Remedial Investigation Work Plan

Precision Engineering Site
Agreed Order No. DE 18079
Cleanup Site ID No. 4532
Facility Site ID No. 2056
Seattle, Washington

for
Dick Morgan

March 31, 2022

GeoEngineers
Earth Science + Technology

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File No. 25806-001-00

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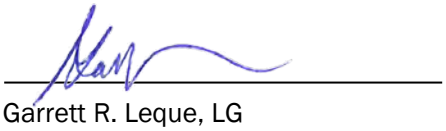

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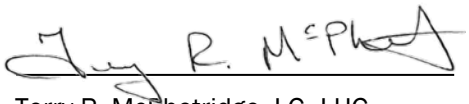

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ACRONYMS AND ABBREVIATIONS

AO	Agreed Order
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
cis-1,2-DCE	cis-1,2-dichloroethene
cPAH	carcinogenic polycyclic aromatic hydrocarbon
the Client	Dick Morgan
COI	chemical of interest
COPC	chemical of potential concern
CSID	cleanup site ID
CSM	conceptual site model
CUL	cleanup level
CVOC	chlorinated volatile organic compound
DRO	diesel-range organics
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
EPA	United States Environmental Protection Agency
EPH	extractable petroleum hydrocarbon
GPR	ground-penetrating radar
GRO	Gasoline range organics
HASP	health and safety plan
heavy oil	Diesel- and oil-range organics (i.e., DRO and ORO, respectively) reported individually or as a sum (i.e., total diesel+oil)
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
Kennedy/Jenks	Kennedy/Jenks Consultants
LDW	Lower Duwamish Waterway
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
LUST	leaking underground storage tank
MFA	Maul Foster & Alongi, Inc.
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
ORO	oil-range organics

Pacific Industrial Supply	Pacific Industrial Supply, Inc.
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCOPC	preliminary chemical of potential concern
PCUL	preliminary cleanup level
plan	work plan
POC	point of compliance
PQL	practical quantitation limits
Precision	Precision Engineering, Inc.
the Property	1231 S Director Street in Seattle, Washington
RI	remedial investigation
SAP/QAPP	sampling and analysis plan and quality assurance project plan
SCAP	Source Control Action Plan
SCUM	sediment cleanup user's manual
SIM	selected ion monitoring
the Site	Precision site
SVOC	semivolatile organic compound
TEE	terrestrial ecological evaluation
TEQ	toxic equivalency quotient
TCE	trichloroethene
total diesel+oil	the sum of diesel- and oil-range organics (i.e., DRO and ORO, respectively)
trans-1,2-DCE	trans-1,2-dichloroethene
UCL	upper confidence limit
µg/L	micrograms per liter
UST	underground storage tank
VCP	Voluntary Cleanup Program
VIP	vapor intrusion priority
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon
WAC	Washington Administrative Code
WBZ	water-bearing zone

1.0 INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) has prepared this remedial investigation (RI) work plan (plan) on behalf of Dick Morgan (the Client) for the Precision Engineering, Inc. (Precision) site (the Site). The Site is associated with the property located at 1231 S Director Street in Seattle, Washington (the Property) (see Figure 1-1). The Property is adjoining the South Park neighborhood of Seattle and King County has jurisdictional authority. Historically, the Property was used for heavy industrial operations. CL Frazier Properties, LLC, currently owns the Property, where Pacific Industrial Supply, Inc. (Pacific Industrial Supply) operates an industrial equipment supply store.

This plan provides a review of data previously collected to characterize the Site and a scope of work for additional data collection to address identified data gaps. The following preliminary RI and Site characterization elements are included in this plan:

- Identification of appropriate preliminary cleanup levels (PCULs) for the Site based on criteria developed for the Lower Duwamish Waterway (LDW)
- Identification of chemicals of interest (COIs) for the Site
- A preliminary chemical of potential concern (PCOPC) selection process developed in coordination with the Washington State Department of Ecology (Ecology) to meet LDW requirements
- Determination of PCOPCs based on the PCOPC selection process
- Identification of PCUL exceedances for COIs and PCOPCs
- Characterization of the nature and extent of PCUL exceedances for PCOPCs
- Identification of data gaps that inform the current understanding of COIs and their distribution throughout the Site, the preliminary conceptual site model (CSM), the nature and extent of COIs and PCOPCs, and potential environmental transport and exposure pathways, including those involving the LDW

COPCs may be added or removed in the RI following collection of additional data as outlined in this plan.

This plan also includes a scope of work for addressing data gaps on the Property and initial off-Property data gaps. Data collected under this plan will inform additional off-Property investigation needed to complete the RI.

1.1. Regulatory Framework

The Site is listed under Ecology cleanup site ID (CSID) 4532 and facility site ID 2056.

The Site is defined by the area where hazardous substances associated with Precision's historical operations on the Property have come to be located in environmental media as a result of historical releases and subsequent environmental fate and transport mechanisms. The Site includes portions of the Property and likely includes portions of adjoining properties. The nature and extent of Site contamination has not been fully characterized; therefore, the boundaries of the Site have not been delineated.

In December 2020, Ecology entered into Agreed Order No. DE 18079 (AO) with the potentially liable parties for the Site, which include the Client. This plan is an AO deliverable and has been developed to provide a framework and scope of work for further assessment of the nature and extent of environmental contamination at the Site for completion of an RI. This plan was developed—and the investigation work proposed in this plan will be implemented—in general accordance with the Model Toxics Control Act (MTCA) (Washington Administrative Code [WAC] 173-340). A draft plan was developed by Maul Foster Alongi (MFA) in 2021. In early 2022, the Client changed consultants to GeoEngineers and GeoEngineers made modifications to the draft plan in consultation with Ecology to prepare this final plan.

The Property is located approximately 1,800 feet upland of the LDW, a U.S. Environmental Protection Agency (EPA) Superfund site. Ecology is working with EPA to identify potential sources of sediment recontamination to the LDW. In the 2013 LDW Source Control Action Plan (SCAP), Ecology identified the Site as an upland facility with the potential to recontaminate sediment in the LDW (Ecology, 2013). In the LDW SCAP, Ecology stated that stormwater runoff and shallow groundwater at the Property may enter the drainage ditch immediately south of the Property and discharge to the S. 96th Street storm drain system, which discharges to the LDW. Given the potential for environmental transport of Site contamination to the LDW, Ecology has requested that Site data be screened to PCULs based on criteria developed for the LDW and that potential exposure pathways to the LDW be evaluated in the RI.

1.2. Purpose and Objectives

The purpose of the RI is to characterize the nature and extent of contaminants at the Site and evaluate potential impacts to human health and the environment sufficiently to inform the development and selection of cleanup actions. The activities outlined in this plan support the following RI objectives:

- Develop PCULs and identify PCOPCs.
- Delineate the Site boundaries.
- Further characterize the nature and extent of hazardous substances, at concentrations above PCULs, present in environmental media on the Property and initial sampling to identify off-Property data gaps. On-Property sampling will inform the need for additional off-Property investigation to complete the RI.
- Obtain geologic and environmental data to further develop the preliminary CSM and the understanding of environmental transport and exposure pathways that are potentially complete now or in the future.
- Evaluate the potential for commingling of contamination associated with adjacent properties.
- Inform the development of potential cleanup actions in the feasibility study to address Site contamination.

2.0 BACKGROUND

2.1. Property Description

The Property is in section 32, township 24 north, range 4 east of the Willamette Meridian, on King County tax parcel 000160-0055 (see Figures 1-1 and 2-1). The approximately 3.5-acre Property is zoned for industrial use. One 62,000-square-foot building comprising three warehouse bays is currently located on the Property. The east side of the building was constructed in 1968, and the west side was added in 1979. The building is surrounded by an asphalt-paved parking lot (see Figure 2-1).

The surrounding area is a mix of industrial operations and residential properties. Since 1997, a towing and limousine service business has operated on the adjacent property to the east, which was formerly the Kaspac/Chiyoda property (also known as the "Carey Limousine" property), referred to herein as the former Kaspac/Chiyoda property, and is an Ecology cleanup site (CSID 2540) (see Figure 2-2). The former Kaspac/Chiyoda property was used for agriculture and agricultural-equipment storage before 1960; a car lot and gas station between 1960 and 1972; a road-striping paint company between 1972 and 1988; and a transmission repair shop, construction contracting company, and roofing contractor between 1988 and 1997 (SAIC, 2013). West of the Property is a business that repairs and sells refrigerators, and north of the Property are residential homes located across S Director Street.

2.2. Property History

Precision operated an industrial manufacturing business on the Property from 1968 to March 1, 2005. The operation included manufacturing and repair of large hydraulic cylinders, large rolls used in the manufacturing of paper and sheet metal products, and other equipment. Services included grinding and polishing, honing, hard-chrome plating, milling, welding, and application of flame- and arc-applied metal coating, much of which involved the use of chromic acid. From 1985 to 2003, approximately 10,000 square feet of the west side of the building was leased to Baszile Metals Service, an aluminum distributorship.

Former operational areas and other historical features of interest associated with Precision's operations, including former tanks used to contain process chemicals and wastes, are shown on Figure 2-2 and are summarized in a table excerpted from the Kennedy/Jenks Consultants (Kennedy/Jenks) 2015 RI report (see Appendix A). Historical features of interest on the Property are described in Section 3.1, and are further detailed in the previous reports (see MFA 2008 RI and RA in Appendix B, Kennedy/Jenks, 2015; SAIC, 2013). Potential chemical releases associated with these features are summarized below:

- **Drainage ditch**. Metals (e.g., chromium, arsenic, and lead) impacts to shallow soil and surface water from impacted surface water runoff into the ditch and potential groundwater intrusion through cracks in storm system piping.
- **Former plating tanks**. Trichloroethene (TCE), chromium, and hexavalent chromium impacts to shallow soil, shallow groundwater, and vapor due to leaking aboveground storage tanks, underground storage tanks (USTs), and temporary tanks.
- **Tank vaults**. Hexavalent chromium impacts to shallow soil and shallow groundwater from cracks and seams in former tank vault 7 and the hydraulic cylinder test vault.
- **Trenches and drains**. TCE, chromium, and hexavalent chromium impacts to shallow soil and shallow groundwater from chrome-plating rinse water, which was discharged to the METRO's sanitary sewer prior to 1986, when it was routed to containment vaults.
- **Scrubber room**. Hexavalent chromium impacts to shallow soil and shallow groundwater from a chromic acid evaporator, chromic acid purification unit, and chromic acid holding tank in the scrubber room.
- **Parts washing**. TCE, TCE degradation products, methyl ethyl ketone, and Stoddard solvent impacts to shallow soil and shallow groundwater from parts washing and degreasing operations.
- **Steam cleaning area**. Petroleum hydrocarbons and metals (copper, lead, nickel, zinc, and chromium) impacts to shallow soil and shallow groundwater from steam cleaning and the use of a sodium

hydroxide tank. In 1986, steam cleaning operations were moved from outside and southeast of the building to inside the building. Fluids were discharged to an oil/water separator.

- **Solid waste dumpster**. Petroleum hydrocarbons, benzo(a)pyrene, and metals (arsenic, copper, lead, nickel, and zinc) impacts to shallow soil and shallow groundwater from surface water runoff near the solid waste dumpster into the drainage ditch.

The Property was sold on March 29, 2007, to CL Frazier Properties, LLC, and is currently occupied by Pacific Industrial Supply, a wire rope and marine/industrial supply distributor (MFA, 2011).

2.3. Regulatory History

Between 1986 and 2003, Precision completed several corrective actions at the Site in response to a February 1986 compliance order issued by Municipality of Metropolitan Seattle and as required by Ecology in response to National Pollutant Discharge Elimination System (NPDES) permit and hazardous waste regulation violations identified during Ecology inspections (SAIC, 2013). Corrective actions included measures to address sanitary sewer and stormwater discharge and hazardous waste storage violations. Precision also conducted several environmental investigations and cleanup actions at the Site between 1988 and 1993. Between 1988 and 1990, investigations were performed under the 1986 Ecology Administrative Order No. DE 86-307, an amendment to that order, and a 1987 Ecology compliance letter (SAIC, 2013). Precision conducted an independent remedial action in 1993. Between 2005 and 2011, Precision conducted additional environmental investigation and cleanup actions at the Site, including an RI, risk assessment, and feasibility study under Ecology's Voluntary Cleanup Program (VCP) (see MFA 2008 RI and RA in Appendix B; MFA 2011). Between 2013 and 2015, Ecology conducted additional environmental investigation of the Site, including an RI (Kennedy/Jenks, 2015). Based on its review of this work, Ecology issued VCP opinion letters in 2009, 2011, and 2015 (Ecology, 2009, 2011, 2015) requesting further action. Previous environmental investigation and cleanup activities at the Site are discussed in Section 2.5.1.

