Draft
Cleanup Action Plan

Dawn Foods Site
6901 Fox Ave South
Seattle, Washington 98108

Agreed Order No. DE 21602
Facility Site Identification No. 3505
Cleanup Site Identification No. 16678

September 3, 2026

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Table of Contents

Executive Summary 1-1

1 Introduction 1-1
- 1.1 Previous Studies 1-1
- 1.2 Previous Remedial Actions 1-2
- 1.3 Regulatory Framework 1-3

2 Site Description 2-1
- 2.1 Property History and Past Land Use 2-1
- 2.2 Human Health and Environmental Concerns 2-2
- 2.3 Cleanup Standards 2-4
  - 2.3.1 Chemicals of Concern 2-4
  - 2.3.2 Cleanup Levels 2-4
- 2.4 Point of Compliance 2-4

3 Cleanup Action Alternatives 3-1
- 3.1 Alternative Descriptions 3-1
  - 3.1.1 Alternative 1 – ERD, Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring 3-2
  - 3.1.2 Alternative 2 – ERD, Targeted Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring 3-4
  - 3.1.3 Alternative 3 – ERD, PRB, Capping, Institutional Controls and Monitoring 3-6
  - 3.1.4 Alternative 4 – ERD, Institutional Controls, Monitoring and Capping 3-8
- 3.2 Summary of Alternative Evaluation 3-9

4 Selected Remedial Alternative 4-1
- 4.1 Description of Selected Remedial Alternative 4-1
  - 4.1.1 Contingent Actions 4-2
- 4.2 Cleanup Standards and Point of Compliance 4-2
- 4.3 Compliance with ARARs 4-3
- 4.4 Restoration Time Frame 4-3
- 4.5 Compliance Monitoring 4-3
- 4.6 Implementation Schedule and Reporting 4-3
  - 4.6.1 Periodic Review 4-4
- 4.7 Institutional/Engineering Controls 4-4
- 4.8 Public Participation 4-4

5 References 5-1

List of Tables

Table 1 Chemicals of Concern and Cleanup Levels
Table 2 MTCA Requirements: Evaluation of Alternatives
Table 3 Disproportionate Cost Analysis for Remedial Alternatives
Table 4 Potentially Applicable Requirements

List of Figures

Figure 1 Vicinity Map
Figure 2 1996 Soil and Groundwater Sample Locations
Figure 3 Previous Investigation Locations
Figure 4 Summary of Interim Action Areas
Figure 5 Stormwater Facility Site Map
Figure 6 Estimated Extent of Groundwater Exceeding Cleanup Levels
Figure 7 Soil Contamination Exceeding Cleanup Levels Prior to Interim Action
Figure 8 Proposed Cleanup Action Alternative 1
Figure 9 Proposed Cleanup Action Alternative 2
Figure 10 Proposed Cleanup Action Alternative 3
Figure 11 Proposed Cleanup Action Alternative 4

List of Appendices

Appendix A Compliance Monitoring and Contingency Response Plan

Acronyms and Abbreviations

ARARs	applicable, relevant and appropriate requirements
AO	Agreed Order
bgs	below ground surface
Bridge	7730 202nd Street, LLC
CMCRP	Compliance Monitoring and Contingency Response Plan
CRETE	CRETE Consulting Incorporated
CSM	conceptual site model
CPOC	Conditional point of compliance
COC	chemical of concern
COI	constituents of interest
CVOC	chlorinated volatile organic compound
CUL	Cleanup up level
DCAP	draft Cleanup Action Plan
Ecology	Washington Department of Ecology
EPA	United States Environmental Protection Agency
ERD	enhanced in-situ reductive dichlorination
EIM	Environmental Information Management System
FBI	Friedman & Bruya, Inc
ft	foot
GWCC	Great Western Chemical/Cascade Columbia Distribution Company
IHSs	indicator hazardous substances
IA	Interim Action
IAWP	Interim Action Work Plan
LDW	Lower Duwamish Waterway
µg/L	microgram per liter
µg/m^3	microgram per cubic meter
µS/cm	microSiemens per centimeter
mg/kg	milligram per kilogram
MTCA	Model Toxics Control Act
PCE	perchloroethylene (tetrachloroethene)
PCBs	polychlorinated biphenyl Aroclors
PCUL	Preliminary Cleanup Level
PMEP	Permanent to the Maximum Extent Practicable
QAPP	Quality Assurance Project Plan
RCW	Revised Code of Washington
RI/FS	Remedial Investigation/Feasibility Study
RIWP	Remedial Investigation Work Plan
Site	Former Dawn Foods facility
SL	Screening level

TEE	terrestrial ecological evaluation
TEQ	Toxic equivalency
TCE	trichloroethene
TOC	Total organic carbon
TPH	total petroleum hydrocarbons
VC	Vinyl Chloride
VOC	volatile organic compound
WAC	Washington Administrative Code
ZVI	Zero-valent iron

Executive Summary

This document presents the draft Cleanup Action Plan (dCAP) for the Dawn Foods Site (Site), located at 6901 Fox Ave South in Seattle, Washington 98108[1] (see Figure 1; King County Parcel Number 000180-0113). The Site is currently owned by Bridge Point Seattle 130 (Bridge). The Site is defined by releases of metals (primarily zinc), petroleum, and chlorinated volatile organic compounds (CVOCs) to soil and groundwater areas that resulted from former industrial activities. The Site is also impacted by CVOCs in groundwater migrating from the upgradient Fox Avenue Building LLC site located at 6900 Fox Avenue (Facility Site ID No. 2282; Cleanup Site ID No. 5082). This upgradient site was previously known as Great Western Chemical Company (GWCC).

This dCAP meets the requirements of the Model Toxics Control Cleanup Act (MTCA) and implementing regulations Chapter 70A.305 Revised Code of Washington (RCW); Washington Administrative Code (WAC) Chapter 173-340. The dCAP describes the proposed cleanup action for this Site and sets forth the requirements for the cleanup. The dCAP has been prepared in accordance with the requirements of Agreed Order DE 21602.

Background: The Site covers 5.4 acres and is located in the Duwamish River Valley in the Georgetown neighborhood of Seattle, Washington.

The Site is located on the eastern shore of the Duwamish Waterway where the Duwamish River formerly meandered throughout the area until the 1913 - 1916 dredging program provided a channelized Duwamish Waterway.

The Site includes a warehouse building built in 1977 that is approximately 128,800 square feet (2.96 acres). It has been used by various food companies, such as Bunge Foods (1988 to 2003), and then Dawn Food Products, Inc (Dawn Foods; 2003 to 2023). In 2020, Bridge purchased the Site from Guimont Fox Avenue LLC and leased the warehouse to Dawn Foods through the end of 2023. Since being vacated, the warehouse has been significantly upgraded and rehabilitated. The entire Site, except for limited landscaping, is covered with buildings, concrete, or asphalt.

Ship building activities, such as ship repair, painting, and fabrication, occurred between about 1917 and 1953. McAteer Shipbuilding, a wooden boat builder, previously occupied the Site. National Steel Corporation, which occupied the parcel south of the Site (currently Seattle Boiler Works, 500 S Myrtle Street), expanded operations around 1929 and took over McAteer Ship Building Company. Aerial photos show that boats were present on the shoreline through 1936 and shoreline filling occurred between 1953 and 1956. Tax records indicate that the former buildings (at least 7 at one time) were constructed around 1929.

Emerson GM Diesel, a sheet metal fabrication and generator manufacturing company, leased and operated on the property after ship building activities decreased in 1967 and ceased in 1969.

[1] [1]Legal Description: LUTHER M COLLINS DC #46 & POR OF ABANDONED BED OF DUWAMISH RIVER IN NW 1/4 29-24-4 & POR VAC S WILLOW ST BEG NXN SWLY MGN OF FOX AVE S & C/L OF VAC S WILLOW ST TH N 88-49-54 W 838.35 FT TO NELY LN C W W #1 TH S 42-24-31 E 384.40 FT TH S 89-03-52 E 834.98 FT TO SWLY MGN SD FOX AVE TH N 42-23-30 W 379.61 FT TO BEG

The Site COCs includes metal (zinc), petroleum, and chlorinated volatile organic compounds (CVOCs) in soil and groundwater. The Site is also impacted by CVOCs in groundwater migrating from the upgradient Fox Avenue Building LLC Site (previously known as Great Western Chemical Company (GWCC)) located at 6900 Fox Avenue (Facility Site ID No. 2282; Cleanup Site ID No. 5082).

Bridge implemented an Interim Action (IA) in November 2024 that included injections of a nutrient-amended carbohydrate electron donor to stimulate in situ enhanced reductive dichlorination (ERD) for CVOCs and anaerobic sulfate-reduction for zinc. The injections were performed in the southeast, southcentral, and southwest portions of the Site. Performance monitoring data indicate that the Interim Action has been successful in reducing groundwater contaminant concentrations pending further performance monitoring data.

Evaluation of Alternatives: A comprehensive remedial investigation (RI) and feasibility study (FS) was approved by Ecology in 2026. 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. The following four cleanup alternatives were evaluated for the Site:

1. Alternative 1 – ERD Interim Action, Excavation and Off-Site Disposal, Institutional Controls, Monitoring, and Capping
2. Alternative 2 – ERD Interim Action, Targeted Excavation and Off-Site Disposal, Institutional Controls, Monitoring, and Capping
3. Alternative 3 – ERD Interim Action, PRB, Institutional Controls, Monitoring, and Capping
4. Alternative 4 – ERD Interim Action, Institutional Controls, Monitoring, and Capping

After evaluation per WAC 173-340-360(3) which included MTCA threshold criteria, evaluation of restoration time frame, and completion of a disproportionate cost analysis, Alternative 4 was identified as the preferred remedial alternative for the Site. This alternative complies with MTCA remedy selection criteria and complies with Ecology's expectations for cleanup remedies as defined in WAC 173-340-370.

Alternative 4 includes the following components:

- IA – Injections to stimulate ERD for CVOCs and sulfate reduction for zinc were implemented in November 2024.
- Maintain the current asphalt pavement and building structure to serve as a cap for the Site.
- Groundwater compliance monitoring to evaluate IA performance and to evaluate compliance with groundwater cleanup levels (CULs) at the shoreline conditional point of compliance (CPOC).

- Institutional controls to ensure that future property activities do not result in human or environmental exposure to impacted soil or subslab vapor and maintain the integrity of the surface cap features.
- Contingency Actions if concentrations of groundwater COCs at the shoreline do not demonstrate a stable or declining trend that will achieve groundwater CULs within a reasonable restoration time frame. Contingency actions will be evaluated during the 5-year review.

1 Introduction

This document presents the draft Cleanup Action Plan (dCAP) for the Dawn Foods Site (Site), located at 6901 Fox Ave South in Seattle, Washington 98108 (see Figure 1; King County parcel number 000180-0113[2]).

This dCAP meets the requirements of the Model Toxics Control Cleanup Act (MTCA) and implements regulations Chapter 70A.305 Revised Code of Washington (RCW); Washington Administrative Code (WAC) Chapter 173-340. The dCAP describes the proposed cleanup action for this Site and sets forth the requirements for the preferred remedial cleanup. The dCAP 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 FS and the remedy selection process
- Describes the cleanup action selected 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 dCAP

1.1 Previous Studies

Site investigations have occurred since 1988 and are summarized below. Additional details of these investigations can be found in the RI/FS. Figures 2 and 3 show the known environmental sampling locations between 1996 and 2025. Below is a summary of environmental investigations completed to date.

- Environmental Site Assessment, 1988 - Earth Consultants, Inc. (ECI) conducted sampling activities to evaluate soil for the presence of petroleum hydrocarbons and heavy metals (ECI 1988). No diagram of sample locations was included with the report and the data contained therein is considered low quality.
- Limited Subsurface Investigation, 1996 - Hart Crowser (HC) completed a limited subsurface investigation in 1996 (Hart Crowser 1996a). Assessment activities included collection of a total of ten soil samples from five locations (HC-1 through HC-5) across the Site. Samples were analyzed for total petroleum hydrocarbons (TPH; gasoline and

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diesel/oil), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), and metals.

- CRETE Investigation Work, 2020 to 2023 - In 2020, prior to the AO, CRETE began investigation activities to confirm prior results. Work included:
    - Soil and groundwater sampling from temporary push probe drilling locations.
    - Installed nine monitoring well location (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, and MW-9).
    - Collected soil and groundwater samples from the monitoring well locations.
    - Sampled subslab and indoor air vapor.
    - Performed a tidal study to assess the potential tidal influence on groundwater at the Site.
- CRETE Remedial Investigation, 2024 - Based on data gaps identified in the Remedial Investigation Work Plan (RIWP, CRETE 2024a), CRETE undertook additional investigation activities including:
    - Installed a well point (PD-1) at the base of the shoreline, downgradient of MW-1.
    - Sampled visible surface water seeps (Seep, Seep-MW1, Seep-MW2) and surface water (Lower Duwamish Waterway [LDW]).
    - MW-3D was installed upgradient of existing well MW-3. Additional soil borings, MW-3B, MW-3C, were completed for geological logging only.
    - Periodic groundwater sampling was performed at monitoring wells MW-1 through MW-11 and well point (PD1).
    - Advanced 12 soil borings from which grab soil and groundwater samples were collected.
    - Collected subslab vapor and indoor air and ambient air vapor samples.
    - Completed a second tidal study in 2023.

1.2 Previous Remedial Actions

To address CVOCs and zinc in groundwater in the southwestern corner, the southcentral portion, and the southeastern corner of the Site, an Interim Action (IA) was implemented from November 8 through 21, 2024. The IA included in-situ enhanced reductive dechlorination (ERD) for chlorinated volatile organic compound (CVOCs) and anaerobic sulfate-reduction for zinc via substrate injection in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8.

All work was performed in accordance with WAC 173-340-430 and the Ecology approved IA Work Plan (IAWP; CRETE 2024b). The extent of the IA is shown on Figure 4.

To address both CVOCs and zinc in groundwater and soil, a nutrient-amended carbohydrate electron donor was injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8. The application of the electron donor to the subsurface created reductive conditions necessary for the reductive dechlorination of CVOCs and the sulfate reduction of zinc sulfate to zinc sulfide which results in removal of zinc from solution and subsequent precipitation.

For CVOCs, the goal was to address the minor mass of chlorinated solvents dissolved in groundwater, and also address chlorinated solvent mass sorbed onto the organic fraction in the soil as it partitions into the groundwater. For zinc, the goal was to transform adequate zinc in soil and groundwater to less soluble zinc sulfide to reduce groundwater concentrations to below the zinc CUL prior to migration to surface water.

The IAWP included installing 2 new monitoring wells – MW-10 and MW-11 (Figure 4). These wells were installed on September 19, 2024. A baseline sampling event was conducted on September 24, 2024, prior to implementing the IA on November 8, 2024. Wells sampled in the baseline event included: MW-1, MW-4, MW-5, MW-8, MW-10 and MW-11. Quarterly sampling has been conducted routinely starting in the first quarter 2025.

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 Interim Action (see Section 1.2) addressed groundwater contaminated with CVOCs and zinc above Preliminary Cleanup Level (PCULs).

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 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. Any required permits will be obtained during cleanup implementation.

4. Provide for compliance monitoring. A Compliance Monitoring and Contingency Response Plan has been developed to document groundwater compliance monitoring and evaluate attainment of groundwater cleanup standards (Appendix A). Contingent remedial actions are included and will be implemented if cleanup levels (CULs) established by MTCA are not met.

5. Use permanent solutions to the maximum extent practicable. The proposed cleanup action was evaluated in the FS and was determined to be permanent to the maximum extent practicable.

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 dCAP available for public review during a formal public comment period. Ecology will respond to public comments and concerns on the dCAP received during the public comment period, prior to preparing the final CAP.

2 Site Description

The Site covers 5.4-acres and is located in the Georgetown neighborhood of Seattle on the eastern shoreline of the Duwamish Waterway. The Site includes a warehouse building built in 1977 that is approximately 128,800 square feet (2.96 acres; King County parcel number 000180-0113[3]). The entire property, except for limited landscaping, is covered with buildings, concrete, or asphalt.

In 2020 Bridge purchased the property from Guimont Fox Avenue LLC. Bridge leased the property, including the warehouse building, to Dawn Food Products, Inc. through the end of 2023 to mix, store, produce, and ship dry food products, such as cake and brownie mixes. Bulk oils, which were used to make the dry food products, such as canola oil were received by truck and were previously received by rail. Currently the building is vacant after undergoing a substantial upgrade and rehabilitation following vacation of the premises by the prior tenant.

The Site stormwater system collects roof drainage and surface flow as shown on Figure 5. The discharge point is a single outfall located on the Seattle Boiler Works property (500 South Myrtle Street, Seattle), with discharge to the Duwamish Waterway (Figure 5). Stormwater associated with operations on the Site is managed in compliance with Industrial Stormwater General Permit No. WAR011560. This stormwater discharges to the Duwamish Waterway at a point south of the southern property boundary. As shown on Figure 5, at least one other source contributes to the discharge point.

The Site is located in the Georgetown neighborhood of Seattle adjacent to the Duwamish Waterway in a predominately industrial/commercial area of Seattle. The Site is zoned General Industrial MML U85 by the City of Seattle, which is for maritime, manufacturing, and logistics uses. Under the City of Seattle 2035 Master Plan[4], the Site will continue to be used for industrial purposes for the foreseeable future.

2.1 Property History and Past Land Use

The history and past land uses of the Site were detailed in the RI/FS. The general history of the Site is summarized below:

- The Site is located in the Duwamish River Valley and is on the eastern shore of the Duwamish Waterway. The river formerly meandered throughout the area until the 1913 to 1916 dredging program provided a channelized Duwamish Waterway.
- Ship building activities, such as ship repair, painting, and fabrication, likely occurred between about 1917 and 1953. National Steel Corporation, which occupied the parcel

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[4] https://www.seattle.gov/opcd/current-projects/seattle-2035-comprehensive-plan

south of the Site (currently Seattle Boiler Works, 500 S Myrtle Street), expanded operations around 1929 to the Site and likely operated through at least 1966. The extent to which National Steel Construction was involved in shipbuilding or repair is unclear. Aerial photos show that boats were present on the shoreline through 1936 and shoreline filling occurred between 1953 and 1956. Tax records indicate that the former buildings (at least 7 at one time) were constructed around 1929.

- Emerson GM Diesel, a sheet metal fabrication and generator manufacturing company, leased and operated on the property after ship building activities decreased/ceased starting around 1967/1969.
- The current warehouse (constructed in 1977) was used by various food companies, Dawn Food Products, Inc (2003 to 2023) and Bunge Foods (1988 to 2003). Other companies associated with the Site include Fox Avenue Warehouse Corporation (around 1977), then Carline Foods and Sam Wylde Flour and Energy Foods which occupied the building up until approximately 1987.
- In 2020 Bridge purchased the property from Guimont Fox Avenue LLC. The property, including the warehouse building, was leased to Dawn Food Products, Inc. through the end of 2023.
- Since being vacated the building has been rehabilitated and is currently vacant.

Bridge has renovated and upgraded the existing warehouse for continued use as an industrial warehouse consistent with local zoning and master use planning. A future tenant would likely use the warehouse for distribution.

2.2 Human Health and Environmental Concerns

There are no current releases or ongoing sources of contamination at the Site. Historical sources which may have contaminated soil, groundwater, and or indoor air/subslab vapor include the following:

- Ship painting and repair activities: Activities such as ship repair, painting, and fabrication likely occurred as early as 1917, and through 1953. These activities occurred primarily in the western and southwestern portion of the Site. Compounds present in soil and groundwater in the southwestern portion of the Site include CVOCs, petroleum, and metals that may be associated with former ship building and repair activities.
    - Known shipbuilding was limited to wooden boat building where primary activities would have included sawing, sanding, joint sealing, and painting. As indicated by aerial photos, the presence of marine railways, and shallow subsurface debris, the former ground surface where shipbuilding activities occurred has since been filled to the current upland grade. As a result, soil contamination in this area is generally present at depths consistent with the historical ground surface.
- Industrial manufacturing and fabrication over much of the central and western portion of the Site: After ship building (which decreased/ceased by 1966), the Site was leased

and used by National Steel Corporation and Emerson GM Diesel until around 1977, when the property was developed to the current layout (the existing building was completed in 1977). These past operations likely resulted in releases and spills in the vicinity of MW-5 and MW-8 that may have resulted in CVOCs, petroleum compounds, and metal (MW-5 only) impacts. PCE and TCE were detected in soil and groundwater above screening levels at RI-SB-11 and RI-SB-13 (PCE only).

  - These past industrial processes are also likely responsible for the other compounds such as PCBs. The source of dioxins and furans in soil appears to be associated with fill and debris along the LDW. The sources and timing of releases are not known.

- The Site is hydraulically downgradient of known chlorinated solvent releases from GWCC and the Emerson/Schultz Distributing block. The impacts at the GWCC Site are well established and known to migrate off-property, with documentation by GWCC confirming the existence of off-property impacts extending onto the Dawn Foods Site. These impacts have resulted in a broad dissolved-phase vinyl chloride plume that has affected much of the Dawn Foods Site and also has contributed PCE and TCE impacts to the eastern portion of the Site. Although under an Agreed Order, the GWCC Site has not been required to assess the maximum downgradient extent of its impacts to groundwater.

Contaminant release mechanisms refer to the way contaminants are released from the primary source. Primary release mechanisms associated with the former ship building facility included upland process-related releases and spills. Given the apparent changes in Site grade and due to changes in the shoreline location, it is possible that some of these historical surface releases are at varied depths below grade with clean fill above. The release mechanisms for the historical on-Site Emerson GM Diesel and National Steel Corporation activities are similarly assumed to be surface releases and the vertical migration through the soil column.

Urban and industrial sources outside the Site, including migration from the GWCC Site, have resulted in impacts to soil and groundwater within the Site boundaries.

The Site is almost entirely paved or covered with concrete and warehouse structures, thereby limiting the potential transport mechanisms to the following:

- Soil leaching to groundwater – Soils are impacted with several compounds and have the potential to impact groundwater. This mechanism is limited for vadose zone soil given the degree of impervious surface cover. Saturated zone soil contamination is located in the southwest and southcentral areas of the Site that were addressed by the IA.

- Groundwater transport to surface water – The hydraulic gradient is toward the LDW with discharge to the waterway through seeps and groundwater flux below the low water level of the LDW.

- Volatilization to Indoor Air – Volatile compounds are known to exist in the soil gas below the warehouse. Those impacts have not affected indoor air quality above a CUL. Future modifications to the property either through remodel or redevelopment can readily address this mechanism through engineering controls (e.g., vapor barrier, passive venting).

Stormwater is currently managed under Industrial Stormwater General Permit No. WAR011560. The majority of the Site is paved (with concrete or asphalt) and stormwater is monitored based on the permit conditions. The Site paving and concrete cover and existing stormwater system prevent any significant interaction between stormwater with soil and groundwater.

Figures 6 and 7 illustrates the combined interpreted maximum extent of groundwater and soil contamination, respectively, based on the detailed analysis presented in the RI/FS.

2.3 Cleanup Standards

2.3.1 Chemicals of Concern

Soil, groundwater and soil vapor and indoor air samples have been collected from across the Site (Figure 3). Based on the data presented in the RI/FS, the following chemicals of concern (COCs) have been selected based on the COIs. The Site COCs include:

- **Soil:**
  - Arsenic, zinc, TCE, PCE, and TPH-Gasoline and TPH-Diesel
- **Groundwater:**
  - Zinc, TCE, PCE, vinyl chloride, TPH-Gasoline and TPH-Diesel
- **Indoor Air:**
  - TCE, PCE and xylenes

2.3.2 Cleanup Levels

Soil and groundwater cleanup standards are based on the PCULs that were calculated to be protective of groundwater to surface water and sediment pathways are presented in Table 1.

Indoor air cleanup standards are based on MTCA Method C industrial indoor air cleanup levels and are presented in Table 1.

2.4 Point of Compliance

For soil cleanup levels based on the leaching to groundwater pathway, the standard point of compliance (POC) is throughout the Site.

For groundwater, a Conditional POC (CPOC) at the LDW shoreline has been selected. Monitoring wells MW-1, MW-2 and MW-3 or MW-3D (Figure 3) were selected as CPOC monitoring wells.

The point of compliance for air at the Site is indoor air throughout the Site.

3 Cleanup Action Alternatives

The RI/FS reviewed possible remedial technologies and developed remedial alternatives based on the MTCA expectations for cleanup action alternatives (WAC 173-340-370) and were evaluated based on the requirements of WAC 173-340-360(3). Technologies and alternatives were developed based on the remedial action objectives (RAOs) which were selected to comply with the requirements of WAC 173-340-351(6)(a). The FS identified the following RAOs:

RAO 1. Protect Worker Contact with Soils

- Reduce risk from soil contact during subsurface work (e.g., buried utilities)
- Soil CULs based on direct contact under an industrial scenario
- Point of compliance – Surface to 15 feet bgs

RAO 2. Protect LDW via Groundwater Discharge

- Reduce risk to aquatic life and humans ingesting fish and shellfish
- Groundwater CULs based on water quality criteria and partitioning to sediment
- Point of compliance – conditional point of compliance is set at the point of discharge to the Duwamish Waterway which is assumed to be the shoreline wells for this dCAP

RAO 3. Protect Groundwater via Soil Leaching

- Reduce risk of soil contamination leaching to groundwater
- Soil CULs based on leaching in the vadose and saturated zones
- Point of compliance – Surface to lowest depth where soil exceeds leaching CULs

RAO 4. Protect Workers via Inhalation of Vapors from Soil or Groundwater

- Reduce risk of vapor exposure in buildings and during subsurface confined space work (e.g., buried utilities)
- Groundwater CULs based on vapor intrusion screening levels
- Soil gas screening levels based on an industrial exposure scenario
- Indoor air CULs based on an inhalation in an industrial exposure scenario
- Points of compliance:
    - Groundwater throughout shallow aquifer
    - Air throughout the Site

No other RAOs are necessary to protect the current or potential future exposure pathways at the Site.

