapor intrusion to enclosed structures would be attached to the property deed.

Notes

ft = feet or foot GCL = geosynthetic clay liner RCC = roller-compacted concrete ZVI = zero-valent iron

Table 4. Sawmill Remedial Alternatives

Remedial Technology	Alternative 1	Alternative 2	Alternative 3	Remedy Detail
Groundwater				
Natural Attenuation	x	x	x	Periodic monitoring would be conducted to ensure cleanup goals are met.
Enhanced Bioremediation		x		Groundwater conditions in the dip tank area indicate a high-pH environment that does not provide an optimal environment for biological activity. Enhanced biodegradation would include the injection of amendments to create a more neutral pH for improved biological activity. Amendment selection could incorporate a bench-scale analysis to determine the optimal application to degrade residual PCP. *(Note that the PCP concentrations have been observed to be generally decreasing over time, suggesting that attenuation is occurring.)*
Extraction and Ex-Situ Treatment (During Soil Removal)			x	Removal of vadose-zone and upper saturated-zone soils would target areas outside the limits of the historical excavation. Excavated soil would be disposed off-site and replaced with clean fill. Groundwater extracted, as needed, to dewater the soil excavation, would be treated ex situ using chemically or biologically destructive means, or through physical media filtration. Treatment could be conducted on- or off-site.
Institutional Controls	x	x		A notification of potential exposure for excavation workers would be attached to the property deed until cleanup levels have been met.
Soil Gas				
Institutional Controls	x	x	x	Methane gas does not present an imminent hazard under existing site conditions. A notification of potential hazardous conditions for trench workers or vapor intrusion to enclosed structures would be attached to the property deed.

Notes
PCP = pentachlorophenol

Remedial Alternative[1]	Protectiveness (25%)[2]	Permanence (20%)	Long-Term Effectiveness (20%)	Short-Term Risk Management (15%)	Technical and Administrative Implementability (10%)	Public Concerns (10%)	Environmental Benefit Score	Probable Cost[3]	Benefit Score / Probable Cost[4]
	Relative Ranking - Scored from 1 (lowest) to 10 (highest)								
Alternative 1 - Cap Overlay - Conveyance System Repair - Permeable Reactive Barrier -Monitored Natural Attenuation - Institutional Controls	Achieves a score for protectiveness that is lower than protectiveness for other alternatives. However, the capping approach is less protective than those under Alternatives 2 and 3. Frequent inspections and sealing of cracks will be required to maintain cap performance. The stormwater repairs are less robust than the system replacement conducted under Alternatives 3 and 5. Protectiveness is enhanced with the use of a contingent PRB.	Achieves a low-medium score for permanence. Permanence under this alternative is lower than under Alternatives 2 and 3, because the capping approach does less to reduce the production of arsenic-contaminated perched groundwater than other alternatives, and no treatment of this water is provided as under Alternative 4. The alternative also uses stormwater line repairs rather than replacing the system. Together these factors result in a greater risk of arsenic migration toward Wapato Creek, and a greater likelihood that contingent groundwater treatment will be required.	Alternative 1 achieves a low-medium score for long-term effectiveness. Unlike Alternative 3, the permeability of the cap is not reduced, and arsenic-contaminated perched water will continue to be generated at significant rates. The cap performance will also require frequent inspections and sealing of cracks that are expected to occur at higher rates than under Alternative 2. Repair in place of the stormwater system has a higher likelihood of failure over the long term in comparison to the system raising and replacement as performed under Alternative 3. Groundwater flux rates will be higher than under Alternatives 2 or 3, placing higher demands on natural attenuation processes and increasing the likelihood that a contingent PRB will be required.	This alternative has a medium-high score for short-term risk management. It involves construction activities that are less extensive than those under any other alternatives, and requires no exposure of arsenic-contaminated soils. The alternative uses routine construction methods (asphalt overlay placement) for capping. Stormwater management risks are minimized by keeping the existing RCC cap in place.	Alternative 1 has a medium-high score for implementability. The requirements for initial design and construction are lower than those under any other alternatives. The alternative uses standard construction methods for capping. It will not require a construction stormwater permit and will not expose contaminated soils. However, this alternative will require more frequent inspections and cap maintenance activities over the long term.	Evaluation pending public comment.	4.2	$9.5M	0.44
	3	**3**	**4**	**8**	**8**	**--**			
Alternative 2 - Enhanced Cap - Conveyance System Repair - Permeable Reactive Barrier -Monitored Natural Attenuation - Institutional Controls	Achieves a medium score for protectiveness. Protectiveness of Alternative 2 is higher than for Alternative 1, because measures are taken to reduce ongoing crack formation within the cap surface layer. However, the capping approach is less protective than Alternative 3. Frequent inspections and sealing of cracks will be required to maintain cap performance. The stormwater repairs are less robust than the system replacement conducted under Alternatives 3 and 5. Protectiveness is enhanced with the use of a contingent PRB.	Achieves a medium score for permanence. Permanence under this alternative is better than under Alternative 1 but lower than under Alternative 3. The capping approach reduces anticipated infiltration in comparison to Alternative 1; however, the capping approach does less to address the generation of perched groundwater than the approach in Alternative 3. This alternative also uses stormwater line repairs rather than replacing the system. Together these factors result in a an intermediate risk of arsenic migration toward Wapato Creek, and an intermediate risk that contingent groundwater treatment will be required.	Alternative 2 achieves a medium score for long-term effectiveness. The long-term cap performance is expected to be better than cap performance under Alternative 1, with reduced surface cracking. However, the permeability of the cap is not reduced as much as under Alternative 3. The cap performance will also require more frequent inspections and maintenance in comparison to those activities for Alternative 3. Repair in place of the stormwater system has a higher likelihood of failure over the long term in comparison to the system raising and replacement as performed under Alternative 3. Groundwater flux rates will be higher than under Alternative 3, placing higher demands on natural attenuation processes, and increasing the likelihood that a contingent PRB will be required.	This alternative has a medium-high score for short-term risk management. It involves construction activities that are less extensive than those under Alternatives 3, 4, or 5. The alternative does not requires exposure of arsenic-contaminated soils and uses routine construction methods (gravel placement and asphalt paving) for capping. Stormwater management risks are minimized by keeping the existing RCC cap in place.	Alternative 2 has a medium-high score for implementability. The requirements for initial design and construction are lower than those under Alternatives 3, 4, or 5. The alternative uses standard construction methods for capping. It will not require a construction stormwater permit and will not expose contaminated soils. However, this alternative will require more frequent inspections and cap maintenance activities over the long term than for Alternative 3.	Evaluation pending public comment.	5.5	$10.5M	0.52
	5	**5**	**6**	**8**	**8**	**--**			

Remedial Alternative[1]	Protectiveness (25%)[2]	Permanence (20%)	Long-Term Effectiveness (20%)	Short-Term Risk Management (15%)	Technical and Administrative Implementability (10%)	Public Concerns (10%)	Environmental Benefit Score	Probable Cost[3]	Benefit Score / Probable Cost[4]
	Relative Ranking - Scored from 1 (lowest) to 10 (highest)								
Alternative 3 - Low-Permeability Cap - Conveyance System Replacement - Permeable Reactive Barrier - MNA - Institutional Controls	Achieves a high level of overall protectiveness through the use of a low-permeability composite cap to reduce infiltration through source material and prevent accumulation of perched water. The infiltration control layer is separated from the cap working surface to minimize the risks of cap damage during long-term maintenance. The stormwater conveyance system will be replaced and raised to prevent groundwater infiltration. Protectiveness is enhanced with the use of a contingent PRB. Given the anticipated reduction in infiltration and groundwater flux, the need for the PRB is less likely than under Alternatives 1, 2, or 4.	Achieves a medium-high score for permanence by including both a more robust cap and a new stormwater system. The cap design is expected to reduce the generation of high-arsenic perched water in comparison to Alternatives 1, 2, and 4. The stormwater system replacement will also prevent future seepage of arsenic-containing groundwater into the storm drainage system.	Achieves a high level of long-term effectiveness through the use of a low-permeability composite cap to reduce infiltration through source material and prevent accumulation of arsenic-contaminated perched water. The infiltration control layer is separated from the cap working surface to maximize long-term cap performance and minimize dependence on ongoing cap inspections and maintenance. The stormwater conveyance system will be replaced and raised, rather than being repaired in place, eliminating risks that leaks would recur over the long term. The reduction in infiltration and groundwater flux under this alternative optimizes conditions for ongoing natural attenuation of arsenic, reducing the likelihood that the contingent PRB will be required. If the PRB is required, the lifespan of the treatment media will be improved relative to other the lifespan of alternatives with higher groundwater flux rates.	This alternative has a medium-high score for short-term risk management. It involves more extensive construction activities during initial cap installation than under Alternatives 1, 2, or 4. However, this initial work is offset over the long term by fewer requirements for on-site inspections and cap maintenance actions. Construction-related risks are lower than risks for Alternative 5, because the arsenic-contaminated soils will not be exposed to workers or to stormwater during cap installation. The alternative includes significant on-site construction activities, but does not involve extensive off-site transportation of contaminated soils as is the case under Alternative 5.	Alternative 3 has a lower score for implementability than Alternatives 1 or 2 because initial design and construction requirements are greater. Though the alternative doesn't require exposure of contaminated soils, it will involve removal of the RCC cap and re-grading of cap materials. A construction stormwater permit will be required. However, this alternative will require less-frequent inspections and cap maintenance activities over the long term than activities necessary for Alternatives 1, 2, and 4.	Evaluation pending public comment.	6.8	$12.3M	0.55
	8	**7**	**8**	**7**	**7**	**--**			
Alternative 3A - Conveyance System Repair - Perched Groundwater Treatment - Permeable Reactive Barrier -Monitored Natural Attenuation - Low Permeability Cap Contingency - Institutional Controls	Achieves a high level of overall protectiveness through the use of a perched groundwater treatment system and a contingent PRB. The stormwater conveyance system will be slip lined in areas affected by groundwater infiltration and replaced when the property is developed or contigency low permeability cap implemented. Protectiveness is enhanced by directly removing perched water and reducing arsenic flux to groundwater and Wapato creek. A contigent PRB near Wapato Creek and a low permeability cap would be implemented if criteria conditions are exceeded. With this tiered approach, the overall protectiveness of the remedy is enhanced.	Achieves a high score for permanence. Permanence under this alternative is enhanced by directly removing perched groundwater. This alternative is more permanent than Alternative 4, as it integrates better with Port land use planning and employs a more robust contigent cap design. The cap design is expected to reduce the generation of high-arsenic perched water in comparison to Alternatives 1, 2, 3, and 4. The stormwater system repair (slip line) and eventual replacement will also prevent future seepage of arsenic-containing groundwater into the storm drainage system.	Achieves a high level of long-term effectiveness through the use of perched groundwater treatment, stormwater system improvements, a PRB, and a contingent low-permeability cap to reduce perched water in source material and subsequent migration pathways. At the time of property development or implementation of the contingent low-permeability cap, the stormwater conveyance system will be replaced, eliminating risks that leaks would recur over the long term. The reduction in infiltration and groundwater flux under this alternative optimizes conditions for ongoing natural attenuation of arsenic, reducing the likelihood that the contingent PRB will be required. If the PRB is required, the lifespan of the treatment media will be improved relative to other alternatives with higher groundwater flux rates.	This alternative has a medium score for short-term risk management. It involves more extensive construction activities during the perched water drain installation and initally during cap installation than under activites in these phases for Alternatives 1, 2, 3, or 4. Construction-related risks are lower than risks under Alternative 5, because the quantity of arsenic-contaminated soils to which workers would be exposed would be much less. The alternative includes significant on-site construction activities, but does not involve extensive off-site transportation of contaminated soils, as needed under Alternative 5.	Alternative 3A has the highest score for implementability because it integrates best with property development planning and current uses. Implementation of the perched water treatment in this alternative is expected to be less complex and requiring less long-term maintenance than for other alternatives, as it is expected to discharge in situ.	Evaluation pending public comment.	7.0	$11.4M	0.61
	8	**9**	**8**	**6**	**7**	**--**			