Pacific Industrial Supply was issued NPDES Permit No. WAR125474 on December 9, 2011. During compliance inspections conducted by Ecology and King County in 2008 and 2009, stormwater best management practices and corrective actions were identified, including cleaning and maintenance actions as well as repairing cracks and holes around a storm drain manhole (SAIC, 2013). After a follow-up inspection in 2011, Ecology determined that the facility complied with the corrective actions and that the potential for sediment recontamination to the LDW from Pacific Industrial Supply's current operations was low, provided that the improvements and source control best management practices were maintained (SAIC, 2013).

2.4. Physical Setting

The Property is relatively flat, aside from nearly vertical (approximately 90 percent) slopes along the northern and western perimeters extending up to 30 feet above Pacific Industrial Supply's operations (see Figure 2-3). The topography shows that the hillslope to the northwest was excavated to obtain a level surface for the Property. The land surface is almost entirely covered with impervious surfaces, including the building and asphalt paving, except for narrow, vegetated landscape strips on the north, west, and south sides of the Property. The steep cut slope on the north side is covered with a concrete facing to prevent soil erosion.

Stormwater at the Property generally runs off toward two catch basins located to the south and east (see Figure 2-3). There is minor pooling in low spots in the asphalt, but overland flow off the Property has not been observed. Both catch basins discharge through stormwater piping to a drainage ditch located to the south and east of the Property and running parallel to the adjoining State Route 99 ramp and Fourteenth Avenue S roadways. The catch basin to the east also collects stormwater from the former Kaspac/Chiyoda property. The drainage ditch receives runoff from both properties as well as adjacent properties to the west and east and the roadways (see MFA 2008 RI and RA in Appendix B). According to the 1990 Sweet-Edwards/EMCON report, stormwater in the drainage ditch discharges into a 24-inch-diameter stormwater drain and then is routed through a network of pipes until it discharges to the LDW (see Figure 1-1 and MFA 2008 RI and RA in Appendix B). This connection will be further evaluated in the RI. The Property is located approximately 1,800 feet west of the LDW.

Subsurface utilities present at the Property include a natural gas line along the eastern perimeter and a portion of the southern perimeter, and water and sanitary sewer service lines extending from S Director Street to the north, toward the building (see Figure 2-3). Historical utilities, including former sanitary sewer lines and drain and trench drains, have been disconnected and sealed (see MFA 2008 RI and RA in Appendix B; MFA, 2020).

Equipment, tanks, and vaults associated with Precision's operations (see Figure 2-2) have been removed and/or sealed, except for a former hydraulic cylinder test vault that remains outside the building, to the west (see Figure 2-3). The former evaporator pit was backfilled and sealed with concrete as part of a 2020 interim action to remove contaminated groundwater seepage in the pit; the seepage was identified as containing chromium at hazardous waste concentrations, as well as TCE at concentrations that posed a risk to indoor air (MFA, 2020b).

2.4.1. Geology

The Property, located in the Puget Sound Lowlands in an alluvial valley of the LDW, is bordered by nearly vertical embankments on its western and northern boundaries. Otherwise, it is relatively flat. The Property is situated on Pleistocene-age glacial deposits adhered to the south edge of a hillock, underlain by Tertiary sedimentary bedrock (Blakely Formation). A thin wedge of fill/recent alluvium is present beneath the eastern and southeastern half of the Property and thickens to the southeast towards the center of the LDW river valley. According to the Geologic Map of Seattle, the Property and vicinity are underlain by Quaternary Vashon recessional outwash deposits consisting of "stratified sand and gravel, moderately sorted to well sorted, and less common silty sand and silt" and Quaternary alluvium consisting of "sand, silt, gravel, and cobbles deposited by streams and running water" (Troost et al., 2005). Quaternary Vashon recessional outwash thicknesses typically range from about 3 to 20 feet; Quaternary alluvium ranges from a few feet to 100 feet thick.

Based on observations of soil from borings advanced on the Property during previous investigations, subsurface geologic deposits dip toward the east (see previous geologic boring logs and cross sections prepared by Sweet Edwards/EMCON [1990] and Kennedy/Jenks [2015] included as Appendix C). Note that the 2015 Kennedy/Jenks A to A' cross section, oriented east/west and located south of the building, identifies the soil type beneath the building as well graded gravel with silt (GM-GW), which is typically used for glacial till – a mixture of silts, sands, and gravels. The 1990 Sweet-Edwards cross section appears to depict the soil type more accurately, identifying the soil type beneath the building as alluvial deposits—silts and sands.

Geology at the Site generally consists of the following units (see MFA 2008 RI and RA in Appendix B; Kennedy/Jenks, 2015):

- **Surficial unit** with anthropogenic fill and alluvium and outwash deposits. This unit exists on the east side of the property. To the west, it appears to pinch out near the middle of the building.
  - Localized anthropogenic fill, including aggregate paving base materials, from 2 feet thick up to 10 feet thick in the eastern portion of the Property.[1]
  - Native alluvial and recessional outwash deposits consisting of silty sands and sandy silts with gravel and lenses of silt, clay, and organic materials (woody debris and peat) from the surface to a depth of approximately 20 feet in the eastern portion of the Property. The lenses are generally less than 1 foot thick, but up to 2 feet in some locations.
- A distinct **sand and silt** unit with shell fragments, associated with and underlying the native alluvium, that is up to 10 feet thick in the eastern portion of the Property and extends beyond the neighboring former Kaspac/Chiyoda property to the east. To the west, this unit also appears to pinch out near the middle of the building.
- **Glacial till unit** consisting of gravelly, sandy silt from the surface to approximately 20 feet below ground surface (bgs) in the western portion of the Property and from 20 feet to 40 feet bgs in the eastern portion of the Property.
- **Advance glacial outwash unit** consisting of sand and gravel starting around 30 to 40 feet bgs.

The maximum depth of exploration at the Property was approximately 50 feet bgs (Kennedy/Jenks, 2015). Bedrock was not encountered in previous borings.

2.4.2. Hydrogeology

Based on previous borings and cross-sections, two water-bearing zones (WBZs) are present beneath the Property: a shallow WBZ in the surficial unit and sand and silt unit beneath the east side of the Property and a deep WBZ in the advance glacial outwash unit beneath the entire Property (see MFA 2008 RI and RA in Appendix B; Kennedy/Jenks, 2015;). The deep WBZ has also been referred to as the "advance outwash WBZ" (Precision, 1993). The shallow WBZ is present in the east portion of the Property from approximately 5 feet bgs to 20 feet bgs, and pinches out near the center of the Property, beneath the building. The deep WBZ is present at approximately 30 feet bgs in the west portion of the Property and at approximately 40 feet bgs in the east portion of the Property. The deep WBZ is hydraulically separated from the shallow WBZ by the glacial till unit (see MFA 2008 RI and RA in Appendix B). Although the shallow WBZ observed at the Site appears confined, the alluvial aquifer with which it is associated may include both confined and unconfined conditions (USGS, 1995). Perched saturated zones have also been observed in coarse interbeds which are presumably present within the surficial alluvium/outwash deposits and within the glacial till unit (Kennedy/Jenks, 2015).

[1] The fill material is thin over most of the Property because much of the Site was cut, or excavated, rather than filled during grading for development. Due to the scale of the cross sections, the thin nature of the fill, and the relative similarity between the fill and the native alluvial and recessional outwash materials underlying it, the cross-sections presented in Appendix B includes the fill as part of the surficial unit.

During the four most recent quarterly groundwater-monitoring events, conducted in 2019 and 2020, water levels in monitoring wells completed in the shallow and deep WBZs were encountered between 0.75 and 6.29 feet bgs, and 0.31 and 6.55 feet bgs, respectively (see Table 2-1). The shallow water levels may reflect confined conditions in the shallow and deep WBZs. Artesian conditions have been encountered in deep WBZ monitoring well MW1 (see MFA 2008 RI and RA in Appendix B). The potentiometric surfaces of the shallow and deep WBZs appear to reflect confined conditions, previous borings logs indicate that saturated conditions were generally first encountered deeper, between approximately 7 and 14 feet bgs (see MFA 2008 RI and RA in Appendix B). Potentiometric surface contour maps from the four most recent groundwater-monitoring events show that the shallow and deep WBZs generally flow from west to east, with a component of flow to the south (see Appendix D). The hydraulic gradient of the shallow WBZ downgradient of the Property was calculated to be 0.003, using site groundwater-elevation data collected from MW6 (located at the Property boundary) on April 17, 2006 (see MFA 2008 RI and RA in Appendix B), and an average daily staff gauge elevation for the LDW on the same day (USGS, 2007).

The Site-specific hydrogeology described above is generally consistent with that described for the central Duwamish Valley in the shallow groundwater use designation report prepared by the Duwamish Coalition (Duwamish Coalition, 1998).

2.5. Previous Environmental Investigation and Cleanup

Previous environmental investigation and cleanup activities at the Site and the adjacent former Kaspac/Chiyoda property are discussed below.

2.5.1. Precision

Extensive site characterization and cleanup actions have been conducted at the Site since 1986. Activities were generally performed in association with regulatory involvement (see Section 2.3):

- Investigation and corrective actions were conducted between 1986 and 1990 in response to Ecology enforcement actions (see Sections 2.3 and 2.5.1.1).
- Investigation and cleanup in 1993 were conducted as independent actions (see Sections 2.3 and 2.5.1.1).
- Investigation and cleanup between 2005 and 2015 were conducted under Ecology's VCP (see Sections 2.3 and 2.5.1.1).
- Investigation and cleanup between 2019 and 2020 were conducted as independent actions in anticipation of entering the AO (see Sections 1.1 and 2.5.1.2).
- Ongoing vapor monitoring initiated in December 2020 is being conducted in accordance with the AO (see Section 2.5.1.2.2).

2.5.1.1. 1986 to 2015

Investigation and cleanup activities conducted between 1986 and 2015 are described in detail in previous reports (Kennedy/Jenks, 2015; MFA, 2005, 2008, 2011; SAIC, 2013) and are summarized in a table excerpted from the Kennedy/Jenks RI report (2015) included in Appendix A.

Previous cleanup actions conducted at the Site include the following:

- 1990 removal of former plating tanks 1 and 2, the tank containment vaults, and approximately 114 cubic yards of contaminated concrete and soil around the tanks with chromium concentrations at or above 80 milligrams per kilogram (mg/kg) to a maximum depth of 13 feet bgs (Precision, 1993)
- 1993 removal of former plating tanks 3 through 6, the tank containment vaults, a 35- by-40-foot section of concrete flooring from below the tanks, and soil visibly contaminated with chromium to a maximum depth of 28 inches bgs (Precision, 1993)
- 2007 and 2008 removal of approximately 100 cubic yards of soil with arsenic and lead concentrations above MTCA Method A unrestricted land use cleanup levels (CULs) from the drainage ditch south of the Property (see MFA 2008 RI and RA in Appendix B)

Previous investigation locations and excavation boundaries are shown on Figure 2-4.

Contamination was left in place following the cleanup actions described above; this included hexavalent chromium in soil in the 1990 and 1993 excavations at concentrations of up to 73 mg/kg and 7,470 mg/kg, respectively (Kennedy/Jenks, 2015), and an approximately 2-yard area of soil in the drainage ditch with lead and arsenic concentrations of up to 1,020 mg/kg and 37 mg/kg, respectively (above MTCA Method A unrestricted land use CULs) (see MFA 2008 RI and RA in Appendix B).