3.1 Alternative Descriptions

Below is a summary of the four remedial alternatives presented and evaluated in the RI/FS.

3.1.1 Alternative 1 – ERD, Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring

Alternative 1 includes ERD (as implemented in the IA), excavation in the soil impacted areas around RI-SB-09 and RI-SB-10 (Area 1; CVOCs and arsenic) and RI-SB-13 (Area 2; CVOCs), and institutional controls and monitoring.

Alternative 1 includes excavation along the shoreline and within the footprint of Site utilities. Utilities, including gas, power, and water lines, would need to be terminated prior to excavation activities and reinstalled upon completion. Stormwater lines which overlap with the removal areas would be abandoned and replaced following excavation activities.

This alternative includes maintaining the current cap and replaces the asphalt cap disturbed during excavation activities, resulting in a continuous cap over impacted soil to prevent migration through erosion and to prevent contact with impacted soils. Excavated soils would be disposed of at an off-site Subtitle D landfill. Site stormwater would be captured and treated, using the current treatment system. This remedy is shown on Figure 8 and includes:

- Excavation of approximately 8,200 tons of soil above the cleanup levels for VOCs (TCE and PCE), metals (zinc), and TPH. Performance monitoring on the bottom and sides of the excavated area to ensure all soil above the remediation levels is removed. The total volume of soil to be removed is 10,000 tons.
- All utilities removed during construction would be reinstalled.
- Monitoring wells MW-4 and MW-5 which are withing excavation footprints (MW-5) or side slopes (MW-4) are expected to be damaged during construction. These monitoring wells would be replaced in close vicinity to the abandoned well and using similar construction details as removed wells (total well depth, diameter, mount and screen interval).
- ERD to address both CVOCs and zinc in groundwater would include a nutrient-amended carbohydrate electron donor injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8 (performed during the IA – See Section 1.2). The IA is ongoing and concentrations of COCs are expected to continue to reduce.
- Maintaining the current asphalt parking and building structure which would serve as a cap for the entire Site.
- Short-term groundwater monitoring of existing Site wells (MW-1, MW-4, MW-5, MW-8, MW-9, MW-10 and MW-11) to determine the effectiveness of the ERD injections and long-term groundwater monitoring of shoreline monitoring wells (MW-1 and MW-2); to evaluate groundwater conditions at the conditional point of compliance.
- Institutional controls to ensure that future property activities do not result in human or environmental exposure to impacted soils or subslab vapor and that the existing capped

surfaces are maintained. A contaminated media management plan would be developed to manage Site soils and vapor conditions below the current building and would protect any future building conditions.

This alternative would address groundwater contamination through active (ERD and excavation) measures and continued groundwater monitoring. The alternative includes active treatment of CVOCs, and zinc at the southwestern corner (vicinity of MW-5 & RI-SB-07/CVOCs/zinc), southcentral portion (vicinity of RI-SB-13, CVOCs), and the southeastern corner (vicinity of MW-8, CVOCs/TPH). Excavation targets CVOC and metal concentrations in the southwestern corner (RI-SB-09, -10, and -11), and TPH located in the southwestern corner (RI-SB-13).

Continued groundwater monitoring at the upgradient portion of the Site (MW-9) and the northwest corner (RI-SB-06; via MW-3D) would address decreasing concentrations of arsenic, include monitoring of CVOCs (RI-SB-06; monitored at MW-3 or MW-3D), TPH located in the southeastern corner (MW-8/TPH-Gx and TPH-DRO).

Contingent actions may be conducted if CULs of groundwater COCs are not achieved at the shoreline. Contingent actions may include additional ERD injection to address CVOC and metal COCs.

Soil contamination is addressed through ERD treatments for contamination within in the saturated zone, excavation and institutional controls.

This alternative complies with the RAOs as summarized below:

- **RAO 1. Protect Worker Contact with Soils and RAO 4. Protect Workers via Inhalation of Vapors from Soil or Groundwater –** Institutional controls (including a contaminated media management plan) are included to reduce the potential risk of worker contact with vapor or for vapor migration into the building if building conditions change. Under this alternative, soil at RI-SB-10, which is above Method A direct contact for arsenic, would be removed and disposed of at an off-site disposal facility. Compliance with this RAO would include documentation of compliance with institutional controls in quarterly/annual reports provided to Ecology.
- **RAO 2. Protect LDW via Groundwater Discharge –** ERD treatment of zinc would treat groundwater above CULs that could discharge to the LDW. Remaining areas of the Site would be monitored through a long-term monitoring plan. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.
- **RAO 3. Protect Groundwater via Soil Leaching –** Excavation at Area 1 (RI-SB-11) and Area 2 (RI-SB-13) would remove vadose and saturated soil contamination eliminating the potential for leaching to groundwater. ERD treatment of zinc and would treat saturated soil contamination. Institutional controls would ensure that the surface features remain. Remaining areas of the Site would be monitored through the long-term monitoring plan. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.

3.1.2 Alternative 2 – ERD, Targeted Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring

Alternative 2 includes ERD (as implemented in the IA), targeted excavation of impacted soil in the vicinity of RI-SB-11 (for soil with CVOCs, metals, and TPH compounds above CULs), institutional controls and monitoring. Alternative 2 is shown on Figure 9.

Proposed excavation is to 9 feet bgs with depth driven by PCE, TCE, and zinc in samples from RI-SB-11. The excavation extent would be pre-determined based on existing data and is would be limited to areas along the shoreline, adjacent to the building and in the utility corridor near the building. Final soil conditions at the limits of the excavation would be documented through sampling and analysis. Excavated soils would be disposed of at an off-site Subtitle D landfill. Shoring would be required along the building and riverbank sides of the excavation to provide support during excavation. Water drainage and stormwater features would be rerouted during excavation. Dewatering would be required to control groundwater infiltration. This alternative avoids the main water lines, power lines and gas lines that run along the south side of the building. The existing stormwater system would be affected by Alternative 2. Catch basins within the footprint of removal (which would be removed) would be replaced after implementation.

This alternative includes maintaining the current cap and replaces the asphalt cap disturbed during excavation activities, resulting in a continuous cap over impacted soil to prevent migration through erosion and to prevent contact with impacted soils. This remedy includes:

- Targeted excavation of approximately 1,100 tons of soil contaminated with PCE, TCE and zinc.
- All utilities removed during construction would be reinstalled. All monitoring wells are outside of excavation footprints and are not expected to be damaged during construction.
- ERD to address both CVOCs and zinc in groundwater would include a nutrient-amended carbohydrate electron donor injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8 (performed during the IA – See Section 1.2). The IA is ongoing and concentrations of COCs are expected to continue to reduce.
- Maintaining the current asphalt parking and building structure which would serve as a cap for the entire Site.
- Short-term groundwater monitoring of existing Site wells (MW-1, MW-4, MW-5, MW-8, MW-9, MW-10 and MW-11) to determine the effectiveness of the ERD injections and long-term groundwater monitoring of shoreline monitoring wells (MW-1, MW-2 and MW-3 or MW-3D); to evaluate groundwater conditions at the conditional point of compliance.
- Institutional controls to ensure that future property activities do not result in human or environmental exposure to impacted soils or subslab vapor and that the existing capped surfaces are maintained. A contaminated media management plan would be developed

to manage Site soils and vapor conditions below the current building and would protect any future building conditions.

This alternative would address soil and groundwater contamination through active measures and continued groundwater monitoring to demonstrate long-term effectiveness. The alternative includes active treatment of CVOCs and zinc at the southwestern corner (vicinity of MW-5 & RI-SB-07, CVOCs/zinc), southcentral portion (vicinity of RI-SB-13, CVOCs), and the southeastern corner (vicinity of MW-8, CVOCs/TPH). Excavation targets CVOC concentrations in the southwestern corner (RI-SB-11).

Continued groundwater monitoring at the upgradient portion of the Site (MW-9) and the northwest corner (RI-SB-06; via MW-3 or MW-3D) would address decreasing concentrations of arsenic, include monitoring of CVOCs (RI-SB-06; monitored at MW-3 or MW-3D), and TPH located in the southeastern corner (MW-8/TPH-Gx and TPH-DRO)

Contingent actions may be conducted if CULs of groundwater COCs are not achieved at the shoreline. Contingent actions may include additional ERD injection to address CVOC and metal COCs.

Soil contamination is addressed through ERD treatments for contamination within in the saturated zone, excavation in the vicinity of RI-SB-11 and institutional controls.

This alternative complies with the RAOs as summarized below:

- **RAO 1. Protect Worker Contact with Soils and RAO 4. Protect Workers via Inhalation of Vapors from Soil or Groundwater –** Institutional controls (including a contaminated media management plan) are included to reduce the potential risk of worker contact with soil (at RI-SB-10), vapor or for vapor migration into the building if building conditions change. Compliance with this RAO would include documentation of compliance with institutional controls in quarterly/annual reports provided to Ecology.
- **RAO 2. Protect LDW via Groundwater Discharge –** ERD treatment of zinc would treat groundwater above CULs that could discharge to the LDW. Remaining areas of the Site would be monitored through a long-term monitoring plan. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.
- **RAO 3. Protect Groundwater via Soil Leaching –** Targeted excavation at Area 1 (RI-SB-11) would remove vadose and saturated soil contamination eliminating the potential for leaching to groundwater. ERD treatment of zinc would treat saturated soil contamination. Remaining areas of the Site would be monitored through the long-term monitoring plan. Institutional controls would ensure that the surface features remain. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.

3.1.3 Alternative 3 – ERD, PRB, Capping, Institutional Controls and Monitoring

Alternative 3 includes ERD (as implemented in the IA), the installation of a permeable reactive barrier (PRB), capping, institutional control and monitoring. Alternative 3 is shown on Figure 10.

A subsurface PRB is proposed downgradient of MW-5 to allow groundwater to flow through a matrix of activated carbon and zero-valent iron (ZVI) which would reductively dehalogenate CVOCs and reduce the mobility of zinc. The PRB would include a physical barrier that intercepts the groundwater plume prior to discharge. Because groundwater is affected by the tidal cycle, the ability for water to go both ways through the system would be maintained. The wall would include side arms that act to capture groundwater flowing towards the river, but during high tides, water can still pass through the PRB. To install the PRB with minimum soil disturbance, a trench installation method is proposed. Excavation would occur along the shoreline and within the footprint of Site utilities, however, using a trenching method the overall footprint would be minimized. Shoring would be minimized by installing the PRB in segments using trench boxes. A continuous silt unit has not been identified in borings at the Site. A treatment depth of 15 is assumed for this FS. Significant dewatering would be required during excavation and placement of the media. Utilities, including gas, power, and water lines, would need to be terminated prior to excavation activities, temporary utilities set up and then reinstalled upon completion. Stormwater lines which overlap with the removal areas would be abandoned and replaced following excavation activities.

Excavated soils would be disposed of at an off-site Subtitle D landfill. This alternative includes maintaining the current surface cap and replaces the asphalt cap disturbed during excavation activities, resulting in a continuous cap over impacted soil to prevent migration through erosion and to prevent contact with impacted soils. Post construction, Site stormwater would be captured and treated, using the current treatment system. This remedy includes:

- Installation of an approximately 170 feet long PRB. The PRB would be installed at a depth to intercept the water table, approximately 3 feet bgs at high tide, and extend to approximately 30 feet bgs. The PRB would be 2 feet thick and would be 15-20% ZVI, a mix of sand and ZVI would be used. The system would include the ability to service the PRB, including the ability to vacuum out media and replace media. Media would be disposed of an off-site Subtitle D landfill. It is assumed for this RI/FS that the replacement would occur after 3 years of operation. It is assumed that zinc would achieve CULs at the shoreline wells after 6 years and the media would be removed to eliminate the potential for the release of bound zinc as the media weathers. As a contingency, the PRB could continue to operate if data suggest that the media is still affectively treating the groundwater.
- All utilities removed during construction would be reinstalled.
- Monitoring wells MW-4 and MW-5 are expected to be on the side slope of the excavation footprints and would likely be damaged during construction. These

monitoring wells would be replaced in close vicinity to the abandoned well and using similar construction details as removed wells (total well depth, diameter, mount and screen interval).

- ERD to address both CVOCs and zinc in groundwater would include a nutrient-amended carbohydrate electron donor injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8 (performed during the IA – See Section 1.2). The IA is ongoing and concentrations of COCs are expected to continue to reduce.
- Maintaining the current asphalt parking and building structure which would serve as a cap for the entire Site.
- Short-term groundwater monitoring of existing Site wells (MW-1, MW-4, MW-5, MW-8, MW-9, MW-10 and MW-11) to determine the effectiveness of the ERD injections and the long-term groundwater monitoring of shoreline monitoring wells (MW-1, MW-2 and MW-3D); to evaluate groundwater conditions at the conditional point of compliance and downgradient of the PRB. MW-5 would provide data on the upgradient side of MW-5.
- Institutional controls to ensure that future property activities do not result in human or environmental exposure to impacted soils or subslab vapor and that the existing capped surfaces are maintained. A contaminated media management plan would be developed to manage Site soils and vapor conditions below the current building and would protect any future building conditions.

This alternative would address soil and groundwater contamination through active measures and continued groundwater monitoring to demonstrate long-term effectiveness. The alternative includes active treatment of CVOCs and zinc at the southwestern corner (vicinity of MW-5 & RI-SB-07/RI-SB-11), southcentral portion (vicinity of RI-SB-13, CVOCs), and the southeastern corner (vicinity of MW-8, CVOCs/TPH).

Continued groundwater monitoring at the upgradient portion of the Site (MW-9) and the northwest corner (RI-SB-06; via MW-3 or MW-3D) would address decreasing concentrations of arsenic, include monitoring of CVOCs (RI-SB-06; monitored at MW-3 or MW-3D), TPH located in the southeastern corner (MW-8/TPH-Gx and TPH-DRO).

Soil contamination is addressed through ERD treatments for contamination within the saturated zone, excavation in the vicinity of RI-SB-11 and institutional controls.

Contingent actions may be conducted if CULs of groundwater COCs are not achieved at the shoreline. Contingent actions may include additional ERD injection to address CVOC and metal COCs.

This alternative complies with the RAOs as summarized below:

- **RAO 1. Protect Worker Contact with Soils and RAO 4. Protect Workers via Inhalation of Vapors from Soil or Groundwater –** Institutional controls (including a contaminated media management plan) are included to reduce the potential risk of worker contact

with soil (at RI-SB-10), vapor or for vapor migration into the building if building conditions change. Compliance with this RAO would include documentation of compliance with institutional controls in quarterly/annual reports provided to Ecology.

- **RAO 2. Protect LDW via Groundwater Discharge –** ERD treatment of zinc would treat groundwater above CULs that could discharge to the LDW. Remaining areas of the Site would be monitored through a long-term monitoring plan. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.
- **RAO 3. Protect Groundwater via Soil Leaching –** Targeted excavation at Area 1 (RI-SB-11) would remove vadose and saturated soil contamination eliminating the potential for leaching to groundwater. Remaining areas of the Site would be monitored through the long-term monitoring plan. Institutional controls would ensure that the surface features remain. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.

3.1.4 Alternative 4 – ERD, Institutional Controls, Monitoring and Capping

Alternative 4 includes ERD (as implemented in the IA), and maintains the existing cap to prevent contact with soils exceeding cleanup levels. This alternative is depicted on Figure 11 and includes:

- ERD to address both CVOCs and zinc in groundwater would include a nutrient-amended carbohydrate electron donor injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8 (performed during the IA – See Section 1.2). The IA is ongoing and concentrations of COCs are expected to continue to reduce.
- Maintaining the current asphalt parking and building structure which would serve as a cap for the entire Site.
- Short-term groundwater monitoring of existing Site wells (MW-1, MW-4, MW-5, MW-8, MW-9, MW-10 and MW-11) to determine the effectiveness of the ERD injections and long-term groundwater monitoring of shoreline monitoring wells (MW-1, MW-2 and MW-3D); to evaluate groundwater conditions at the conditional point of compliance.
- Institutional controls to ensure that future property activities do not result in human or environmental exposure to impacted soils or subslab vapor and that the existing capped surfaces are maintained. A contaminated media management plan would be developed to manage Site soils and vapor conditions below the current building and would protect any future building conditions.
- This alternative addresses groundwater contamination through active (ERD) measures and continued groundwater monitoring. The alternative includes active treatment of CVOCs and zinc at the southwestern corner (vicinity of MW-5 & RI-SB-07, CVOCs/zinc), southcentral portion (vicinity of RI-SB-13/CVOCs), and the southeastern corner (vicinity of MW-8, CVOCs/TPH).

- Continued groundwater monitoring at the upgradient portion of the Site (MW-9) and the northwest corner (RI-SB-06; via MW-3 or MW-3D) would address decreasing concentrations of arsenic, include monitoring of CVOCs (RI-SB-06; monitored at MW-3D), TPH located in the southeastern corner (MW-8/TPH-Gx and TPH-DRO).

Soil contamination is addressed through ERD treatments for contamination within in the saturated zone and institutional controls.

Contingent actions may be conducted if CULs of groundwater COCs are not achieved at the shoreline. Contingent actions may include additional ERD injection to address CVOC and metal COCs.

This alternative addresses the RAOs as summarized below:

- **RAO 1. Protect Worker Contact with Soils and RAO 4. Protect Workers via Inhalation of Vapors from Soil or Groundwater –** Institutional controls (including a contaminated media management plan) are included to reduce the potential risk of worker contact with soil (at RI-SB-10), vapor or for vapor migration into the building if building conditions change. Compliance with this RAO would include documentation of compliance with institutional controls in quarterly/annual reports provided to Ecology.
- **RAO 2. Protect LDW via groundwater discharge -** ERD treatment of zinc would treat groundwater above CULs that could discharge to the LDW. Remaining areas of the Site would be monitored through a long-term monitoring plan. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.
- **RAO 3. Protect Groundwater via Soil Leaching -** ERD treatment of zinc would treat saturated soil contamination. Remaining areas of the Site would be monitored through the long-term monitoring plan. Institutional controls would ensure that the surface features remain. Groundwater compliance with this RAO would be measured at shoreline monitoring wells.

3.2 Summary of Alternative Evaluation

This section summarizes the evaluation results for cleanup action alternatives using a quantitative approach as prescribed in MTCA 173-340-350 and -360 and per the Ecology's Guidance for Making Cleanups Permanent to the Maximum Extent Practicable (PMEP Guidance; Ecology 2025). Four alternatives were evaluated for the Site as summarized in Table 2 and Table 3. Each of the cleanup action alternatives meet the MTCA requirements. A more detailed evaluation is included in the RI/FS.

The degree to which each cleanup action alternative uses permanent solutions to the maximum extent practicable was determined using a disproportionate cost analysis. Alternatives were evaluated against weighted benefit criteria, scored on a scale from 1 (lowest score) to 10 (highest score) and summed to develop a total weighted relative benefit score for the alternative. A brief

discussion of the scoring considerations for each criterion and the cost of each alternative is presented in the sections that follow.

- **Protectiveness -** All the alternatives provide adequate protection of human health and the environment through a combination of removing source material, monitoring and institutional controls. All alternatives protect marine surface waters through ERD treatments and by groundwater monitoring and possible contingent actions. Alternative 4 is ranked the lowest because source material is contained on-site while the other alternatives include greater source area removal, by removing source material from the Site and placing contaminated soil in an off-site landfill. Alternatives 2 and 3 are incrementally more protective, as these alternatives permanently remove progressively more contaminated material or remove groundwater contamination through the PRB treatment. Alternative 1 has the highest ranking as it removes the most contaminated material.
- **Permanence -** All alternatives include permanent treatment technologies. However, due to the extent of soil excavation, Alternatives 1 and 2 are more permanent than Alternatives 3 and 4. Alternative 1 removes the greatest quantity of impacted soil; therefore, it is expected to be the most permanent. Alternative 3 and 4 have the same permanence as they both include treatment that converted contaminants to non-toxic (ERD) or immobile species (PRB).
- **Long-Term Effectiveness -** Effectiveness over the long-term varies depending on the degree of certainty that a remedy will be successful, the reliability of a remedy, and the residual risk of a remedy. All of the remedial alternatives have been used extensively as remedial alternatives at other MTCA cleanup sites, and have high degrees of certainty and reliability of use. Alternative 1 performs the highest because it depends on excavation and off-site disposal, and ranks higher than Alternatives 2 and 3 because it has a higher volume of excavation and off-site disposal. Alternatives 4, which depends on in-situ injections (ERD) and institutional controls and monitoring, rank last.
- **Management of Short-Term Risks -** Management of short-term risks relates to the risk to human health and the environment, including vulnerable populations and overburdened communities, during construction and implementation, and the effectiveness of measures to control such risks. Short-term risks associated with each alternative can be effectively managed during implementation through administrative controls. Alternative 4 poses the least short-term risk, since contaminated soil remains in place. The excavation and disposal options, Alternatives 1 and 2, have the highest short-term risk to human health and the environment during construction because of the handling and transporting of hazardous waste. Alternative 3 has many of the same aspects as Alternatives 1 and 2 (excavation and construction) and is scored in the middle since it is expected to have lower duration and lower number of trucks for transporting soils excavated during installation of the PRB. These risks can be effectively managed through appropriate health and safety plans and procedures.

- **Technical and Administrative Implementability -** Technical and administrative implementability relates to the ability of an alternative to be implemented, including whether the alternative is technically possible, availability of necessary off-site facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions. All the alternatives are readily implemented with local equipment and local expertise. Alternative 4 is the most readily implemented remedy and requires the least amount of permitting, coordination and access. Alternatives 1 through 3 require the handling and transportation of hazardous substances. Alternative 1 requires additional measures to protect the shoreline, utilities, and building during the extensive excavation efforts required to remove contaminated soils.
- **Cost -** Table 3 summarizes the expected cost for each alternative. The cost of the remedies range from approximately $1,109,000 for Alternative 4 to $7,118,000 for Alternative 1 (including long-term monitoring and maintenance).

The disproportionate cost analysis (DCA) involves comparing the costs and benefits of the four alternatives and selecting the alternative with incremental costs that are not disproportionate to the environmental benefits resulting from that alternative. As outlined in WAC 173-340-360(5)(c)(iv), costs are determined to be disproportionate to benefits if the incremental cost of a more expensive alternative compared to a lower cost alternative exceeds the incremental degree of benefits achieved by the more expensive alternative. A relative cost-to-benefit ratio is used to compare the cleanup action alternatives to determine whether costs are disproportionate to benefits.

Table 3 presents the total weighted relative benefit score for each alternative calculated using the raw scores and respective weighting factor for each criterion.

The total weighted relative benefit scores for the alternatives range from 5.2 (Alternative 3) to 7.2 (Alternative 1). Under MTCA, costs must be considered when selecting the alternative that is permanent to the maximum extent practicable. Costs are considered 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 lower cost alternative. Using the PMEP Guidance and the PMEP Tool following the semi-quantitative PMEP method, the four alternatives were ranked by degree of permanence. Alternatives 3 and 4 have the same level of permanence. Per Section 5.2.4 of the PMEP Guidance, Alternative 3 was eliminated from the DCA screening because Alternative 4 is more cost-effective than Alternative 3 (i.e., Alternative 4 has the lowest cost per degree of benefit). Alternatives 1, 2, and 4 were then evaluated using the PMEP Tool. Alternative 4 was determined to be the permanent to the maximum extent practicable alternative and thus the preferred remedial action. Output of the PMEP is included in Appendix F.

4 Selected Remedial Alternative

Ecology has selected Alternative 4 as the preferred remedial alternative for the Site based on the evaluation conducted in the FS Report and as described in Sections 4.2 of this dCAP. This alternative meets all the threshold requirements under MTCA, provides a reasonable restoration time frame (see Section 4.5), and has 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 3.2.2). This alternative also complies with Ecology's expectations for cleanup remedies as defined in WAC 173-340-370.

4.1 Description of Selected Remedial Alternative

Alternative 4 is the preferred remedial alternative. This remedy was chosen after a careful review of the remedy selection requirements in the MTCA Cleanup Regulation, the Site conditions and the remedy alternatives presented in this report. Alternative 4 fulfills the requirements and the evaluation for practicable permanence (WAC 173-340-360(5)(d)(ii). The remedy fulfills the site-specific cleanup objectives by permanently removing source materials, eliminating the exposure pathway of direct contact with soils, achieving the lowest most protective cleanup standards, and performing short-term monitoring (to evaluate active treatments) and long-term monitoring to demonstrate that groundwater conditions are stable or decreasing.

This remedial alternative satisfies the requirements of a final cleanup under the AO. As discussed above, Alternative 4 satisfies the substantive and administrative requirements of MTCA, will achieve and maintain compliance with cleanup levels (demonstrated through monitoring), and includes institutional controls to ensure that the environment and human health are protected from possible exposure pathways. Alternative 4 will also prevent recontamination of the property from other areas of the Site through institutional controls and, environmental oversight during redevelopment.