Remedial Alternative[1]	Protectiveness (25%)[2]	Permanence (20%)	Long-Term Effectiveness (20%)	Short-Term Risk Management (15%)	Technical and Administrative Implementability (10%)	Public Concerns (10%)	Environmental Benefit Score	Probable Cost[3]	Benefit Score / Probable Cost[4]
	Relative Ranking - Scored from 1 (lowest) to 10 (highest)								
Alternative 4 - Cap Overlay - Conveyance System Repair - Perched Water Ex Situ Treatment - Permeable Reactive Barrier -Monitored Natural Attenuation - Institutional Controls	Achieves a medium score for overall protectiveness through the continued use and maintenance of a surface cap to reduce infiltration through source material, stormwater conveyance system repairs, natural attenuation and institutional controls. Perched water is actively addressed through extraction, ex situ treatment, and discharge to Wapato Creek. Protectiveness is enhanced with the use of a contingent PRB. However, the capping approach is less protective than the approaches for Alternatives 2 and 3 because more cracking and infiltration will likely occur under Alternative 1.	Achieves a medium score for permanence. Like Alternative 1, the capping approach of this alernative does less to address the production than Alternatives 2 or 3. The active extraction and treatment of this water will require extensive ongoing operation and maintenance in order to remain effective. Repair in place of the stormwater system has a higher likelihood of failure over the long term than the system raising and replacement under Alternative 3.	Alternative 4 achieves a medium level of long-term effectiveness. Unlike Alternative 3, the permeability of the cap is not reduced, and arsenic-contaminated perched water will continue to be generated at significant rates. Although the perched water is managed through extraction and treatment, these measures will require extensive ongoing operation, monitoring, and maintenance to prevent inadvertent discharge of contaminated groundwater. The cap performance will also require frequent inspections and sealing cracks that are expected to occur at higher rates than would be expected under Alternative 2. Repair in place of the stormwater system has a higher likelihood of failure over the long term than the likelihood of failure for system raising and replacement under Alternative 3.	This alternative has a medium score for short-term risk management. It involves more extensive construction activities during initial cap installation than under Alternatives 1 or 2, including installation of drains and sumps for extraction of groundwater. Appropriate methods will be required to prevent discharge of contaminated groundwater during treatment system startup and initial operation. Construction-related risks are lower than construction-related risks under Alternative 5, because the arsenic-contaminated soils will not be exposed to workers or to stormwater during cap installation. The alternative includes significant on-site construction activities, but does not involve extensive off-site transportation of contaminated soils as is proposed under Alternative 5.	Alternative 4 has a lower score for implementability than Alternatives 1, 2, or 3. This reduction in score reflects the increased complexity of construction associated with installation of the perched water extraction and treatment system. Alternative 4 uses standard construction methods for capping, will not require a construction stormwater permit, and will not expose contaminated soils. However, this alternative will require more frequent inspections and cap maintenance activities over the long term than are needed for Alternative 3. Alternative 4 also require long-term operation and maintenance of the water treatment system, including procurement and periodic renewal of a NPDES permit.	Evaluation pending public comment.	5.1	$10.9M[5]	0.47
	6	**5**	**6**	**6**	**5**	**--**			
Alternative 5 - Conveyance System Repair - Excavation and Disposal -Conveyance System Replacement - Permeable Reactive Barrier -Monitored Natural Attenuation - Institutional Controls	Achieves a high level of overall protectiveness through excavation and off-site disposal of arsenic-contaminated soils. Residual groundwater contamination will remain and will be managed by stormwater system replacement, monitored natural attenuation, and institutional controls. Given the presence of residual groundwater contamination and potential increases in groundwater infiltration and flux after cap removal, this alternative includes a contingent PRB to ensure protectiveness.	Achieves a higher score for permanence than other alternatives by removing slag and contaminated soils that are a potential ongoing source of groundwater contamination. Residual groundwater contamination will remain. That contamination is managed through institutional controls, stormwater system replacement, and a contingent groundwater PRB.	Achieves a high score for long-term effectiveness through excavation and offsite disposal of arsenic contaminated soils. These soils will be transferred to an off-site commercial landfill, rather than contained on-site beneath an environmental cap. Residual groundwater contamination will remain and will be managed by stormwater system replacement, monitored natural attenuation, and institutional controls. Given the presence of residual groundwater contamination and potential increases in groundwater infiltration and flux after cap removal, this alternative includes a contingent PRB to ensure the long-term effectiveness of groundwater controls.	Alternative 5 has a low-medium score for short-term risk management. Short-term risks associated with this alternative would be moderately high. The work includes extensive construction activities to remove, transport, and safely manage contaminated soils without exposing workers to contaminant-related risks. Stormwater and dust will need to be appropriately managed during construction activities. This alternative also involves significant modifications to existing site conditions, with the removal of the existing cap and changes to groundwater control measures. These changes could affect existing groundwater attenuation processes (this risk is managed with the contingent PRB).	This alternative has a medium score for implementability. The project will require a construction general stormwater permit and additional control measures to manage construction-related stormwater containing arsenic. The project will require extensive off-site transportation of contaminated soils. The duration of the construction project is longer than for any of the other aternatives, impacting ongoing site uses to a greater degree.	Evaluation pending public comment.	7.2	$31.0M	0.23
	9	**10**	**9**	**4**	**5**	**--**			

Notes

[1] Consideration of public concerns is not addressed in this table because the public has not yet had an opportunity to provide comments.

[2] Each of the DCA criteria listed were weighted, so the overall DCA score would be influenced by criteria directly relating to protectiveness and effectiveness. A score of 10 represents an alternative that satisfies the criteria to the highest degree.

[3] Probable cost reflects the total estimated cost including applicable contingencies (see cost detail in Appendix A).

[4] Probable costs were evaluated in increments of $1 million for comparison to benefit scoring.

[5] A formula error in the original FS cost estimating tables for Alternative 4 was corrected as part of this FS Addendum effort, correspondingly, the Alternative 4 cost has been updated.

DCA = disproportionate cost analysis

FS = feasiblity study M = million MNA = monitored natural attenuation NPDES = National Pollutant Discharge Elimination System PRB = permeable reactive barrier

Remedial Alternative[1]	Protectiveness (25%)[2]	Permanence (20%)	Long-Term Effectiveness (20%)	Short-Term Risk Management (15%)	Technical and Administrative Implementability (10%)	Public Concerns (10%)	Environmental Benefit Score	Probable Cost[3]	Benefit Score / Probable Cost[4]
	Relative Ranking - Scored from 1 (lowest) to 10 (highest)								
Alternative 1 - Monitored Natural Attenuation - Institutional Controls	Achieves a medium score for overall protectiveness through ongoing monitored natural attenuation.	Residual contamination can be permanently detoxified through natural processes. This alternative receives a medium-high score for permanent reduction of mass and toxicity of hazardous substances at the Site.	This alternative receives a medium score for effectiveness, as the time to complete the cleanup is longer than the time to complete under the other alternatives. The long-term effectiveness of this alternative depends upon maintaining institutional controls until contaminants attenuate and degrade.	This alternative was scored high for short-term risk management. This alternative does not require any ex situ handling of residual contamination, as treatment would occur in situ. There are no additional construction-related risks requiring management.	This alternative is scored high for implementability. This alternative requires only routine site monitoring.	Evaluation pending public comment.	6.2	$495K	1.24
	6	**6**	**6**	**9**	**9**	**--**			
Alternative 2 - Enhanced Bioremediation - Monitored Natural Attenuation - Institutional Controls	Achieves a medium-high score for overall protectiveness through accelerated in situ biodegradation and monitored natural attenuation, reducing the expected amount of time necessary until residual contamination is below cleanup levels in all wells.	This alternative receives a high score for permanent reduction of mass and toxicity of hazardous substances at the Site. This alternative will be effective at a faster rate than Alternative 1. Residual contamination can be permanently detoxified through natural processes.	This alternative receives a medium-high score for effectiveness because the time required to complete the cleanup is less than the time required under Alternative 1. Long-term effectiveness of this alternative depends on maintaining institutional controls until contaminants attenuate and degrade.	This alternative was scored medium-high for short term-risk management. This alternative does not require any ex situ handling of residual contamination, as treatment would occur in situ. However, some handling of corrosive chemicals would be required during amendment injection.	This alternative is scored high for implementability. Neutralization agents and injection mechanisms are well-developed technologies that could be rapidly procured and implemented.	Evaluation pending public comment.	7.2	$539K	1.34
	8	**8**	**8**	**8**	**8**	**--**			
Alternative 3 - Expanded Excavation and Off-Site Disposal - Temporary Groundwater Extraction and Treatment - Monitored Natural Attenuation - Institutional Controls	Achieves a high score for overall protectiveness by reducing residual contaminant mass through excavation and temporary groundwater treatment, reducing the expected amount of time necessary until residual contamination is below cleanup levels in all wells.	This alternative receives a high score for rapid removal of remaining groundwater contamination at the Site, relative to Alternatives 1 or 2.	This alternative receives a high score for long-term effectiveness because it has shortest restoration time frame and interim institutional controls are not likely required for groundwater.	This alternative was score medium for short-term risk management. Excavation and ex situ treatment are included as remedial elements in this alternative. Ex situ handling of contaminated media creates the potential for short-term exposure for site workers or fugitive emissions.	This alternative is scored medium for implementability. The alternative will require management of stormwater and extracted groundwater during construction as well as off-site management of excavated soils.	Evaluation pending public comment.	7.1	$742K	0.96
	9	**9**	**9**	**5**	**5**	**--**			

Notes

[1] Consideration of public concerns is not addressed in this table because the public has not yet had an opportunity to provide comments.

[2] Each of the DCA criteria listed were weighted, so the overall DCA score would be influenced by criteria directly relating to protectiveness and effectiveness. A score of 10 represents an alternative that satisfies the criteria to the highest degree.

[3] Probable cost reflects the total estimated cost including applicable contingencies (see cost detail in Appendix C).

[4] Probable costs were evaluated in $100,000 increments for comparison to benefit scoring.