2.5.1.2. 2019 to 2021

2.5.1.2.1 Groundwater Monitoring

Four quarters of groundwater monitoring were conducted at the Site between July 2019 and April 2020, including monitoring wells MW1 through MW11 (see Figure 2-4). Water level measurements are summarized in Table 2-1. Potentiometric surface contour maps for the shallow and deep WBZs are included as Appendix D. Analytical results are included in this plan (see Section 6).

Laboratory analytical reports are provided in Appendix E. Analytical data and the laboratory's internal quality assurance and quality control data were reviewed to assess whether they met data quality objectives, consistent with EPA procedures for evaluating laboratory analytical data (EPA, 2017a,b). Memoranda summarizing data validation procedures, data usability, and deviations from specific field and/or laboratory methods are also provided in Appendix E. All analytical results were deemed acceptable, with assigned qualifiers, for their intended use.

Following the groundwater-monitoring events, analytical results were compared to MTCA Method A CULs and MTCA Method B standard table values for chemicals with no Method A CUL. Chemicals with CUL exceedances are shown by location on the potentiometric surface contour maps (see Appendix D). Results were compared with previous quarterly groundwater monitoring results from August 2014 to April 2015 (Kennedy/Jenks, 2015), and it was determined that groundwater flow conditions and chemical concentrations were consistent with previous observations and exhibited no increasing trends. Therefore, additional quarterly groundwater monitoring was suspended, but may resume following completion of the data-collection activities proposed in this plan.

2.5.1.2.2 Vapor Assessments and Interim Remedial Actions

Following Ecology's adoption of new indoor air TCE action limits for protection of a fetus during early stages of development, as outlined in Ecology's Implementation Memorandum No. 22 (Ecology, 2019a), Ecology requested that a vapor assessment be conducted to determine if TCE in indoor air at the Property exceeded the new action limits (Ecology, 2019b). MFA conducted a preliminary site visit on November 20, 2019, to

identify potential occupational TCE sources (none were identified) and to assess conditions relevant to the potential for vapor intrusion (MFA, 2019). Following the site visit, MFA conducted an initial vapor assessment, including sub-slab soil gas and 24-hour indoor and ambient (i.e., outdoor) air sampling, on February 1 and 2, 2020 (MFA, 2020b). The investigation results indicated that TCE was present in indoor air above the new, workplace scenario short-term action limit and that sub-slab soil gas was the primary source of TCE in indoor air via vapor intrusion, primarily through cracks in the concrete building slab. Based on those results, MFA installed air purifiers equipped with carbon filters as an immediate mitigation measure and conducted additional passive indoor air and eight-hour indoor air sampling to further characterize the potential exposure risk of TCE inside the building. MFA also collected a sample of groundwater seepage from the former evaporator pit (MFA, 2020b). The former evaporator pit is shown on Figure 2-2.

Investigation results confirmed that TCE exceeded the short-term action limit during normal working conditions and that groundwater seepage in the former evaporator pit may also have been contributing to TCE in indoor air. Water in the pit also contained chromium at hazardous waste concentrations. Based on those results, MFA conducted interim remedial actions to decommission, backfill, and seal the former evaporator pit; and to seal cracks and joints in the concrete slab. Post-interim-remedial-action indoor air sampling confirmed that TCE concentrations had been reduced to below the short-term action limit but remained above MTCA Method B indoor air CULs.

Based on the effectiveness of the interim actions, air purification was terminated, but the potential remains for new cracks to form in the concrete slab and/or for degradation of the crack seals, allowing vapor intrusion to increase in the building (MFA, 2020b). To address those concerns, air monitoring and slab inspections are being conducted on a quarterly basis in accordance with an Ecology-approved vapor intrusion priority (VIP) work plan, an AO deliverable that was included in MFA's 2020 vapor report (MFA, 2020b). Results from the first quarterly VIP monitoring and slab inspection event completed in December 2020 and January 2021 indicate that TCE concentrations in indoor air remain below the short-term action limit and above MTCA Method B indoor air CULs (MFA, 2021). Quarterly VIP monitoring will continue until cleanup of the sub-slab soil gas source has been completed.

2.5.2. Former Kaspac/Chiyoda Property

Petroleum hydrocarbon, solvent, and metals contamination have been documented in soil and groundwater at the former Kaspac/Chiyoda property. Historical operations on that property were identified as the contamination source. Primary contaminants include gasoline-, diesel-, and oil-range hydrocarbons; benzene, toluene, ethylbenzene, and xylene (BTEX); arsenic, cadmium, chromium, copper, lead, silver, and zinc; and tetrachloroethene and TCE (SAIC, 2013).

Appendix F includes a figure showing previous sample locations and excavation boundaries on the former Kaspac/Chiyoda property, as well as tables summarizing soil and groundwater analytical results, excerpted from the Kennedy/Jenks RI (2015).

The following contamination sources were identified at the former Kaspac/Chiyoda property (Kennedy/Jenks, 2015; SAIC, 2013) (see Figure 8 included in Appendix F):

- An 8,000-gallon, leaded gasoline, leaking underground storage tank (LUST)
- Soil to the west of Building 1, contaminated with paint from improper disposal of waste paint

- Surface spills and/or leaks of oil, gas, diesel, and hydraulic fluid on the southwestern corner of the property and near a former loading dock

Several independent cleanup actions were completed between 1989 and 1997, including decommissioning, via removal, of the former LUST; excavation of petroleum-contaminated soil associated with the LUST and near the loading dock; excavation of paint-stained soils; and groundwater treatment via pumping and discharge to the sanitary sewer (Kennedy/Jenks, 2015; SAIC, 2013).

In 1997, following completion of the remedial actions, quarterly groundwater monitoring was conducted (SAIC, 2013). Based on the 1997 groundwater monitoring results and previous independent cleanup actions, Ecology issued a VCP No Further Action (NFA) determination for the site in 1998. Petroleum and BTEX constituents at concentrations below MTCA Method A CULs remain in soil and groundwater on the south portion of the property and in soil in the central portion of the property, near the former UST area (SAIC, 2013) (see Appendix F). Additionally, arsenic is widespread in groundwater across the property. Before 1960, the property was undeveloped and used for agriculture and the storage of agricultural equipment (SAIC, 2013). Since historical documentation of agricultural activities was not available for review, it is unknown if arsenic-containing agricultural chemicals (e.g., lead arsenate pesticides) were used on the property. From the 1890s to 1988, when they were banned by EPA, lead arsenate pesticides were generally used to control row-crop pests.

3.0 SITE CHARACTERIZATION

This section discusses known and suspected areas of contamination at the Site, based on identified features of interest associated with Precision's historical operations, areas of contamination identified during previous sampling activities, and the nature and extent of COIs. As discussed in this section and Section 8, data gaps remain, and these will be addressed by the sampling proposed in Section 9 of this plan.

3.1. Features of Interest

Features of interest are activities, conveyances, and physical features (e.g., equipment, tanks, and vaults), associated with Precisions former operations, that may have resulted in a release of hazardous substances to environmental media at the Site. Several features of interest have been identified as known sources of contamination at the Site. Historical features of interest are shown on Figure 2-2 and are summarized in Table 1 from Kennedy/Jenks' 2015 RI report (see Appendix A). Detailed descriptions of previous tanks and tank details, materials used in Precisions' operations, Precision's waste-handling practices, and corrective actions identified during regulatory inspections conducted during and immediately after Precision's operations are provided in previous reports (see MFA 2008 RI and RA in Appendix B; Kennedy/Jenks, 2015; SAIC, 2013).

Equipment, tanks, and vaults associated with Precision's operations (see Figure 2-2) have been removed and/or sealed, except for a former hydraulic cylinder test vault that remains outside the building, to the west (see Figure 2-3). Chromium-contaminated soil and concrete associated with former plating tanks 1 through 6 were removed as part of cleanup actions conducted in 1990 and 1993, but contamination in these areas was left in place (see Section 2.5.1).

Previous environmental investigations have identified soil, groundwater, and vapor contamination in association with Precision's historical operations (see Section 2.5.1). In general, previous sampling was conducted to assess the following conditions or features of interest (see Figures 2-2 and 2-4 and Section 2.5.1):

- Soil and groundwater contamination associated with Precision's former chrome-plating operations in and hydraulically downgradient of former plating areas (the area where chromic-acid-plating tanks 1 through 6 were once located; and the temporary plating area, including former chromic-acid-plating tank 7 [see Figure 2-2])
- Soil, groundwater, soil gas, and air contamination associated with former solvent use and storage throughout the building, but also specifically in the former cylinder shop and TCE tank and steam clean pit locations (see Figure 2-2)
- Petroleum hydrocarbon contamination in soil and groundwater, primarily along the eastern Property boundary
- Characterization of Site geology and hydrogeology
- Chemicals associated with historical Precision operations in soil and groundwater in off-Property, hydraulically downgradient locations to the east and southeast

Investigation and cleanup activities conducted in the drainage ditch to the south of the Property are discussed in the next section.

Features of interest on the Property that have not been adequately characterized but that are suspected sources of contamination include the following (features are described in detail in a table in Appendix A, shown on Figure 2-2, and previous sample locations are shown on Figure 2-4):

- The hydraulic cylinder test vault and nearby groundwater seepage through joints in the concrete building slab.
- Steam cleaning and solid and hazardous waste storage activities in the hazardous waste containment area, including the former steam clean pit, waste-oil tank, and sodium hydroxide tanks.
- A former cooling-water tank, chromic acid evaporator, chromic acid purification unit, chromic acid waste storage, and aboveground chromic acid holding tank in the scrubber room (the former evaporator pit is in this room).
- A potential abandoned heating-oil UST in the former boiler room.
- The drainage ditch to the south of the building which receives surface water runoff (see Section 3.2, below).
- Former sanitary sewer lines beneath building that previously connected to trench drains, catch basins, and other parts of the operations area and could serve as preferential pathways for transport of groundwater or vapors.

Data gaps associated with these features of interest are discussed in Section 8.

Known or suspected chemicals associated with the historical Precision operations discussed above include volatile organic compounds (VOCs), chlorinated VOCs (CVOCs), semivolatile organic compounds (SVOCs),

metals (primarily chromium), petroleum hydrocarbons, and polychlorinated biphenyls (PCBs). Those chemicals were reviewed for selection as Site COIs (see Section 3.4).

3.2. Drainage Ditch

The drainage ditch is south and east of the Property (see Figure 2-3). Contamination attributed to the Site has been identified in both the south and east portions of the ditch (see MFA 2008 RI and RA in Appendix B; Kennedy/Jenks, 2015). The south part of the ditch receives stormwater runoff from the Property (see Section 2.4), and chemicals associated with Precision's historical operations were identified in soil in the ditch during previous environmental investigations (see Section 2.5.1). Soil contaminated with lead and arsenic was excavated from the southern part of the ditch in 2007 and 2008; however, an approximately 2-yard area of contamination, including soil with detections of metals (lead, arsenic, chromium, hexavalent chromium, copper, mercury, nickel, and zinc), PAHs (benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene) and petroleum hydrocarbons (DRO, GRO, and ORO), was left in place (see Section 2.5.1). Off-Property investigation activities conducted as part of Kennedy/Jenks' 2015 RI identified Site chemicals associated with Precision's historical operations in soil and groundwater adjacent to the portion of the ditch east of the Property (Kennedy/Jenks, 2015).

The portion of the ditch to the south of the Property receives stormwater runoff from the Property and the former Kaspac/Chiyoda property via stormwater catch basins, stormwater piping, and an outfall to the ditch located on the Property's southern border (see MFA 2008 RI and RA in Appendix B) (see Figure 2-3). Portions of the ditch to the south and east of the Property likely receive stormwater runoff via overland flow from the Property, the former Kaspac/Chiyoda property, 14th Street South, and the US-99 northbound entrance; and may receive discharges of groundwater from the shallow WBZ impacted with chemicals associated with Precision's historical operations. Potential sources and mechanisms for soil and groundwater contamination at the Site to contribute to contamination in the ditch are not well understood and are considered data gaps, as discussed in Section 8.