This alternative is depicted on Figure 11. The main components of this remedy include:

- ERD to address both CVOCs and zinc in groundwater will include a nutrient-amended carbohydrate electron donor injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8 (performed during the IA – See Section 3.2). The IA is ongoing and concentrations of COCs are expected to continue to decrease.
- Maintaining the current asphalt parking and building structure which will serve as a cap for the entire Site.
- Short-term groundwater monitoring of existing Site wells (MW-1, MW-4, MW-5, MW-8, MW-9 [upgradient well], MW-10 and MW-11) to evaluate active treatment and long-term groundwater monitoring of shoreline monitoring wells (MW-1, MW-2 and MW-3 or MW-3D).
- Institutional controls to ensure that current and future Site activities do not result in human or environmental exposure to impacted soils or subslab vapor and maintain the integrity of the surface cap features. A contaminated media management plan

will be developed to manage Site soils and vapor conditions below the current building and address future activities on or beneath the Site.

4.1.1 Contingent Actions

Groundwater monitoring will be performed to document compliance with the CULs. In the event that groundwater concentrations along the shoreline monitoring wells have not stabilized or have not demonstrated a declining trend that will achieve CULs within a reasonable restoration time frame, contingent remedial actions will be considered for implementation.

After 2 years of quarterly groundwater monitoring, groundwater concentrations relative to CULs and groundwater concentration trends will be evaluated annually. The need for a contingent remedial action will initially be evaluated after 4 years of quarterly groundwater monitoring.

Trend analysis will be conducted using a Mann-Kendall statistical test following the guidance provided by EPA (EPA 2009). Trend analysis will be completed for COCs present above the CUL using the full groundwater data set.

Assessment of the need for a contingent action will include evaluation of groundwater concentrations and trends, as discussed above, and additional factors as discussed in the Compliance Monitoring and Contingency Response Plan (CMCRP; Appendix A):

- Statistical analysis of the UCL of the COC concentrations per WAC 173-340-709 and 720.
- Potential for impacts from other sources or changes in exposure pathways – upgradient sources, etc.
- CVOC degradation process – which could increase concentrations of breakdown products during degradation activities.
- Total versus dissolved metals concentrations and trends.
- Data from sampling locations downgradient of CPOC monitoring wells (i.e. seeps and well points) that are closer to the point of discharge to surface water.

Contingent actions may be conducted if concentrations of groundwater COCs at the CPOC and performance monitoring wells have not demonstrated a declining trend that will achieve CULs within a reasonable restoration time frame as discussed in Appendix A. Ecology will make the final determination regarding whether a contingent action is necessary and what contingent action will be utilized to protect human health and the environment.

4.2 Cleanup Standards and Point of Compliance

CULs are provided on Table 1 (Section 2.3).

For groundwater, a CPOC at the shoreline monitoring wells has been selected. Monitoring wells MW-1, MW-2 and MW-3 or MW-3D (Figure 11) were selected as CPOC monitoring wells.

4.3 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 the formal MTCA program (e.g., a consent decree) is exempt from the procedural requirements of certain state and local environmental laws, the action must comply with the substantive requirements of such laws (RCW 70A.305.090; 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 4. The list of applicable ARARs may be refined during remedial design if contingent actions are triggered.

4.4 Restoration Time Frame

Restoration time frame represents the time it takes to achieve CULs at the points of compliance. For Alternative 4, the restoration time frame for groundwater is expected to be 3 to 6 years.

4.5 Compliance Monitoring

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. Protection monitoring requirements were defined in the IAWP for the completed Interim Actions (CRETE 2024b).
- **Performance monitoring:** Includes monitoring activities to confirm that the cleanup action has attained cleanup standards and other performance requirements. Performance groundwater monitoring requirements are defined in the Compliance Monitoring and Contingency Response Plan (CMCRP; Appendix A). This monitoring started in first quarter 2025 after completion of IA. Groundwater analytical results are provided in Attachment 1 of 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 are defined in the CMCRP (Appendix A).

4.6 Implementation Schedule and Reporting

Groundwater monitoring started in first quarter of 2025, following implementation of the IA. Results have been included in the RI/FS. Quarterly groundwater sampling has continued during the development of this DCAP.

After 4 years of quarterly monitoring, the program will transition to long-term monitoring and include shoreline monitoring wells (MW-1, MW-2 and MW-3 or MW-3D) as well as performance monitoring wells (MW-4, MW-5, MW-8, MW-10 and MW-11) to evaluate groundwater conditions at the Site unless a contingent action is triggered. If a contingent action is triggered,

Quarterly monitoring will restart for the appropriate subset of wells that are associated with the contingent action for a minimum of two years as described in Appendix A.

Long-term monitoring would include semiannual for 3 years, annual monitoring until the CULs are achieved at the CPOC, and monitoring every 5 years thereafter.

Annual reports will be prepared for groundwater compliance monitoring. Annual reports will assess groundwater conditions and trend analysis beginning with the 2026 annual report.

4.6.1 Periodic Review

WAC 173-340-420 states that at sites where a cleanup action requires an institutional control, a periodic review shall be completed no less frequently than every 5 years after the initiation of a cleanup action. Periodic Reviews are required for this Site.

4.7 Institutional/Engineering Controls

The purpose and implementation requirements for Institutional Controls (ICs) are defined under WAC 173-340-440. ICs are legal or administrative measures designed to limit or control activities that could result in exposures to contamination before, during, and after a cleanup action, particularly if contaminant residues are likely to remain above CULs for an extended period.

For the selected remedial action, ICs may include restrictive covenants (WAC 173-340-440(9)) commonly referred to as Environmental Covenants (ECs) which are recorded against a property deed and which run with land and are binding on future owners of a property which is part of a Site. These ICs would restrict future groundwater use (including groundwater recovery) and would identify the location of known groundwater and soil contamination. A soil management plan will be required which will document soil remaining under capped surfaces and include maintenance and inspection required to ensure the integrity of those caps.

4.8 Public Participation

Ecology and Bridge will keep the public informed, seek community input, and address any concerns as part of the cleanup action selection process as required per WAC 173-340-600. Public comments on this dCAP will be solicited from the community during the formal comment period, following Ecology's input.

5 References

CRETE 2024a. Remedial Investigation Work Plan, Dawn Foods 6901 Fox Ave South, Seattle WA. January 31, 2024.

CRETE 2024b. Interim Action Work Plan, Dawn Foods 6901 Fox Ave South, Seattle WA. June 10, 2024.

CRETE 2026. Remedial Investigation and Feasibility Study, Dawn Foods 6901 Fox Ave South, Seattle WA. Public Review Draft. August 24, 2026.

ECI 1988. Preliminary Environmental Audit Industrial Building and Property 6901 Fox Avenue South, Seattle, Washington. Letter from Donna L. Hewitt and Don W. Spencer to Larco Development Group. May 31

Ecology 2025. Guidance for Making Cleanups Permanent to the Maximum Extent Practicable. Washington State Department of Ecology. Publication No. 25-09-059. December 2025.

Hart Crowser 1996a. Limited Subsurface Investigation Fox Avenue Property 6901 Fox Avenue South, Seattle Washington. November 12, 1996.

Tables

Table 1 Chemicals of Concern and Cleanup Levels
Bridge - Former Dawn Foods

Chemicals of Concern	Cleanup Levels	CUL Unit	Basis
Soil			
Arsenic (Vicinity of RI-SB-10)	20	mg/kg	Method A Direct Contact Value
Zinc	100/85	mg/kg	Vadose/Saturated listed. Protect SW via GW (vadose)/Natural Background
Gasoline Range Organics (TPH-Gx)	100	mg/kg	Protect SW via GW
Total Diesel Range (DRO+ORO)	2,000	mg/kg	Protect SW via GW
Trichloroethene (TCE)	0.0044/ 0.00027	mg/kg	Vadose/Saturated listed. Protect SW via GW
Tetrachloroethene (PCE)	0.029/ 0.0016	mg/kg	Vadose/Saturated listed. Protect SW via GW
Groundwater			
Zinc	81	µg/L	Protect Surface Water
TPH-G (Vicinity of MW-8)	1700 *	µg/L	Protect Surface Water
TPH-Dx (Vicinity of MW-8)	2100*	µg/L	Protect Surface Water
PCE	2.9	µg/L	Protect Surface Water
TCE	0.70	µg/L	Protect Surface Water
Vinyl Chloride	0.18	µg/L	Protect Surface Water
Indoor Air (see Note 1)			
PCE	40	µg/m3	MTCA Method C Industrial
TCE	2.00	µg/m3	MTCA Method C Industrial
Xylenes	100	µg/m3	MTCA Method C Industrial

Notes:

1. The indoor air COCs TCE, PCE, and xylenes since these compounds were present in sub-slab vapor above screening levels and may pose a risk if building conditions change or if subsurface work is conducted that could result in the accumulation of vapors (such as confined space work). No sub-slab vapor cleanup levels have been established by Ecology.

*Values based on Ecology's Implementation Memorandum #23 for Petroleum Hydrocarbon Contaminants

COC - contaminant of concern

mg/kg - milligram per kilogram

ug/L - microgram per liter

$\mu g/m^3$ = micrograms per cubic meter of air

Table 2 MTCA Requirements: Evaluation of Alternatives
Bridge - Former Dawn Foods Site

MTCA Cleanup Action Requirement	Alternative 1 ERD, Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring	Alternative 2 ERD, Targeted Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring	Alternative 3 ERD, PRB, Capping, Institutional Controls and Monitoring	Alternative 4 ERD, Institutional Controls, Monitoring and Capping
General Criteria				
Protect Human Health and the Environment	Yes	Yes	Yes	Yes
Compliance with Cleanup Standards and Laws	Yes	Yes	Yes	Yes
Comply with Applicable State and Federal Laws	Yes	Yes	Yes	Yes
Prevent or Minimize Releases and Migration of Hazardous Substances	Yes	Yes	Yes	Yes
Provide Resilience to Climate Change Impacts	Yes	Yes	Yes	Yes
Compliance Monitoring and Protection	Yes	Yes	Yes	Yes
Not rely Primarily on Institutional Controls and Monitoring	Yes	Yes	Yes	Yes
Not Rely Primarily on Dilution and Dispersion	Yes	Yes	Yes	Yes
Reasonable Restoration Time Frame	Yes	Yes	Yes	Yes
Permanence	Yes	Yes	Yes	Yes
Action-Specific Criteria				
Use Institutional Controls in Accordance with WAC	Yes	Yes	Yes	Yes
Provide for Financial Assurances in Accordance with WAC	Yes	Yes	Yes	Yes
Provide for Periodic Reviews in Accordance with WAC	Yes	Yes	Yes	Yes
Public Concerns and Tribal Rights and Interests				
Consideration for Public Concerns and Tribal Rights and Interests	Yes	Yes	Yes	Yes

Notes:
MTCA = Model Toxics Control Act
ERD = Enhanced in-situ reductive dichlorination
PRB = permeable reactive barrier
WAC = Washington Administrative Code

Table 3 Disproportionate Cost Analysis for Remedial Alternatives
Bridge - Former Dawn Foods Site

Alternative	Criteria Weight Fraction	Alternative 1 ERD, Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring	Alternative 2 ERD, Targeted Excavation and Off-Site Disposal, Capping, Institutional Controls and Monitoring	Alternative 3 ERD, PRB, Capping, Institutional Controls and Monitoring	Alternative 4 ERD, Institutional Controls, Monitoring and Capping
Evaluation of Permanence Using MTCA Disproportionate Cost Analysis					
Protectiveness	20%	10	7	7	5
Permanence	20%	10	7	4	4
Long-Term Effectiveness	20%	10	7	5	3
Management of Implementation Risks	20%	3	5	5	10
Technical/Administrative Implementability	20%	3	5	5	10
Overall Weighted Benefit Score	**100%**	**7.2**	**6.2**	**5.2**	**6.4**
Disproportionate Cost Analysis					
Remedy Permanate to the Maximum Extent Practicable		Yes	Yes	Yes	Yes
Probable Cost		$7,118,000	$2,540,000	$4,263,000	$1,109,000
Total Benefit Score		7.2	6.2	5.2	6.4
Total Estimated Cost (Millions)		$7.12	$2.54	$4.26	$1.11
Cost Effectiveness (Cost/Benefit Ratio)		1.0	0.4	0.8	0.2

Notes:

Notes: 1 = Lowest Relative Ranking, 10=Highest Relative Ranking

ERD = Enhanced in-situ reductive dichlorination

PRB = permeable reactive barrier

WAC = Washington Administrative Code

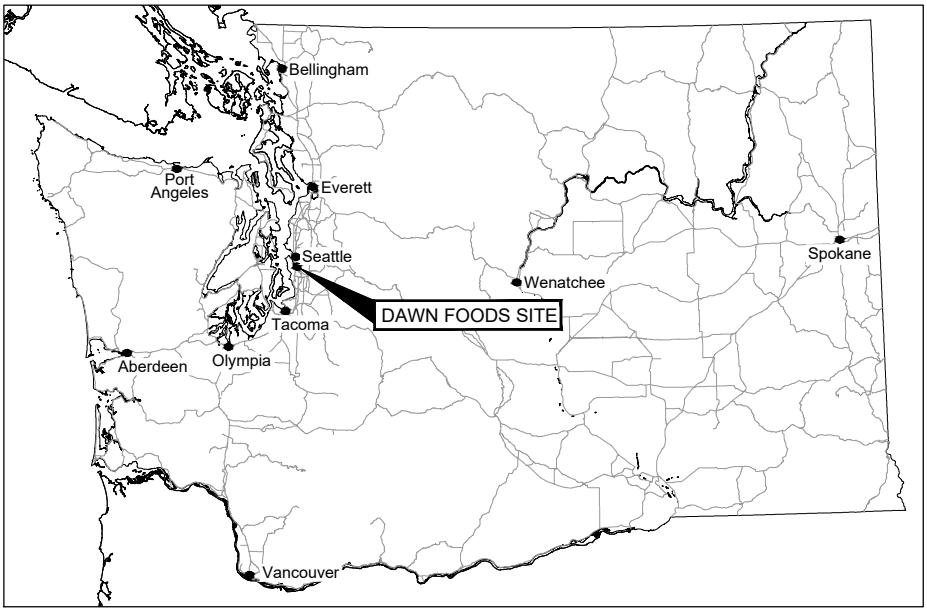
Table 4 Potentially Applicable Requirements

Potentially Applicable Requirements for Cleanup Levels			
Medium	**Standard/ Criterion**	**Citation**	**Comments**
Soil	State of Washington requirements for establishing numeric or risk-based goals and selecting cleanup actions.	Model Toxics Control Act (WAC 173-340, Sections 740 and 745, 747)	Applicable.
Groundwater and surface water	State of Washington requirements for establishing numeric or risk-based goals and selecting cleanup actions.	Model Toxics Control Act (WAC 173-340, Sections 720 and 730 and WAC 173-246-290)	Applicable.
Surface Water	State water quality standards; conventional water quality parameters and toxic criteria.	Washington Water Pollution Control Act - State Water Quality Standards for Surface Water (RCW 90.48) WAC 173-201A	Applicable - quantitative criteria for protection of Aquatic Life (Marine/Chronic) and Human Health Consumption of Organisms and Water.
Surface Water	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) 40 CFR 131	Applicable - National Recommended Water Quality Criteria (NRWQC - Marine/Chronic) for the human consumption of organisms and water at 1 X 10^{-6} risk.
Surface Water	Ambient water quality criteria for the protection of aquatic organisms and human health.	National Toxics Rule 40 CFR 131	Applicable - Washington Toxics Rule (Marine Chronic) Human Health Consumption of Organisms and Water.
Groundwater (Protective of Drinking Water)	SDWA National Primary Drinking Water Standards: Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), Proposed MCLs and MCLGs.	Safe Drinking Water Act (SDWA) 40 CFR 141	Not applicable but relevant and appropriate as WAC 173-160-205(2) specifies 100-foot minimum setback distances for water supply wells from storm or sanitary sewers, public rights of way, and buildings.
Potentially Applicable Requirements for Disposal			
Activity	**Requirement**	**Citation**	**Comments**
General Remediation	State hazardous waste management requirements. Management of wastes that designate as Washington hazardous waste as specified in WAC 173-303-070.	General Facility Standards (WAC 173-303-280-395)	Relevant and appropriate to site remediation.
Designation of Waste for Disposal	State criteria for dangerous waste, which are broader than federal criteria and include toxicity and persistence.	Washington Dangerous Waste Regulations (WAC 173-303) Designation procedures (Section -070) and WAC 173-350 (solid waste regulations).	Applicable to waste disposal. Waste designation should be made for IDW or other waste generated during remedial actions, according to WAC 173-303-100. Soil with PCE, TCE and VC are considered a listed F002 dangerous waste unless Ecology determines that these materials do not warrant management as a dangerous waste. Soil and groundwater that are not classified as dangerous waste will be considered 'contaminated soils', according to WAC 173-350-100. Soil and groundwater with solvents present will require Ecology to make a contained-in determination, which will determine if the media contains hazardous waste for disposal.
Treatment, Storage, or Disposal of Hazardous Wastes	Effective November 8, 1988, disposal of contaminated soil or debris is subject to land disposal prohibitions or treatment standards.	40 CFR 268 Federal Land Disposal Restrictions; WAC 173-303-140, -141 Land Disposal Restrictions	Potentially relevant for contingent remedies with qualifying treatment of residues/sludges.
Discharge to POTWs (Publicly Owned Treatment Works)	Contaminated water must be pretreated to certain limits prior to discharge.	National Pretreatment Standards (40 CFR 403); Metro District Wastewater Discharge Ordinance	Potentially applicable to contingent remedies that could require pretreatment and permitting prior to discharge to POTW.
Point Source or Other Defined Emission Source	State implementation of ambient air quality standards.	Washington State Clean Air Act (70.94 RCW) General Requirements for Air Pollution Sources (WAC 173-400)	Potentially applicable to contingent remedial actions.
	PSAPCA ambient and emission standards.	PSAPCA Regulations I and III	
Potentially Applicable Requirements for Remediation Activities			
Location/Activity	**Requirement/Prerequisite**	**Citation**	**Comments**
General Remediation	Site worker health and safety.	WISHA (WAC 296-62) OSHA (29 CFR 1910.120)	Relevant requirement.
	Erosion and sedimentation controls.	Puget Sound Water Quality Management Plan (RCW 90.70.070)	Relevant requirement.
Monitoring Wells	Standards for construction, testing, and abandonment of water and resource protection wells.	WAC 173-160-010 through -303, -050 through -060	Applicable requirement for remediation activities.
Washington Underground Injection Control Program	Requirements for underground injection control applicable to cleanup alternatives that include injection of materials into subsurface groundwater and soil.	WAC 173-218	Potentially relevant depending on remedial activities selected.
Noise Control	Maximum noise levels	Noise Control Act of 1974 (RCW 70.107; WAC 173-60)	Potentially relevant depending on remedial activities selected.
Air Emissions	Regional ambient air quality standards applicable to regulated air contaminant.	Puget Sound Air Pollution Control Agency (PSAPCA) Regulation III	Emissions from site not expected to qualify as major source unless: a) emissions are greater than 100 tons/yr; or b) emissions of a specified air contaminant occur.
	New Source Pretreatment Standards applicable to new source of hazardous air pollutants.	40 CFR 60	Potentially applicable to releases from contingent remedial actions.
	Controls for New Sources of Toxic Air Pollutants for emission of any Class A or Class B toxic air pollutant (identified in WAC 173-460-150 through -160) into ambient air.	WAC 173-460	Potentially applicable to releases from contingent remedial actions.
	Regional Emission Standards for Toxic Air Pollutants. Source of toxic air contaminant requires a notice of construction.	PSAPCA Regulation III	Potentially applicable depending on remedial technology used.
	Regional Emission Standards for fugitive dust. BACT to control dust.	PSAPCA Regulation I	Potentially applicable to releases from remedial actions which include the treatment of vapor and the release of emissions.
Disturbance of Greater than 5 Acres	NPDES Stormwater Permit for construction activity.	WAC 173-226, RCW 90.48	Potentially applicable depending on contingent remedial technology used and footprint.
Archaeological and Historic Preservation Act	Establishes procedures for the preservation of historical and archeological data that might be destroyed through alteration of terrain because of a federally licensed activity or program.	16 USC 469	Potentially applicable depending on contingent remedial technology.
Archaeological Resources Protection Act	Specifies the steps that must be taken to protect archaeological resources and sites that are on public and Native American lands and to preserve data uncovered.	16 USC 470aa; 43 CFR 7	Potentially applicable depending on contingent remedial technology.
Within State Siting Criteria for Waste Management Facilities	Siting criteria to be used as initial screen for consideration of solid or dangerous waste facility sites.	WAC 173-304, WAC 173-303-282(2)(b)(iii)	Not likely to be applicable as no new solid or dangerous waste management facilities are planned.
State Environmental Policy Act	State law intended to ensure state and local government officials consider environmental values when making decisions or taking an official action such as approving the Cleanup Action Plan.	RCW 43.21C; WAC 197-11; WAC 173-802	Potentially applicable depending on contingent remedial technology.

Notes:

CFR – code of federal regulations; CULs – cleanup levels; MTCA – Model Toxics Control Act; RCW – Revised Code of Washington; WAC – Washington Administrative Code; WISHA – Washington State Department of Labor and Industries

Figures



WASHINGTON LOCATION MAP



VICINITY MAP

0 800 1600

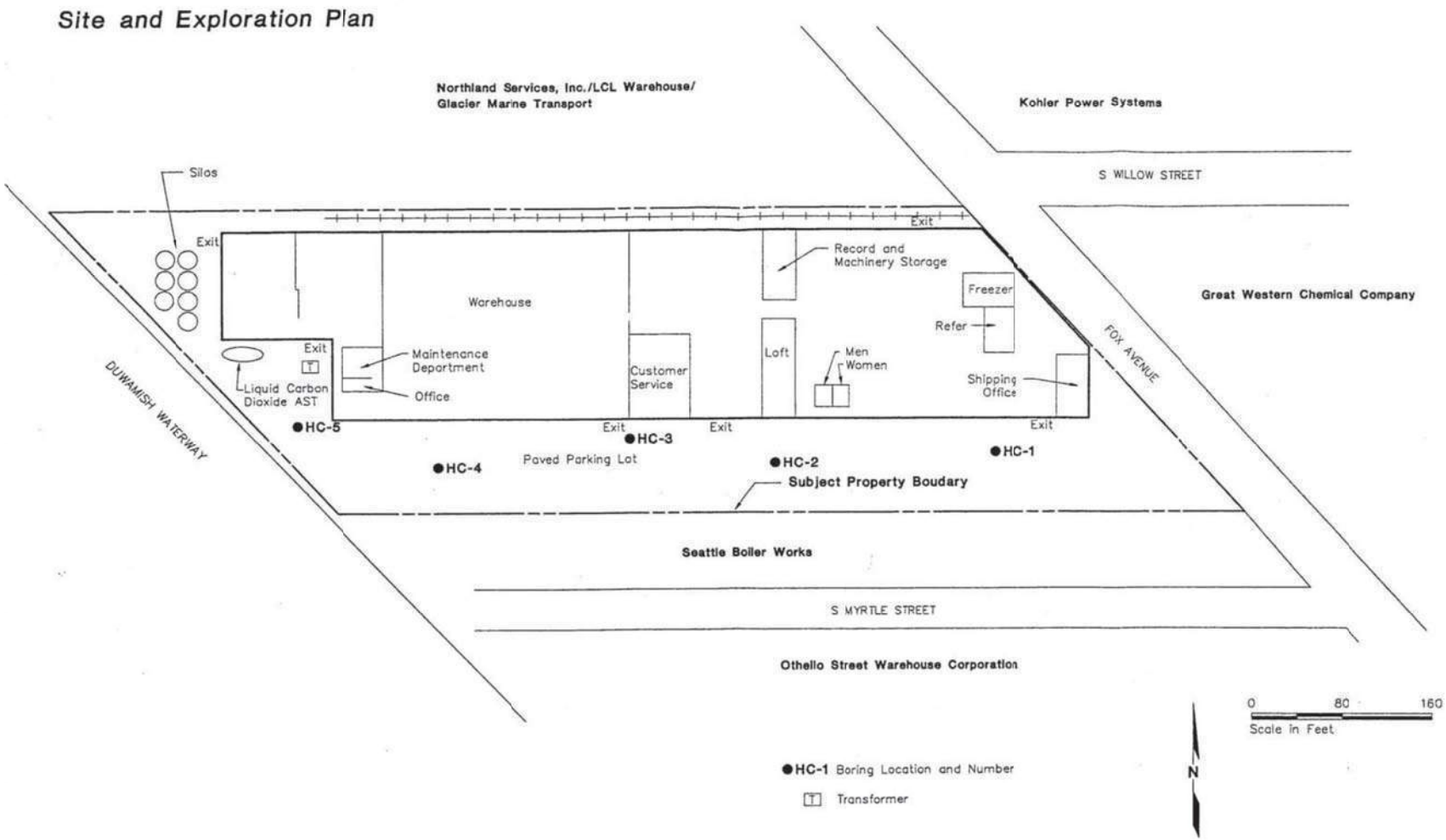
SCALE IN FEET

Source: Google Earth. Image date 8/22/2022

CRETE CONSULTING, INC.