DCA = disproportionate cost analysis
FS = feasiblity study
K = thousand
MNA = monitored natural attenuation
PRB = permeable reactive barrier

Medium	Standard / Criterion	Citation
All media	Federal requirements for proper management of contaminants encountered at concentrations that fall under the Toxic Substances Control Act (TSCA) requirements	Toxic Substances Control Act (15 USC §§2601 et seq. [1976])
All media	Federal and State of Washington requirements for proper management of hazardous wastes "from cradle to grave."	Federal Resource Conservation and Recovery Act (40 CFR 261 et seq.), Washington Hazardous Waste Management Act (including Dangerous Waste Regulations, RCW 70.105)
All media	Federal requirements for conservation of threatened and endangered plants and animals and the habitats in which they are found.	Federal Endangered Species Act (16 USC §§1531 et seq. [1973])
Air	Federal requirements regulating air emissions from stationary and mobile sources. Applicable mainly during active construction periods. Methane soil gas concentrations will be a consideration during future building construction for indoor air and during open-excavation activities.	Federal Clean Air Act (42 USC §§7401 et seq.)
Soil	State of Washington requirements for establishing numeric or risk-based goals and selecting cleanup actions.	MTCA (WAC 173-340, §§740, 745, 747)
Soil	Federal requirements for preservation of historic artifacts encountered during soil disturbance activities	National Historic Preservation Act (36 CFR 63 et seq.)
Soil / Surface Water	Federal and State of Washington requirements for controlling construction-related runoff.	Washington WPCA - State Water Quality Standards for Surface Water (RCW 90.48), federal WPCA / CWA (33 USC 1251 et. seq.)
Surface Water / Groundwater	State of Washington requirements for protecting state water resources including surface water and groundwater.	Washington Water Resource Act (RCW 90.54)
Stormwater (Surface Water) / Groundwater (Protection of Sediment)	Federal and State of Washington requirements for controlling discharge of pollutants in stormwater from industrial facilities. State water quality standards; conventional water quality parameters and toxic criteria.	Washington WPCA - State Water Quality Standards for Surface Water (RCW 90.48), federal WPCA / CWA (33 USC 1251 et. seq.)
Groundwater / Surface Water	State of Washington requirements for establishing numeric or risk-based goals and selecting cleanup actions.	MTCA (WAC 173-340, §§720, 730)
Surface Water / Groundwater (Protection of Sediment)	Ambient water quality criteria for the protection of aquatic organisms and human health.	Federal Water Pollution Control Act/ Clean Water Act (CWA) §304 (33 USC 1251B1376, 40 CFR 100B149), National Toxics Rule 40 CFR 131
Groundwater (Protection of Drinking Water)	SDWA National Primary Drinking Water Standards: maximum contaminant levels (MCLs), maximum contaminant level goals (MCLGs), Proposed MCLs and MCLGs.	MTCA (WAC 173-340, §§720, 730)
Sediment	State of Washington standards to reduce and ultimately eliminate adverse effects on biological resources and significant threats to human health from surface sediment contamination	Washington State Sediment Management Standards (WAC 173-204)

Notes

CFR = Code of Federal Regulations
CWA = Clean Water Act of 1972
et seq. = and following
MCL = maximum contaminant level
MCLG = maximum contaminant level goal
MTCA = Model Toxics Control Act
RCW = Revised Code of Washington
SDWA = Safe Drinking Water Act
TSCA = Toxic Substances Control Act
USC = Code of Laws of the United States of America
WAC = Washington Administrative Code
WPCA = Water Pollution Control Act

Figures

FIGURE 1

Site Map

Cleanup Action Plan
Parcel 15
Tacoma, WA

LEGEND

- Monitoring Well
- Perched Monitoring Well
- Outfall
- Vault
- Stormwater Conveyance Pipe
- Site Boundary
- Site Area
- Former Dip Tank
- Fill Containing Slag
- Railroad
- Watercourse
- Waterbody

NOTE:
Site boundary defined in Exhibit A of the Draft Agreed Order No. DE 11237 (Ecology, 2015).

N

0 150 300 450
Feet

Date: April 7, 2020
Data Sources: PORTAC, Aerial from METRO 2018

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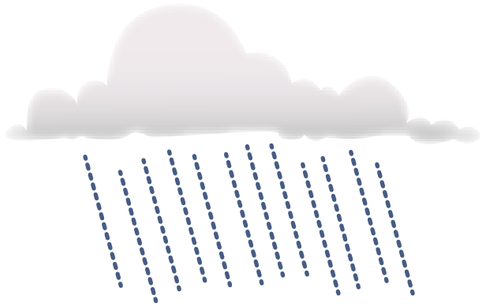


POINT OF EXPOSURE

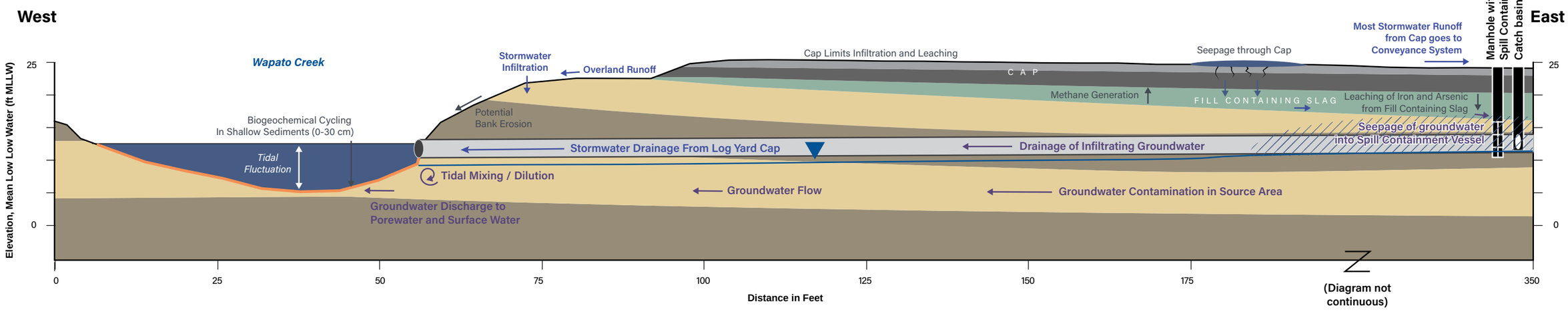
- Bioactive zone sediments (0-10 cm)
- Surface water

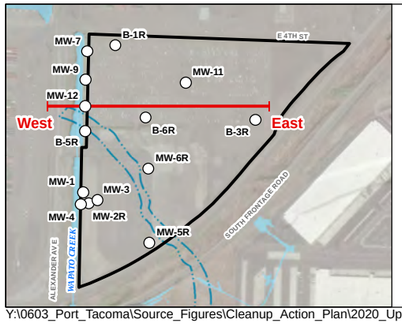
NEARSHORE TRANSITION ZONE

- Tidally influenced groundwater mixing
- Stormwater infiltration and mixing
- Changes in groundwater geochemistry

UPLAND CAPPED ZONE

- Cap limits infiltration and leaching
- Fill containing slag remains a potential source of arsenic to groundwater
- Gradient toward Wapato Creek
- Seasonal fluctuation in groundwater elevation
- Some seepage through the cap occurs through cracks and/or in areas with ponded water
- Some seepage of groundwater into the spill containment vault and stormwater conveyance system





LEGEND

- Stormwater Pipe
- Catch Basin/Manhole
- Spill Containment System
- May 2016 Water Level
- Perched Groundwater

Geology

- Roller-Compacted Concrete
- Gravel Base Course
- Fill Containing Slag
- Silty Sand
- Fine-Grained Deposits (Silt and Clay)
- Bioactive Zone Sediments

NOTE

Vertical Exaggeration = 1X
ft = feet
cm = centimeters

FIGURE 2

Conceptual Site Model - Current Conditions - Log Yard

Cleanup Action Plan
Parcel 15
Tacoma, WA

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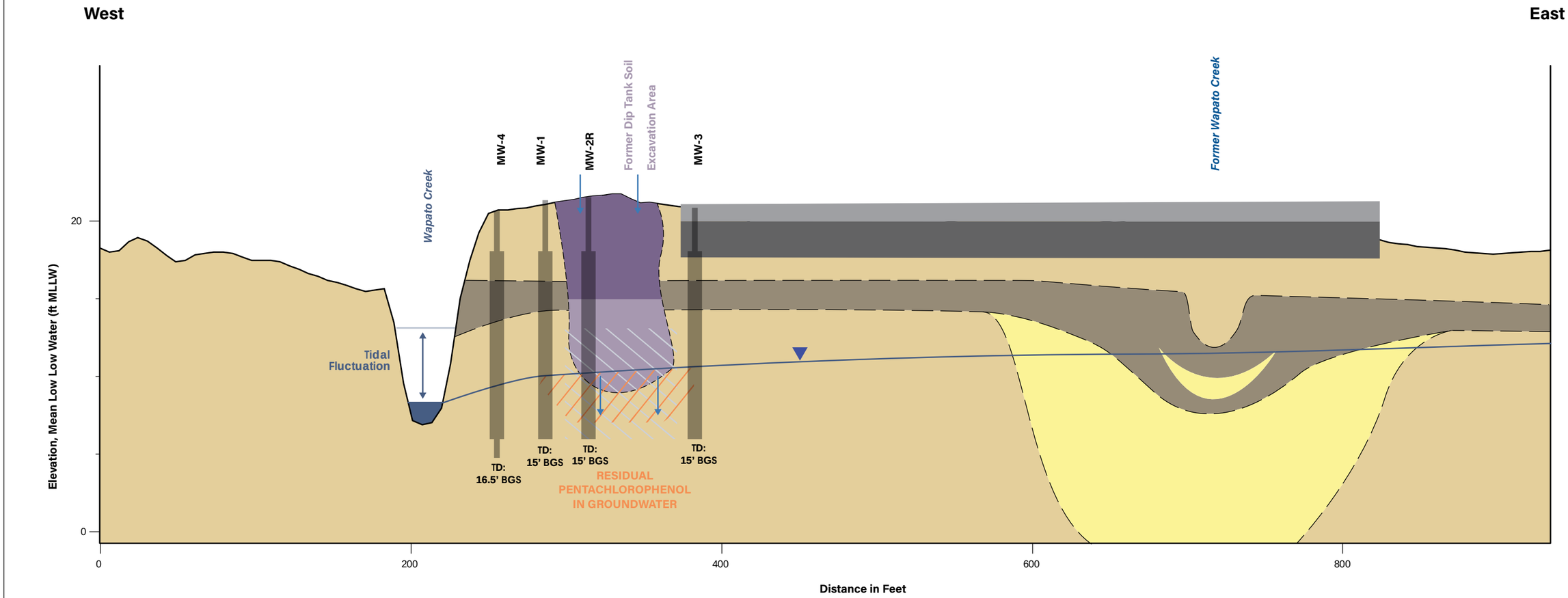

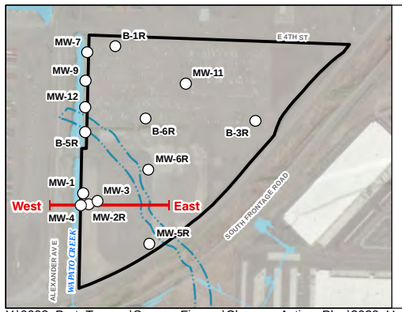

LEGEND

- Groundwater Surface
- May 2016, Estimated Water Level
- Precipitation Infiltration
- Residual Pentachlorophenol
- Groundwater with Elevated pH

Geology

- Asphalt Concrete
- Gravel Base Coarse
- Crushed Concrete Fill
- Sand FIll (Soil Excavation Area)
- Silty Sand
- Fine-Grained Deposits (Silt and Clay)
- Sand

NOTES

Vertical Exaggeration = 10X
Lidar data is from 2010 from Puget Sound Lidar Consortium's website (http://pugetsoundlidar.ess.washington.edu/lidardata/). Data converted from NAVD88 to MLLW by adding 2.67', made by GSI.