3.3. Former Kaspac/Chiyoda Property

COIs for the former Kaspac/Chiyoda property include chemicals that are also associated with Precision's historical operations (i.e., petroleum hydrocarbons, metals, BTEX [VOCs], and CVOCs). Contamination at the former Kaspac/Chiyoda property was cleaned up and received an NFA in 1997; however, some contamination remains (see Section 2.5.2). The potential exists for commingling of contamination between the sites, primarily petroleum hydrocarbon contamination in shallow groundwater along the eastern Property boundary. The nature and extent of Site contamination on the Property has not been fully characterized; therefore, the potential for commingled contamination between the sites is considered a data gap, as discussed in Section 8.

3.4. Contaminants of Interest

COIs were selected for the Site based on previous investigation results. Analytical results from investigations conducted between 2005 and 2021 are summarized by media and screened against PCULs in Tables 3-1 to 3-6. For details on screening level development and the data screening process, refer to Sections 5 and 6, respectively. Previous investigation locations are shown on Figure 2-4.

Note that soil samples from the drainage ditch south of the Property from areas that were excavated as part of the drainage ditch excavations conducted in 2007 and 2008 are not included in Table 3-3 or Figure

2-4 (includes samples from locations HA3, HA4, HA5, and HA22) (see MFA 2008 RI and RA in Appendix B for data associated with those sample locations), but are provided in Appendix B. Those samples are no longer considered representative of Site conditions, as the soil no longer remains and the primary source of contamination to that soil associated with the Site (discharge of stormwater including surface runoff potentially contaminated with process and waste chemicals associated with Precision's former operations) was removed when Precision ceased operations. Samples collected on the former Kaspac/Chiyoda property are also excluded from Tables 3-1 through 3-6 but are provided in Appendix F. Other samples collected from the drainage-ditch and off-Property areas to the west are included in Tables 3-1 through 3-6.

The analytical results compiled in Tables 3-1 through 3-6 were used to select COIs for the Site. Any chemical associated with historical operations at the Property that was analyzed and detected at least once in any media was selected as a COI. Chemicals that have not been detected but that were identified as data gaps as part of the PCOPC selection process (i.e., based on frequency of reporting limits exceeding PCULs; see Section 7) were also selected as COIs. A full list of chemicals analyzed during previous investigations and the subset of those chemicals that were selected as COIs are provided in Table 3-7. Additionally, Ecology has requested supplemental analysis for non-PAH SVOCs and PCBs at select shallow soil and groundwater locations during the RI (see Section 9.1).

Each analyte was assigned to one of the following analyte groups: VOCs, SVOCs that are polycyclic aromatic hydrocarbons (PAHs) (SVOCS—PAHs), other SVOCs (SVOCs—Other), metals, petroleum hydrocarbons, and PCBs (see Table 3-7). Of those analyte groups, only PCBs did not include any COIs.

Figures 3-1 through 3-8 show the spatial distribution of detections and PCUL exceedances by analyte group and media for air and soil gas, soil, and groundwater. Each figure shows which locations were sampled for the media and analyte group of interest. If a location was sampled and analyzed for the media specified and included at least one analyte in the analyte group of interest, one of the following results is displayed around that location (see Figure 3-1 and 3-8):

- At least one analyte in the analyte group was detected at a concentration above its PCUL (yellow results)
- At least one analyte in the analyte group was detected, but all detected concentrations were below PCULs (orange results)
- No analytes in the analyte group were detected, but the reporting limit concentration for at least one non-detect result was above a PCUL (green results)
- No analytes in the analyte group were detected and all reporting limit concentrations were below PCULs (blue results)
- Not one analyte in the analyte group was analyzed (i.e., not sampled) (gray results)

Note that the results are divided into the following sample depth categories for comparison to PCULs (see Section 5.2):

- Vadose soil—soil at or less than 5 feet bgs
- Saturated soil—soil deeper than 5 feet bgs
- Shallow groundwater—groundwater in the shallow WBZ

- Deep groundwater—groundwater in the deep WBZ
- Sub-slab soil gas
- Air

Media were separated into the above categories based on the preliminary CSM (see Section 4). Groundwater categories correspond to the hydrogeologic units present beneath the Site that are hydraulically separated by a layer of low-permeability glacial till (see Section2.4.2). Groundwater present at depths less than approximately 20 feet bgs and deeper than approximately 20 feet bgs are in the shallow and deep WBZs, respectively. Soil was characterized as vadose or saturated based on the average water table depth observed during drilling, as recorded on boring logs (Kennedy/Jenks, 2015).

Saturated soil was further divided into two categories: above and below 20 feet bgs, which corresponds with the approximate bottom depth of the shallow WBZ (see Section 2.4.1). Note that although previous cross sections (see Appendix C) infer that WBZ depths vary across the Site, based on an observed westward dipping of geologic units (see Section 2.4.1), WBZ depths were consistent in previous boring and monitoring wells located primarily on the eastern portion of the Site. Soil and groundwater depth categories may have to be revisited after additional data collection if observations indicate that depth variations are present as inferred in the cross sections.

The spatial distribution of results for analyte groups by media indicates that the following data gaps exist for COIs in all analyte groups, except PCBs, in soil and groundwater (see Figures 3-3 through 3-8) (MFA, 2020a):

- The nature and extent of COIs that were analyzed at reporting limits exceeding PCULs
- The horizontal and vertical extent of PCUL exceedances

The current characterization of air and soil gas contamination is considered sufficient, based on our current understanding of potential soil and groundwater vapor sources. Ongoing quarterly passive air monitoring is being conducted to evaluate continued effectiveness of the vapor interim action described in Section 2.4. Note that indoor air sampling results through January 7, 2021 are provided in Table 3-1, but results through only June 5, 2020 are included in Figure 3-1. The potential need for further characterization of COIs in air and soil gas will be revisited following additional collection of soil and groundwater data.

3.5. Arsenic

Arsenic has been detected in soil and groundwater throughout the Site (see Figure 3-9).

The groundwater arsenic data presented in Figure 3-9 include results from both filtered (i.e., dissolved fraction) and unfiltered (i.e., total fraction) samples from developed monitoring wells and undeveloped temporary borings (i.e., reconnaissance groundwater borings). Whereas these results may be useful for identifying potential areas of interest for future assessment, data collected with these different sample collection methods are not directly comparable. Therefore, it is difficult to discern concentration trends with the current data set. Data from similar sample collection methods and hydrogeologic conditions (e.g., filtered results from developed monitoring wells completed in the shallow WBZ) are too sparse to draw definitive conclusions.

The highest soil arsenic concentration was detected in the off-Property ditch to the southeast of the Property, in sample SS3 at 37 mg/kg (see Figure 3-9). Sources other than Precision's historical operations may have contributed arsenic to soil in the ditch (e.g., overland flow from adjacent roadways and properties and/or stormwater discharges from possible former agricultural operations on the former Kaspac/Chiyoda property, as mentioned in Section 2.5.2). Arsenic in soil on the Property was detected at a maximum concentration of 11.3 mg/kg, compared to the PCUL of 7.3 mg/kg.

Arsenic in groundwater at the Property was detected at a maximum total fraction concentration of 300 micrograms per liter (µg/L) from reconnaissance boring (SB5) at 13.5 feet bgs (see Figure 3-9). The maximum total fraction arsenic concentration detected in an off-Property reconnaissance boring was 210 µg/L at 34.5 feet bgs from boring SB18, located to the southeast of the Property. Maximum dissolved fraction groundwater concentrations were detected between 42.8 and 48.7 µg/L from a monitoring well (MW6) in the shallow WBZ from the four most recent groundwater-monitoring events (July 2019 to April 2020), compared to the PCUL of 8 µg/L. No off-Property monitoring wells exist for direct comparison to the arsenic concentrations observed in monitoring well MW8. The difference in the dissolved and total fraction groundwater results suggest that suspended sediment may be contributing to higher arsenic concentrations observed in groundwater samples from reconnaissance borings.

There are no known or suspected sources of arsenic at the Site associated with Precision's historical operations; however, the magnitude of arsenic concentrations in groundwater suggests an anthropogenic source. Site-wide collection of both filtered and unfiltered groundwater samples from developed wells and geochemical indicators from key locations is needed to better understand arsenic trends and potential sources. If higher arsenic concentrations are associated solely with naturally reducing conditions, arsenic should not be selected as a COPC in ground water. If higher arsenic concentrations are associated with petroleum contamination, arsenic should be identified as a COPC; although, in that case, the remedial solution to address arsenic will likely be cleanup of the petroleum source. If higher arsenic concentrations are not associated with either naturally reducing conditions or petroleum, additional evaluation will be needed to understand the source.

The nature and extent of arsenic in soil and groundwater on the Property for the purposes of identifying potential sources, including on- or off-Property, areawide, and natural background sources, is considered a data gap, as discussed in Section 8. Further, we will also review historical aerial photographs for the Property as part of the RI to identify and look for potential historical activities prior to Precision operations (e.g., agricultural uses) that may have contributed to arsenic concentrations on the Property.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

A CSM describes potential chemical sources, release mechanisms, environmental transport processes, exposure routes, and receptors. The primary purpose of the CSM is to describe pathways by which human and ecological receptors could be exposed to site-related chemicals. A complete exposure pathway consists of four necessary elements: (1) a source and mechanism of chemical release to the environment, (2) an environmental transport medium for a released chemical, (3) a point of potential contact with the impacted medium (referred to as the exposure point), and (4) an exposure route (e.g., dust inhalation) at the exposure point. A preliminary CSM for the Site, based on our current understanding of physical conditions, historical operations, and previous investigation results (see Sections 2 and 3), is described below and is illustrated

in Figure 4-1. Environmental transport and exposure pathways were evaluated based on the preliminary CSM, as discussed below.

4.1. Primary Sources and Release Mechanisms

Potential sources of contamination associated with historical operations at the Site were identified during previous environmental investigations (see Sections 2.5.1 and 3.1). Based on previous investigations and documented historical uses and activities (see MFA 2008 RI and RA in Appendix B; Kennedy/Jenks 2015; SAIC 2013), it appears that leaks and spills of process chemicals, fuels, solvents, and wastes associated with former Precision operations and with the following former features and activities may have contributed to contamination at the Site (see Figure 2-2 for historical site features and Figure 2-3 for current site features):

- Tanks and vaults associated with chrome-plating activities, including plating tanks and plating tank vaults; caustics, acids, and wastewater tanks; and evaporator tanks and vaults (see Figure 2-2).
- Solvent use and storage associated with parts-cleaning and -degreasing activities, including a steam cleaning pit and a TCE tank in the chrome-plating/ steam cleaning area (see Figure 2-2), an oil/water separator that received steam cleaning liquids, and a degreaser system in the cylinder shop.
- Solid and hazardous waste storage, including a solid waste dumpster and waste-oil tank (see Figure 2-2).
- Leaks of hydraulic oil associated with general equipment use.
- Grinding and machining of metal parts.
- Hydraulic cylinder test vault (see Figure 2-2).
- Possible abandoned-in-place UST(s) in the former boiler room (see Figure 2-2).

These potential sources may have released contamination to the soil, groundwater, indoor air, and ambient air via direct releases to surface and subsurface soil or groundwater; or via leaks or discharges from sumps, vaults, trenches, and drainage features.

4.2. Fate and Transport Processes

The primary mechanisms with the potential to influence the fate and transport of chemicals at the Site include natural biodegradation, sorption to soil, advection and dispersion in groundwater, vertical groundwater transport from shallow to deep WBZs, volatilization of chemicals from soil or groundwater to indoor and ambient air, leaching of chemicals from soil to groundwater, stormwater entrainment and discharge to the drainage ditch, infiltration of chemicals in soil or groundwater into stormwater features (e.g., stormwater pipes and vaults) and discharge to the drainage ditch, and discharge of groundwater to the drainage ditch. It is unknown whether all these processes are currently complete or have the potential to be complete in the future. Additional sampling is proposed to address those unknown pathways, which are discussed further in Section 8.1. The relative importance of these processes varies, depending on the chemical and physical properties of the released contaminant. The properties of soil and the dynamics of groundwater flow also affect contaminant fate and transport.