Dawn Food Site 6901 Fox Ave South August 2, 2026	Figure 1 Vicinity Map

File: Dawn Foods Vicmap.dwg Layout: Vicmap



Source: Figure 2 from Limited Subsurface Investigation Fox Avenue property, 6901 Fox Avenue, Seattle, Washington. Prepared by Hart Crowser, November 12, 1996.

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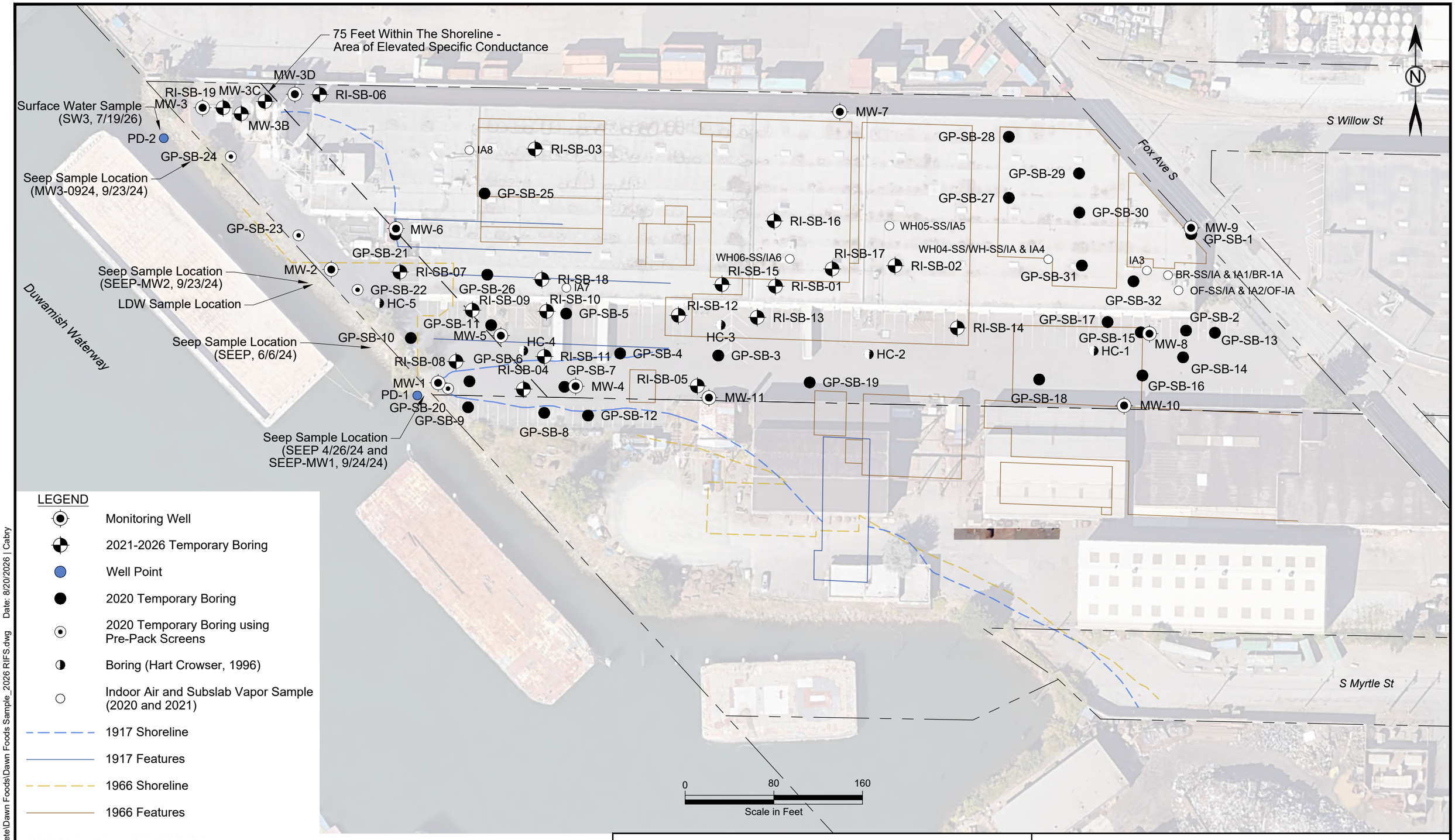
Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
August 2, 2026

Figure 2
1996 Soil and Groundwater Sample Locations



LEGEND

- Monitoring Well
- 2021-2026 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- Indoor Air and Subslab Vapor Sample (2020 and 2021)
- 1917 Shoreline
- 1917 Features
- 1966 Shoreline
- 1966 Features

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Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 3
Previous Investigation Locations

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry



NOTES

1. Utility locations are based on City of Seattle GIS map information and in-field observations, and should be considered approximate.

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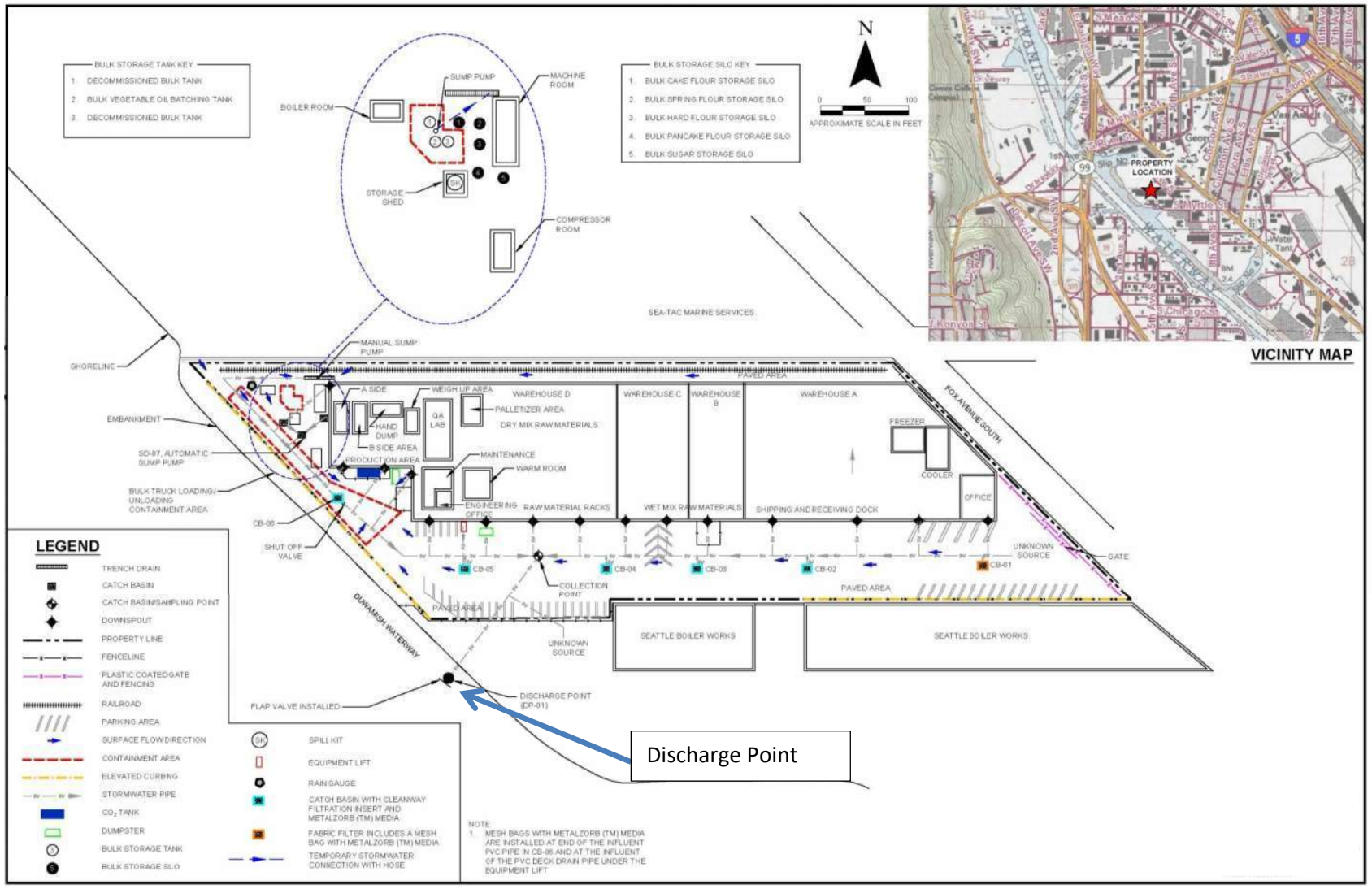
Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 4
Summary of Interim Action Areas

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry



Source of Figure –Stormwater Treatment Engineering Design Report. Perpared by Clear Water Servi es and Landau Assoicates, Inc. May 2021.

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Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
August 2, 2026

Figure 5
Stormwater Facility Site Map

MW-3D
RI-SB-19
MW-3C
RI-SB-06
MW-3
MW-3B
PD-2
GP-SB-24
Seep Sample Location
(MW3-0924, 9/23/24)
RI-SB-03
MW-7
GP-SB-28
S Willow St
Fox Ave S
GP-SB-29
GP-SB-27
GP-SB-30
GP-SB-25
RI-SB-16
GP-SB-23
MW-6
MW-9
GP-SB-1
GP-SB-21
RI-SB-17
RI-SB-02
MW-2
RI-SB-07
RI-SB-18
RI-SB-15
RI-SB-01
GP-SB-31
Seep Sample Location
(SEEP-MW2, 9/23/24)
GP-SB-22
GP-SB-26
LDW Sample Location
HC-5
RI-SB-09
RI-SB-10
GP-SB-5
RI-SB-12
RI-SB-13
GP-SB-32
GP-SB-17
GP-SB-2
Duwamish Waterway
GP-SB-11
RI-SB-14
GP-SB-10
MW-5
HC-4
HC-3
GP-SB-15
MW-8
GP-SB-13
Seep Sample Location
(SEEP, 6/6/24)
RI-SB-11
GP-SB-4
GP-SB-3
HC-2
HC-1
RI-SB-08
GP-SB-6
RI-SB-04
GP-SB-7
GP-SB-14
MW-1
RI-SB-05
GP-SB-19
GP-SB-18
GP-SB-16
PD-1
MW-4
MW-11
GP-SB-20
MW-10
GP-SB-9
GP-SB-12
GP-SB-8
Seep Sample Location
(SEEP 4/26/24 and
SEEP-MW1, 9/24/24)
S Myrtle St
0
80
160
Scale in Feet

LEGEND

- Monitoring Well
- 2021-2026 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- Estimated Extent of Vinyl Chloride Groundwater Plume

Estimated Extent in Groundwater

- Estimated PCE or TCE Extent
- Estimated TPH-Gasoline Extent
- Estimated TPH-Diesel Extent
- Estimated Zinc Extent

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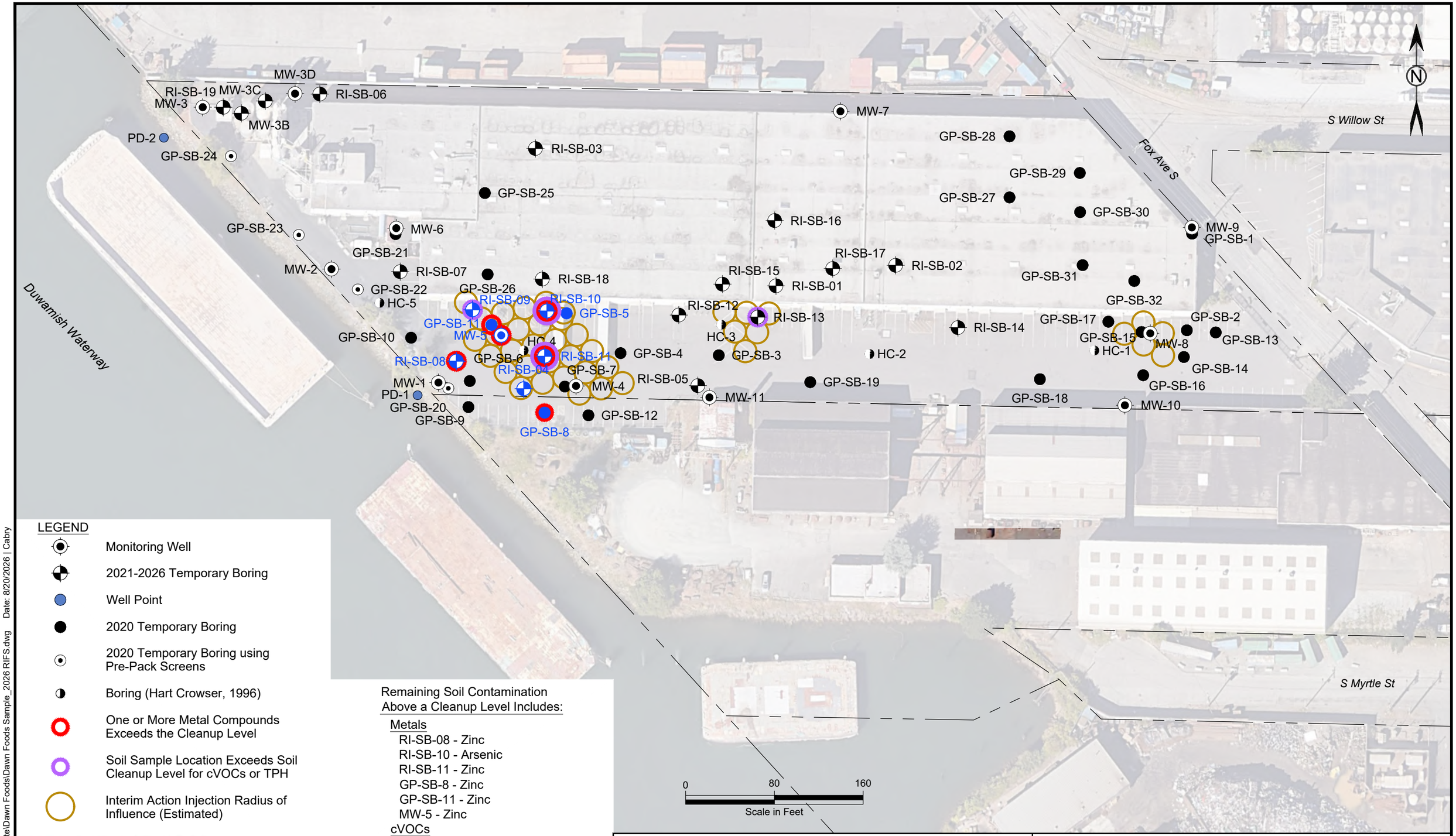
Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 6
Estimated Extent of Groundwater
Exceeding Cleanup Levels

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry



LEGEND

- Monitoring Well
- 2021-2026 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- One or More Metal Compounds Exceeds the Cleanup Level
- Soil Sample Location Exceeds Soil Cleanup Level for cVOCs or TPH
- Interim Action Injection Radius of Influence (Estimated)

Remaining Soil Contamination Above a Cleanup Level Includes:

Metals
- RI-SB-08 - Zinc
- RI-SB-10 - Arsenic
- RI-SB-11 - Zinc
- GP-SB-8 - Zinc
- GP-SB-11 - Zinc
- MW-5 - Zinc

cVOCs
- RI-SB-09 - TCE and PCE
- RI-SB-11 - TCE and PCE
- RI-SB-13 - PCE

TPH
- RI-SB-10 - TPH Gx and Dx

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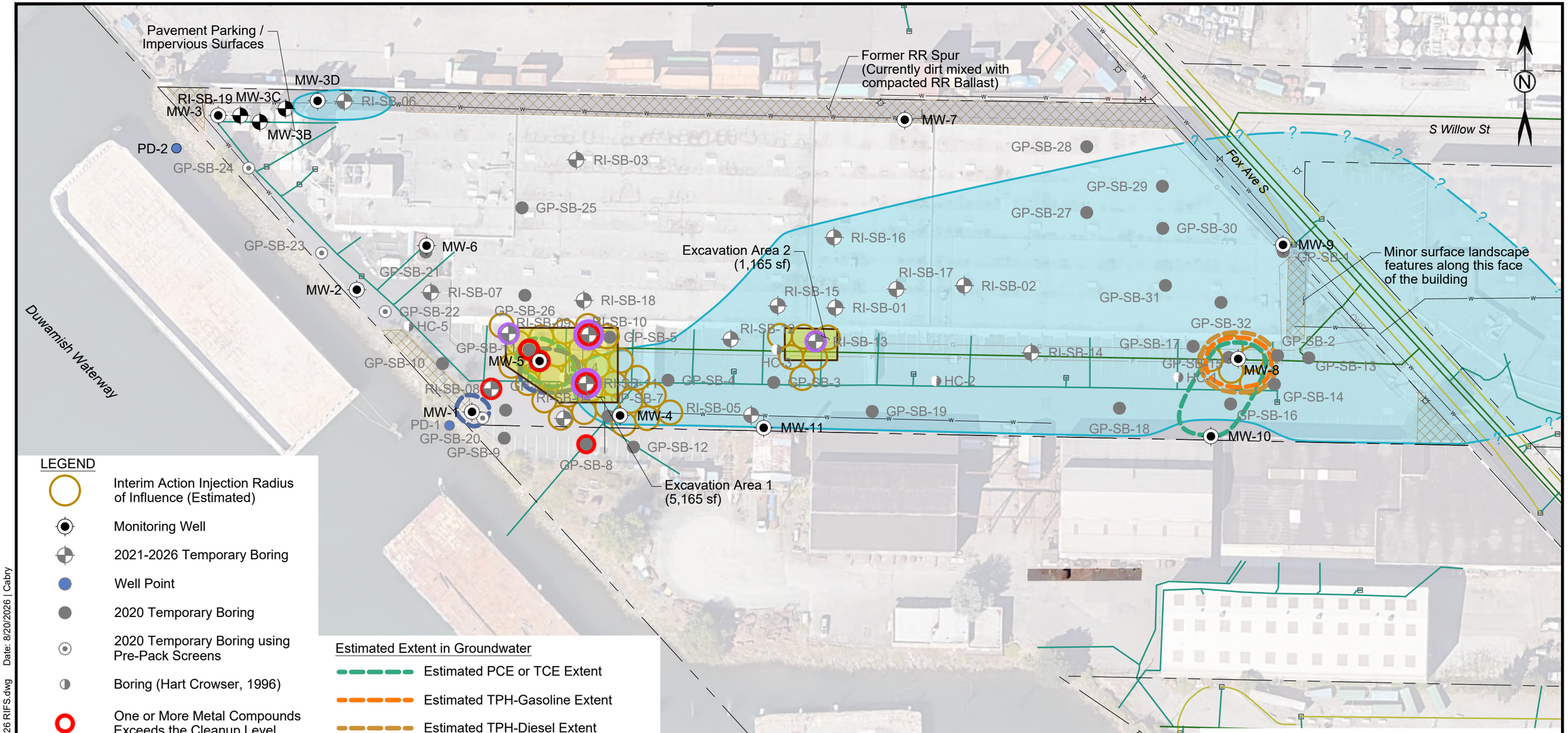
Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 7
Soil Exceeding Cleanup Levels
Prior to Interim Action

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry



LEGEND

- Interim Action Injection Radius of Influence (Estimated)
- Monitoring Well
- 2021-2026 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- One or More Metal Compounds Exceeds the Cleanup Level
- Soil Point Exceeding for cVOCs or TPH
- Estimated Extent of Vinyl Chloride Groundwater Plume
- Excavation Area
- Permeable Surfaces (Approx.)

Estimated Extent in Groundwater

- Estimated PCE or TCE Extent
- Estimated TPH-Gasoline Extent
- Estimated TPH-Diesel Extent
- Estimated Zinc Extent

Utilities

- Water Main or Service
- Water Valve
- Fire Hydrant
- Drainage Pipe
- Wastewater Pipe
- Culvert
- Catch Basin
- Manhole
- Powerline - Overhead
- Powerline - Underground
- Power Pole
- Gasline

CRETE CONSULTING, INC.

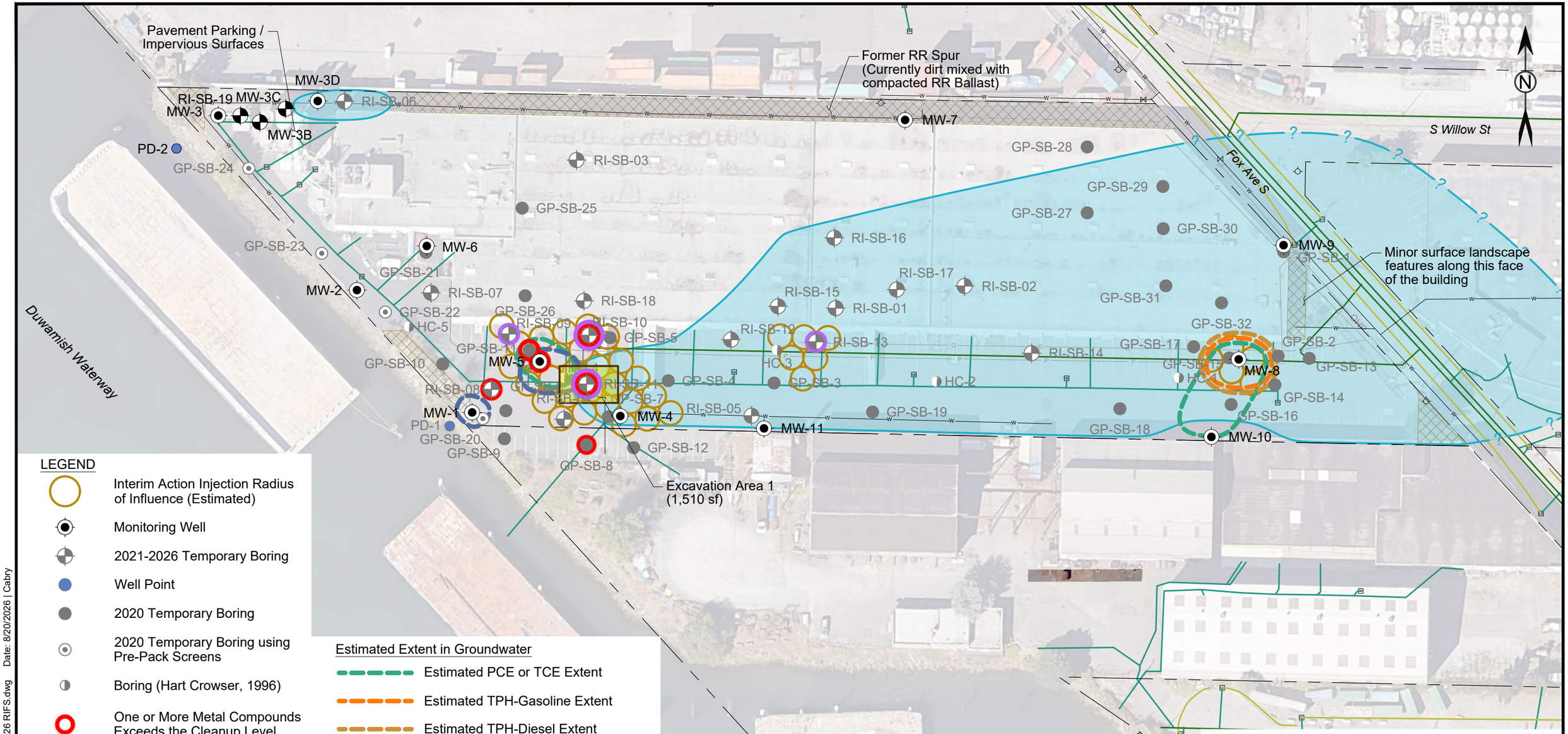
PROPOSED CLEANUP ACTION ALTERNATIVE NOTES

1. Monitoring wells within in excavation footprints (including slide slopes) will be abandoned and reinstalled in the vicinity of the original locations post excavation and backfill.
2. Replacement wells will be labeled with an "R", as an example, the replacement well for MW-5 will be called MW-5R. Replacement wells will be constructed similar to the original well.

Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 8
Proposed Cleanup Action Alternative 1

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry



LEGEND

- Interim Action Injection Radius of Influence (Estimated)
- Monitoring Well
- 2021-2026 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- One or More Metal Compounds Exceeds the Cleanup Level
- Soil Point Exceeding for cVOCs or TPH
- Estimated Extent of Vinyl Chloride Groundwater Plume
- Excavation Area
- Permeable Surfaces (Approx.)

Estimated Extent in Groundwater

- Estimated PCE or TCE Extent
- Estimated TPH-Gasoline Extent
- Estimated TPH-Diesel Extent
- Estimated Zinc Extent

Utilities

- Water Main or Service
- Water Valve
- Fire Hydrant
- Drainage Pipe
- Wastewater Pipe
- Culvert
- Catch Basin
- Manhole
- Powerline - Overhead
- Powerline - Underground
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CRETE CONSULTING, INC.