FIGURE 3

Conceptual Site Model - Sawmill

Cleanup Action Plan
Parcel 15
Tacoma, WA

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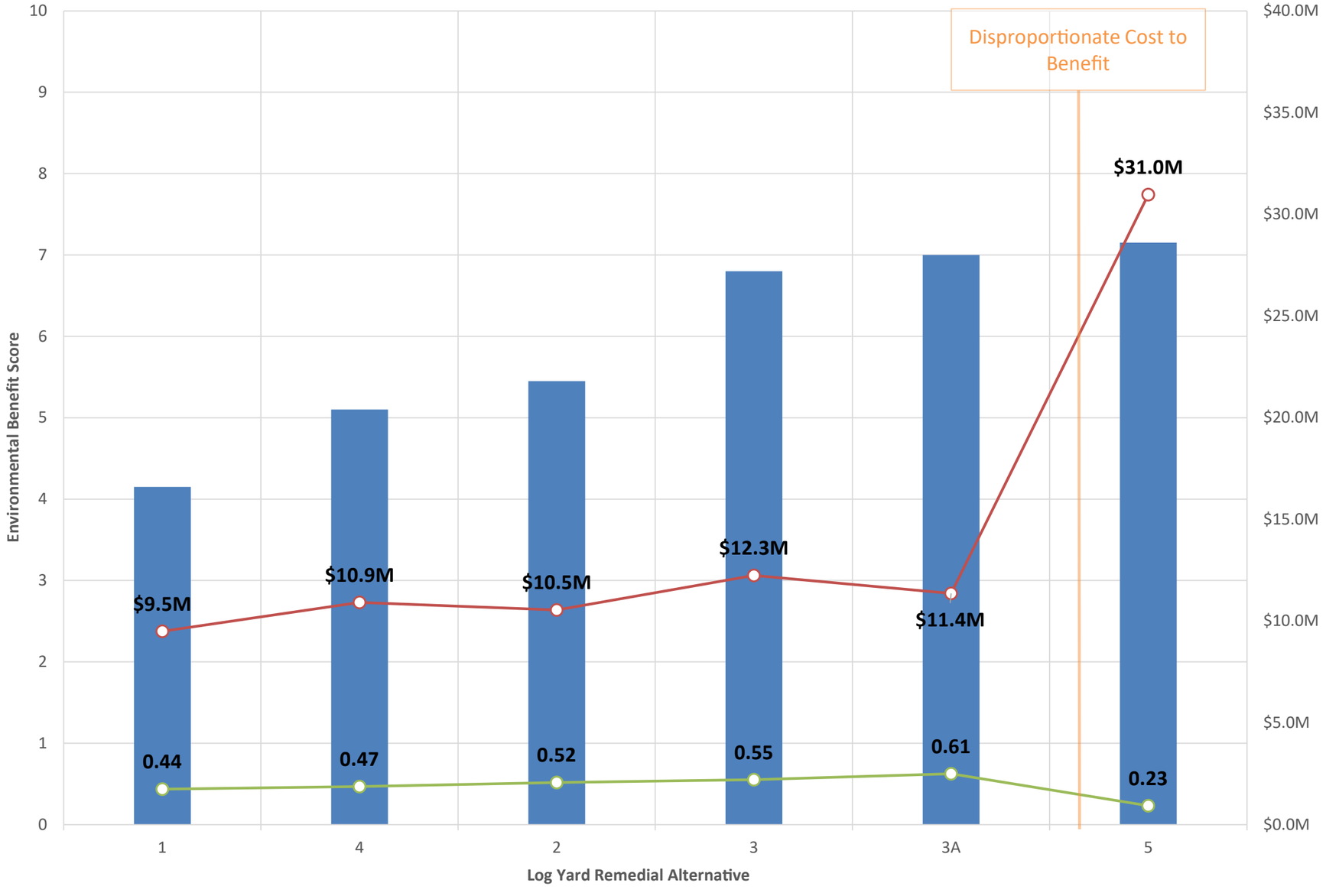

LEGEND

- Environmental Benefit Score
- Relative Benefit / Cost ($M)
- Estimated Cost

NOTE

M = Millions

FIGURE 4

Log Yard Disproportionate Cost Analysis

Cleanup Action Plan
Parcel 15
Tacoma, WA

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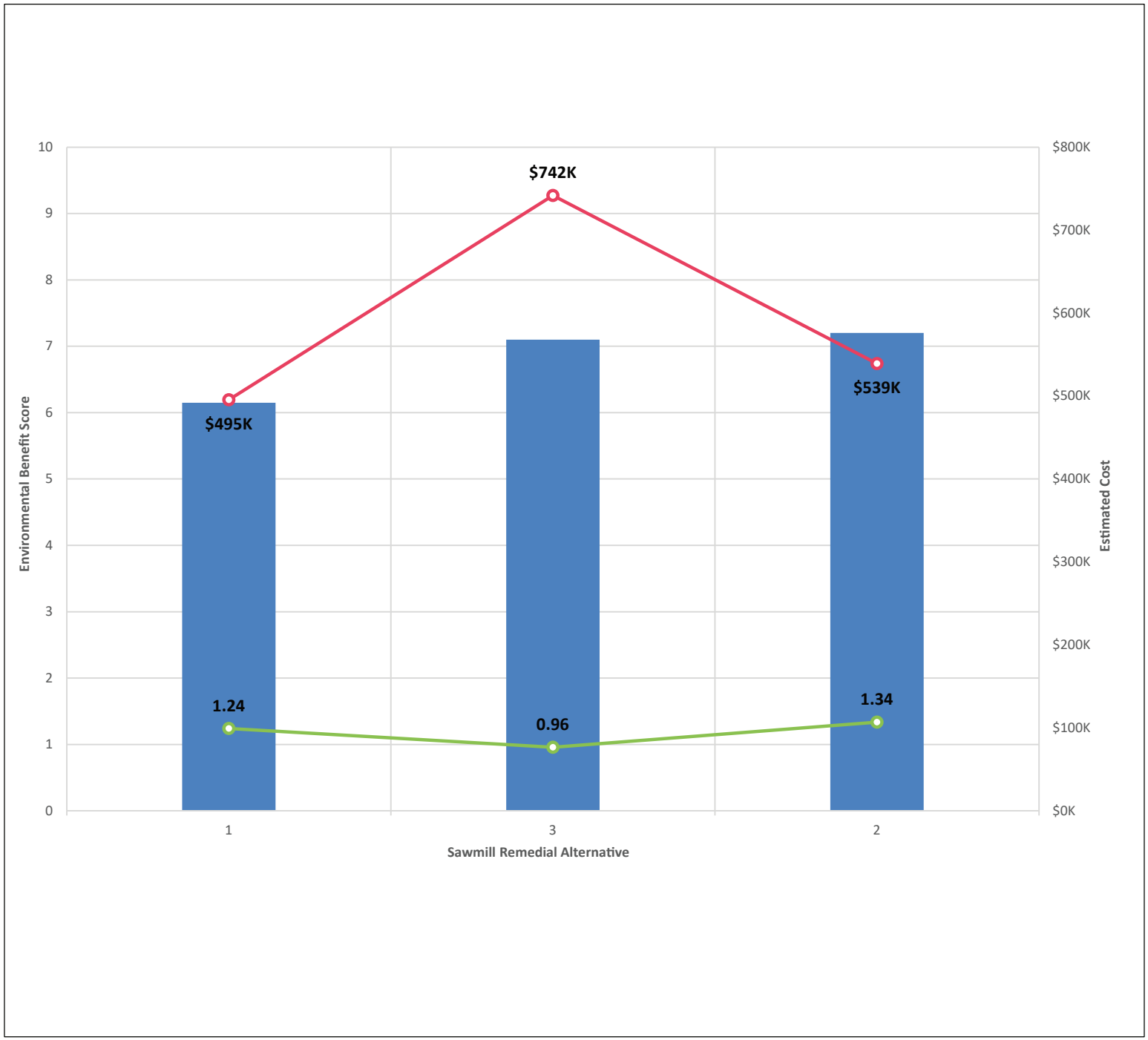

FIGURE 5

Sawmill Disproportionate Cost Analysis

Cleanup Action Plan
Parcel 15
Tacoma, WA

LEGEND

- Environmental Benefit Score
- Relative Benefit / Cost ($100K)
- Estimated Cost

NOTE

K = Thousands

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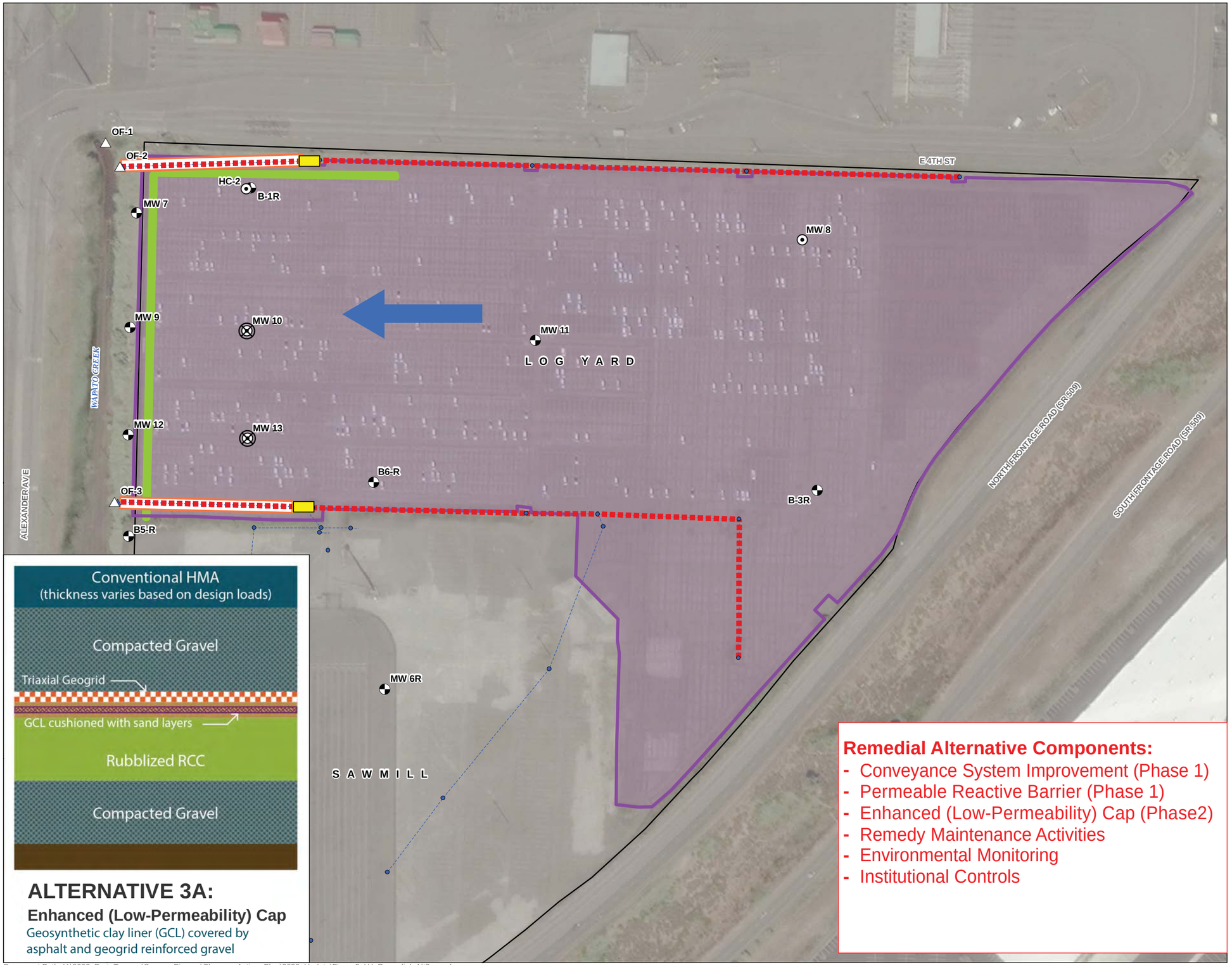
FIGURE 6