Contaminant releases to the surface or subsurface have the potential to migrate vertically downward to the water table, resulting in impacts to shallow soil and dissolved-phase impacts to groundwater in the shallow

WBZ beneath the Site. Volatile contaminants in surface and subsurface soil and/or groundwater may also partition to the vapor phase, resulting in impacts to indoor or ambient air quality.

Dissolved-phase contamination has the potential to migrate via groundwater flow, potentially resulting in downgradient groundwater, surface water, and/or sediment impacts via discharge to the drainage ditch, and subsequent stormwater transport and discharge to the LDW. Fish intake of contaminated surface water or sediment in the LDW could result in the bioaccumulation of contaminants in fish tissue. Previous groundwater contaminant transport modeling results indicate that the off-Property extent of Site groundwater impacts will not reach the LDW directly (see Appendix B). Ecology accepted the previous modeling work as a reasonable indicator that Site groundwater would not directly discharge to the LDW but noted that the conclusions must be supported with data (Ecology, 2009). The groundwater model will be re-evaluated by incorporating more recent groundwater data and updating screening levels.

The potential exists for off-Property dissolved-phase Site contamination to commingle with contamination from the former Kaspac/Chiyoda site or other sources. Contamination has the potential to discharge to the drainage ditch and subsequently migrate to the LDW. Those conditions will be reassessed following further characterization of the nature and extent of Site COIs, as proposed in this plan, and refinement of the CSM.

Groundwater redox conditions and pH can influence the solubility and mobility of arsenic. Under reducing conditions, arsenic mobility and total arsenic concentrations in groundwater can increase. Naturally occurring arsenic may be mobilized by reducing conditions, and biodegradation of organic carbon compounds can contribute to these conditions (American Petroleum Institute [API], 2011). Anthropogenic sources of organic carbon at the Site include petroleum hydrocarbon, VOC, and SVOC contamination in soil and groundwater.

The Property is almost entirely covered with impervious surfaces, with the exception of a vegetated strip that runs east/west along the southern border of the Property, north of the State Route 99 on-ramp (see Section 2.4) therefore, stormwater runoff and discharge and wind entrainment and transport of surface soil are not currently complete environmental transport pathways for contamination associated with former Precision operations, but they would be complete in the future if the impervious surfaces were removed.

Potential mechanisms for transport of Site contamination to the portion of the ditch to the south of the Property include groundwater transport and discharge; soil or groundwater infiltration into stormwater pipes or vaults through cracks, followed by discharge through the outfall to the south of the Property (see Figure 2-3); or erosion and stormwater entrainment of contaminated shallow soil along the embankments of the ditch to the south. The only potential mechanism identified for Site contamination to be transported to the portion of the ditch located to the east of the Property is via groundwater transport and discharge. Historical stormwater runoff to the ditch during Precision's operations may have contributed contamination to the ditch. Historical stormwater discharges to the ditch will be considered as part of future off-Property investigation efforts.

4.3. Potential Exposure Scenarios

Depending on the extent of impacts at the Site, the following are potentially complete current or future exposure pathways:

- Incidental ingestion of and dermal contact with chemicals in soil

- Ingestion of and dermal contact with chemicals in groundwater
- Inhalation of airborne particles generated from soil
- Inhalation of indoor air vapors emanating from soil and/or groundwater via vapor intrusion into the building

The following pathways are considered unknown based on inadequate data:

- Incidental ingestion of and dermal contact with chemicals in surface water and/or sediment
- Consumption of aquatic organisms that have bioaccumulated chemicals in their tissues

These potential exposure pathways will be evaluated further upon completion of the Site characterization.

4.4. Potential Receptors

The following current and future human and ecological receptors may potentially be exposed to chemicals originating from the Site:

- Occupational workers at industrial and commercial businesses located within the Site boundaries
- Residents of residential areas within the Site boundaries
- General public (including visitors to residences and/or industrial and commercial businesses located within the Site boundaries, people accessing the drainage ditch, and recreational fishers in the LDW)
- Construction and trench workers working within the Site boundaries
- Terrestrial and aquatic biota in the LDW

4.5. Terrestrial Ecological Evaluation

The terrestrial ecological evaluation (TEE) process is required at all MTCA sites where there has been a release or a threatened release of a hazardous substance that may pose a threat to the terrestrial environment. The TEE procedure is structured with the intent of protecting terrestrial wildlife at industrial and commercial sites and protecting terrestrial plants, soil biota, and terrestrial wildlife at other sites, as provided under WAC 173-340-7490(3)(b). A simplified TEE was conducted for the Site to present sufficient information to evaluate the ecological protectiveness of current and future conditions at the Site (see WAC 173-340-7490[1][b]). Note that the TEE discussed in this section applies to Site conditions on or near the Property and does not consider potential ecological exposure in the LDW. Potential environmental transport pathways and exposure routes for ecological receptors in the LDW are discussed in the next section.

The Site does not meet the TEE exclusionary criteria; however, the Site qualifies for a simplified TEE because the site-specific TEE criteria outlined in WAC 173-340-7491(a) do not apply. MFA completed MTCA Table 749-1 to determine that land use at the Site and in the surrounding area makes substantial wildlife exposure unlikely (WAC 173-340-7492; see Appendix G). Based on MTCA Table 749-1, the Site is unlikely to pose a threat to ecological receptors and the TEE evaluation may be ended. The simplified TEE findings are consistent with the simplified TEE conducted during the 2008 MFA RI (see MFA 2008 RI and RA in Appendix B).

4.6. LDW Environmental Transport and Exposure Pathways

As part of the RI, Ecology is requiring an evaluation of potentially complete environmental transport and exposure pathways to the surface water, including the LDW, and screening of Site data to PCULs developed for the LDW (MFA, 2020a).

Environmental transport and exposure pathways to the LDW are summarized in Ecology's LDW PCUL workbook supplemental information document (Ecology, 2020b). MFA reviewed each of the LDW transport pathways provided in that document and made a determination of whether the pathway was currently complete, potentially complete in the future, incomplete, or unknown based on a lack of information. These determinations were made based on the preliminary CSM, as discussed above. LDW transport pathways and MFA's determination for each are summarized in Table 4-1.

Where significant data gaps exist, environmental transport pathways were identified as "unknown." Unknown pathways are considered data gaps and will be evaluated further as proposed in this plan (see Section 9).

At this time, the only pathway considered incomplete—both on- and off-Property, currently and under potential future conditions—is the Site-specific TEE pathway for unrestricted land use (LDW PCUL SL-9) (see Table 4-1). This determination was made based on the simplified TEE results discussed in the previous section.

Pending further evaluation of potential exposure pathways for the LDW, Ecology is requiring that Site COIs be screened to PCULs developed for the LDW. PCUL development and screening are discussed in Sections 5 and 6.

In addition to the pathways that involve the LDW, the LDW screening criteria include a deep soil gas for protection of indoor air pathway (LDW PCUL SG-2) that is considered unknown for the Site, based on the preliminary CSM. The potential exists for volatile contaminants in soil and/or groundwater deeper than 15 feet bgs to volatilize and accumulate in unsaturated zones below 15 feet bgs and migrate via preferential pathways to the surface where they could impact indoor air via vapor intrusion. Existing deep soil and groundwater observations and chemical results are considered insufficient for evaluating this pathway. The lack of adequate data to assess this pathway and is considered a data gap (see Section 8) (MFA, 2020a).

5.0 SCREENING LEVELS

Ecology is requiring that Site data be screened to PCULs based on criteria developed for the LDW given the potential for complete environmental transport pathways to the LDW (see Section 4.6). MFA developed screening levels for the Site based on the PCULs provided in Ecology's May 2020 LDW PCUL workbook (Ecology, 2020a) and in consultation with Ecology (MFA, 2020b). As such, screening levels in this plan are referred to throughout as "PCULs". The PCULs provided in this plan are based on reasonable maximum exposures and maximum beneficial use for all potentially complete or potential future environmental transport pathways in the preliminary CSM (see Section 4 and Table 4-1). The CSM, PCOPCs, and PCULs will be reevaluated in the RI.

PCULs were developed for each of the media categories identified in Section 3.4: vadose soil, saturated soil, shallow groundwater, deep groundwater, sub-slab soil gas, and air.

The most stringent PCULs, based on the maximum beneficial use and reasonable maximum exposure and adjusted for natural background concentrations in accordance with Ecology PCUL guidance and workbook values (Ecology, 2020a,b), were selected for each COI in each media category. If no PCUL was available in Ecology's PCUL workbook (i.e., those chemicals with no MTCA CUL), no PCUL was assigned to the chemical (except for the soil gas PCULs for 1,3,5-trimethylbenzene, 2-hexanone, and acetone, which were obtained from the Cleanup Levels and Risk Calculation list, per Ecology request). No PCULs were developed for deep soil gas, as no deep soil gas data exist for the Site. The potential presence of deep soil gas is considered a data gap (Sections 4.6 and 8). Deep soil gas PCULs will be developed as needed based on the results of additional data collection as proposed in this plan.

Table 3-7 provides a summary of PCULs selected for each COI in each media category. Existing data were screened to these PCULs, as discussed in Sections 3.4 and 6. Following additional data collection, LDW environmental exposure pathways will be reviewed for completeness and PCULs adjusted as necessary for comparison to new and existing data. Any updates to Ecology's PCUL workbook from the May 2020 version will also be incorporated into the RI.

6.0 SCREENING PROCESS

Analytical results compiled from previous investigations conducted between 2005 and 2021 (see Section 3.4) were compared to PCULs (see Section 5). Summaries of analytical results by media with PCUL exceedances highlighted are provided in Tables 3-1 through 3-6 and shown in Figures 3-1 through 3-8. Detected results that exceed a PCUL and non-detect results for which the reporting limit exceeds a PCUL are identified.

PCUL exceedances for both detect and non-detect sample results were used in the PCOPC selection process discussed in Section 7.

Both laboratory-reported values and calculated values were compared to PCULs. Procedures used to calculate values for comparison to PCULs are discussed below.

6.1. Data Calculation Procedures

This section describes the procedures that were used to calculate values for comparison to PCULs (see Tables 3-1 to 3-6) and that will be carried forward for use in the RI.

The following values were calculated for comparison to PCULs:

- Trivalent chromium
- Total xylenes
- Total diesel- and oil-range hydrocarbons (total diesel+oil) (i.e., the sum of diesel- and oil-range organics [DRO and ORO, respectively])
- Carcinogenic PAH (cPAH) toxic equivalency quotient (TEQ)
- Total low-molecular-weight PAHs (LPAHs)
- Total high-molecular-weight PAHs (HPAHs)

- Total benzofluoranthenes

Trivalent chromium. Trivalent chromium was calculated by subtracting the hexavalent chromium value from the total chromium value (Ecology, 2020b). If total chromium was detected and hexavalent chromium was non-detect at the reporting limit, then the trivalent chromium value was assumed to be equal to the total chromium value. If total chromium was non-detect, both species were assumed to be non-detect at the reporting limit.

Total xylenes. Total xylenes were calculated by summing concentrations for the individual m-, p-, and o-xylene isomers. Non-detect results were summed at one-half the reporting limit. When all individual isomer results were non-detect, the highest reporting limit was used as the total xylenes value.

DRO and ORO. DRO and ORO results were summed for comparison to the DRO PCUL, as directed in the Guidance for Remediation of Petroleum Contaminated Sites (Ecology, 2016). Non-detect results were summed at one-half the reporting limit. When both results were non-detect, the highest reporting limit was used as the DRO and ORO value.

cPAH TEQ. Consistent with WAC 173-340-708(8), mixtures of cPAHs are considered a single hazardous substance in evaluating compliance with CULs such that the toxicity of a particular cPAH is expressed relative to the most toxic cPAH, (i.e., benzo[a]pyrene). The toxicity of cPAHs as a group was assessed using a toxic equivalent approach (MTCA Table 708-3).

Per a discussion with Ecology statistician Arthur Buchan, non-detect cPAHs were incorporated into the cPAH TEQ as follows (Buchan, 2020):

- One-half the reporting limit was used for non-detect cPAHs that had been detected on the Site in one or more media in the past.
- Zero was used for non-detect cPAHs that had not been detected on the Site in one or more media in the past.
- If no cPAHs were detected in a given sample, the highest of the reporting limits for each of the individual cPAH compounds was used as the TEQ.