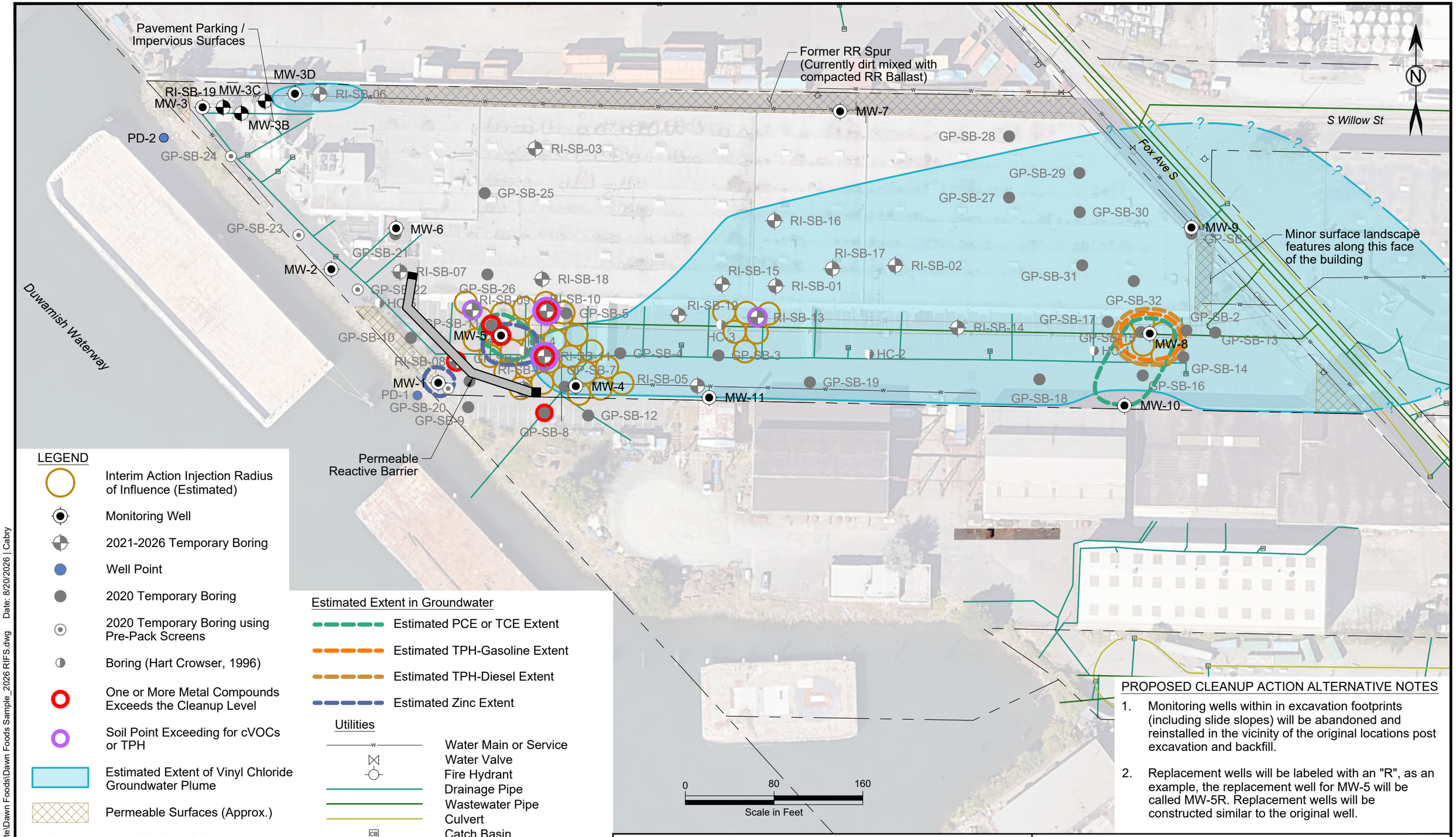
PROPOSED CLEANUP ACTION ALTERNATIVE NOTES

1. Monitoring wells within in excavation footprints (including slide slopes) will be abandoned and reinstalled in the vicinity of the original locations post excavation and backfill.
2. Replacement wells will be labeled with an "R", as an example, the replacement well for MW-5 will be called MW-5R. Replacement wells will be constructed similar to the original well.

Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 9
Proposed Cleanup Action Alternative 2

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry



LEGEND

- Interim Action Injection Radius of Influence (Estimated)
- Monitoring Well
- 2021-2026 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- One or More Metal Compounds Exceeds the Cleanup Level
- Soil Point Exceeding for cVOCs or TPH
- Estimated Extent of Vinyl Chloride Groundwater Plume
- Permeable Surfaces (Approx.)

Estimated Extent in Groundwater

- Estimated PCE or TCE Extent
- Estimated TPH-Gasoline Extent
- Estimated TPH-Diesel Extent
- Estimated Zinc Extent

Utilities

- Water Main or Service
- Water Valve
- Fire Hydrant
- Drainage Pipe
- Wastewater Pipe
- Culvert
- Catch Basin
- Manhole
- Powerline - Overhead
- Powerline - Underground
- Power Pole
- Gasline

PROPOSED CLEANUP ACTION ALTERNATIVE NOTES

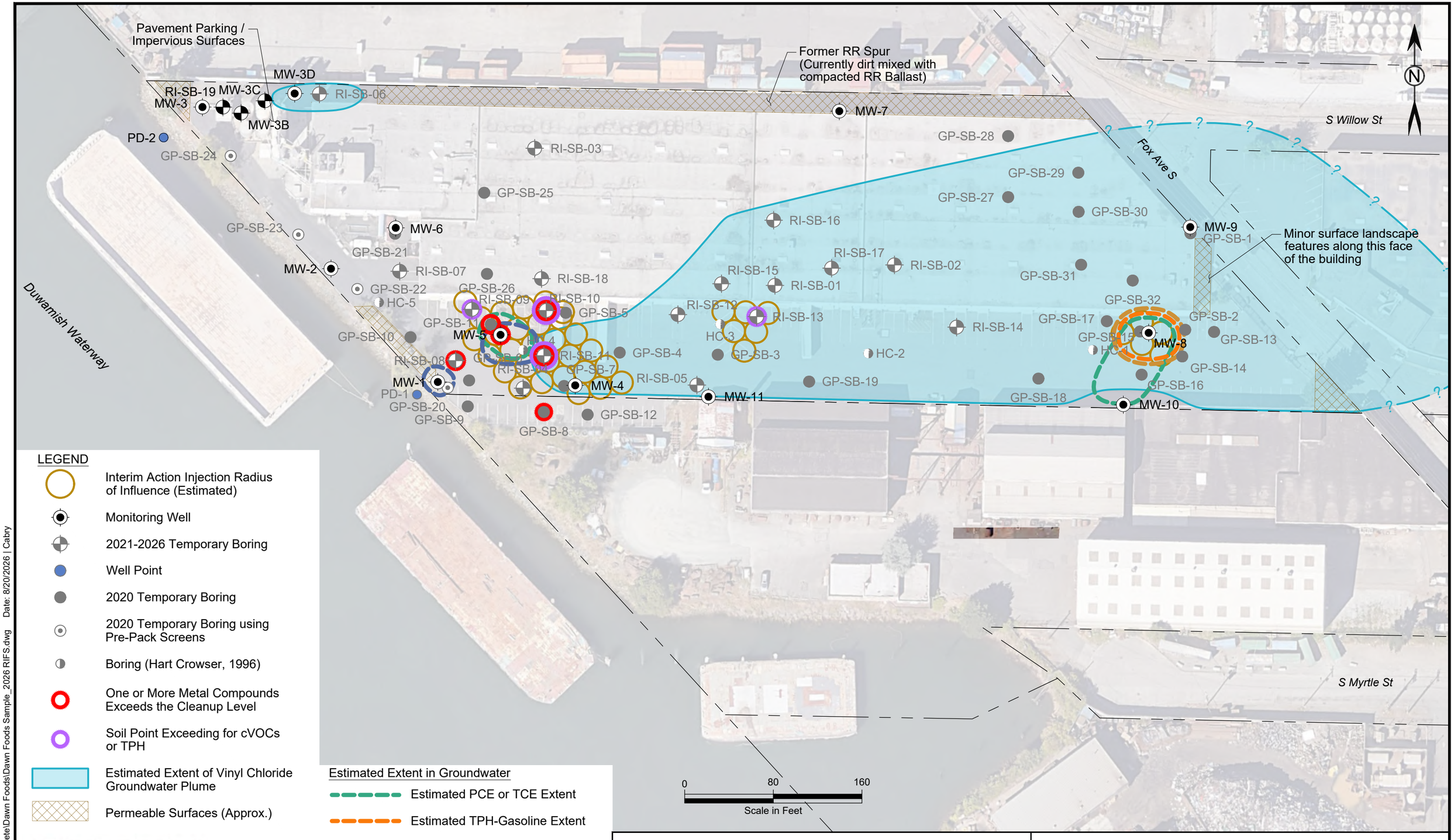
1. Monitoring wells within in excavation footprints (including slide slopes) will be abandoned and reinstalled in the vicinity of the original locations post excavation and backfill.
2. Replacement wells will be labeled with an "R", as an example, the replacement well for MW-5 will be called MW-5R. Replacement wells will be constructed similar to the original well.

CRETE CONSULTING, INC.

Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 10
Proposed Cleanup Action
Alternative 3

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry



LEGEND

- Interim Action Injection Radius of Influence (Estimated)
- Monitoring Well
- 2021-2026 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- One or More Metal Compounds Exceeds the Cleanup Level
- Soil Point Exceeding for cVOCs or TPH
- Estimated Extent of Vinyl Chloride Groundwater Plume
- Permeable Surfaces (Approx.)

Estimated Extent in Groundwater

- Estimated PCE or TCE Extent
- Estimated TPH-Gasoline Extent
- Estimated TPH-Diesel Extent
- Estimated Zinc Extent

CRETE CONSULTING, INC.

Dawn Food Site
6901 Fox Ave South
August 1, 2026

Figure 11
Proposed Cleanup Action
Alternative 4

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 RIFS.dwg Date: 8/20/2026 | Cabry

Appendix A

Compliance Monitoring and Contingency Response Plan

DRAFT CLEANUP ACTION PLAN
APPENDIX A: COMPLIANCE MONITORING AND CONTINGENCY RESPONSE PLAN

Dawn Foods Site
6901 Fox Ave South
Seattle, Washington 98108

September 3, 2026

Prepared for:

BRIDGE

DRAFT CLEANUP ACTION PLAN
APPENDIX A: COMPLIANCE MONITORING AND CONTINGENCY RESPONSE PLAN

Dawn Foods Site
6901 Fox Ave South
Seattle, Washington 98108

Setember 3, 2026

Prepared by:

CRETE
CONSULTING, INC.

Table of Contents

1 Introduction....1-1
1.1 Selected Remedy....1-1
1.2 Groundwater Chemicals of Concern....1-2
1.3 Organization....1-2

2 Sampling and Analysis Plan....2-3
2.1 Groundwater Sampling Methods....2-7
2.2 Sampling Equipment....2-8
2.3 Decontamination....2-8
2.4 Sample Nomenclature....2-9
2.5 Sampling Containers....2-9
2.6 Field Logs....2-10
2.7 Chain-of-Custody Procedures....2-11

3 Evaluation of Groundwater Results....3-1
3.1 Monitoring Well Data Analysis....3-1
3.2 Contingent Action Data Evaluation....3-1

4 Schedule and Reporting....4-1
4.1 Periodic Review....4-1

5 References....5-1

List of Tables

Table 1 Groundwater Compliance Monitoring Program
Table 2 Cleanup Levels

List of Figures

Figure 1 Sample Location Map

List of Attachments

Attachment 1 Quality Assurance Project Plan
Attachment 2 Standard Operating Procedures and Field Forms

Acronyms and Abbreviations

AO	Agreed Order
Bridge	Bridge Point Seattle 130, LLC
CMCRP	Compliance Monitoring and Contingency Response Plan
CRETE	CRETE Consulting Incorporated
CPOC	Conditional point of compliance
COC	chemical of concern
CVOC	chlorinated volatile organic compound
DCE	cis-1,2-dichloroethene
CUL	Cleanup level
DCAP	draft Cleanup Action Plan
Ecology	Washington Department of Ecology
EPA	United States Environmental Protection Agency
EPH/VPH	Extractable/Volatile Petroleum Hydrocarbons
ERD	enhanced in-situ reductive dechlorination
EIM	Environmental Information Management System
FBI	Friedman & Bruya, Inc
GC/MS	gas chromatography/mass spectrometry
GWCC	Great Western Chemical/Cascade Columbia Distribution Company
IA	Interim Action
LDW	Lower Duwamish Waterway
µg/L	microgram per liter
mg/L	milligram per liter
MTCA	Model Toxics Control Act
NTU	nephelometric turbidity unit
PCE	perchloroethylene (tetrachloroethene)
PQL	Practical quantitative limit
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
Site	Former Dawn Foods facility
TCE	trichloroethene
TOC	Total organic carbon
TPH	total petroleum hydrocarbons
VC	Vinyl Chloride
VOC	volatile organic compound
WAC	Washington Administrative Code

1 Introduction

This Compliance Monitoring and Contingency Response Plan (CMCRP) has been prepared for the for the Dawn Foods Site (Site), located at 6901 Fox Ave South in Seattle, Washington 98108 (Site; Figure 1). This CMCRP accompanies the Draft Cleanup Action Plan (dCAP) and provides:

- procedures for performance and confirmational groundwater sampling and analysis (Section 2)
- an evaluation framework for compliance monitoring data to assess the need for a contingent action (Section 3).

The attached Quality Assurance Project Plan (QAPP; Attachment 1) describes quality assurance/quality control (QA/QC) procedures associated with collecting, analyzing, validating, and using groundwater data from groundwater compliance monitoring.

1.1 Selected Remedy

The history, chemicals of concern (COCs), and other background information for the Site are described in the Remedial Investigation and Feasibility Study (RI/FS; CRETE 2026).

The dCAP presented the selected cleanup alternative for the Site, identified as Alternative 4. The selected Alternative 4 includes the following components:

- Enhanced in-situ reductive dichlorination (ERD) to address both chlorinated volatile organic compounds (CVOCs) and zinc in groundwater would include a nutrient-amended carbohydrate electron donor injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8 (performed during the IA – See Section 3.2). The Interim Action (IA) is ongoing and concentrations of COCs are expected to continue to reduce. The final cleanup design for this Site may be affected by the further reduction of groundwater COCs.
- Maintaining the current asphalt parking and building structure which would serve as a cap for the entire Site.
- Performance groundwater monitoring of existing Site wells (MW-1, MW-4, MW-5, MW-8, MW-9, MW-10 and MW-11) to determine the effectiveness of the ERD injections and long-term groundwater confirmational monitoring of shoreline monitoring wells (MW-1, MW-2 and MW-3D) to evaluate groundwater conditions at the conditional point of compliance (CPOC).
- Institutional controls to ensure that future property activities do not result in human or environmental exposure to impacted soils or subslab vapor and that the existing capped surfaces are maintained. A contaminated media management plan would be developed to manage Site soils and vapor conditions below the current building and would protect any future building conditions.

1.2 Groundwater Chemicals of Concern

The groundwater chemicals of concern (COCs) for the Site are as follows:

- **Groundwater:**
  - Zinc (total and dissolved),
  - Trichloroethene (TCE),
  - Tetrachloroethene (PCE),
  - vinyl chloride (VC), and
  - total petroleum hydrocarbons (TPH)-Gasoline and TPH-Diesel

1.3 Organization

This CMCRP includes the following sections and attachments:

- Section 2: Sampling and Analysis Plan
- Section 3: Evaluation of Groundwater Results
- Section 4: Schedule and Reporting
- Section 5: References
- Attachment 1: QAPP
- Attachment 2: Standard Operating Procedures and Field Forms

2 Sampling and Analysis Plan

Compliance monitoring will include the collection and analysis of groundwater samples from existing monitoring wells (Figure 1). Monitoring wells will be sampled for the following chemicals of concern (COCs):

- Zinc (total and dissolved),
- TCE,
- PCE,
- cis-1,2-dichloroethene (DCE)[1]
- vinyl chloride,
- TPH-Gasoline (TPH-Gx) and
- TPH-Diesel (TPH-Dx).

A conditional point of compliance (CPOC) at the shoreline has been selected. CPOC monitoring wells include: MW-1, MW-2 and MW-3 or MW-3D (Figure 1).

Compliance monitoring is divided into the following sequential phases:

- **Performance -** Includes monitoring activities to confirm that the cleanup action has attained cleanup standards. Groundwater monitoring will be conducted at performance monitoring wells (MW-1, MW-4, MW-5, MW-8, MW-10 and MW-11) to determine the effectiveness of the remedial alternative. Performance monitoring will occur quarterly for 4 years, semiannually for 3 years, and annually until CULs are achieved at the performance monitoring wells. The shoreline CPOC monitoring wells (MW-1, MW-2 and MW-3 or MW-3D) will be sampled at the same frequency during this time. Beginning after the first 4 years of quarterly monitoring, groundwater concentrations and trends will be evaluated. The need for a contingent action will be assessed after 4 years of quarterly monitoring. The monitoring program is summarized on Table 1. CULs are listed on Table 2. If a contingent action is triggered, performance monitoring will restart for the appropriate subset of wells with quarterly monitoring for 2 to 4 years.
- **Confirmational monitoring:** Includes monitoring activities to confirm the long-term effectiveness of the cleanup action once performance standards have been attained. This monitoring will be initiated when CULs are achieved at the performance and CPOC monitoring wells. Monitoring will occur annually for the next 5 years then every 5 years thereafter.

[1] cis-1,2-dichloroethene (DCE) is not a site COC but has been added as it is a daughter product of the biodegradation of PCE and TCE

It is acknowledged that concentrations of some COCs may drop below CULs before others. Section 3.0 addresses data analysis and adapting the monitoring program based upon the data collected.

Table 1 Groundwater Compliance Monitoring Program

Well Network	Well ID	Performance Monitoring	Confirmational Monitoring	COC list (See Note 1)
Upgradient Monitoring Well	MW-9	Quarterly for 4 years. Semiannually monitoring for 3 years. Annually until the CULs are achieved at performance monitoring wells.	Once CULs are achieved for all COCs at CPOC and performance monitoring wells, groundwater sampling will occur annually for 5 years followed by monitoring every 5 years thereafter.	TCE, PCE, VC, and DCE[2]
CPOC Monitoring Wells	MW-1 MW-2 MW-3 or MW-3D	Quarterly for 4 years. Semiannually monitoring for 3 years. Annually until the CULs are achieved at performance monitoring wells.	Once CULs are achieved for all COCs at CPOC and performance monitoring wells, groundwater sampling will occur annually for 5 years followed by monitoring every 5 years thereafter.	Zinc, TCE, PCE, VC, and DCE[2], and TPH-Gx and DRO
Performance Monitoring Wells	MW-1 MW-4 MW-5 MW-8 MW-10 MW-11	Quarterly for 4 years. Semiannually for 3 years. Annually until CULs are achieved. Restart at quarterly for 2 to 4 years if a contingent action is triggered for the appropriate subset of wells.	Once CULs are achieved for all COCs at CPOC and performance monitoring wells, groundwater sampling will occur annually for 5 years.	Zinc, TCE, PCE, VC, and DCE[2], and TPH-Gx and DRO

Notes:

Monitoring may be reduced, including reducing COCs at specific wells or removing wells from the sampling program, based on monitoring data and as approved by Ecology.
TPH = Total Petroleum Hydrocarbon; Gx = Gasoline Range; DRO = Diesel Range Organics
CUL = Cleanup Levels

1. Additional inorganic analysis (e.g., ammonia, nitrate/nitrite, sulfate, phosphate, dissolved iron, dissolved manganese, and chloride), ethene, ethane, methane, and total organic carbon (TOC) may be collected during groundwater sampling events to provide data on the IA. Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) may be analyzed to calculate site-specific risk-based CULs (see Table 2).These are not constituents of concerns but are important in understanding degradation pathways and or compliance with CULs.
2. DCE (cis-1,2-dichloroethene) is not a site COC but has been added as it is a daughter product of the biodegradation of PCE and TCE.

Table 2 Cleanup Levels

Chemical	CUL microgram per liter (ug/L)
Metals	
Zinc (total and dissolved)	81
Chlorinated Solvents	
Trichloroethene (TCE)	0.70
Tetrachloroethene (PCE)	2.9
cis-1,2-dichloroethenei(DCE)	182 (See Note 1)
Vinyl Chloride	0.18
Total Petroleum Hydrocarbons (see Note 2)	
Total diesel and oil range hydrocarbons	2100
Gasoline range hydrocarbons	1700

Notes:
CUL = Cleanup Levels

1. cis-1,2-dichloroethene (DCE) is not a site COC but has been added as it is a daughter product of the biodegradation of PCE and TCE.
2. Method B - MTCATPH Workbook requires the use of Volatile Petroleum Hydrocarbons (VPH) and Extractable Petroleum Hydrocarbons (EPH) analytical methods to calculate site-specific risk-based CULs per WAC 173-340-720(4)(b)(iii)(C). This method may be used to demonstrate compliance with the CUL.

2.1 Groundwater Sampling Methods

The QAPP is included in Attachment 1 and standard operating procedures are included in Attachment 2. Groundwater samples will be collected using peristaltic groundwater pumps with new disposable sampling equipment (i.e. sample collection tubing, filters, sample jars) during each event. Groundwater sampling will include measurement of field parameters to evaluate stability of groundwater collected from wells and in support of fate and transport analyses. Field water quality instruments will be calibrated at the beginning of each day (prior to sampling). Calibration data will be recorded on a field form or log book.

New, disposable, polyethylene tubing will be used to draw water from each monitoring well. The following tasks will be performed at each well:

- Measure and record static water level (distance from top of casing) to the nearest 0.01 foot using an electric well sounder and measuring tape.
- Use the United States Environmental Protection Agency (EPA) Low-Flow Groundwater Sampling Procedure (EPA 2019). This procedure includes several steps and can be summarized as follows. First, purge groundwater at a low rate (~100-200 milliliters per minute). Second, monitor the discharge water for temperature, pH, and specific conductance at least three times during the purging period. Third, measure the purge volume using a calibrated bucket. Fourth, record purge water volume, time, and field parameter values in the field notes.
- Sampling may begin after three consecutive field parameter measurements (temperature, specific conductance, and pH) are stable (defined in the QAPP; Attachment 1). Continue purging water until three consecutive stable measurements are recorded. Sampling may be conducted without stabilization if the parameter trends are reasonably attributed to in-aquifer variability such as tidal flux.
- Hands and clothing will be clean when handling sampling equipment and during sampling. Clean, disposable, nitrile gloves will be worn when filling bottles for analyses. Gloves will be changed when dirty and between samples. All water samples will be collected from the pump discharge lines directly into the appropriate sample containers. Samples submitted for dissolved metals analyses only will be filtered in the field prior to filling the sample container.

Collect groundwater samples in the following manner:

- Chlorinated Solvents (volatile organic compounds), TPH-Gasoline and VPH: For each sample, fill three 40-ml vials preserved with hydrochloric acid. Slowly fill each vial until all air is removed and sample water bulges slightly over the top of the vial. Wet cap with sample water and screw onto top of vial. Invert vial and tap with finger. The properly filled vial has NO visible air bubbles.

- Other Parameters (TPH-diesel/TPH-EPH): There are no headspace or filtering concerns related to these parameters. Fill the laboratory prepared sample bottles almost to the top, taking care not to overfill.
- Metals: Samples will be collected directly into lab-supplied bottles. For dissolved metals, samples will be collected after passing through an in-line, disposable, 0.45-micron capsule filter installed in the discharge line of the pump. A new capsule filter will be used for each sample. Before sampling from the filter, the filter will be flushed with sample water. Sample bottles will be filled almost to the top but not overfilled. Metals by Method 1638 do not require field preservation in the sample containers.

Record sample identification data on each sample container, in the field notes, and on the chain-of-custody. Sample identification will be the same as the well name/number and the sample collection date, see Section 2.5.

Using the EPA Low-Flow Groundwater Sampling Procedure (EPA 2019), stable is defined as when three consecutive water quality measurement readings are within the following limits:

- Dissolved Oxygen (DO) (10% for values greater than 0.5 mg/L, if three DO values are less than 0.5 mg/L, consider the values as stabilized),
- Specific Conductance (3%),
- Temperature (3%),
- pH (± 0.1 unit),
- Oxidation/Reduction Potential (±10 millivolts).
- Turbidity (10% for values greater than 5 Nephelometric Turbidity Units (NTU); if three Turbidity values are less than 5 NTU, consider the values as stabilized),

The container and preservative requirements are listed in the QAPP Table 2 (Attachment 1).

2.2 Sampling Equipment

Field equipment and supplies include sampling equipment (e.g., tubing, tape measures), disposables (e.g., filters, nitrile gloves), decontamination supplies, sample containers, coolers, log books and forms, personal protection equipment, and personal gear. Protective wear (e.g., hard hats, gloves) are described in the project Health and Safety Plan, which is prepared by the consultant conducting the field work. Sample containers, coolers, and packaging material will be supplied by the analytical laboratories.

2.3 Decontamination

All non-disposable equipment used during the groundwater sampling event that comes into contact with groundwater, shall be washed with Liquinox™ detergent and rinsed three times with distilled water prior to use and between sampling stations. Water and detergent used for decontamination will be collected in buckets and disposed of appropriately with purge water.

Gloves will be changed between each sample. Tubing used to collect groundwater samples is also disposable and new tubing will be used at each well for each sampling event. Water level and field parameter meters will require decontamination between sample collection locations.

2.4 Sample Nomenclature

All samples will be assigned a unique sample identification name based on the sampling location designation. Sample names may include the sampling date, depth to sampling and type of sample. Typical types of sample identification include the following examples:

- MW = monitoring well
- Groundwater samples collected from the monitoring wells will include the well ID in the sample ID. Example: A groundwater sample collected from MW-1 on August 28, 2026 will be identified as “MW-1-0826”.
- Duplicates shall not include information linking the parent sample to the duplicate. Example: DUP-01-0826.
- Trip Blanks (TB) should include the date. Example: TB-1-082826. One trip blank will be required per cooler that have volatile organic analysis vials.
- Equipment Rinsate Blanks (EB) are not anticipated because dedicated sampling equipment will be used, but if other blanks are collected, they shall include an identification acronym followed by the date. Example: EB-01-0426.