Log Yard Remedial Alternative 3A

Cleanup Action Plan
Parcel 15
Tacoma, WA



ALTERNATIVE 3A:

Enhanced (Low-Permeability) Cap

Geosynthetic clay liner (GCL) covered by asphalt and geogrid reinforced gravel

Remedial Alternative Components:

- Conveyance System Improvement (Phase 1)
- Permeable Reactive Barrier (Phase 1)
- Enhanced (Low-Permeability) Cap (Phase2)
- Remedy Maintenance Activities
- Environmental Monitoring
- Institutional Controls

LEGEND

Site Features[1]
- Monitoring Well
- Perched Monitoring Well
- Stormwater Outfall

Site Storm Features
- Outfall
- Vault
- Storm Line

Remedial Alternative Features
- Well to be Abandoned and Replaced
- Replace Stormwater Vault
- Slip Line Stormwater Pipe
- Permeable Reactive Barrier[4]
- Enhanced Cap
- Replace Stormwater System

All Other Features
- Site Boundary[2]
- Groundwater Flow Direction

NOTES

1. Locations surveyed May 2016.
2. Site boundary defined in Exhibit A of the Draft Agreed Order No. DE 11237 (Ecology, 2015).
3. Cap extent defined on Figure 2 of the Former Portac Inc. Site (AQEA, 2014).
4. Permeable reactive barrier dimensions and extent are subject to change during remedial design.

HMA: Hot Mix Asphalt
RCC: Roller-Compacted Concrete
GCL: Geosynthetic Clay Liner

N

0 90 180 270
Feet

Date: April 13, 2020
Data Sources: PORTAC, Aerial photo taken September 2018 by Metro

GSI Water Solutions, Inc.

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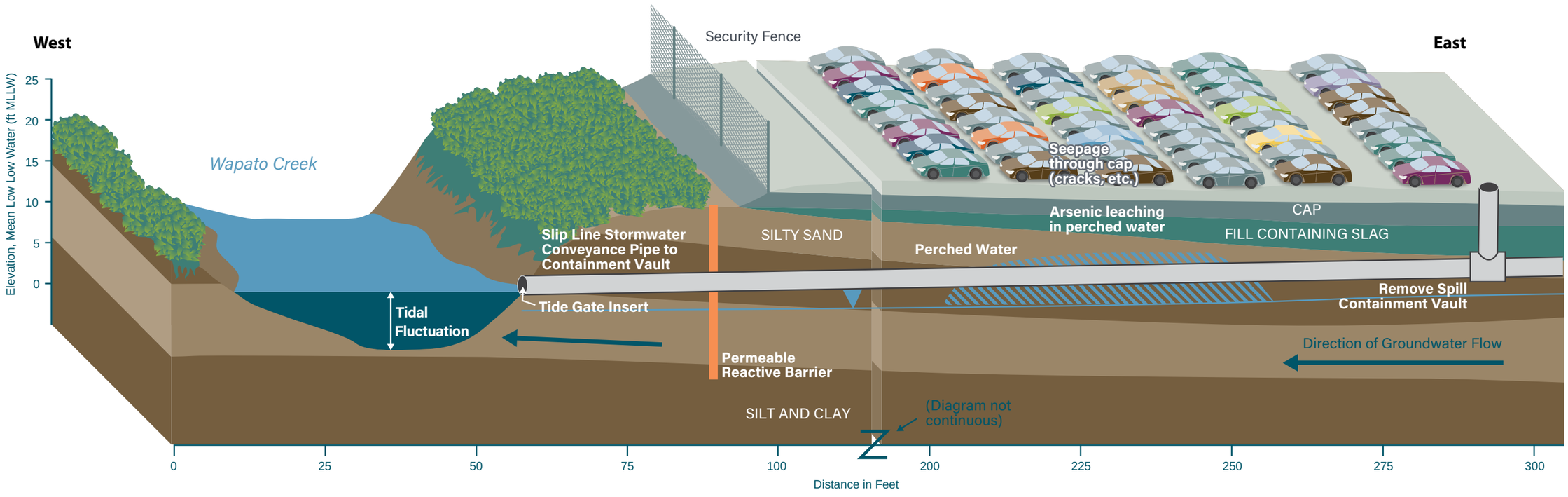

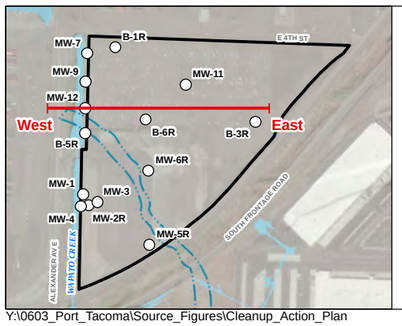

FIGURE 7

Log Yard Remedial Alternative 3A Cross Section

Cleanup Action Plan
Parcel 15
Tacoma, WA

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Project Year					Yr0	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10	Yr11	Yr12	Yr13	Yr14	Yr15	Yr16	Yr17	Yr18	Yr19	Yr20	Yr20+
Calendar Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Planning Tasks																										
	Remedial Investigation																									
		Feasibility Study																								
			Cap Maintenance (Interim Action)																							
					Groundwater Quality Monitoring																					
					Cap Maintenance																					
					Cleanup Action Plan																					
Remedial Design and Remedial Actions																										
Stormwater						Stormwater Tidegate Installation (Interim Action)																					
								Log Yard Conveyance System Inspection and Cleaning																		
									Log Yard Conveyance System Improvements																	
														Conveyance System Improvements (upgradient of perched zone)												
																				Conveyance System Replacement (date uncertain)						
Groundwater						Groundwater Quality Monitoring in Log Yard and Sawmill																					
									Permeable Reactive Barrier																	
														Perched Zone Drainage and Treatment System Installation												
Soil						Institutional Controls: Log Yard Cap Inspections, Soil Management requirements, Stormwater system inspections, Soil Gas vapor intrusion notifications, deed restrictions.																					
																				Low Perm Cap Enhancement (date uncertain)						

Completed Activity
Ongoing Activity
Planned Activity
Contingent Activity

FIGURE 8

Log Yard Estimated Cleanup Action Timeline

Cleanup Action Plan
Parcel 15
Tacoma, WA

GSI Water Solutions, Inc.

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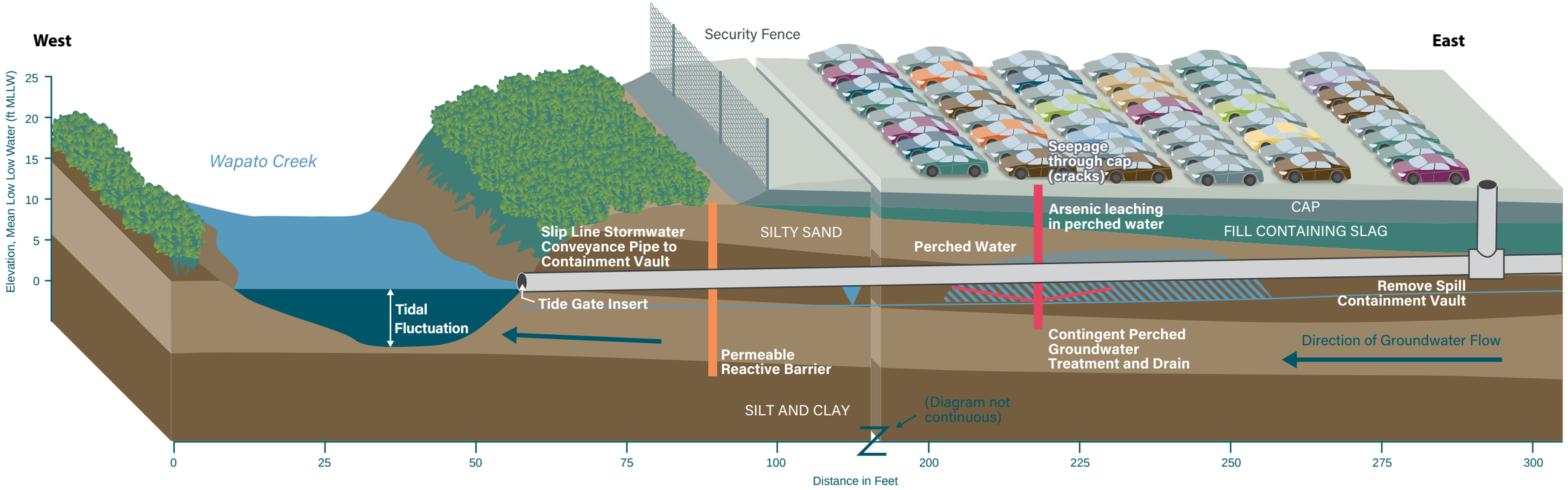

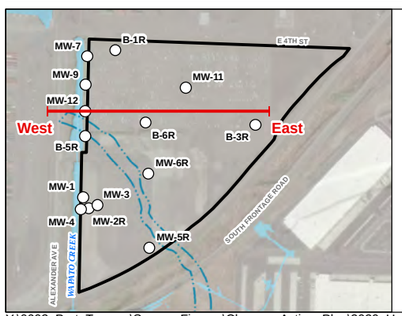

FIGURE 9

Log Yard Remedial Alternative 3A Contingent Perched Groundwater Trearment

Cleanup Action Plan
Parcel 15
Tacoma, WA

GSI Water Solutions, Inc.