Total LPAHs. Total LPAHs were calculated by summing acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene (WAC 173-204-562[2][i]), as described in the sediment cleanup user's manual (SCUM) II (Ecology, 2019c). Non-detect results were summed at one-half the reporting limit. When all results were non-detect, the highest reporting limit was used.

Total HPAHs. Total HPAHs were calculated by summing benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene, and total benzofluoranthenes (WAC 173-204-562[2][j]), as described in SCUM II (Ecology, 2019c). Non-detect results were summed at one-half the reporting limit. When all results were non-detect, the highest reporting limit was used.

Total benzofluoranthenes. Total benzofluoranthenes were calculated by summing concentrations of the b, j, and k isomers of benzofluoranthenes (WAC 173-204-562[2][k]), as described in SCUM II (Ecology,

2019c). Non-detect results were summed at one-half the reporting limit. When all results were non-detect, the highest reporting limit was used.

7.0 PRELIMINARY CHEMICAL OF POTENTIAL CONCERN

Given that 106 COIs were identified for the Site, it was not practicable to conduct a nature-and-extent evaluation for all COIs in all seven media categories for inclusion in this plan. Therefore, PCOPCs are identified in this plan for the purpose of identifying Site contaminants for which to conduct a more detailed nature-and-extent evaluation relative to PCULs. The goal was to identify significant data gaps in this plan that might not otherwise be identified if PCOPC selection was delayed until the RI.

PCOPCs were selected for the Site based in part on a screening of Site data collected between 2005 and 2021 against PCULs (see Section 6). This section discusses the PCOPC selection process, identification of PCOPCs and data gaps, and a summary of PCOPC PCUL exceedances by media. The selection of COPCs will be revisited in the RI following refinement of the CSM and PCUL development based on additional data collection as proposed in this plan, but the procedures and methods described herein are proposed for use in the RI.

7.1. PCOPC Selection Process

Ecology developed general guidance for COPC selection in the LDW (Ecology, 2020b). Ecology-recommended steps and procedures are outlined in a flowchart provided to MFA on July 13, 2020 (see Appendix H1). MFA used the Ecology-provided COPC selection process to select PCOPCs for the Site (MFA, 2020a) except that the following criteria were not evaluated for the purposes of the work plan: three-part statistical rule, frequency of detection, and potential hot spots. The complete screening process will be performed on the full data sets in the remedial investigation.

Note that during Ecology's data review, minor data discrepancies between Ecology's Environmental Information Management (EIM) database and MFA's Appendix H data tables were identified. MFA conducted a comprehensive data review to resolve those discrepancies and to identify any other potential discrepancies. Minor discrepancies were identified that will be addressed by MFA in the RI, and are detailed below:

- The following sample results were provided in EIM, but were not included in Appendix H:
  - A soil cadmium result for sample GP2-S-1.0, collected on 6/9/2005
  - A groundwater styrene result for sample MW8-122805, collected on 12/28/2005
  - Groundwater HFC-134a results for samples collected from monitoring wells MW1 through MW4, collected in June 2005

The Ecology-provided PCOPC selection process provides a series of "yes" or "no" questions that are used to determine for each individual chemical if it is considered a "PCOPC," "not a PCOPC," or a "data gap." If there is no PCUL and a PCUL will not be developed, the chemical is not a PCOPC. If there is a PCUL, the following screening scenarios are applied:

- If the frequency of PCUL exceedances among reporting limits is greater than 10 percent, the maximum ratio of reporting limit to PCUL is greater than five, and the maximum reporting limit is greater than five

times the achievable reporting limit, the chemical has a data gap that needs to be addressed with better detection limits in the RI.

- If the frequency of PCUL exceedances among reporting limits is less than 10 percent, or the maximum ratio of reporting limit to PCUL is less than 5, or the maximum reporting limit is less than 5 times the achievable reporting limit:
  - If the maximum detected concentration does not exceed the PCUL, the chemical is not a PCOPC.
  - If the maximum detected concentration exceeds the PCUL, the chemical is a PCOPC and will be retained for further evaluation as a COPC in the RI based on the three-part statistical rule, frequency of detection, and potential hot spot criteria specified in the PCOPC selection process.

Some chemicals not identified as PCOPCs in the RI work plan may become COPCs in the RI after evaluation of additional data. Conversely, some chemicals identified as PCOPCs in the RI work plan may be eliminated from the COPC list in the RI after more complete evaluation of all data.

To determine if a reporting limit is greater than five times the achievable reporting limit, MFA developed a set of achievable reporting limits. MFA selected the "target practical quantitation limits (PQLs)" from Ecology's PQL compendium (i.e., summary tables of PQLs by analyte, analytical method, and medium) to define achievable reporting limits for evaluation of PCOPCs (Ecology, 2020c; MFA, 2020b).

Analytical results in each medium (see Section 5) were evaluated to determine for each chemical if it was a PCOPC, not a PCOPC, or a data gap. Statistics (i.e., number of samples analyzed, number of exceedances, number of reporting limit exceedances, and exceedance ratios) were generated for each sample set, using Microsoft Excel pivot tables in the PCOPC selection process. A series of Microsoft Excel tables with formulas were used to calculate detection and exceedance frequencies based on the sample set statistics and to generate responses to each of the yes/no questions in the PCOPC selection process for each chemical.

As part of the COPC selection process that will be conducted in the RI, if a chemical in air, soil gas, or groundwater is identified as a COPC or data gap based on Ecology's flow chart, GeoEngineers will then review analytical results for that chemical to determine if it should potentially be ruled out as a COPC or data gap based on recent concentration trends or availability of recent data with acceptable reporting limits (e.g., last four quarters of groundwater-monitoring results or if there was an air or soil gas sampling event with more acceptable reporting limits for the chemical).

Tables summarizing pivot-table-generated sample set statistics, PCOPC selection results, and assigned PQLs for each chemical by media category are provided in Appendix H2 (see Tables H2-1 through H2-6). Note that indoor air sampling results through only June 5, 2020 were included in Table H2-6.

Based on Ecology's flow chart (see Appendix H1), a chemical that otherwise would be selected as a PCOPC based on detected exceedances (steps 9 through 12) could be identified as a data gap (steps 5 through 6). This could apply in a scenario where sufficient detections may be available to identify a chemical as a PCOPC, but there is also a high frequency of reporting limit exceedances. In those cases, analytical results were evaluated and the chemical was selected for inclusion as a PCOPC. This applied to the following chemicals by media:

- Saturated Soil: benzene, cis-1,2-dichloroethene (cis-1,2-DCE), naphthalene, selenium, and TCE

- Shallow Groundwater: benzo(a)anthracene, hexavalent chromium, copper, naphthalene, TCE, vinyl chloride, and arsenic
- Deep Groundwater: arsenic and copper

7.2. PCOPCs and Data Gaps

A determination was made for each Site COI (see Section 3.4) if it was a PCOPC (i.e., identified as "Retain" in the Appendix H Tables H2-1 through H2-6), not a PCOPC, or a data gap based on the results of the PCOPC selection process (see Section 7.1). COIs, PCOPC selection results, and PCULs by media are summarized in Table 3-7.

PCOPCs were divided into groups as follows (see Table 3-7):

- Benzene and ethylbenzene.
- Chlorinated hydrocarbons (1,2-dichloroethane, carbon tetrachloride, and methylene chloride).
- Chromium (hexavalent chromium, trivalent chromium, and total chromium).
- cPAHs and naphthalene (benzo[a]anthracene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene were identified as PCOPCs, but were not included in this PCOPC group individually because they are included in the cPAH TEQ calculation).
- Heavy oils (includes DRO and ORO, reported individually, and as a sum (i.e., total diesel+oil).
- Metals (arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc; chromium is included in a separate group).
- TCE and degradation products (cis-1,2-DCE, trans-1,2-dichloroethene [trans-1,2-DCE], TCE, and vinyl chloride; although cis-1,2-DCE was not identified as a PCOPC, it was included in this PCOPC group because it is a TCE degradation product).

The spatial distribution of PCUL exceedances for PCOPCs included in these PCOPC groups was evaluated to identify potential data gaps, as discussed below. The discussion below is based on a preliminary review of the data. Additional discussion regarding PCOPC PCUL exceedances, non-exceedances, and subtleties due to PQLs to inform the scope of work as discussed between Ecology and GeoEngineers, is presented in Section 9.

7.3. PCOPC PCUL Exceedances

A series of figures (Figures 7-1 through 7-6) was developed to assess the spatial distribution of PCUL exceedances for all PCOPCs included in the PCOPC groups identified in Section 7.2, except for ethylbenzene. For the purposes of this plan, only benzene was included in the figures given that benzene was also exceeded in all samples with an ethylbenzene exceedance. All media analyzed for each PCOPC group are included in the figures. The figures show the maximum detected results since 2005 in air, sub-slab soil gas, vadose soil, and saturated soil. For groundwater, data from reconnaissance grab samples are included. Therefore, for groundwater detections shown in the figures, the nature and extent do not represent current, dissolved concentrations, but better represent potential release and source areas for comparison to soil data. Refer to Figure 3-8 for a summary of analyte groups in groundwater with detections and exceedances based on the last four quarters of groundwater monitoring from 2019 to 2020 in

monitoring wells. Additionally, historical reconnaissance groundwater results from temporary boring locations are shown on Figure 3-8.

The following is a discussion of observations based on review of those figures relevant to identification of data gaps (see Section 8) and proposed sampling scope development (Section 9):

- Benzene and chlorinated hydrocarbons (benzene, 1,2-dichloroethane, carbon tetrachloride, and methylene chloride) (see Figure 7-1)—detected in air, soil gas, and soil. All but methylene chloride had at least one PCUL exceedance in air. No PCUL exceedances were observed in soil gas, but only one sample was analyzed for benzene, carbon tetrachloride, and methylene chloride (see Table 3-7). No PCUL exceedances were observed in vadose soil, but in saturated soil (less than or equal to 20 feet bgs), methylene chloride PCUL exceedances were observed in 11 locations (six of them off Property), and benzene PCUL exceedances were found in two locations (one of them off Property) for benzene.
- Chromium (hexavalent chromium, trivalent chromium, and total chromium) (see Figures 7-2A and 7-2B)— all three isomers were detected in soil and groundwater throughout the Property and off-Property. PCUL exceedances were observed in all sampled media, both on and off Property, with the highest concentrations in the former plating areas (i.e., the area where former chromic-acid-plating tanks 1 through 6 were located, as well as the temporary plating area, including former chromic-acid-plating tank 7 as shown in Figure 2-2). Deep groundwater chromium concentrations in off-Property reconnaissance borings to the west (unfiltered, total fraction results) exhibited higher concentrations than deep groundwater in monitoring wells along the eastern Property boundary (filtered, dissolved fraction results), indicating that representative groundwater concentrations from wells may differ significantly from those observed in reconnaissance groundwater borings.
- cPAHs and naphthalene (cPAH TEQ and naphthalene) (see Figure 7-3)—spatial coverage of previous sampling results is limited but shows detected PCUL exceedances in soil and groundwater in and downgradient of former plating areas (see Figure 2-2). Contamination may be associated with heavy oils (i.e., DRO, ORO, and total diesel+oil), but data are too limited to be conclusive.
- Total diesel+oil (see Figure 7-4)—spatial coverage of previous sampling results is limited but shows detected PCUL exceedances in soil and groundwater in and downgradient of former plating areas (see Figure 2-2). The highest soil and groundwater concentrations were detected in areas adjacent to and potentially downgradient of the former boiler room (boring GP21 and monitoring well MW8, respectively) (see Figure 2-2), which is a potential source of petroleum hydrocarbon contamination associated with a former UST(s). There is no clear source for heavy oils in shallow groundwater along the eastern Property boundary, north of the former boiler room, but the adjacent former Kaspac/Chiyoda property is a potential source contributor (see Section 3.3).
- Metals (arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc) (see Figures 7-5A and 7-5B). No clear sources or concentrations trends are evident because of the limited spatial coverage of existing data; however, the number of detected PCUL exceedances varied between on- and off-Property samples, particularly in groundwater from monitoring wells (filtered, dissolved fraction results) versus reconnaissance borings (unfiltered, total fraction results), as follows (arsenic is not discussed here but is discussed in detail in Section 3.5):
  - Cadmium—two vadose zone samples, one on-Property (former cylinder shop) and one off-Property (south drainage ditch) (GP13 and HA2, respectively)