All sample identification names will be clearly labeled on sample jars and recorded on the associated field forms and tracking sheets (such as chain-of-custodies).

2.5 Sampling Containers

Requirements for sample containers and storage conditions are provided in Table 2 of the QAPP (Attachment 1). Samples containers for volatile organic compounds (VOCs) will be supplied by the laboratory with the proper chemical preservatives already in them. All sample containers will have screw-type lids so that they are adequately sealed. Lids of the glass containers will have Teflon™ inserts to prevent sample reaction with the plastic lid and to improve the quality of the seal. Commercially available, pre-cleaned jars will be used and provided by the laboratory, and the laboratory will maintain a record of certification from the suppliers. The container shipment documentation will record batch numbers for the bottles. With this documentation, containers can be traced to the supplier, and bottle rinse blank results can be reviewed.

Sampling containers will be filled to minimize head space and will be appropriately labeled and stored prior to shipment or delivery to the laboratory. Samples must be packed to prevent damage to the sample containers and labeled to allow sample identification. All samples must be packaged so that they do not leak, break, vaporize or cause cross-contamination of other samples. Each individual sample must be properly labeled and identified. When refrigeration is required for sample preservation, samples must be kept

cool, by means of ice packs or double-bagged ice in coolers, during the time between collection and final packaging. The container and preservative requirements are listed in Table 2 of the QAPP (Attachment 1).

2.6 Field Logs

All field activities and observations will be noted on weatherproof paper at the time they occur. The field logs will be compiled in a binder in the chronological order they were completed. Information will include personnel, date, time, station designation, sampler, types and number of samples collected, photographs taken, weather conditions, health and safety meetings conducted (tailgate meeting), and general observations. Any changes that occur at the site (e.g., personnel, responsibilities, deviations) and the reasons for these changes will be documented in the field log. It will also identify onsite visitors observing the sampling. The Site is an actively used property, therefore only those specifically visiting/observing sampling activities will be documented. The Field Manager is responsible for ensuring that the field logs are correct.

All field activities and observations will be noted during fieldwork. The descriptions will be clearly written with enough detail so that participants can reconstruct events later, if necessary. Requirements for entries include:

- Field logs will be compiled in chronological order in a 3-ring binder, with the date and observer clearly marked on all field forms and note sheets.
- Entries will be made legibly with black (or dark) waterproof ink or pencil.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The date and time, based on a 24-hour (military) clock (e.g., 0900 for 9 a.m. and 2100 for 9 p.m.), will appear on each page.
- When the field activity is complete, the field binder will be physically entered into the project file and the pages will be scanned to a PDF file and saved in the electronic project library. Scanning of sheets may also occur after each day’s field activities.
- The person recording the information must initial and date each sheet. If more than one individual makes entries on the same sheet, each recorder must initial and date each entry. The bottom of the page must be signed and dated by the individual who makes the last entry.
- The Field Manager, after reading the day’s entries, also must sign and date the last page of each daily entry.
- Corrections will be made by drawing a single line through the original entry allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed, dated, and explained.

2.7 Chain-of-Custody Procedures

All samples must be clearly identified immediately upon collection. Each sample container label will list:

- Client and project name
- A unique sample description/sample ID (see Section 2.5, above)
- Sample collection date and time.

Additionally, the container's label may include:

- Sampler's name or initials
- Preservative, if applicable
- Analyses to be performed.

Chain-of-custody procedures will be used to document sample possession from the time of collection, through analysis, to disposal. Chain-of-custody forms will document transfers of sample custody. A sample is considered to be under custody if it is in one's possession, view, or in a designated secure area. One set of chain-of-custody forms will be used per laboratory shipment. The chain-of-custody record will include, at a minimum, the following information:

- Client and project name
- Sample collector's name
- Sampler's company mailing address and telephone number
- Designated recipient of data (name, email, and telephone number)
- Analytical laboratory's name and city
- Description of each sample (i.e., unique identifier and matrix)
- Date and time of collection
- Quantity of each sample or number of containers
- Type of analysis required
- Any unique features of analysis, such as lower reporting limits
- Any requests to hold/archive samples
- Addition of preservative, if applicable
- Requested turn-around times
- Date and method of shipment.

When transferring custody, both the staff relinquishing custody of samples and the staff receiving custody of samples will sign, date, and note the time on the form. Samples to be analyzed by Friedman & Bruya Laboratory will not be shipped, but will be delivered by project personnel to the laboratory at the end of each sampling day. If samples are to be analyzed by other laboratories, they will either be delivered or shipped, depending on the location. All samples will be stored appropriately by the laboratory. Groundwater samples will be submitted for analysis by the methods and to the reporting limits identified in Table 2 of the QAPP.

3 Evaluation of Groundwater Results

3.1 Monitoring Well Data Analysis

Data collected during the performance groundwater monitoring program will be evaluated against the CULs (Table 2). If a COC compound is below the CUL for 4 consecutive sampling events at a monitoring well, that COC compound will be proposed for removal from the analysis list for that monitoring well.

Proposed revisions to the groundwater sampling program will be communicated to Ecology for approval prior to implementation.

Compliance with the CUL will consider the following conditions:

- Total versus dissolved concentrations – it is possible variations between the total and dissolved fraction could affect CUL compliance (WAC 173-340-720). Well conditions, such as turbidity levels and variability between total and dissolved results, may be evaluated to determine if significant differences are apparent between the total and dissolved fractions.

- CVOC concentrations in groundwater are expected to fluctuate and decrease over time due to a variety of factors, including: (1) an ongoing unresolved source of VOCs in the upgradient groundwater from the Great Western Chemical Company/Fox Avenue Building LLC site located at 6900 Fox Avenue (Facility Site ID No. 2282; Cleanup Site ID No. 5082) (2) sampling and analytical variability, (3) seasonal fluctuations in the groundwater elevations, and (4) desorption of CVOCs from soil to the groundwater where it can degrade in the dissolved phase.

After 8 quarters of groundwater monitoring, groundwater concentrations and trends will be evaluated to assess progress toward achieving CULs and to propose changes to the monitoring schedule based upon the available data and concentration trends.

3.2 Contingent Action Data Evaluation

Groundwater monitoring will be performed to document compliance with cleanup standards. In the event that progress toward achieving compliance with CUL is not apparent following implementation of the remedial action and environmental monitoring, contingent remedial actions will be evaluated.

Beginning after the first 4 years of groundwater monitoring, groundwater concentrations and trends will be evaluated annually to assess the potential need for a contingent action. The potential need for contingent action will be evaluated based on concentrations relative to CULs at the following monitoring wells for associated COCs:

- CPOC Monitoring Wells: MW-1, MW-2 and MW-3 or MW-3D
- Performance Monitoring Wells: MW-4, MW-5, MW-8, MW-9, MW-10 and MW-11

A contingent action may be triggered when the following occurs:

1. A CUL exceedance in a CPOC or performance well for 4 consecutive quarters, AND
2. Trend analysis for the well/COC pair identified in 1, above, indicates that the COC concentration is not decreasing or stable

Other considerations when evaluating if a contingent action is warranted include:

- Does the upper confidence limit (UCL) of the COC concentration at the CPOC well also exceed the CUL (WAC 173-340-709 and 720).
- Total versus dissolved concentrations – it is possible that trends will be different when evaluating the total or dissolved fractions. Well conditions may be evaluated to determine if significant differences are apparent between the total and dissolved fractions.
- Impacts from upgradient sources (e.g. Fox Avenue Site), including PCE/TCE impacts in the southeastern corner and VC on a large portion of the Dawn Foods Site.
- Groundwater data from surrounding wells and upgradient wells may be used to inform the decision process and understand trends observed at the CPOC and performance wells (e.g., if concentrations of COCs at upgradient wells are decreasing or below CULs, increasing trends at the CPOC wells may reflect the final degradation of the plume).
- The location of the performance well of concern (e.g. MW-5 and MW-8 are upgradient of other performance wells and may not trigger a contingent action if the COC concentrations at downgradient wells are below the CUL or decreasing).
- CVOC degradation process – which could increase concentrations of breakdown products during degradation activities.
- Data from sampling locations downgradient of CPOC monitoring wells (i.e. seeps and well points) that are closer to the point of discharge to surface water. While data from seep and other groundwater discharge points will be considered, a surface water CPOC under WAC 173-340-720(8)(d)(i) has not been selected for the site.
- Potential changes in exposure pathways.

Trend analysis will be conducted using a Mann-Kendall statistical test following the guidance provided by EPA (EPA 2009). Trend analysis will be completed at CPOC and performance monitoring wells.

Any contingent action would be based on the specific compounds that remain elevated and implemented as a targeted treatment plan to address those compounds at the CPOC.

4 Schedule and Reporting

Performance groundwater monitoring started in first quarter 2025[2], following completion of all on-Property interim action. Quarterly groundwater monitoring will continue through 2028 with semiannual monitoring currently anticipated to occur in 2029, 2030, and 2031.

Annual reports will assess groundwater conditions, including trend analysis, beginning with the 2026 annual report (prepared in early 2027). The need for a contingent action will initially be evaluated in the 2028 annual report (prepared in early 2029).

4.1 Periodic Review

As long as groundwater cleanup levels have not been achieved, WAC 173-340-420 states that at sites where a cleanup action requires an institutional control, a periodic review shall be completed no less frequently than every five years after the initiation of a cleanup action. Periodic reviews will be required at this Site.

[2] A baseline groundwater sampling event was completed in September 2024. Quarterly sampling started in First Quarter 2025 following the Interim Action, which was completed in November 2024.

5 References

EPA 1996. Low Flow (Minimal Drawdown) Ground-Water Sampling Procedures. Document No. EPA/450/S-95/504. April 1996.

CRETE 2026. Public Draft Remedial Investigation and Feasibility Study. Former Dawn Foods Site. CRETE Consulting. August 2026.

Figures

MW-3D
MW-3C
MW-3
MW-3B
MW-7
S Willow St
Fox Ave S
MW-9
MW-6
MW-2
MW-5
MW-8
MW-1
MW-4
MW-11
MW-10
Duwamish Waterway
S Myrtle St
N
0
80
160
Scale in Feet

LEGEND

- Interim Action Injection Radius of Influence (Estimated)
- Monitoring Well
- Conditional Point of Compliance Monitoring Well
- Performance Monitoring Well
- Upgradient Monitoring Well
- Estimated Extent of Vinyl Chloride Groundwater Plume

Estimated Extent in Groundwater

- Estimated PCE or TCE Extent
- Estimated TPH-Gasoline Extent
- Estimated TPH-Diesel Extent
- Estimated Zinc Extent

CRETE CONSULTING, INC.

Dawn Food Site
6901 Fox Ave South
August 24, 2026

Figure 1
Groundwater Sampling Program

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2026 CMCRP.dwg Date: 8/26/2026 | Cabry

Attachment 1

Quality Assurance Project Plan

APPENDIX A: COMPLIANCE MONITORING AND CONTINGENCY RESPONSE PLAN
ATTACHMENT 1: QUALITY ASSURANCE PROJECT PLAN

Dawn Foods Site
6901 Fox Ave South
Seattle, Washington 98108

September 3, 2026

Prepared for:

BRIDGE

APPENDIX A: COMPLIANCE MONITORING AND CONTINGENCY RESPONSE PLAN
ATTACHMENT 1: QUALITY ASSURANCE PROJECT PLAN

Dawn Foods Site
6901 Fox Ave South
Seattle, Washington 98108

September 3, 2026

Prepared by:

CRETE
CONSULTING, INC.

Table of Contents

1 Introduction 1-1
1.1 Background 1-1
1.2 Project Description 1-1
1.3 Organization and Schedule 1-2
1.3.1 Roles and Responsibilities 1-2
1.3.2 Schedule 1-2

2 Quality Objectives 2-1
2.1 Precision 2-1
2.2 Accuracy 2-1

3 Sampling Process Design 3-1
3.1 Representativeness 3-1
3.2 Comparability 3-1
3.3 Completeness 3-1
3.4 Laboratory QC Procedures 3-1

4 Measurement Procedures 4-1

5 Quality Control 5-1
5.1 Laboratory Quality Control 5-1
5.2 Additional Laboratory Quality Control Procedures 5-2
5.3 Field Quality Control 5-3
5.4 Instrument and Equipment Testing, Inspection, and Maintenance 5-3
5.5 Instrument and Equipment Calibration and Frequency 5-4
5.6 Inspection and Acceptance of Supplies and Consumables 5-5

6 Corrective Actions 6-1

7 Audits and Reports 7-1

8 Data Verification and Validation 8-1

9 Data Quality (Usability) Assessment 9-1

10 References 10-1

List of Tables

Table 1 Project Roles and Responsibilities
Table 2 Groundwater Sample Analytes
Table 3 Measurement Quality Objectives

Acronyms and Abbreviations

CMCRC	Compliance Monitoring and Contingency Response Plan
COC	contaminant of concern
CLP	Contract Laboratory Program
CRETE	CRETE Consulting, Inc.
CVOC	chlorinated volatile organic compound
dCAP	Draft Cleanup Action Plan
DQO	data quality objective
EDD	electronic data deliverable
EIM	Ecology Environmental Information Management system
EPA	United States Environmental Protection Agency
EPH/VPH	Extractable/Volatile Petroleum Hydrocarbons
ERD	enhanced in-situ reductive dechlorination
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
MDL	method detection limit
MRL	method reporting limit
MS/MSD	matrix spike/matrix spike duplicate
PARCC	precision, accuracy, representativeness, comparability, and completeness
Property	Former Bunge Foods facility
PDF	portable document format
PQL	practical quantitation limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	relative percent difference
SOP	standard operating procedure
TPH	total petroleum hydrocarbons
VOC	volatile organic compound
WAC	Washington Administrative Code

1 Introduction

1.1 Background

This Quality Assurance Project Plan (QAPP) accompanies this Compliance Monitoring and Contingency Response Plan (CMCRP) for the Dawn Foods Site (Site), located at 6901 Fox Ave South in Seattle, Washington 98108 (Site).

This QAPP describes quality assurance/quality control (QA/QC) procedures associated with collecting, analyzing, validating, and using groundwater data. This QAPP uses Ecology's Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. July 2004. Publication No. 04-03-030 (Ecology 2004).

1.2 Project Description

The history, contaminants of concern (COCs), and other background information for the Site are described in the Remedial Investigation and Feasibility Study (RI/FS; CRETE 2026).

The dCAP presented the selected cleanup alternative for the Site, identified as Alternative 4. The selected Alternative 4 includes the following components:

- Enhanced in-situ reductive dechlorination (ERD) to address both chlorinated volatile organic compounds (CVOCs) and zinc in groundwater would include a nutrient-amended carbohydrate electron donor injected in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8 (performed during the IA – See Section 3.2). The interim action (IA) is ongoing and concentrations of COCs are expected to continue to reduce. The final cleanup design for this Site may be affected by the further reduction of groundwater COCs.
- Maintaining the current asphalt parking and building structure which would serve as a cap for the entire Site.
- Short-term groundwater monitoring of existing Site wells (MW-1, MW-5, -MW-6, MW-8, MW-9, MW-10 and MW-11) to determine the effectiveness of the ERD injections and long-term groundwater monitoring of shoreline monitoring wells (MW-1, MW-2 and MW-3D); to evaluate groundwater conditions at the conditional point of compliance.
- Institutional controls to ensure that future property activities do not result in human or environmental exposure to impacted soils or subslab vapor and that the existing capped surfaces are maintained. A contaminated media management plan would be developed to manage Site soils and vapor conditions below the current building and would protect any future building conditions.

This QAPP address groundwater sampling and analysis from existing monitoring wells as part of the short-term and long-term groundwater monitoring. Roles and responsibilities are defined in Table 1; the sampling program is summarized on Table 2; and data quality objectives are presented on Table 3.

1.3 Organization and Schedule

1.3.1 Roles and Responsibilities

Roles and responsibilities are defined in Table 1.

Friedman & Bruya (volatile organic compounds [VOC]s, total petroleum hydrocarbons [TPH], degradation byproducts), and Alliance Technical Group (Extractable/Volatile Petroleum Hydrocarbons [EPH/VPH]) and Brooks Applied Laboratories (metals analysis) will perform the chemical analyses of the groundwater samples collected by CRETE Consulting, Inc. (CRETE).

Other laboratories may be added should specialized testing be required, or as logistics require.

1.3.2 Schedule

Samples will be delivered to the laboratory within applicable holding times and within 24 hours of collection time, when possible, with schedule constraints. Samples will be delivered to the laboratory by field personnel or arranged for pickup by laboratory couriers. Chain-of-custody procedures will be maintained during transit to the laboratory.

Data verification and validation will be completed prior to entry into the project database.

Groundwater data will be uploaded to the Ecology Environmental Information Management (EIM) system at the same time as summary reports are provided to Ecology.

2 Quality Objectives

The overall data quality objective for this project is the collection of representative data of known and acceptable quality. The QA procedures and measurements that will be used for this project are based on Ecology (Ecology 2004) and EPA guidance (EPA 2019 and 2020). Parameters related to precision, accuracy or bias, representativeness, completeness, and comparability (PARCC) will be used to assess the quality data (Table 3).

2.1 Precision

Precision is a measure of how closely one result matches another result expected to have the same value. Field precision will be assessed by collecting one duplicate sample for every twenty field samples. Field precision is determined by the relative percent difference (RPD) between a sample and its duplicate. However, results from the analysis of a duplicate sample also test laboratory precision. Therefore, the RPD between the sample and the field replicate provides an indication of both the field and laboratory precision. The tolerance limit for percent differences between field duplicates will be $\pm$ 35 percent for groundwater. If the RPDs exceed these limits, a replicate sample may be run to verify laboratory precision. If any RPD exceedance is linked to field sampling, the Field Manager will recheck field sampling procedures and identify the problem. Resampling and analysis may be required.

Laboratory precision can be measured through the evaluation of laboratory control samples/duplicates (LCS/ LCSD). The laboratory will perform the analysis of one set of LCS/LCSD samples for every 20 samples. Precision will be evaluated by the RPD for each analyte between LCS/LCSD and parent/field duplicate samples.

$$RPD = \frac{ABS(R1-R2)}{(R1+R2)/2} \times 100$$

Where:
ABS = absolute value
R1 = Sample result
R2 = Duplicate sample result.

The tolerance limit for percent differences between laboratory duplicates will be $\pm$ 20 percent for groundwater samples. If the precision values are outside this limit, the laboratory will recheck the calculations and/or identify the problem. Reanalysis may be required.

2.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage of the true or reference value for reference material or as spike recovery from matrix spike/matrix spike duplicate (MS/MSD)

samples. The RPD between the MS and MSD is used to evaluate laboratory precision. Target goals for the RPD are provided on Table 3. The following equations are used to express accuracy:

- For reference materials:
  - Percent of true value = (measured value/true value) x 100
- For spiked samples:
  - Percent recovery = ([SQ – NQ]/S) x 100

    SQ = quantity of spike or surrogate found in sample
    NQ = quantity found in native (unspiked) sample
    S = quantity of spike or surrogate added to native sample

The performance of the method will be monitored using surrogate compounds or elements. Surrogate standards are added to all TPH samples, method blanks, matrix spikes, and calibration standards.

Laboratory method reporting limits (MRL) are listed in Tables 2. All RLs are below project cleanup levels.

3 Sampling Process Design

The adequacy of the sampling design is evaluated by representativeness, comparability, and completeness of the data produced. The data must also be adequate to characterize nature and extent of contamination and to evaluate the completeness of pathways.

3.1 Representativeness

Representativeness is the degree to which data from the project accurately represent a particular characteristic of the environmental matrix which is being tested. Representativeness of samples is achieved by adherence to standard field sampling protocols and standard laboratory protocols. Representativeness will be achieved through following of the sampling plan design, sampling techniques, and sample handling protocols.

3.2 Comparability

Comparability is the qualitative similarity of one dataset to another (i.e., the extent to which different datasets can be combined for use). Comparability will be addressed through the use of field and laboratory methods that are consistent with methods and procedures recommended by Ecology and that are commonly used for groundwater studies.

3.3 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

Completeness = (number of valid measurements/ total number of data points planned) x 100

The data quality objective (DQO) for completeness for all analytes is 95%. Data that have been qualified as estimated (J qualified) will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness. Results will be considered valid if all the precision and accuracy targets are met. Resampling or re-analysis of remaining sample aliquots may be required if the completeness DQO is not met.

3.4 Laboratory QC Procedures

Additional laboratory QC procedures will be evaluated to provide supplementary information regarding overall quality of the data, performance of instruments and measurement systems, and sample-specific matrix effects.

QC samples and procedures are specified in each method protocol. All QC requirements will be completed by the laboratory as described in the protocols, including the following (as applicable to each analysis):

- Instrument tuning
- Initial calibration

- Initial calibration verification
- Continuing calibration
- Calibration or instrument blanks
- Method blanks
- LCS/LCSD
- Internal standards
- Surrogate spikes
- Serial dilutions
- MS/MSD.

4 Measurement Procedures

Groundwater samples will be analyzed by the methods and to the reporting limits identified in Table 2.

5 Quality Control

5.1 Laboratory Quality Control

Only laboratories accredited in accordance with WAC 173-50, Accreditation of Environmental Laboratories will be used for this project. EPA Contract Laboratory Program (CLP) QA/QC procedures or similar efforts will be used for the analyses. Internal quality control procedures are used to produce consistently high-quality data. A routine QC protocol is an essential part of the analytical process. The minimum requirements for each analytical run are described here. Additional description of laboratory QA/QC procedures can be found in the laboratory's QA manual. A project narrative detailing analytical results must accompany all data packages submitted by the laboratory.

Preparation batches have a maximum of 20 field samples of the same matrix. QA/QC samples processed with each batch are:

- **One method blank**. The method blank is used to assess the preparation batch for possible contamination during the preparation and processing steps. It is processed along with and under the same conditions as the environmental samples. Concentrations of compounds detected in the blank will be compared to the samples. Any concentration of common laboratory contaminants (i.e., metals) in a sample lower than 10 times that found in the blank will be considered a laboratory contaminant and will be so qualified. For other contaminants, any compounds detected at concentrations lower than five times that found in the blank will be considered laboratory contamination (EPA 2020). Values reported for the method blanks are expected to be below the method detection limits (MDLs) for all analytes, except the common laboratory contaminants. Deviations from this must be explained in the laboratory project narrative(s).
- **One Trip Blank**. One trip blank will be added per cooler with volatile organic analysis (volatile organic analysis vials) samples. This will allow for analysis to detect and measure any volatile chemical contamination introduced to the sample during transport, handling and storage.
- **One LCS**. The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps.
- **One MS**. Matrix specific QA/QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and is not normally used to determine the validity of the entire batch.
- **At least one duplicate**. Duplicates are replicate aliquots of the same sample taken through the entire analytical procedure. The results from this analysis indicate the precision of the results for the specific sample using the selected method. One duplicate sample is analyzed with each preparation batch. If sufficient sample is provided, this will be either an MSD. If not, an LCSD will be analyzed.

- **Initial and continuing calibration:** A calibration standard will be analyzed each time an instrument is calibrated. The instruments used to perform the analyses will be calibrated, and the calibrations will be verified as required by EPA methodologies. For example, a standard five-point initial calibration will be utilized to determine the linearity of response with the gas chromatograph/electron capture detection. Once calibrated, the system must be verified every 12 hours. All relative response factors, as specified by the analytical method, must be greater than or equal to 0.05. All relative standard deviations, as specified by the analytical method, must be less than or equal to 30 percent for the initial calibration and less than or equal to 25 percent for the continuing calibration.
- **Surrogate evaluations:** Surrogate recovery is a QC measure used in organics analyses. Surrogates are compounds added to every sample at the initiation of preparation to monitor the success of the sample preparation on an individual sample basis (accuracy). Although some methods have established surrogate recovery acceptance criteria that are part of the method or contract compliance, for the most part, acceptable surrogate recoveries need to be determined by the laboratory. Recoveries of surrogates will be calculated for all samples, blanks, and QC samples. Acceptance limits will be listed for each surrogate and sample type and will be compared against the actual result by the data validator.
- **Laboratory management review:** The Laboratory Manager will review all analytical results prior to final external distribution (preliminary results will be reported before this review). If the QA Officer finds that the data meet project quality requirements, the data will be released as “final” information. Data which are not acceptable will be held until the problems are resolved, or the data will be flagged appropriately.

5.2 Additional Laboratory Quality Control Procedures

Additional laboratory quality control procedures will be evaluated to provide supplementary information regarding overall quality of the data, performance of instruments and measurement systems, and sample-specific matrix effects.

QC samples and procedures are specified in each method protocol. All QC requirements will be completed by the laboratory as described in the protocols, including the following (as applicable to each analysis):

- Instrument tuning
- Initial calibration
- Initial calibration verification
- Continuing calibration
- Calibration or instrument blanks
- Method blanks

- LCS/LCSD
- Internal standards
- Surrogate spikes
- Serial dilutions
- MS/MSD.