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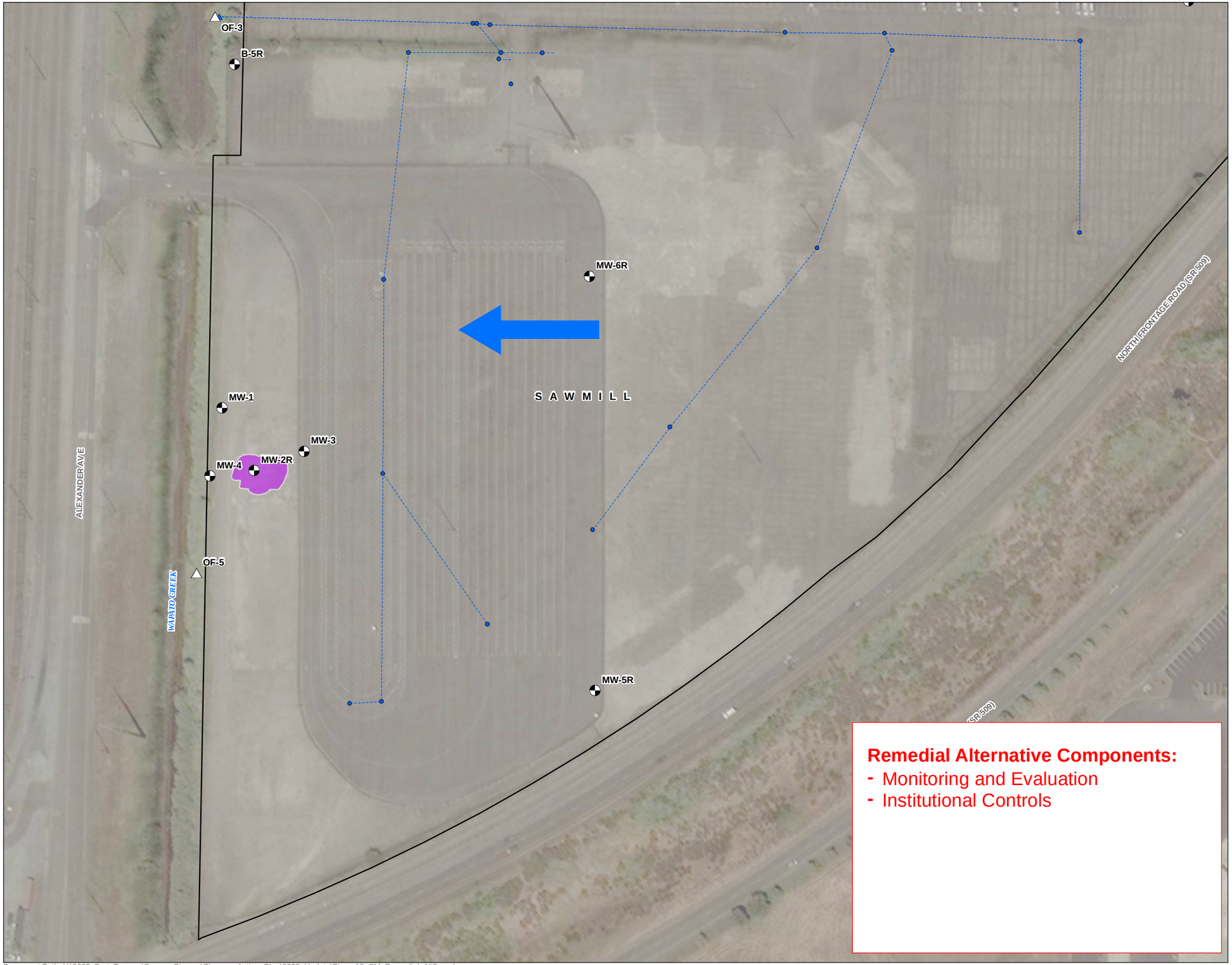
FIGURE 10

Sawmill Remedial Alternative 1

Cleanup Action Plan
Parcel 15
Tacoma, WA



Remedial Alternative Components:
- Monitoring and Evaluation
- Institutional Controls

LEGEND

Site Features[1]
- Monitoring Well
- Stormwater Outfall

Storm Features
- Outfall
- Vault
- Stormwater Conveyance Pipe

Remedial Alternative Features
- Former Dip Tank Excavation/Fill Extent (Approximate)

All Other Features
- Site Boundary[2]
- Groundwater Flow Direction

NOTES

1. Locations have been surveyed, May 2016.
2. Site boundary defined in Exhibit A of the Draft Agreed Order No. DE 11237 (Ecology, 2015).

N

0 65 130 195
Feet

Date: April 13, 2020
Data Sources: PORTAC, Aerial photo taken September 2018 by Metro

GSI Water Solutions, Inc.

Document Path: Y:\0603_Port_Tacoma\Source_Figures\Cleanup_Action_Plan\2020_Update\Figure10_SM_Remedial_Alt2.mxd

FIGURE 11

Point of Compliance Locations

Cleanup Action Plan
Parcel 15
Tacoma, WA

BLAIR WATERWAY

E 4TH ST

MW-7

MW-9

MW-12

MW 2R

LOG YARD AREA

SAWMILL AREA

ALEXANDER AVE

NORTH FRONTAGE ROAD (SR 509)

SOUTH FRONTAGE ROAD (SR 509)

LEGEND

Point of Compliance Location

- Monitoring Well
- Surface Water

All Other Features

- Vault
- Stormwater Conveyance Pipe
- Former Dip Tank
- Site Boundary[1]
- Railroad
- Watercourse
- Waterbody

NOTE

1. Site boundary defined in Exhibit A of the Draft Agreed Order No. DE 11237 (Ecology, 2015).

N

0 150 300 450
Feet

Date: April 9, 2020
Data Sources: PORTAC, Aerial photo taken September 2018 by Metro

GSI Water Solutions, Inc.

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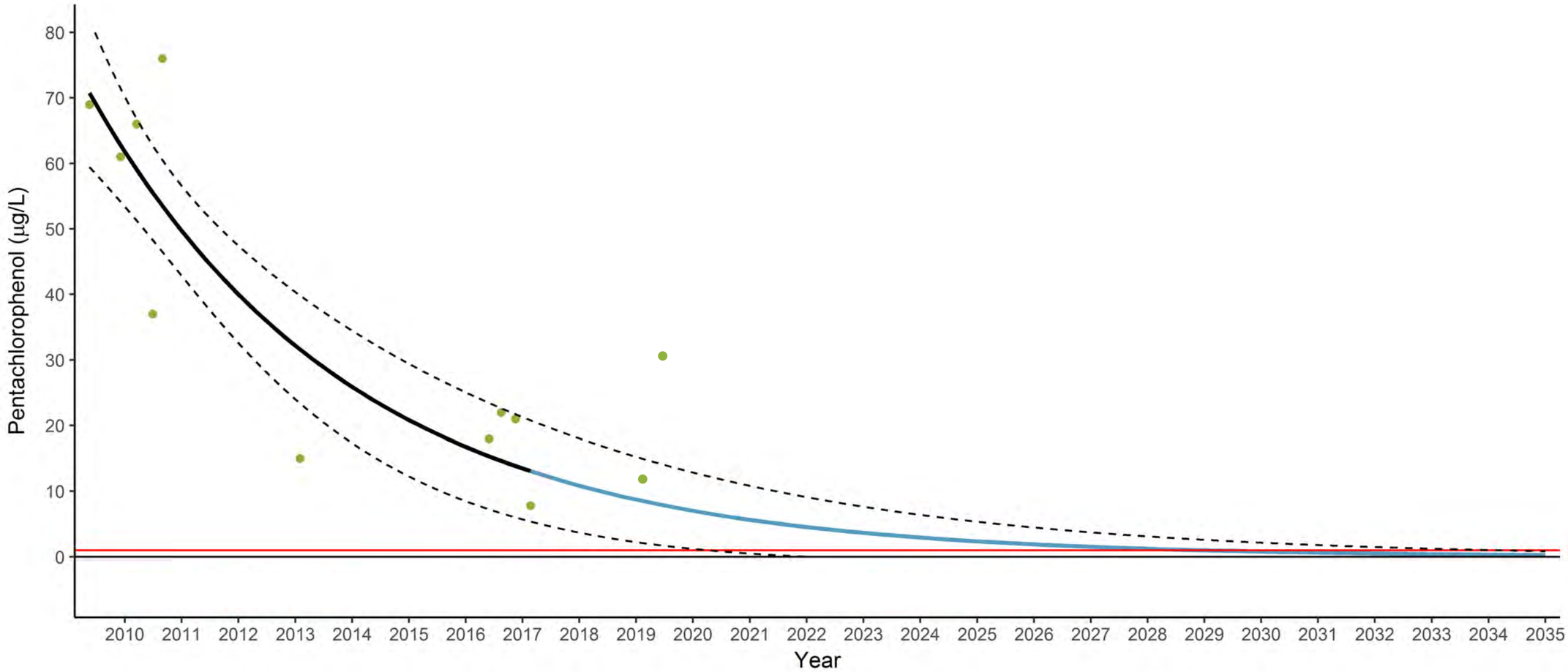
Appendix A

PCP Concentrations at Site Well MW-2R



LEGEND

- Target Concentration
- Log Regression of Available Data
- Predicted Decay Values
- Upper and Lower 85% Confidence Limit

NOTE:

Half-life is 3.19 years, calculated based on modeled decay constat
Decay prediction equation, y=exp(6.30-0.217*(x)); where x is the decimal year

MW-2R DATA

EVENT	PCP (ug/kg)	pH
1	18	12.01
2	22	11.72
3	21	11.21
4	7.8	11.84
5	12	11.85
6	31	11.02

APPENDIX A

PCP Concentrations at Site Well MW-2R

Cleanup Action Plan
Parcel 15
Tacoma, WA

GSI Water Solutions, Inc.

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Appendix B

Revised Environmental Benefit and Probable Cost Tables and DCA Figure

Remedial Alternatives		Net Present Value[2]
Log Yard		
Alternative 1	Asphalt Overlay, Stormwater System Repair, MNA, PRB Contingency	$9,505,000
Alternative 2	Enhanced Cap, Stormwater System Repair, MNA, PRB Contingency	$10,549,000
Alternative 3	Low Permeability Cap, Stormwater System Replacement, MNA, PRB Contingency	$12,254,000
Alternative 3A	Perched Zone Treatment, PRB, Stormwater System Repair, MNA, Low Permeability Cap Contingency	$11,507,000
Alternative 4	Asphalt Overlay, Stormwater System Repair, Ex Situ Treatment, MNA, PRB Contingency	$10,921,000
Alternative 5	Excavation & Off-site Disposal, Stormwater System Replacement, MNA, PRB Contingency	$30,964,000

Notes:

1. Estimated costs are in 2017 dollars

2. Net present value (NPV) based on reasonable return on investment (ROI) estimate (5.5%) subtracted from average City of Tacoma consumer price index (CPI) between 1998 and 2016 (2.4%) for a discount rate of (3.1%).

TABLE A-5 (revisions highlighted)

COST ESTIMATE
LOG YARD ALTERNATIVE 3A

Feasibility Study
Parcel 15
Tacoma, WA

Initial and Annual Costs[1]

Item	Quantity	Unit	Rate/ %	Total
Initial (Year 1) Costs				
Mobilization			6%	$4,000
Stormwater System Repair	1	LS	$58,500	$58,500
Design and Permitting			15%	$9,000
Construction Management			10%	$6,000
Project Management			8%	$5,000
Ecology Review/Oversight for Implementation			2%	$1,000
Sales Tax (City of Tacoma)			10.1%	$6,000
			Year 1 Costs Subtotal	**$89,500**
Stormwater System Slip Lining (Year 2) Costs				
Mobilization			6%	$23,000
Stormwater System Repair (Slip Line)	1	LS	$270,000	$270,000
Stormwater System Repair (Vault Replacement)	1	LS	$107,000	$107,000
Design and Permitting			8%	$30,000
Construction Management			4%	$15,000
Project Management			3%	$11,000
Ecology Review/Oversight for Implementation			1%	$4,000
Sales Tax (City of Tacoma)			10.1%	$40,000
			Year 2 Costs Subtotal	**$500,000**
Perched Zone Treatment and Drain (Year 5) Costs				
Mobilization			8%	$27,000
Perched Zone Treatment and Drain Installation (8- 12' bgs, ZVI sumps 12-18'bgs)	1	LS	$342,000	$342,000
Design and Permitting			12%	$41,000
Construction Management			8%	$27,000
Project Management			5%	$17,000
Ecology Review/Oversight for Implementation			2%	$7,000
Sales Tax (City of Tacoma)			10.1%	$37,000
			Year 5 Costs Subtotal	**$498,000**
PRB (Year 10) Costs				
Mobilization			6%	$60,000
PRB Installation (10% ZVI @ 25'-10'bgs)	1,000	LF	$1,000	$1,000,000
Design and Permitting			8%	$80,000
Construction Management			4%	$40,000
Project Management			3%	$30,000
Ecology Review/Oversight for Implementation			1%	$10,000
Sales Tax (City of Tacoma)			10.1%	$107,000
			Year 10 Costs Subtotal	**$1,327,000**
Cap Improvement Contingency (Year 15) Costs				
Mobilization			4%	$283,000
Low Permeability Cap (GCL, 5" HMA cover)	1	LS	$6,360,000	$6,360,000
Stormwater System Replacement	1	LS	$672,000	$672,000
Monitoring well repairs/replacement	18	EA	$2,500	$45,000
Design and Permitting			4%	$281,000
Construction Management			3%	$211,000
Project Management			2%	$141,000
Ecology Review/Oversight for Implementation			1%	$70,000
Sales Tax (City of Tacoma)			10.1%	$743,000
			Year 15 Costs Subtotal	**$8,806,000**
Initial Other Costs				
Institutional controls	1	LS	$10,000	$10,000
			Initial Construction and Other Costs Subtotal	**$9,403,500**
			Initial Construction Costs Contingency[2] (20%)	**$1,880,700**
			Total Initial Construction and Other Costs	**$11,284,200**