- Copper—shallow and deep groundwater and vadose soil in and downgradient of the former plating areas (MW6, MW7, MW8, MW9, GP18, and GP31) on Property; and off-Property vadose soil in the south drainage ditch (HA2 and HA12)
- Lead—shallow groundwater from on-Property reconnaissance borings (unfiltered, total fraction results; SB3, SB4, SB5, and SB7); deep and shallow groundwater from off-Property reconnaissance borings (unfiltered, total fraction results; SB11 to SB19) and vadose soil in the south drainage ditch (C1, C2, HA17, HA21, HA25, P10, SS3)
- Mercury—two vadose soil samples on Property in the former plating areas (GP18) and south of the former scrubber room (GP29); two off-Property vadose soil samples in the south drainage ditch (HA1 and HA2)
- Nickel—one deep (MW7) and two shallow (MW5 and MW6) groundwater-monitoring well locations on Property, east of the former plating areas; none off Property
- Zinc—vadose soil in the off-Property south drainage ditch (HA1 and HA2); none on Property

- TCE and degradation products (cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride) (see Figure 7-6)—PCUL exceedances in air, soil gas, vadose soil, saturated soil, and shallow groundwater on Property, but no detected PCUL exceedances in off-Property soil or groundwater. Air and soil gas exceedances were observed throughout the building; shallow groundwater in and downgradient of the former plating areas (GP6, GP8, MW5, and MW8) and in the former cylinder shop (GP13); and soil in the former plating areas (GP6, GP11, and GP14) and adjacent to the former hazardous waste containment area (GP29). Deep groundwater was sampled for TCE and degradation products both on and off Property, but results were non-detect at reporting limits above PCULs (see Figure 3-8 and Table 3-6).

The following PCOPCs will most likely be the primary focus for cleanup actions at the Site based on detection and PCUL exceedance frequencies and the magnitude of PCUL exceedance ratios:

- Air and soil gas: TCE, vinyl chloride, carbon tetrachloride, and benzene
- Vadose soil: cPAH TEQ, naphthalene, trivalent chromium, copper, nickel, zinc, and mercury
- Saturated soil: cPAH TEQ, naphthalene, trivalent chromium, TCE, cis-1,2-dichloroethene, benzene, methylene chloride, and selenium
- Shallow groundwater: hexavalent chromium, nickel, and vinyl chloride
- Deep groundwater: trivalent chromium, cPAH TEQ, arsenic, and nickel

The PCOPCs listed above exhibited a 100 percent detection frequency (except arsenic in deep groundwater, which had an 82 percent detection frequency) and 100 percent detected PCUL exceedance frequency (see Tables H2-1 through H2-6), including both total and dissolved fraction metals results in groundwater and all groundwater results from 2005 to 2020. Detected PCUL exceedance ratios for those chemicals ranged from 88 times (chromium in deep groundwater) to 9,375 times (hexavalent chromium in shallow groundwater). Additional chemicals may be added to this list in the RI based on a more complete COPC screening. On the other hand, some chemicals may be eliminated from this list when better detection limits are achieved or more detailed, chemical-specific evaluations are performed.

Based on the magnitude and distribution of PCOPC exceedances throughout the Site (see Figures 7-1 through 7-6); detection and exceedance frequencies and exceedance ratios; and discussions between

GeoEngineers and Ecology in January 2022 (see Section 9), the known PCOPCs most likely to be the primary focus for cleanup actions at the Site are TCE and degradation products, petroleum, and chromium.

8.0 REMEDIAL INVESTIGATION DATA GAPS

Data gaps identified as part of the preliminary Site characterization, CSM development, and PCOPC selection process (see Sections 3, 4, and 7) are summarized in this section.

Identified data gaps generally fall within the following categories:

- Evaluation of unknown environmental transport and exposure pathways, including those that involve sediment and surface water in the LDW
- Further characterization of arsenic in soil and groundwater to assess whether Precision's historical operations are the source or if there is an areawide or off-Property source, and if natural background conditions may also be contributing to an elevated baseline of concentrations
- Evaluation of the potential presence of contamination associated with features of interest that were not previously evaluated
- Further characterization of heavy oils in shallow groundwater along the eastern Property boundary and the potential for contaminant contributions from the adjoining former Kaspac/Chiyoda property
- Characterization of the nature and extent of COIs throughout the Property

Data gaps in off-Property areas of the Site will be identified following completion of the sampling proposed in this plan.

Identified data gaps in each of those categories are discussed below. Sample locations proposed to address these data gaps are discussed in Section 9.

Although contamination identified in the drainage ditch has been attributed to the Site (see Section 3.2), and contamination in the ditch has not been fully characterized (Kennedy/Jenks, 2015), no sampling of the ditch is proposed. The approach proposed in this plan is to better characterize the nature and extent of on-Property contamination and potential environmental transport pathways to the ditch first and then use that information to develop an informed and focused scope for off-Property sampling at the Site. Data gaps for off-Property areas of the Site and the need for additional off-Property investigation to complete the RI will be identified following completion of the investigation activities proposed in this plan.

8.1. Environmental Transport and Exposure Pathways

The following data gaps were identified in association with the evaluation of environmental transport and exposure pathways (see Section 4.6, Figures 3-3 to 3-9):

- The potential for COIs in deep groundwater to migrate to shallower zones and discharge or infiltrate into a stormwater conveyance
- The potential for COIs in shallow soil and shallow groundwater to infiltrate into a stormwater pipe that discharges to the drainage ditch

- The potential for COIs in shallow soil adjacent to the drainage ditch to erode or to be transported via stormwater runoff into the ditch
- The potential for COIs in shallow groundwater to discharge into the drainage ditch
- The potential for volatile-contaminant-COIs in deep (more than 15 feet bgs) soil or groundwater to volatilize and accumulate in deep, unsaturated zones and migrate via preferential pathways to the surface
- The potential for COIs in shallow or deep groundwater to migrate to the LDW; this pathway was evaluated previously and considered incomplete but will be re-evaluated to confirm those conclusions.

Refinement of the preliminary CSM to identify potential preferential pathways and further characterization of COIs in deep soil and groundwater are proposed to address those data gaps (see Section 9). Further characterization of COIs in shallow soil and groundwater along the south and east Property boundaries and adjacent to stormwater features is proposed to address those data gaps (see Section 9).

8.2. Arsenic

The following data gaps were identified in association with the evaluation of arsenic concentrations on the Site (see Section 3.5):

- The nature and extent of arsenic in soil and groundwater on the Property for the purposes of source identification, including area-wide, off-Property, and naturally occurring sources (see Section3.5).
- The existing coverage of geologic and hydrogeologic data, particularly in the deep WBZ, is insufficient for refining the CSM to better understand potential arsenic sources.
- Spatial coverage of arsenic results relative to potential other sources of contamination at the Site and in groundwater from monitoring wells versus borings is insufficient (significant concentration differences were observed between the two, as discussed in Section3.5).

Further characterization of the geology, hydrogeology, geochemical conditions, and arsenic occurrence in soil and groundwater is proposed to address these data gaps (see Section 9).

Arsenic concentrations on the Property in locations both in and upgradient of areas known to be contaminated with other COIs will be evaluated for arsenic concentration trends relative to other COI contamination sources on the Property.

Although arsenic in the drainage-ditch soil has been detected above PCULs and MTCA CULs, additional characterization proposed in this plan is focused on the Property, except for the initial off-Property investigation locations proposed in Section 9. The proposed approach is to better understand conditions on the Property and then use that information to assess the need for additional off-Property sampling.

Proposed site-characterization activities related to arsenic will be used to assess potential sources, mechanisms for release, and transport pathways for arsenic. The extent and magnitude of arsenic concentrations will be evaluated relative to the nature and extent of other COIs, geochemical conditions, and known source areas and features of interest to identify potential Site-related arsenic sources and colocated contamination that could be contributing to mobilization of naturally occurring soil arsenic. Arsenic concentrations will also be evaluated relative to the geologic CSM to identify potential naturally

occurring sources. Further characterization of the geologic CSM will also allow for identification of potential transport pathways associated with identified arsenic contamination. These data will inform the potential need for further characterization of areawide, natural background, or off-Property sources.

8.3. Features of Interest

Data gaps associated with the following features of interest (see Section 3.1) were identified:

- Hydraulic cylinder test vault and groundwater seepage
- Hazardous waste containment area
- Scrubber room
- Boiler room UST
- Heavy oils in shallow groundwater

Note that the drainage ditch to the south of the Property and former sanitary sewer lines beneath building were also identified as features of interest in Section 3.1. Data gaps associated with environmental transport and exposure pathways that include the drainage ditch are included in Section 8.1. The drainage ditch is also a feature of interest due to the potential for historical stormwater runoff from the Property during Precision's operations to have contributed to soil contamination in the ditch. That, and other off-Property data gaps, will be considered in the RI. Former sanitary sewer lines beneath the building that previously connected to trench drains, catch basins, and other parts of the operations area could serve as preferential transport pathways. No data gaps were identified specifically for the former sanitary sewer lines.

The hydraulic cylinder test vault may contain groundwater seepage impacted with COIs. The vault is currently covered with a locked, concrete lid, but is considered a potential exposure point via direct contact with, incidental ingestion of, or inhalation of volatile contaminants from COI-impacted groundwater seepage in the vault. Metals in groundwater were detected above PCULs in the closest sample location (GP5; see Figure 3-8). Groundwater seepage through joints in the nearby concrete building slab (see Figure 2-4) may also contain COIs. Characterization of COIs in water in the vault and in soil and groundwater in observed seepage locations is proposed to address these data gaps (see Section 9).

No samples were previously collected in the former hazardous waste containment area, scrubber room, or boiler room (see Figures 2-2 and 2-4). The potential exists for contamination in soil and/or groundwater associated with those features of interest (see Section 3.1). Characterization of COIs in soil and groundwater in the area surrounding those features of interest and assessment of the potential presence of a UST(s) in the boiler room are proposed to address these data gaps (see Section 9).

8.4. Heavy Oils in Shallow Groundwater

Heavy oils have been detected above PCULs in shallow groundwater along the east and southeast Property boundaries (see Figure 3-8). Groundwater flow, as generally observed, is to the east (see Section 2.4.2). Potential petroleum hydrocarbon impacts in the former boiler room may be contributing to heavy-oil impacts in groundwater near the southeastern Property boundary but are unlikely to be contributing to impacts along the eastern Property boundary. Petroleum hydrocarbons are included as COIs, for which data gap status and additional sampling are proposed (see Section 8.4). Additional COI characterization will

contribute to the understanding of other potential petroleum hydrocarbon sources on the Property. Petroleum hydrocarbons are also a COI for the former Kaspac/Chiyoda property adjacent to and east of the Property (see Section3.3). Further lateral characterization of heavy oils in shallow groundwater toward the interior of the Property and along the eastern Property boundary will better inform the potential for heavy-oil contributions from the adjacent site.

8.5. Contaminants of Interest

The spatial distribution of COIs in all media, particularly relative to identified PCOPCs, is insufficient to conclusively identify contaminant trends and source areas (see Sections 3.4 and 7.3). In addition to the PCOPC data gaps identified in Section 7.3, other COI data gaps include the following:

- The frequency and distribution of reporting limit exceedances for non-detect results limit the usability of existing data for Site characterization purposes.
- The limited spatial distribution of data horizontally and vertically, but most evidently in the west and northwest portions of the Property and in the deep groundwater WBZ, which is of particular concern for TCE (a dense nonaqueous-phase liquid that may have migrated vertically downward into the deep WBZ).
- A lack of soil and groundwater data from Warehouses 1 and 2, where air and soil gas impacts, primarily TCE and degradation products, have been detected above PCULs (see Figure 7-6).