5.3 Field Quality Control

Field quality control samples (QA/QC samples) will be collected during the groundwater investigations. QA/QC samples will be collected during all sampling activities. Trip blank, field duplicate, and matrix spike/matrix spike duplicate samples will be collected as follows:

Field duplicate samples will use the same naming system as the environmental samples; thus, they are submitted "blind" to the laboratory. Field duplicates are useful in identifying problems with sample collection or sample processing. One duplicate sample will be collected for every 20 field samples of the same matrix. Each field duplicate will be analyzed for the same parameters as the samples to evaluate heterogeneity attributable to sample handling.

One matrix spike/matrix spike duplicate sample (MS/MSD) will be collected for every 20 field samples. Extra sample containers (the same as those for the environmental sample) collected for MS/MSD analyses will be noted in field notes and on chain-of-custody forms submitted to the analytical laboratory. Extra sample bottles for MS/MSD will be labeled with a "-MS/MSD" suffix for clarity in sample processing.

Rinsate and equipment blanks will not be collected for groundwater samples because samples will be collected using either disposable or dedicated sample tubing, which prevents cross-contamination.

The goal is to have no detectable contaminants in the trip and decontamination blanks. If contamination is detected, the nature of the interference and the effect on the analysis of each sample in the batch will be evaluated. Data from affected samples may require qualification as "estimated" or "rejected."

As appropriate, schedules and records of calibration and maintenance of field equipment will be maintained in the field notebook. Equipment that is out of calibration or is malfunctioning will be removed from operation until it is recalibrated or repaired.

5.4 Instrument and Equipment Testing, Inspection, and Maintenance

The primary objective of an instrument/equipment testing, inspection, and maintenance program is to aid in the timely and effective completion of a measurement effort by

minimizing the downtime due to component failure. Testing, inspection, and maintenance will be carried out on all field and laboratory equipment in accordance with manufacturer's recommendations and professional judgment.

Analytical laboratory equipment preventative testing, inspection, and maintenance will be addressed in the laboratory QA manual, which will be kept on file at the contracted laboratory. As appropriate, schedules and records of calibration and maintenance of field equipment will be maintained in the field notebook. Equipment that is out of calibration or is malfunctioning will be removed from operation until it is recalibrated or repaired.

5.5 Instrument and Equipment Calibration and Frequency

Field equipment and laboratory instrumentation used for monitoring and sample analysis will be subject to the following calibration requirements:

- **Identification**. Either the manufacturer's serial number or the calibration system identification number will be used to uniquely identify equipment. This identification, along with a label indicating when the next calibration is due, will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference.
- **Standards**. Equipment will be calibrated, whenever possible, against reference standards having known valid relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of natural physical constraints. If national standards do not exist, the basis for calibration will be described and documented.
- **Frequency.** Equipment will be calibrated at prescribed intervals and/or prior to use. Frequency will be based on the type of equipment, inherent stability, manufacturers' recommendations, intended use, and observation of equipment readings over the course of the field work. All sensitive equipment to be used in the field or laboratory will be calibrated or checked prior to use. Field probe calibration will be done each day before sampling, using calibration solutions provided by the manufacturer and checked for expiration before use.
- **Records**. Calibration records (certifications, logs, etc.) will be maintained for all measuring and test equipment used.

If field or laboratory equipment is found to be out of calibration, the validity of previous measurements will be investigated, and/or corrective action will be implemented. The Field Manager or the Laboratory Manager, respectively, will lead the evaluation process, which will be document in the field forms or laboratory log book, respectively.

All laboratory calibration requirements must be met before sample analysis may begin. The laboratory will follow the calibration procedures dictated by the analytical methods to be

performed. If calibration non-conformances are noted, samples will be reanalyzed under compliant calibration conditions within method-specified hold times.

5.6 Inspection and Acceptance of Supplies and Consumables

The Field Manager will be responsible for material procurement and control. The Field Manager will verify upon receipt that materials meet the required specifications and that, as applicable, material or standard certification documents are provided, maintained, and properly stored with the project files. The Field Manager will also verify that material storage is properly maintained and that contamination of materials is not allowed.

The laboratory must document and follow procedures related to:

- Checking purity standards, reagent grade water, and other chemicals relative to intended use
- Preparing and storing chemicals
- Handling disposable glassware (including appropriate grade).

The Field Manager will be responsible for procuring and transporting the appropriate sample containers, equipment, and consumables (e.g., soap) to the Site. The containers will be pre-cleaned and certified by lot. If needed, reagents provided will be of the appropriate grade for the analysis. Records of these certifications and grades of material will be maintained on file at the laboratory.

6 Corrective Actions

Upon receipt of data, the QA Officer will evaluate field and laboratory precision by the RPDs between the field duplicate and sample data. Non-conforming items and activities are those which do not meet the project requirements or approved work procedures. Non-conformance may be identified by any of the following groups:

- **Field staff/Manager**: during the performance of field activities, supervision of subcontractors, performance of audits
- **Laboratory staff**: during the preparation for and performance of laboratory testing, calibration of equipment, and QC activities
- **QA Staff**: during the performance of audits and during data validation, through the use of data to make decisions (i.e., do the data make sense?).

If possible, the Field Manager will identify any action that can be taken in the field to correct any non-conformance observed during field activities. If necessary and appropriate, corrective action may consist of a modification of methods or a re-collection of samples. If implementation of corrective action in the field is not possible, the non-conformance and its potential impact on data quality will be discussed in the data quality section of the groundwater summary reports.

All corrective actions must be documented. The person identifying the nonconformance will be responsible for its documentation. Documentation will include the following information:

- Name(s) of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Any required approval signatures
- Method(s) for correcting the nonconformance or description of the variance granted.

Documentation will be made available to project, laboratory, and/or QA management. Appropriate personnel will be notified by the management of any significant nonconformance detected by the project, laboratory, or QA staff. Implementation of corrective actions will be the responsibility of the Field Manager or the QA Officer. Any significant recurring nonconformance will be evaluated by project or laboratory personnel to determine its cause. Appropriate changes will then be instituted in project requirements and procedures to prevent future recurrence. When such an evaluation is performed, the results will be documented. If there are unavoidable deviations from this QAPP, the Project Manager will document the alteration and track the change in the subsequent deliverables.

7 Audits and Reports

Field investigators will maintain field notes in a bound notebook or on field forms, and all documents, records, and data collected will be kept in a case file in a secure records filing area. These field documents will also be scanned for electronic archive. All laboratory deliverables with verifiable supporting documentation shall be submitted by the laboratory to the QA Officer. The following documents will be archived at the laboratory: 1) signed copies of sampling and chain-of-custody records; and 2) electronic files of analytical data including extraction and sample preparation bench sheets, raw data, and reduced analytical data. The laboratory will store all laboratory documentation of sample receipt and login; sample extraction, cleanup, and analysis; and instrument output in accordance with the laboratory Standard Operating Procedure (SOP) or QA manual. Laboratory will, as part of the audit process, provide for consultant's review, written details of any and all analytical Method modifications planned.

PDFs of all analytical reports will be retained in the laboratory files, and at the discretion of laboratory management, the data will be archived electronically. The consultant will also retain a copy of the laboratory reports for Site monitoring and reporting requirements.

No audits, other than the identified data verification and validation (see Section 8 below) will be conducted.

8 Data Verification and Validation

Analytes detected at concentrations between the MRL and the method detection limit (MDL) will be reported with a J qualifier to indicate that the value is an estimate (i.e., the analyte concentration is below the calibration range). J-qualified data are considered valid when completeness is calculated. Undetected data will be reported at the MRL. The MRL will be adjusted by the laboratory as necessary to reflect sample dilution or matrix interference.

The data will be evaluated in accordance with the QAPP. All chemical data will be reviewed with regard to the following, as appropriate to the particular analysis.

- Chain of custody/documentation
- Holding times
- Instrument calibration
- Method blanks
- Detection limits
- Surrogate recoveries
- Matrix spike/matrix spike recoveries
- Laboratory control sample recoveries
- Laboratory and field duplicate relative percent differences

The results of the data quality review, including text assigning qualifiers in accordance with the EPA National Functional Guidelines (EPA 2020a/2020b) and a tabular summary of qualifiers, will be generated by the Quality Assurance Officer . Verification of completeness and method compliance, as well as raw data entry and calculations by analysts will be reviewed by the Laboratory Manager. The Laboratory Manager will be responsible for checking each group or test data package for precision, accuracy, method compliance, compliance to special client requirements, and completeness. A quality assurance summary of the review will be generated by the Quality Assurance Officer. An EPA stage 2 data validation report will be generated. This summary and copies of the complete review will be presented as an appendix to the monitoring reports in Ecology's Environmental Information Management compatible format. The final data will be uploaded to Ecology's Environmental Information Management database.

9 Data Quality (Usability) Assessment

The QA Officer will review the field notebooks, laboratory reports, and the data validation report to determine if the data quality objectives have been met. Instances where the data quality objectives were not met will be documented. The usability of the data will depend on the magnitude of the data quality objective exceedance. Data that has been rejected will be flagged as “R” or “REJ”. The QA Officer will determine if rejected data trigger additional sample collection.

10 References

CRETE 2026. Pubic Review Draft Remedial Investigation and Feasibility Study Report. Former Dawn Foods Site. CRETE Consulting. August 2026.

Ecology 2004. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication No. 04-03-030. July 2004.

EPA 2020a. Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review. OSWER 9240.1-51. EPA 542-R-20-006. November 2020.

EPA 2020b. Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review. OSWER 9240.1-51. EPA 542-R-20-006. November 2020.

EPA 2019. Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Revision 4, September 19, 2017. EQASOP-GW4.

Tables

Table 1 Project Roles and Responsibilities

Role	Person	Responsibilities
Ecology Project Manager	David Unruh - Ecology	• Direct other Ecology staff and their consultants to review and comment on materials • Grant final approval on this QAPP, on data use, and on further data collection.
Consultant Team Project Manager	Grant Hainsworth – CRETE Consulting (253-797-6323)	• Primary point of contact with the Owner • Review all technical documents associated with the project for technical accuracy and feasibility, as well as adherence to budget and schedule.
Quality Assurance Officer	Jamie Stevens – CRETE Consulting (206-799-2744)	• Monitor all aspects of the project to verify that work follows project plans • Review laboratory analytical data and prepare data validation summaries • Serve as liaison between the laboratory and Field Manager • Maintain a complete set of laboratory data • Evaluate conformance of the analyses with the specifications of this QAPP • Verify the reported results with the raw data • Check that EDDs match the analytical reports • Review compliance with field methods and procedures.
Field Manager	Rusty Jones – CRETE Consulting (832-330-1359)	• Collect or direct collection of groundwater samples • Maintain a log (field log book) for all sampling-related activities • Coordinate the sampling operations to verify that the this QAPP is followed • Identify any deviations from this QAPP • Prepare the field data and information • Maintain the integrity of samples throughout sample collection and transport to the laboratory.
Laboratory Manager	Eric Young – Friedman & Bruya (also Alliance Technical Manager) (206-285-8282) Amy Goodall Brooks Applied Labs. 206-632-6206	• Conduct analysis of groundwater samples • Practice quality assurance methods per internal laboratory SOPs and this QAPP, and document such practices • Verify quality of samples (e.g., cooler temperature) as they're received at the laboratory • Verify accuracy and completeness of laboratory reports and EDDs.

Table 2 Groundwater Sample Analytes

Analyte	Preparation Method	Analytical Method	Method Reporting Limit	Cleanup Level	Holding Time	Sample Container/ Preservation/ Storage
Dissolved/Total Zinc (µg/L)	200.8/ EPA Method 1638 ICP-DRC-MS *	200.8 with reductive precipitation/ Method 1638	0.0068 – 0.18 (CAS-calculated MDLs)	81	6 months	Field filter into 500-mL plastic bottle with HNO_3 preservative to pH <2; Dark, 4°C
Trichloroethene (TCE; µg/L)	5030	EPA 8260C; potentially with SIM for groundwater	0.5	0.70	14 days (if preserved)	Three 40-ml vials preserved with hydrochloric acid (HCL); Dark, 4°C; freeze VOCs with 48 hours if not analyzed.
Tetrachloroethene (PCE; µg/L)			0.5	2.9		
Vinyl chloride (µg/L)			0.02	2.4		
Cis-1,2-dichloroethene (µg/L)	5030		1	NA		
TPH -Gasoline Range Organics (µg/L)	5030	Northwest (NW)TPH-Gx	100	1,700		
TPH -Diesel Range Organics (µg/L)	3510	NWTPH-Dx With/with out silica gel cleanup	50	500	14 days to extract; 40 days to analysis	500-mL amber glass
Extractable/Volatile Petroleum Hydrocarbons (EPH/VPH) (µg/L)	---	Northwest (NW) EPH/NWVPH	Variable	MTCA-TPH	14 days	1-liter amber glass and three 40 mL vials preserved HCl
Nitrate, nitrite, phosphate, sulfate, and chloride (mg/L)	---	SM 4500 NH3 B/C (EPA 350.2)	varies	NA	48 hours	500-mL plastic bottle; Dark, 4°C
Dissolved Iron	---	6020B	varies	NA	6 months	Field filter into 250-mL plastic bottle with HNO_3 preservative to pH <2; Dark, 4°C
Dissolved Manganese	---	6020B	varies	NA		
Ammonia	---	SM 4500 NH3	varies	NA	28 days	500-mL plastic bottle, H2SO4
total organic carbon (mg/L)	---	SM 5310 D(M) (EPA 415.1)	varies	NA		
ethene, ethane, and methane (mg/L)	---	RSK 175(M)	varies	NA	14 days	three 40 mL vials preserved HCl

Table 2 Groundwater Sample Analytes (continued)

Notes: 1. Filters are certified and provided by the laboratory
* ICP-DRC-MS = Inductively Coupled Plasma Dynamic Reaction Cell Mass Spectrometry
µg/L = micrograms per liter; mg/L = milligrams per liter; mL = milliliter; MTCA = Model Toxics Cleanup Act; TPH = Total Petroleum Hydrocarbons; NA = not applicable; HCL = hydrochloric acid; HNO3 = nitric acid; H2SO4 = sulfuric acid.

Table 3 Measurement Quality Objectives

Parameter	Precision (RPD; lab/field)	Accuracy	Completeness
Metals	Water: 20%/35%	70-130%	95%
Petroleum Hydrocarbons			
Volatile Organic Compounds			

Notes:
RPD – relative percent difference

Attachment 2

Standard Operating Procedures and Field Forms

1 INTRODUCTION

1.1 Purpose and Applicability

This standard operating procedure (SOP) is concerned with the collection of valid and representative samples of groundwater from monitoring wells. The scope of this document is limited to field operations and protocols applicable during groundwater sample collection.

This SOP is written in a broad-based manner and considers the application of a variety of sampling equipment in the collection of representative groundwater samples. Respective state and/or federal agency regulations may require specific types of equipment to be used when applying this SOP to a particular project. The project manager should review the applicable regulatory requirements, if any, prior to the start of the field sampling program. Deviations from this SOP to accommodate regulatory requirements should be reviewed in advance of the field program and documented in the project work plan.

This SOP has been developed based on the Washington State Department of Ecology (Ecology) Standard Operating Procedure for Purging and Sampling Monitoring Wells plus Guidance on Collecting Samples for Volatiles and other Organic Compounds (Ecology 2014) and the Environmental Protection Agency Low Stress Purging and Sampling Procedures for Collection of Groundwater Samples from Monitoring Wells (EPA 2017).

1.2 Quality Assurance Planning

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific QAPP. Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements typically suggest the collection of a sufficient quantity of quality control (QC) samples such as field duplicate, equipment and/or field blanks and matrix spike/matrix spike duplicate (MS/MSD) samples. These requirements should be outlined in the QAPP. Additional information regarding quality assurance sample collection relevant to groundwater sampling is contained in Section 5.0 of this SOP.

1.3 Health and Safety Considerations

Groundwater sampling may involve chemical hazards associated with the materials being sampled. Adequate health and safety measures must be taken to protect project sampling personnel from potential chemical exposures or other hazards.

These measures must be addressed in the project Health and Safety Plan (HASP). This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

2 RESPONSIBILITIES

2.1 Project Manager

The project manager is responsible for ensuring that project-specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the measurements in accordance with this SOP and the project-specific work plan.

2.2 Sampling Technician

It is the responsibility of the sampling technician to be familiar with the sampling procedures outlined within this SOP and with specific sampling, quality assurance, and health and safety requirements outlined within project-specific work plans (Sampling Plan, HASP, and QAPP). The sampling technician is responsible for collection of groundwater samples and for proper documentation of sampling activities as samples are being collected.

3 REQUIRED MATERIALS

Groundwater sampling objectives may vary significantly between projects. Project objectives should be defined within the project-specific work plans. The list of required materials below identifies the types of equipment which may be used for a range of groundwater sampling applications. From this list, a project-specific equipment list should be selected based upon project objectives and other factors such as the depth to groundwater, well construction, required purge volumes, and analytical parameters, among others. The various types of sampling equipment which may be used include:

<u>Well Purging Equipment</u>

- Bailers
- Bladder pumps
- Submersible pumps
- Peristaltic pumps
- Centrifugal Pumps
- WaterraTM pumps

Field Instruments

• Individual or multi-parameter meter(s) to measure temperature, pH, specific conductance, dissolved oxygen (DO) oxidation reduction potential (ORP), and/or turbidity

• Water level measuring device

• Interface probe or product detection paste

Sampling Equipment

• Reusable or disposable bailers

• Peristaltic pump

• Bladder pump

Sample Preparation Equipment

• Filtration equipment

• Intermediate containers

• Sample kit (i.e., bottles, labels, preservatives, custody records, cooler)

General Equipment

• Project-specific sampling plans (SAP, QAPP, HASP)

• Sample collection records

• Field notebook/pen

• Waterproof marker pens

• Deionized water dispenser bottler

• Sample cup

• Buckets

• Coolers, or sample shuttles

- Instrument calibration solutions
- Power source (generator of 12V marine battery)
- Equipment decontamination supplies
- Health and safety supplies
- First-Aid kit
- Tool box

Expendable Materials

- Deionized water supply
- Disposable bailer string (nylon or polypropylene)
- 0.45 micron filters
- Paper towels
- Plastic sheeting
- Ice/blue ice for sample preservation
- Disposable latex powder-free glove liners
- Disposable nitrile gloves
- Plastic trash bags
- Ziplock® bags

This equipment list was developed to aid in field organization and should be used in preparation for each sampling event. Depending on the site-specific sampling plan, additional material and equipment may be necessary and should be determined before the scheduled sampling event. Similarly, not all of the items shown in this list may be necessary for any one sampling event.

4 Method

4.1 Free Product Determination

Wells that may potentially contain free product should be assessed for product with an interface probe or product detection paste. Interface probes generally operate on the same principle as a water level tape although they are designed to register water and product levels usually with different audible tones. Product paste generally is used in combination with some type of measuring tape which is lowered into the well with a coating of paste applied to it. Wells containing free product are generally not used for groundwater sampling, since the concentration of contaminants present in the free product can adversely affect the quality of the water sample, lending to a non-representative water sample.

4.2 Water Level Measurement

To obtain a water level measurement, lower the probe of a water level measuring device into the well until the audible sound of the unit is detected or the light on an electronic sounder illuminates. At this time the precise measurement should be determined (to nearest 0.01 feet) by repeatedly raising and lowering the tape to converge on the exact measurement. Obtain the reading of the TOC measuring point. The water level measurement should be entered on the Groundwater Sample Collection Record or in the field records.

The measurement device shall be decontaminated immediately after use with a non-phosphatic detergent and rinsed with distilled water. Generally, only that portion of the tape which enters the water table should be cleaned. It is important that the measuring tape is never placed directly on the ground surface or allowed to become kinked. Measuring devices, including interface probes, which come into contact with free product will likely require more thorough decontamination.

4.3 Purge Volume Calculation

Wells designated for sampling require purging to remove stagnant water in the well. A single casing volume of groundwater will be calculated after measuring the length of the water column and checking the well casing diameter.

The amount of standing water can be calculated using a variety of methods. One equation is:

Well volume: V = 0.041 x HD2 = ____ gallons, where

- V is volume of water in the well, in gallons,
- H is height of water column in well (i.e. total well depth – measured depth to water), in feet, and
- D is the inside diameter of the well casing, in inches

4.4 Well Purging Methods and Procedures

4.4.1 Objectives

Prior to sample collection, purging must be performed for all groundwater monitoring wells to remove stagnant water from within the casing and gravel pack and to ensure that a representative groundwater sample is obtained.

There are three general types of non-dedicated equipment used for well purging and include: bailers, surface pumps and down-well pumps. The purge method and equipment selected should be specified in the project-specific work plans.

NOTE: This SOP only describes the most common equipment and methods used for purging. Other purging equipment, as well as dedicated equipment, can be used provided that the method employed does not have an adverse effect on the overall quality of the groundwater.

Regardless of the purge method, purge water temperature, pH, and specific conductance will be monitored at predetermined purge volumes and recorded on the Groundwater Sample Collection Record. Additional water quality parameters may be required by the project-specific sampling plan. In general, purging will be considered complete following the withdrawal of at least 3 to 5 well volumes of groundwater and when all field parameters have stabilized.

Purging a well to dryness may occur under some low-yield conditions or tidal conditions. When the well recovers, a cascading effect may occur within the screened zone which can volatilize some organic compounds. This may be considered inappropriate by regulatory agencies when volatile organic compounds (VOC) are the target analyte of interest. Purging a well to dryness, then sampling after it has recovered may be acceptable for other target analytes, however. Under low yield conditions, low-flow sampling pumps such as bladder pumps may be required for VOC sample collection.

4.4.2 Bailing

General

Bailing is often the most convenient method for well purging especially if only a small volume of purge water is required during the purge routine. Bailers are constructed using a variety of materials including PVC, polyethylene, stainless steel, and Teflon®. Teflon® bailers are generally most "inert" and are available in reusable and disposable form. Disposable polyethylene bailers are relatively inert and inexpensive. Reusable stainless steel and PVC bailers must be decontaminated between uses. Most commercially available bailers are constructed to fit into a 2-inch diameter well, although other bailer diameters are available.

Waterra™ foot valves are essentially bailer check valves which manually thread onto the bottom of standard pump tubing (polyethylene, teflon). The foot valves are commercially available in a variety of

diameters in stainless steel, Teflon®, and high-density plastic (Delrin). The foot valves operate by manually or mechanically raising and lowering the valve assembly within the water column which raises the water level within the discharge tube. Flow rates usually in the vicinity of 1 gallon per minute can be achieved with these devices.

Measurements of the pumping rate, temperature, pH, and specific conductance (and/or other parameters as required) should be made after each purge volume is removed and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been withdrawn and the field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

Bailing presents two potential problems with well purging. First, increased suspended solids may be present in samples as a result of the turbulence caused by raising and lowering the bailer through the water column. High solids concentrations may affect sample representativeness. Second, bailing may be less feasible for deep wells or wells which require a large volume of water to be removed during purging because of the time involved with continuous insertion and removal/emptying of the bailer.

Bailing Procedure

Obtain a clean bailer and a spool of clean polypropylene or nylon bailer cord. Uncover the top end of the bailer and tie a bowline knot, or equivalent, through the bailer loop. Test the knot and the bailer itself to ensure that all knots and parts are secure prior to inserting the bailer into the well.

Remove the protective wrapping from the bailer, and lower the bailer to the bottom of the monitoring well and cut the cord at a proper length. Bailer rope should never touch the ground surface at any time during the purge routine. Tie a hand loop at the end of the bailer cord.

Raise the bailer by grasping a section of cord using each hand alternatively in a "rocking" action. This method requires that the sampler's hands be kept approximately 2-3 feet apart and that the bailer rope is alternately looped onto or off each hand as the bailer is raised and lowered.

Grab the bailer with one hand as it emerges from the well. Pour the bailed groundwater from the bailer into a graduated bucket to measure the purged water volume. Repeat this procedure until one complete purge volume of water is removed from the well.

At the end of one complete well purge volume, place a small of purged water into a sample cup. Measure temperature, pH and specific conductance (and for other assigned parameters) and record the results on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been withdrawn and the specific field parameters have stabilized to within 10% of their preceding measurement.

4.4.3 Surface Pumps

General

Well purging using pumps located at the ground surface can be performed with peristaltic or centrifugal pumps if the water level in the well is within approximately 20 feet of the top of the well.

Peristaltic pumps provide a low rate of flow typically in the range of 0.02-0.2 gallons/minute (75-750 ml/min). For this reason, peristaltic pumps are not particularly effective for well purging. Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses.

Centrifugal pumps are designed to provide a high rate of pumping, in the range of 5 to 40 gallons/minute (gpm), depending on pump capacity. Discharge rates can also be regulated somewhat, provided the pump has an adjustable throttle. These pumps also require polyethylene or teflon-lined polyethylene tubing as suction line. The pump may also require priming to initiate flow.

Peristaltic Pump Procedure

Attach a new suction and discharge line to the peristaltic pump. Silicon tubing must be used through the pump head and must meet the pump head specifications. A second type of tubing may be attached to the silicon tubing for use as the suction and discharge continuous discharge. If drawdown causes the discharge to stop, the suction line will be lowered very slowly further down into the well until pumping restarts.

Measurements of temperature, pH and specific conductance (and/or other assigned parameters) should be made after each well purge volume and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been removed and the specific field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

Measure the length of the suction line and lower it down the monitoring well until the end is in the upper foot or more of the water column. Start the pump and direct the discharge into a graduated bucket. Adjust the pumping rate with the speed control knob so that a smooth flowing discharge is attained.