Annual Long Term Costs	No. of Events	Unit	Rate/ %	Annual Total	Years	Total
Annual Costs - Yr 1-5						
Maintain Inst. Controls	1	LS	$1,000	$1,000	5	$5,000
Cap Inspections	1	LS	$8,500	$8,500	5	$42,500
Cap Repairs	1	LS	$54,000	$54,000	5	$270,000
Ground/Surface Water Sampling & Annual Reporting (YR 1)	4	LS	$11,500	$46,000	1	$46,000
Ground/Surface Water Sampling & Annual Reporting	2	LS	$14,500	$29,000	4	$116,000
Porewater Sampling (YR 4)	2	LS	$14,500	$29,000	1	$29,000
Ecology Review/Oversight for annual events		5%	$5,500	$5,500	5	$27,500
Annual Costs - Yrs 6-15						
Maintain Inst. Controls	1	LS	$1,000	$1,000	10	$10,000
Cap Repairs	1	LS	$54,000	$54,000	5	$270,000
Cap Inspections	1	LS	$8,500	$8,500	10	$85,000
Groundwater Sampling and Annual Reporting	2	LS	$13,500	$27,000	10	$270,000
Porewater Sampling (YR 9)	2	LS	$14,500	$29,000	1	$29,000
Ecology Review/Oversight for annual events		5%	$6,000	$6,000	10	$60,000
Annual Costs - Yrs 16-100						
Maintain Inst. Controls	1	LS	$1,000	$1,000	85	$85,000
Cap Inspections	1	LS	$8,500	$8,500	85	$722,500
Reduced Groundwater Sampling & Reporting (YRs 16-21)	1	LS	$17,000	$17,000	5	$85,000
Reduced Groundwater Sampling & Reporting (Twice/5YR)	0.4	LS	$17,000	$6,800	85	$578,000
Ecology Review/Oversight for annual events		5%	$1,700	$1,700	85	$144,500
Other Periodic Costs						
GCL Liner Repair		3%	$190,800	$190,800	yr 25, 50, 80	$572,400
PRB Maintenance/Repair		25%	$331,750	$331,750	yr 45	$331,750
Perched Zone PRB Maintenance/Repair		10%	$49,800	$49,800	yr 20, 50, 80	$149,400
Abandon wells	12	EA	$1,500	$18,000	yr 100	$18,000

Net Present Value Calculation

Year	Initial/One Time Costs	Annual	Contingency (20%)	Total	Inflated Cost (2.4%)	NPV Cost (ROI 5.5%)	Year	Initial/One Time Costs	Annual	Contingency (20%)	Total	Inflated Cost (2.4%)	NPV Cost (ROI 5.5%)
1	$89,500	$115,000	$40,900	$245,400	$251,290	$238,189	51	$0	$18,000	$3,600	$21,600	$72,402	$4,719
2	$500,000	$98,000	$119,600	$717,600	$752,458	$676,048	52	$0	$18,000	$3,600	$21,600	$74,140	$4,581
3	$0	$98,000	$19,600	$117,600	$126,272	$107,535	53	$0	$18,000	$3,600	$21,600	$75,919	$4,446
4	$0	$127,000	$25,400	$152,400	$167,566	$135,262	54	$0	$18,000	$3,600	$21,600	$77,741	$4,315
5	$1,327,000	$98,000	$285,000	$1,710,000	$1,925,289	$1,473,105	55	$0	$18,000	$3,600	$21,600	$79,607	$4,189
6	$0	$96,500	$19,300	$115,800	$133,508	$96,826	56	$0	$18,000	$3,600	$21,600	$81,518	$4,065
7	$0	$96,500	$19,300	$115,800	$136,713	$93,981	57	$0	$18,000	$3,600	$21,600	$83,474	$3,946
8	$0	$96,500	$19,300	$115,800	$139,994	$91,220	58	$0	$18,000	$3,600	$21,600	$85,477	$3,830
9	$0	$125,500	$25,100	$150,600	$186,434	$115,147	59	$0	$18,000	$3,600	$21,600	$87,529	$3,718
10	$498,000	$96,500	$118,900	$713,400	$904,342	$529,429	60	$0	$18,000	$3,600	$21,600	$89,630	$3,608
11	$0	$96,500	$19,300	$115,800	$150,317	$83,412	61	$0	$18,000	$3,600	$21,600	$91,781	$3,502
12	$0	$96,500	$19,300	$115,800	$153,925	$80,961	62	$0	$18,000	$3,600	$21,600	$93,983	$3,399
13	$0	$96,500	$19,300	$115,800	$157,619	$78,583	63	$0	$18,000	$3,600	$21,600	$96,239	$3,299
14	$0	$96,500	$19,300	$115,800	$161,402	$76,273	64	$0	$18,000	$3,600	$21,600	$98,549	$3,203
15	$8,816,000	$96,500	$1,782,500	$10,695,000	$15,264,414	$6,837,436	65	$0	$18,000	$3,600	$21,600	$100,914	$3,108
16	$0	$28,200	$5,640	$33,840	$49,457	$20,999	66	$0	$18,000	$3,600	$21,600	$103,336	$3,017
17	$0	$28,200	$5,640	$33,840	$50,644	$20,382	67	$0	$18,000	$3,600	$21,600	$105,816	$2,928
18	$0	$28,200	$5,640	$33,840	$51,860	$19,783	68	$0	$18,000	$3,600	$21,600	$108,355	$2,842
19	$0	$28,200	$5,640	$33,840	$53,104	$19,201	69	$0	$18,000	$3,600	$21,600	$110,956	$2,759
20	$49,800	$28,200	$15,600	$93,600	$150,409	$51,550	70	$0	$18,000	$3,600	$21,600	$113,619	$2,678
21	$0	$18,000	$3,600	$21,600	$35,543	$11,547	71	$0	$18,000	$3,600	$21,600	$116,346	$2,599
22	$0	$18,000	$3,600	$21,600	$36,396	$11,207	72	$0	$18,000	$3,600	$21,600	$119,138	$2,523
23	$0	$18,000	$3,600	$21,600	$37,269	$10,878	73	$0	$18,000	$3,600	$21,600	$121,997	$2,449
24	$0	$18,000	$3,600	$21,600	$38,164	$10,558	74	$0	$18,000	$3,600	$21,600	$124,925	$2,377
25	$190,800	$18,000	$41,760	$250,560	$453,326	$118,877	75	$0	$18,000	$3,600	$21,600	$127,924	$2,307
26	$0	$18,000	$3,600	$21,600	$40,018	$9,947	76	$0	$18,000	$3,600	$21,600	$130,994	$2,239
27	$0	$18,000	$3,600	$21,600	$40,978	$9,655	77	$0	$18,000	$3,600	$21,600	$134,138	$2,173
28	$0	$18,000	$3,600	$21,600	$41,962	$9,371	78	$0	$18,000	$3,600	$21,600	$137,357	$2,109
29	$0	$18,000	$3,600	$21,600	$42,969	$9,096	79	$0	$18,000	$3,600	$21,600	$140,653	$2,047
30	$0	$18,000	$3,600	$21,600	$44,000	$8,828	80	$240,600	$18,000	$51,720	$310,320	$2,069,218	$28,550
31	$0	$18,000	$3,600	$21,600	$45,056	$8,569	81	$0	$18,000	$3,600	$21,600	$147,486	$1,929
32	$0	$18,000	$3,600	$21,600	$46,137	$8,317	82	$0	$18,000	$3,600	$21,600	$151,025	$1,872
33	$0	$18,000	$3,600	$21,600	$47,245	$8,073	83	$0	$18,000	$3,600	$21,600	$154,650	$1,817
34	$0	$18,000	$3,600	$21,600	$48,378	$7,836	84	$0	$18,000	$3,600	$21,600	$158,362	$1,764
35	$0	$18,000	$3,600	$21,600	$49,540	$7,605	85	$0	$18,000	$3,600	$21,600	$162,162	$1,712
36	$0	$18,000	$3,600	$21,600	$50,729	$7,382	86	$0	$18,000	$3,600	$21,600	$166,054	$1,662
37	$0	$18,000	$3,600	$21,600	$51,946	$7,165	87	$0	$18,000	$3,600	$21,600	$170,040	$1,613
38	$0	$18,000	$3,600	$21,600	$53,193	$6,954	88	$0	$18,000	$3,600	$21,600	$174,121	$1,565
39	$0	$18,000	$3,600	$21,600	$54,469	$6,750	89	$0	$18,000	$3,600	$21,600	$178,299	$1,519
40	$0	$18,000	$3,600	$21,600	$55,777	$6,552	90	$0	$18,000	$3,600	$21,600	$182,579	$1,475
41	$0	$18,000	$3,600	$21,600	$57,115	$6,359	91	$0	$18,000	$3,600	$21,600	$186,960	$1,431
42	$0	$18,000	$3,600	$21,600	$58,486	$6,172	92	$0	$18,000	$3,600	$21,600	$191,448	$1,389
43	$0	$18,000	$3,600	$21,600	$59,890	$5,991	93	$0	$18,000	$3,600	$21,600	$196,042	$1,349
44	$0	$18,000	$3,600	$21,600	$61,327	$5,815	94	$0	$18,000	$3,600	$21,600	$200,747	$1,309
45	$331,750	$18,000	$69,950	$419,700	$1,220,217	$109,667	95	$0	$18,000	$3,600	$21,600	$205,565	$1,270
46	$0	$18,000	$3,600	$21,600	$64,306	$5,478	96	$0	$18,000	$3,600	$21,600	$210,499	$1,233
47	$0	$18,000	$3,600	$21,600	$65,849	$5,317	97	$0	$18,000	$3,600	$21,600	$215,551	$1,197
48	$0	$18,000	$3,600	$21,600	$67,430	$5,161	98	$0	$18,000	$3,600	$21,600	$220,724	$1,162
49	$0	$18,000	$3,600	$21,600	$69,048	$5,009	99	$0	$18,000	$3,600	$21,600	$226,021	$1,128
50	$240,600	$18,000	$51,720	$310,320	$1,015,799	$69,853	100	$18,000	$18,000	$7,200	$43,200	$462,892	$2,189
												Net Present Value[3]	$11,507,000

Table 2. Log Yard DCA Evaluation (revisions show in red font)