Centrifugal Pump Procedure

Attach a new suction and discharge line to the centrifugal pump. Start the pump and record the stabilized rate of discharge. As with other well purging systems, measurement of temperature, pH, and specific conductance (or other parameters as required) will be made after each well purge volume has been removed. These measurements shall be recorded on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been removed

and the field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

4.4.4 Down-Well Pumps

Groundwater withdrawal using non-dedicated down-well pumps may be performed with a submersible pump or a bladder pump.

Electric submersible pumps provide an effective means for well purging and in some cases sample collection. Submersible pumps are particularly useful for situations where the depth to water table is greater than 20 feet and where the depth or diameter of the well requires that a large purge volume be removed before sample collection.

Commonly available submersible pumps include the Johnson-Keck pump model SP-82, the Grunfos Ready-Flow 2 pump, and disposable marine galley pumps, all of which are suited for operation in 2-inch or larger internal diameter wells.

Recently, the use of bladder pumps (positive gas-displacement pumps) has been promoted by the EPA for use in well purging and sampling primarily because the pumps can be operated at low flow rates (less than 1 liter per minute). Bladder pumps generally reduce the potential turbidity of the sample and theoretically reduce the potential for loss of VOC constituents, ultimately providing a more representative groundwater sample. Use of bladder pumps may require additional time for purging and sampling because of the low flow rate. Please note, however, that when using bladder pumps, it may not be necessary to purge an entire well volume of water prior to each check of the water quality parameters. Well purging is accomplished at such a low rate that, theoretically, the influent flow into the pump represents groundwater flow through the well screen, thereby eliminating the requirement for purging several entire well volumes of water before sample collection.

Bladder pumps usually consist of a stainless steel pump housing with an internal teflon or polyethylene bladder. Discharge tubing is generally made from teflon, polyethylene, or teflon-lined polyethylene. The pump is operated by lowering it into the water column within the well screen, then pulsing air into the bladder with an air compressor and pump controller unit. Pumps and controllers are often not interchangeable between manufacturers; therefore, it is usually necessary to have both items provided by the same manufacturer. Pump bladders are generally field-serviceable and replaceable.

A check of well condition may be required prior to inserting any down-well pump if the well has not been sampled for some time or if groundwater quality conditions are not known. The well condition check should include a check of casing plumbness as a bent well casing could cause a pump to get stuck. Casing plumbness can be checked by lowering a clean cylindrical tube with the approximate pump dimensions into the well. If the well casing is not plumb then an alternative purging method should be used.

The well inspection should also include a check of air quality or headspace conditions within the well for potentially explosive gasses and a check for free product which could foul the pump. Well casing headspace conditions can be monitored with a photoionization detector (PID) and/or an explosimeter for the presence of potentially explosive gasses. If potentially hazardous conditions exist, then an alternative purging method should be used. In general, it is rare for explosive conditions to be present.

The presence of free product should be determined before inserting the submersible pump into the well because free product may contaminate the pump's internal mechanisms making it extremely difficult to decontaminate. An interface probe should be used to check for free product.

Electric Submersible Pump Procedure

Once the above well conditions have been assessed, and assuming it's safe to precede, slowly lower the submersible pump with attached discharge line into the monitoring well taking notice of any roughness or restriction within the well riser pipe. The pump should be placed in the uppermost section of the static water column of the monitoring well. The power cord should be attached to the discharge line with an inert material (i.e., zip-ties) to prevent the power cord from getting stuck between the pump, discharge line, and the well casing. Secure the discharge line and power cord to the well casing, using tape or a clamp, taking care not to crimp or cut either the discharge line or power cord.

Connect the power cord to the power source (i.e., rechargeable battery pack, auto battery, or generator) and turn the pump on. Voltage and amperage meter readings on the pump controller (if provided) should be monitored closely during purging. The operations manual for the specific pump used should be reviewed regarding changes in voltage/amperage and the potential impacts on pump integrity. Pumping should be discontinued if warning conditions occur and/or if the well is pumped to where drawdown falls below the pump's intake level.

If drawdown continues to the extent that the well is pumped dry, the pump should be shut off and the well allowed to recharge. This on/off cycle may be necessary in order to purge the well properly.

Measurements of the pumping rate, temperature, pH, and specific conductance (and/or other required parameters) should be made after each purge volume is removed and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been withdrawn and the field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

Bladder Pump Procedure

To operate the bladder pump system, the pump and discharge line should be lowered into the well close to the bottom of the well screen, and then secured to the well casing with a clamp. The air compressor

should then be turned on to activate pumping. The pump controller is used to vary the discharge rate to the required flow.

Measurements of the pumping rate, temperature, pH, and specific conductance (and/or other required parameters) should be made at periodic intervals while water is removed and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required field parameters have stabilized to within 10% of their preceding measurement. Generally, because of the low flow rate, samples are usually obtained from the bladder pump discharge line.

4.5 Sample Collection Methods and Procedures

4.5.1 Objectives

Groundwater samples can be collected using similar methods employed for purging, provided these methods do not adversely affect the quality of the groundwater. These methods include bailing, surface pumping and down-well pumping.

In most cases during sampling, groundwater will be transferred to the appropriate containers directly for the discharge source. During transfer, discharge tubing and other equipment shall not contact the inside of the sample containers. In addition, a clean pair of nitrile or latex gloves will be worn during sample collection and handling.

As a general rule of thumb, samples should be collected in order of decreasing volatilization of the target parameters. The preferred order of sample collection is as follows: volatile organic compounds, extractable organic compounds (e.g., semivolatile organic compounds, PCBs, pesticides), metals, and general water chemistry (ions and turbidity).

4.5.2 Bailers

The methods and procedures described in this section also apply to collecting groundwater samples with a bailer. If a bailer was used to purge the well, the same bailer may be used for sampling. If other well purging equipment was used, a decontaminated or new disposable bailer should be used for sampling.

When volatile organic compounds are the target sampling parameter, a bottom discharge tip should be used during sample transfer. A discharge tip restricts the outflow of the sample from the bailer and diminishes the potential for volatilization. Reusable bailers may require a special screw-on tip fitted with a bottom discharge top. Disposable bottom discharge tips are usually supplied with disposable bailers.

Bailer cord shall be discarded after sampling is completed. Disposable bailers should only be used in one well. Reusable bailers should be appropriately decontaminated between uses.

4.5.3 Surface Pumps

The methods and procedures described in this section for peristaltic and centrifugal pumps also apply to groundwater sample collection.

Peristaltic Pumps

Peristaltic pumps equipped with the appropriate type tubing will be used to collect groundwater from wells in which the water resides at a depth less than 20 feet. Sample bottles shall be filled directly from the pump's discharge line and care shall be taken to keep the discharge tube from contacting the sample container.

Groundwater samples requiring filtration prior to placement in sample containers can be placed in intermediate containers for subsequent filtration, or may be filtered directly with in-line disposable 0.45-micron filters.

After sampling is complete, all used tubing and filters shall be disposed of appropriately.

Centrifugal Pumps

Centrifugal pumps are generally not recommended for use in sample collection, especially when volatile organic compounds are the target analyte of interest. Samples for other analytes, however, may be obtained with use of an in-line sample trap. It is suggested that if samples cannot be obtained before going through the pump, that samples be obtained by using a bailer once purging is complete and pumping has ceased. Collecting samples from the pump discharge is not recommended.

After sampling is complete, all suction line tubing should be disposed of properly.

4.5.4 Down-Well Pumps

Electric Submersible Pump

Using the pump methods described in Section 4.9.4, groundwater samples can be collected directly from the pump discharge line, provided the discharge line is composed of inert material. Sample bottles will be filled directly from the discharge line of the pump. This method is generally not recommended for collection of volatile organic samples.

Bladder Pumps

Groundwater samples, including those collected for VOC analysis may be collected directly from the pump discharge tubing under active pumping conditions. Sample bottles will be filled directly from the discharge line of the pump.

After sampling is complete, the pump, discharge line and power cord shall be decontaminated and/or disposed of as required by the project-specific work plan.

Low Volume and Poor Recovery Wells - Purging and Sampling Procedures

Even with a low pumping rate, some wells experience significant drawdown or in extreme cases may even purge dry. Slow recovering wells or wells that purge dry require extra care in order to be purged and sampled with minimal disturbance to the water column and fine materials in and around the well screen.

For low volume and poor recovery wells, review past field data sheets if available for previous purge rates, amounts of drawdown, and purge volume prior to sample collection. Measure the well's water level. If you suspect the well may be low yielding, calculate the amount of standing water in one well volume as described in step 4.3.

If the well is not equipped with a dedicated sampling system, install a decontaminated pump or pump tubing. Slowly lower the equipment through the water column to avoid stirring up particulates. The final pump intake depth should be near the bottom of the screened interval. To prevent stirring up particulates it is important not to touch the well bottom. Record the intake depth on the field data sheet.

Once the pump or pump tubing is in place, slowly lower the water level probe back into the well. It is important to frequently measure the water level throughout purging in low volume or poor recovery wells to enable the pump rate to be adjusted downward if necessary.

Start purging at a rate less than 0.5 liter per minute if the pump capacity allows. Record the pump rate on the field data sheet. At regular intervals record field parameter values, water level, time of measurement, and amount of purge water discharged. Allow at least one complete exchange of water in the flow cell between measurements. Note and provide qualifying remarks if parameter readings are anomalous, the water level is dropping or if at some point the water level stabilizes. Record observations on the pumped waters appearance (e.g. clarity, odor, etc.) during purging and sampling. Continue purging until field parameters stabilize.

Attempts should be made to avoid purging low yielding wells dry. However, if this is not possible shut the pump off and allow the well to recover at least once before collecting samples. This generally constitutes an adequate purge, and the well can be sampled as soon as it has recovered sufficiently to produce an adequate volume of water to fill the sample containers. If time permits, purge the well a second time and allow it to recover before sampling. Samples should be collected within 24 hours of the final purge/recovery cycle.

It should be noted that there can be significant alterations in groundwater chemistry when a well is purged dry and allowed to recover before sampling. Groundwater chemistry can change as formation water surrounding or entering the screened interval of the well is exposed to air which can affect volatile organics and redox sensitive analytes. Increased turbidity can also be an issue when sampling metals and some general chemistry parameters (Ecology 2014). Collect samples once field parameters stabilize and any end of purge analysis has been conducted.

If the well has been purged dry and allowed to recover, field parameters should be measured after sample collection if there is an adequate volume of water. Sample containers should be filled in the order specified in the project QAPP. However, when sampling low-yielding wells which may not have a sufficient volume of water to fill all the sample containers, the relative importance of each analyte should be evaluated. Samples for analytes of most interest should be collected first.

4.6 Sample Filtration

Groundwater samples collected for total dissolved metals analyses will be filtered prior to being placed in sample containers and properly preserved. Groundwater filtration will be performed using a peristaltic pump and a 0.45-micron in-line water filter. Disposable filters are commonly available in 0.45-micron size. Low-capacity or high-capacity cartridges are available and may be selectively used based on sample turbidity.

The filtration of groundwater samples shall be performed either directly from the pump discharge line or from laboratory-supplied intermediate containers. In either case, well purging shall be performed first. Fresh groundwater shall then be filtered directly into sample containers.

4.7 Sample Handling

All samples collected should be packaged and handled according to ensure no breakage during shipping. Preservatives should be used where analytical methods require preservation. The QAPP will indicate the type of sample preservation necessary.

5 QUALITY CONTROL

5.1 Field Blank/Equipment Blank Sample Collection

Field blank samples serve as a quality assurance check of equipment and field conditions at the time of sampling. Field blank samples are usually prepared by transferring analyte-free water into a clean set of sample containers, then analyzing it as a sample. Sometimes, the analyte-free water is transferred over or through the sampling device before it is placed into the sample containers. This type of field blank sample is known as an equipment blank. The QAPP contains specific information regarding the type and number of field blanks or equipment blanks required for collection.

5.2 Field Duplicate Sample Collection

Field duplicate samples are collected for the purpose of providing two sets of results for comparison. These samples are used to assess precision. Duplicate samples are usually prepared by splitting the sample into two sets of sample containers, then analyzing each set as a separate sample. The QAPP contains specific information regarding the type and number of duplicate samples for collection.

5.3 MS/MSD Sample Collection

MS/MSDs provide information about the effect of the sample matrix on digestion and measurement methodology. For samples submitted for MS/MSD analysis, triple sample volume is generally required (contact the analytical laboratory for information specific to the project analytical parameters). The QAPP contains specific information regarding the frequency of MS/MSD samples.

6 DOCUMENTATION

Specific information regarding sample collection should be documented in several areas: the sample chain-of-custody record, sample collection record, field notebook, and sample labels, tags. Additional information regarding each form of documentation is presented in the following paragraphs:

6.1 Sample Chain-of-Custody Record

This ENSR standard form requires input of specific information regarding each collected sample for laboratory analytical purposes. The information requested includes site name and location, project number, field notebook reference, collection date and type of analysis requested. Each sample submitted for analysis is also listed individually using its field identification number, number and type of container, and requested analyses.

6.2 Groundwater Sample Collection Record

This form (Attachment 1 or 2) requires input of specific information regarding the collection of each individual sample including sample identification, water quality parameters, collection method, and containers/preservation requirements.

6.3 Field Logbook

This logbook should be dedicated to the project and should be used by field personnel to maintain a general log of activities throughout the sampling program. This logbook should be used in support of, and in combination with, the sample collection record. Documentation within the logbook should be thorough and sufficiently detailed to present a concise, descriptive history of the sample collection process.

6.4 Sample Labels/Tags

Sample labels shall be completed at the time each sample is collected and attached to each sample container. Labels will include the information listed below.

- Client or project name/project number
- Sample number
- Sample designation
- Analysis type
- Preservative
- Sample collection date
- Sample collection time
- Sampler's name

7 TRAINING/QUALIFICATIONS

Groundwater sample collection is a relatively involved procedure requiring formal training and a variety of equipment. It is recommended that initial sampling attempts be supervised by more experienced personnel. Sampling technicians should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous waste materials are considered to be present.

8 REFERENCES

Washington State Department of Ecology (Ecology) Standard Operating Procedure for Purging and Sampling Monitoring Wells plus Guidance on Collecting Samples for Volatiles and other Organic Compounds. Version 2.0. January 27, 2014.

EPA, Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, EQASOP-GW4. Revised September 19, 2017.

EPA, Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA-600/4-82-029, September 1982.

EPA, RCRA Groundwater Monitoring Technical Enforcement Guidance, November 1992.

Geotrans, Inc., RCRA Permit Writer's Manual, Groundwater Protection, prepared for the U.S. EPA, Contract No. 68-01-6464, October 1983.

Code of Federal Regulations, Chapter 40 (Section 261.4(d)).

Low Flow Groundwater Sample Collection Record

Date:	**Well ID:**
Project Name:	**Location:**
Project Number:	**Collector(s):**
Start Time:	**End Time:**

Water Level Data

Total Well Depth:		Water Table Depth:	
Screen Interval:		Tubing Placement Depth:	
Well Volume		**Well Volume = 3.14*(R^2*H*(CF)** R= Radius (feet), 2 inch = 0.17 feet H = Height of the water column CF = conversion factor = 7.48 gal/ft3	
Purge Method:		Purge Rate:	

Water Quality Parameters

Time (24 hr)	Vol. Purged (L)	Temp (C)	pH	Spec. Cond (uS/cm)	DO (mg/L)	ORP (mv)	Turbidity (NTU)	Flow Rate (ml/min)	DTW	Color/ Odor

Acceptance Criteria defined:										
Temp	3%	pH	+/- 1.0 unit	Spec. Cond	3%	DO	10%			
Turbidity	<5 NTU*	ORP	+/- 10 MV	Drawdown	<0.3'*					
Sample Collection:								Duplicate Details:		

*Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. If after 2 hours of purging indicator field parameters have not stabilized, discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization.

CRETE CONSULTING, INC.

1 INTRODUCTION

1.1 Purpose and Applicability

This Standard Operating Procedure (SOP) describes the methods used for decontamination of field equipment used in the collection of environmental samples which may have contacted investigated media (including soil, groundwater, surface water, sediment, and other media). It is important to follow these procedures from a quality control (QC) perspective to ensure that environmental data generated in the field are of the highest quality and are not misrepresented or misinterpreted due to cross-contamination. Also, improperly decontaminated sampling equipment can lead to cross contamination and could expose field personnel to hazardous materials.

This SOP discusses the decontamination procedures to be used with reusable field equipment. Respective state or federal agency regulations may require specific types of equipment or procedures used in the decontamination of field equipment. The Project Manager should review applicable state/federal regulations (if any) prior to the start of field work and update this SOP per those regulations.

1.2 General Principles

Potential hazards associated with the planned tasks should be thoroughly evaluated prior to conducting field activities. The site-specific Health and Safety Plan (HASP) provides a description of potential hazards and associated safety and control measures.

Decontamination is accomplished by manually scrubbing, washing, or spraying equipment with detergent solutions, tap water, distilled/deionized water, steam and/or high pressure water or solvents. Generally this is conducted between each sampling site or collection points, unless sufficient sampling collecting tools are available. Waste decontamination materials, such as spent liquids and solids, are collected and managed as investigation-derived waste for later disposal.

Sampling personnel must wear powder-free nitrile gloves while performing the procedures described in this SOP. Specifically, nitrile gloves must be worn while preparing sample bottleware, preparing and decontaminating sampling equipment, collecting and processing samples, and packing samples. At a minimum, nitrile gloves must be changed prior to the collection of each sample or as necessary to prevent the possibility of cross-contamination with the sample, the sample bottleware, or the sampling equipment.

Consideration should be given to the order in which the samples are collected. In general, samples should be collected from areas suspected to be least impacted by contamination followed by areas suspected to be most impacted by contamination, thereby minimizing the potential for cross-contamination Prior to field activities, the field team should consider how investigation-derived waste (such as decontamination fluids) is to be handled.

1.3 Quality Assurance Planning Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific Quality Assurance Project Plan (QAPP). Proper quality assurance requirements should be provided which will allow for collection of equipment blank samples in order to determine the effectiveness of the decontamination procedures.

Solvent selection is an important consideration and should be evaluated for each scope of work, at each site. There are several factors which shall be considered. The solvent should not be an analyte of interest, the sampling equipment should be resistant to the solvent, and the solvent must evaporate or be water soluble or preferably both.

Pesticide-grade methanol is the solvent of choice for general organic analysis. Hexane, acetone, and isopropanol are also good choices for organic analysis. A 10% nitric acid in deionized water solution is the solvent of choice for general metals analysis. Nitric acid can be used on Teflon, plastics and glass. If used on metal equipment, the nitric acid will eventually corrode the metal and could introduce metals from the sampling equipment into the environmental samples. Dilute hydrochloric acid can also be used for metal analysis.

All Decontamination should be performed a safe distance away from the sampling area as to not interfere with sampling activities.

1.4 Health and Safety Considerations

The health and safety considerations for the site, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). All field activities will be conducted in conformance to this HASP.

At a minimum, the following precautions should be taken in the field during these cleaning operations:

• When conducting field cleaning or decontamination using laboratory detergent, safety glasses with splash shields or goggles, and latex gloves will be worn.

• No eating, smoking, drinking, chewing, or any hand to mouth contact should be permitted during cleaning operations

2 RESPONSIBILITIES

2.1 Sampling Technician

It will be the responsibility of the sampling technician to be familiar with the decontamination procedures outlined within this SOP, the HASP, the QAPP, and the Sampling Plan. The sampling technician is responsible for the proper decontamination of all field equipment and proper documentation. The sampling technician is also responsible for ensuring that all decontamination producers are following by all subcontractors. Decontamination may be required on heavy equipment; it is the responsible of the sampling technician to ensure all equipment has been properly decontaminated.

2.2 Field Project Manager

It will be the responsibility of the field project manager to ensure that the sampling technician understands the decontamination producers and has access to all materials required for decontamination. The field project manager is also responsible for all waste generated during decontamination producers.

3 REQUIRED MATERIALS

In addition to those materials provided by the subcontractor, the project geologist/sampling engineer may require:

- Decontamination agents
- Chemical free paper towels
- Waste storage containers
- Cleaning storage containers
- Cleaning brushes
- Pressure sprayers (if required)
- Squeeze bottles
- Plastic sheeting
- Aluminum foil
- Health and safety equipment (as required by HASP)
- Project notebook/field sheets/pen

Sampling equipment which comes in direct contact with environmental samples during the sample collection process should be constructed of stainless steel, teflon, or glass, unless specified otherwise in the Project Sampling Plan or QAPP.

4 METHOD

4.1 General Method Description

It should be assumed that all sampling equipment, even new items, are contaminated until the proper decontamination procedures have been performed, unless, certificate of analysis is available and demonstrates the items are clean.

It is important to set up a decontamination cleaning station. This will vary depending on site acitivites and site access. Generally speaking, an decontamination area for small/hand held equipment cleaning should include a barrier (e.g. plastic sheeting) to work on, should decontamination tubs and/or buckets and rinse bottles in order of use on top of the barrier. Decontamination solution containing solutions and water should be gathered and put into accessible containers within easy reach of the decontamination tubs). Record the source of the water in the field logbook.

For decontamination of drilling rigs or backhoes/excavators, establish an area for decontamination that will meet the program and site-specific requirements for collection of decontamination fluids. If necessary, set up a decontamination pad. If containerization of decontamination fluids associated with decontaminating large equipment (such as drilling rigs and backhoes/excavators) is required, it is imperative to ensure that the subcontractor will have appropriate equipment onsite. This equipment may include a portable electric generator and a high-pressure steam-cleaner or steam-jenny. In addition, a decontamination pad or portable containment system should be used to collect fluids. The contractor shall conduct gross decontamination (such as removing general mud from large equipment) prior to arriving at site.

All equipment used for sampling, testing, or measuring, including excavating and drilling equipment, that comes in contact with potentially sampled media will be decontaminated prior to use unless the equipment is prepackaged and sealed by a manufacturer of environmental sampling equipment. Reusable sampling equipment will also be decontaminated between sampling locations. If disposable sampling equipment (clean prepackaged materials) is used, this equipment will not be decontaminated before use and will be disposed of properly after one use. Disposable equipment will not be used at more than one sampling location.

The following presents decontamination procedures for manual sampling equipment and heavy equipment.

4.2 Equipment Decontamination – Small Hand Held Equipment

The following general decontamination steps should be applied to all equipment prior to initial use (unless using clean prepackaged environmental sampling equipment) or that have been utilized to collect sample media for analytical purposes. Site-specific project control documents may specify modifications to these procedures and should be followed when applicable. It is important to note that no acids or solvents will be used to decontaminate any electrical or electronic instrumentation unless specified by the manufacturer.

a. Physically remove visible material from the sampling equipment to the extent practical before decontaminating the equipment with decontamination fluids. If this material appears to be impacted based on visual observation, instrument readings, or other credible indication, collect and manage this material in accordance proper procedures.
b. Immerse (to the extent practicable) the equipment in the cleaning solution and scrub the equipment thoroughly with a stiff brush until visible residual material is removed and the equipment is visibly clean. Circulate detergent solution through equipment that cannot be disassembled such as submersible pumps (ASTM, 1990).
c. Rinse the equipment thoroughly with potable water.
d. Rinse the equipment with organic desorbing agent (e.g., isopropyl alcohol). If samples are not being collected for analysis of organic compounds, omit this step (ASTM, 1990).
e. Rinse the equipment thoroughly with potable or DI water.
f. To the extent practicable, allow the equipment to air dry in a clean area (equipment does not need to be completely dry before reuse; under certain weather conditions, complete air drying is not possible).
g. Change the initial decontamination solution daily and/or between sites at a minimum and more frequently as needed. Collect decontamination solvents in a separate container from water/detergent solutions and properly containerize, store, and dispose of decontamination solutions.

If decontaminated equipment will not be used immediately, the equipment may be wrapped in aluminum foil (if used for organics only) or sealed in a plastic bag for storage. Decontamination activities, including date, time, and reagents used, should be documented in the field logbook and decontaminated sampling equipment should be labeled with this information as appropriate.

4.3 Equipment Decontamination – Decontamination of Heavy Equipment

The following steps for decontamination can be applied to heavy equipment.

a. Physically remove as much of the visible material as possible from the heavy equipment after use and prior to steam cleaning. If contaminated material is suspected as determined by visual observations, instrument readings, or other means, collect material in an appropriate container. Otherwise, return the material to the area where it originated.
b. Place the heavy equipment on the decontamination pad in the decontamination area. If wash water is to be collected, ensure that the collection mechanism functions properly and that the decontamination pad has no leaks.
c. Steam clean parts of the heavy machinery that come into contact with visible material (such as tires, bulldozer bucket, augers, and back of drill rig).
d. For any portion of the heavy equipment that comes into contact with the sampling media, decontaminate by following listed in Section 4.2.
e. Containerize fluids, if appropriate. Place solids in a drum or other appropriate container.

5 QUALITY CONTROL

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

Equipment blanks and Field blanks are generally made by pouring laboratory-supplied deionized water into, over, or through the freshly decontaminated sampling equipment. Blanks should be labeled as a sample and submitted to the laboratory to be analyzed for the same parameters as the associated sample.

6 DOCUMENTATION

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms include:

- Boring logs
- Field log books
- Sample collection records
- Chain-of-custody records
- Shipping labels

The field team should document and log all field sampling decontamination methods. Repetitive decontamination of small items of equipment does not need to be logged each time the item is cleaned.

7 REFERENCES

ASTM. Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites: D 5088-90, 1990.