Remedial Alternative[1]	Protectiveness (25%)[2]	Permanence (20%)	Long-Term Effectiveness (20%)	Short-Term Risk Management (15%)	Technical and Administrative Implementability (10%)	Public Concerns (10%)	Environmental Benefit Score	Probable Cost[3]	Benefit Score / Probable Cost[4]
	Relative Ranking - Scored from 1 (lowest) to 10 (highest)								
Alternative 3	**8**	**7**	**8**	**7**	**7**	**--**			
Alternative 3A - Conveyance System Repair - Permeable Reactive Barrier - Perched Groundwater Treatment -MNA - Low Permeability Cap Contingency - Institutional Controls	Achieves a high level of overall protectiveness through the use of a PRB with a contingent perched groundwater treatment system. The stormwater conveyance system will be sliplined in areas affected by groundwater infiltration and replaced when the property is developed or contigency low permeability cap implemented. Protectiveness is enhanced by installing a PRB near Wapato Creek. A contingent action will directly remove perched water groundwater and reduce arsenic flux to groundwater and Wapato Creek. A contigent low permeability cap would be implemented if criteria conditions are exceeded. With this tiered approach the overall protectiveness of the remedy is enhanced.	Achieves a high score for permanence. Permanence under this alternative is enhanced over Alternatives 1, 2 and 3 by directly removing perched groundwater. This alternative is more permanent than Alternative 4 as it integrates better with Port land use planning and employs a more robust contigent cap design. The cap design is expected to reduce the generation of high-arsenic perched water in comparison to Alternatives 1, 2 3, and 4. The stormwater system repair (slipline) and eventual replacement will also prevent future seepage of arsenic-containing groundwater into the storm drainage system.	Achieves a high level of long-term effectiveness through the use of perched groundwater treatment, stormwater system improvements, a PRB, and a contingent low-permeability cap to reduce perched water in source material and subsequent migration pathways. At the time of property development or implementation of the contingent low permeability cap, the stormwater conveyance system will be replaced eliminating risks that leaks would recur over the long-term. The reduction in infiltration and groundwater flux under this alternative optimizes conditions for ongoing natural attenuation of arsenic, reducing the likelihood that the contingent PRB will be required. If the PRB is required, the lifespan of the treatment media will be improved relative to other alternatives with higher groundwater flux rates.	This alternative has a medium score for short-term risk management. It involves more extensive construction activities during the perched water drain installation and initally during cap installation than under Alternatives 1, 2, 3, or 4. Construction-related risks are lower than under Alternative 5, because the quantity of arsenic-contaminated soils workers will be exposed to will be much less. The alternative includes significant on-site construction activities, but does not involve extensive off-site transportation of contaminated soils as under Alternative 5.	Alternative 3A has the highest score for implementability because it integrates best with property development planning and current uses. Implementation of the perched water treatment in this alternative is expected to be less complex and requiring less long term maintenance as it is expected to discharge in situ.	Evaluation pending public comment.	7.3	$11.5M	0.63
	9	**9**	**8**	**6**	**7**	**--**			

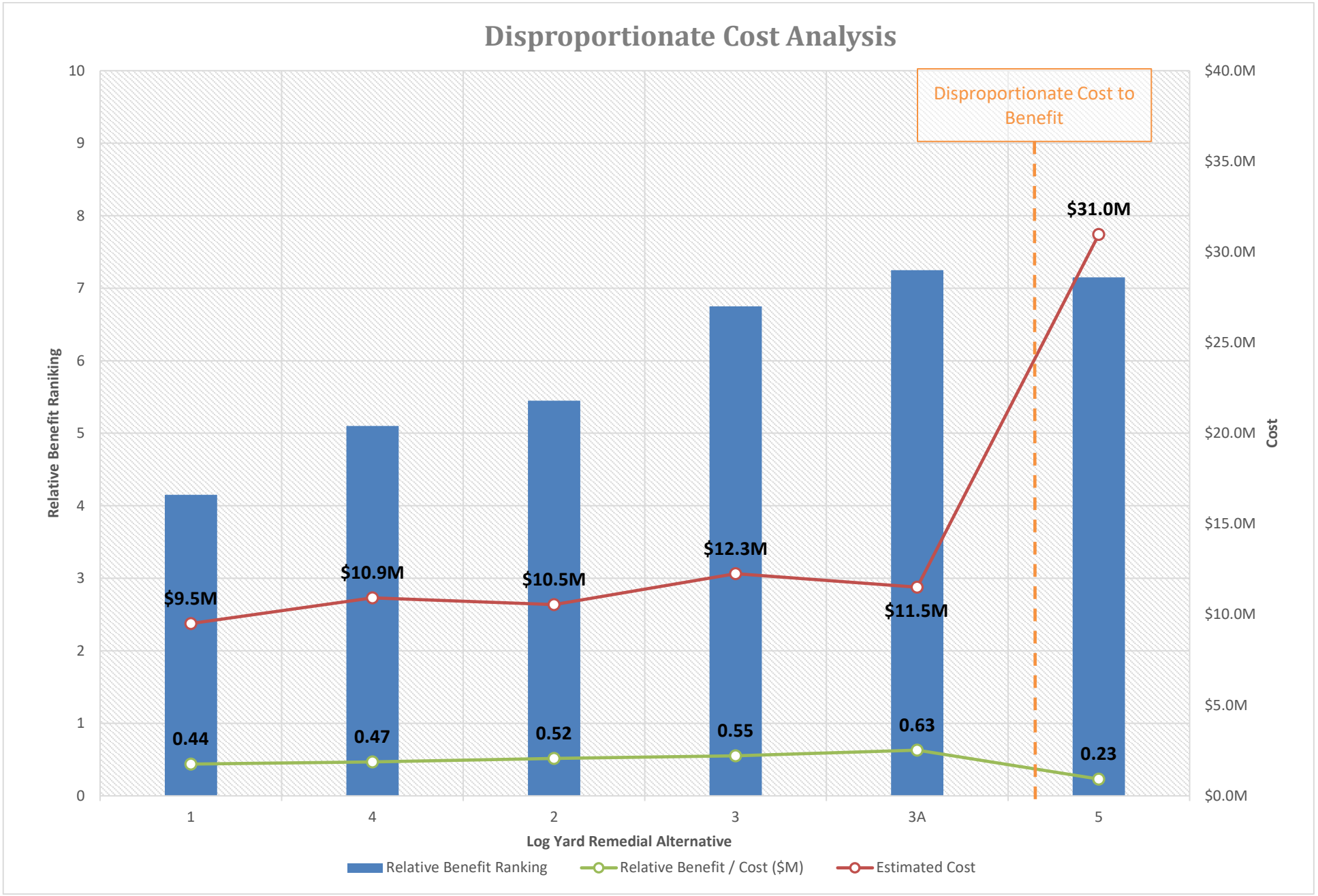
Remedial Alternative[1]	Protectiveness (25%)[2]	Permanence (20%)	Long-Term Effectiveness (20%)	Short-Term Risk Management (15%)	Technical and Administrative Implementability (10%)	Public Concerns (10%)	Environmental Benefit Score	Probable Cost[3]	Benefit Score / Probable Cost[4]
	Relative Ranking - Scored from 1 (lowest) to 10 (highest)								

Notes:

1. Consideration of public concerns is not addressed in this table because the public has not yet had an opportunity to provide comments.
2. Each of the DCA criteria listed were weighted, so the overall DCA score would be influenced by criteria directly relating to protectiveness and effectiveness. A score of 10 represents an alternative that satisfies the criteria to the highest degree.
3. Probable cost reflects the total estimated cost including applicable contingencies (see cost detail in Appendix A).
4. Probable costs were evaluated in increments of $1 million for comparison to benefit scoring.
5. A formula error in the orginal FS cost estimating tables for Alternative 4 was corrected as part of this FS Addendum effort, correspondingly Alternative 4's cost has been updated.

PRB = permeable reactive barrier
MNA = monitored natural attenuation

Revised Figure 6 from FS Addendum



Appendix C

Revised Environmental Benefit Table and DCA Figure

Table 8. Sawmill DCA Evaluation (revisions shown in red font)

Feasibility Study
Parcel 15

Remedial Alternative[1]	Protectiveness (25%)[2]	Permanence (20%)	Long-Term Effectiveness (20%)	Short-Term Risk Management (15%)	Technical and Administrative Implementability (10%)	Public Concerns (10%)	Environmental Benefit Score	Probable Cost[3]	Benefit Score / Probable Cost[4]
	Relative Ranking - Scored from 1 (lowest) to 10 (highest)								
Alternative 1 - MNA - Institutional Controls	Achieves a medium score for overall protectiveness through ongoing monitored natural attenuation.	Residual contamination can be permanently detoxified through natural processes. This alternative receives a medium-high score for permanent reduction of mass and toxicity of hazardous substances at the Site.	This alternative receives a medium score for effectiveness as the time to complete the cleanup is longer than under the other alternatives. Long term effectiveness of this alternative depends upon maintaining institutional controls until contaminants attenuate and degrade.	This alternative was scored high for short term risk management. This alternative does not require any ex situ handling of residual contamination as treatment would occur in situ. There are no additional construction-related risks requiring management.	This alternative is scored high for implementability. This alternative requires only routine site monitoring.	Evaluation pending public comment.	6.2	$495K	1.24
	6	**6**	**6**	**9**	**9**	**--**			
Alternative 2 - Enhanced Bioremediation - MNA - Institutional Controls	Achieves a medium score for overall protectiveness because injection of amendments is not expected to accelerate in situ biodegradation and natural attenuation great than would occur for Alternative 1.	This alternative receives a medium score for permanent reduction of mass and toxicity of hazardous substances at the Site. Injection of amendments is not expected to result in a faster rate than under Alternative 1.	This alternative receives a medium score for effectiveness because the time required to complete the cleanup is expected to be the same as Alternative 1. Long term effectiveness of this alternative depends upon maintaining institutional controls until contaminants attenuate and degrade.	This alternative was scored medium-high for short term risk management. This alternative does not require any ex situ handling of residual contamination as treatment would occur in situ. However, some handling of corrosive chemicals would be required during amendment injection.	This alternative is scored high for implementability. Neutralization agents and injection mechanisms are well-developed technologies that could be rapidly procured and implemented.	Evaluation pending public comment.	5.9	$539K	1.09
	6	**6**	**6**	**8**	**8**	**--**			
Alternative 3 - Expanded Excavation and Off-Site Disposal - Temporary Groundwater Extraction and Treatment - MNA - Institutional Controls	Achieves a high score for overall protectiveness by reducing residual contaminant mass through excavation and temporary groundwater treatment, reducing the expected timeline until residual contamination is below cleanup levels in all wells.	This alternative receives a high score for rapid removal of remaining groundwater contamination at the Site, relative to Alternatives 1 or 2.	This alternative receives a high score for long-term effectiveness because it has shortest restoration time-frame and interim institutional controls are not likely required for groundwater.	This alternative was score medium for short term risk management. Excavation and ex situ treatment are included as remedial elements in this alternative. Ex situ handling of contaminated media creates short term exposure potential for site workers or fugitive emissions.	This alternative is scored medium for implementability. The alternative will require management of stormwater and extracted groundwater during construction, and off-site management of excavated soils.	Evaluation pending public comment.	7.1	$742K	0.96
	9	**9**	**9**	**5**	**5**	**--**			

Notes:
1. Consideration of public concerns is not addressed in this table because the public has not yet had an opportunity to provide comments.
2. Each of the DCA criteria listed were weighted, so the overall DCA score would be influenced by criteria directly relating to protectiveness and effectiveness. A score of 10 represents an alternative that satisfies the criteria to the highest degree.
3. Probable cost reflects the total estimated cost including applicable contingencies (see cost detail in Appendix C).
4. Probable costs were evaluated in $100,000 increments for comparison to benefit scoring.
MNA = monitored natural attenuation

Revised Figure 14 from Feasibility Study