The current characterization of air and soil gas contamination is considered sufficient based on our current understanding of potential soil and groundwater vapor sources. The potential need for further characterization of COIs in air and soil gas will be revisited following additional collection of soil and groundwater data.

Off-Property data gaps have not been identified in this plan. GeoEngineers proposes to better characterize the nature and extent of on-Property COIs and refine the CSM before conducting additional off-Property investigation.

Perfluoroalkyl substances (PFAS), PCBs and some non-PAH SVOCs were not selected as COIs for the Site using the COI selection approach outlined in Section 3.4 because they were not analyzed. Ecology has requested soil samples be collected within the vadose and saturated zones in four borings for supplemental chemical analysis of PFAS, non-PAH SVOCs, and PCB Aroclors in soil. PFAS, non-PAH SVOCs, and PCBs will be analyzed in selected groundwater monitoring wells.

9.0 SCOPE OF WORK

GeoEngineers met with Ecology to discuss the RI scope of work to be performed as part of “Tier 1” fieldwork with the goal of completing Tier 1 fieldwork by April 22, 2022. Meetings were held via conference (video) calls between GeoEngineers and Ecology on January 14, January 20, and January 25, 2022.

Meeting discussions were focused on the nature and extent of contamination in terms of major analyte groups[2] in vadose soil, saturated soil, shallow groundwater, and deep groundwater. Major analyte groups discussed include chromium, TCE (and degradation products), TPH, VOCs, and cPAHs. The following summarizes discussions of each major analyte group. The following figures were developed to aid and focus the discussion on the contaminant drivers for this site:

- Figure 9-1: Locations where chromium, TCE (and degradation products), and TPH have been sampled in soil. Each location had at least one vadose sample analyzed to date. Most locations also have one or two saturated soil samples that were analyzed for the same analyses.
- Figure 9-2: Summary of chromium, TCE, and TPH in soil.
- Figure 9-3: Summary of chromium, TCE, and TPH in groundwater.

9.1. Chromium

9.1.1. Chromium in Vadose and Saturated Soil

Figure 9-1 shows the locations where soil has been sampled within vadose and saturated zones on and off the property for analysis of total and hexavalent chromium (and other COIs). Sample locations include borings GP1 through GP32 (and hand augers HA1 and HA2; vadose only) performed in 2005 by MFA following Precision ceasing operations, as well as borings SB1, SB3 through SB8, SB10 through SB19, and MW9 and MW11 in 2014/2015 by Kennedy Jenks.

Vadose soil samples that have been analyzed were collected from 1 to 2 feet bgs. Saturated soil samples that have been analyzed were collected from 5 to 15 feet bgs in most borings. Additional deeper samples collected were analyzed in soil from borings SB15 through SB19 located near the ditch east of the former Kaspac-Chiyoda property to depths up to 50.5 feet bgs.

Borings have primarily been located in the southeastern portion of the building where features of interest were located (e.g. chromic acid plating tanks), and to the east (downgradient) and south of the building. Borings located in other areas of the site include SB10, GP24, GB5, and GP25. The vadose and saturated soil sample results from SB10, GP24, GP5, and GP25 generally do not contain concentrations of COIs above the PCULs. This plan includes additional sampling in select areas to confirm this pattern as discussed further in Section 9.7 below.

Review of chromium data in vadose soil (Table 3-3) and saturated soil (Table 3-4) indicates the following regarding trivalent and hexavalent chromium[3] (see Figure 9-2):

- Trivalent and hexavalent chromium are elevated in vadose and saturated soil within the area of the former chromic acid plating tanks, specifically in borings GP1, GP2, GP3, GP4, GP6, GP18, GP23, and

[2] Major analyte groups are those groups that are considered "drivers" for the site because there is a known source for the analyte group, the analyte(s) have been widely detected in at least one media, and further horizonal or vertical delineation may be needed.

[3] Total chromium concentrations compared to PCULs are not discussed because there are no instances where total chromium exceeds a PCUL where trivalent or hexavalent does not already exceed.

GP32. Trivalent and/or hexavalent chromium were detected in soil at concentrations (up to several thousand mg/kg in some samples) greater than the respective PCULs in these borings.

- The lateral extent of the relatively high chromium concentrations is bounded on the southwest side by borings GP7, GP9, GP10, and GP22, with vadose soil chromium concentrations below the PCULs. Saturated soil samples were collected from GP7, GP10 and GP22 with the results indicating chromium concentrations are below the PCULs. The saturated sample collected in boring GP22 was not detected for hexavalent chromium with the trivalent chromium concentration at 32.1 that is slightly greater than the saturated PCUL of 27 mg/kg but lower than Puget Sound background concentration for total chromium of 48 mg/kg.
- The lateral extent of the relatively high chromium concentrations is generally bounded on the northeast side by borings GP14, GP16, GP19, and GP20 with the chromium concentrations in vadose soil below the PCULs. GP17 contains elevated chromium and is located outside the former tank area and will be investigated further.

  Saturated soil samples were collected from GP14, GP19 and GP20. The sample from GP14 contains hexavalent and trivalent chromium concentrations that are only slightly above PCULs: an estimated 1.2 mg/kg hexavalent chromium (PCUL is 0.93) and an estimated 30.2 mg/kg trivalent chromium (PCUL 27, noting that Puget Sound background for total chromium is 48 mg/kg). Saturated samples from GP19 and GP20 are all below PCULs except for trivalent chromium in GP19 that had a concentration of 27.1 mg/kg (PCUL 27, noting that Puget Sound background for total chromium is 48 mg/kg).
- The area does not appear to be laterally bounded to the northwest and south directions.
- The area is not vertically bounded because multiple borings contain elevated chromium concentrations at up to 15 feet bgs with no underlying "clean" soil data.

Additional vadose and saturated soil sampling for chromium is warranted to laterally bound the northwest and south sides of the former tank area, as well as additional investigation around GP17 based on the results discussed above. Soil sampling deeper than 15 feet bgs within the former tank area specifically for chromium is not recommended because the current and future pathways for chromium include transport in shallow or deep groundwater. These pathways have been and will continue to be investigated as described further in Section 9.7 below to evaluate direct exposure to workers or possibly to future site inhabitants (i.e., soil less than 15 feet bgs)[4]. Deeper soil sampling may occur in a future phase of sampling. Notwithstanding the above, one deeper soil boring is proposed in the former tank area based on discussions with Ecology and to evaluate TCE and other PCOPCs.

9.1.2. Chromium in Shallow and Deep Groundwater

Figure 9-3 shows the locations of the shallow and deep groundwater monitoring wells where chromium (and other COIs) has been sampled. The figure and the discussion that follows excludes groundwater grab

[4] Deeper soil and deep groundwater investigation is proposed immediately downgradient of the former tank area, as well as other areas of the site, for other contaminants of interest, as discussed elsewhere in this section.

results as these are known to be biased high compared to results obtained from properly installed and developed groundwater monitoring wells.

Deep monitoring well MW1 and shallow monitoring wells MW2 through MW6 and MW8 have been sampled during 11 to 12 events spanning 2005 to 2020. Deep monitoring wells MW7 and MW9, and shallow monitoring well MW11 have been sampled during seven events spanning 2014 to 2020. Analyses have included total or dissolved chromium during the various events.

Review of chromium data in shallow groundwater (Table 3-5) and deep groundwater (Table 3-6) indicate the following (see Figure 9-3).

Shallow Groundwater:

- Shallow monitoring well MW5 contains elevated concentrations of chromium. MW5 is located just downgradient of the former chromic acid plating tanks.
- Shallow monitoring well MW6 has been sampled 11 times with no PCUL exceedances of hexavalent chromium. The reporting limit for hexavalent chromium exceeded the PCUL during three out of 11 of the sampling events. Trivalent chromium was detected at concentrations of 27.5 µg/L to 47 µg/L that slightly exceeded the PCUL of 27 µg/L during four out of 11 sampling events.
- There were no other exceedances of chromium PCULs in any other shallow groundwater monitoring wells with the reporting limit for trivalent chromium below PCULs in the wells during each event. The reporting limit for hexavalent chromium was below the PCUL in most sampling events (e.g. 10 out of 12 events).

Deep Groundwater:

- There have been no PCUL exceedances of chromium in deep groundwater monitoring wells MW1, MW7, and MW9 during any sampling event. The hexavalent chromium result in MW1 during the first sampling event in 2005 is reported as detected at 269 µg/L (greater than the PCUL of 48 µg/L). However, the result cannot be accurate as the total chromium result in the same sample is reported as not detected at 20 µg/L. Trivalent and hexavalent chromium were non-detect in MW1 in the following 10 sampling events spanning 2005 to 2020 with the reporting limits less than the PCULs. This corroborates that the reported result of 269 µg/L hexavalent chromium during the first sampling event is erroneous.
- Additional deep groundwater monitoring wells are needed north of MW7 and in other areas of the site. These wells will be installed and sampled as described in Section 9.7 below.

9.1.3. Summary of Chromium in Soil and Groundwater

There are elevated concentrations of chromium in soil located within the area of the former chromic acid plating tanks including at boring GP17. Chromium concentrations are much lower elsewhere on the site. Additional soil sampling for chromium is warranted.

Shallow groundwater at MW5 located just downgradient of the former chromic acid plating tank area contains elevated chromium in shallow groundwater. However, chromium does not appear to have been transported in shallow groundwater beyond the property boundary except for results in shallow groundwater at MW6. The shallow groundwater exceedances at MW6 include occasional (four out of 11 events)

exceedances of trivalent chromium at concentrations less than two times the PCUL, and include sampling events that span timeframes including immediately after Precision Engineering ceased chromium plating activities (i.e., 2005) through 2020. Additional shallow groundwater sampling for chromium is warranted.

There have been no chromium exceedances in deep groundwater monitoring wells. However, additional deep groundwater wells will be needed north of MW7 and in other areas of the site. Additional deep wells (and shallow wells) are included in this plan as discussed further in Section 9.7 below.

9.2. Trichloroethene

9.2.1. Trichloroethene In Vadose and Saturated Soil

TCE has been sampled in vadose and saturated soil in generally the same locations as chromium, i.e., as shown in Figure 9-1, and at the same vadose and saturated depths.

Review of TCE data in the vadose soil (Table 3-3) and saturated soil (Tables 3-4) indicates the following (see Figure 9-2).

- Soil collected in boring GP6 located in the former chromic acid plating tank area and southeast of the former TCE tank contains elevated concentrations of TCE. TCE was detected at a concentration of 0.0405 mg/kg in the vadose sample that is greater than the PCUL of 0.00441 mg/kg. TCE was detected at concentration of 1.16 mg/kg in the saturated soil sample that is greater than the PCUL of 0.00027 mg/kg.
- Soil collected in boring GP11 located north of the former chromic acid plating area contains elevated TCE. TCE was detected at concentration of 0.0872 mg/kg in the vadose soil sample that is greater than the PCUL of 0.00441 mg/kg. TCE was detected at a concentration of 0.281 mg/kg in the saturated soil sample that is greater than the PCUL of 0.00027 mg/kg.
- Soil collected in boring GP14 (located roughly between GP6 and GP11) contains slightly elevated TCE in the vadose sample only with a concentration of 0.00449 mg/kg. This concentration is only slightly elevated above the PCUL of 0.0041 mg/kg. TCE was not detected in the saturated soil sample. The reporting limit for the saturated soil sample (0.00262 mg/kg) exceeds the PCUL of 0.00027 mg/kg. However, it should be noted that the PCUL will potentially need to be adjusted upwards to the PQL. The reporting limit in the saturated sample of 0.00262 mg/kg is close to the median PQL in Ecology's PQL compendium (0.002 mg/kg) and is less than the maximum PQL in the compendium (0.005 mg/kg).
- TCE is generally not elevated in any other vadose or shallow soil samples. TCE is not detected in vadose soil in any samples besides GP6, GP11, and GP14. Reporting limits in eight out of 34 vadose samples exceed the maximum PQL in the PQL Compendium by up to a factor of three. However, the data set is useful in evaluating where high concentrations of TCE appear to be located in vadose soil that need further horizontal or vertical bounding (i.e., GP6, GP11, and GP14). TCE is not detected in saturated soil in any samples besides GP6 and GP11. Reporting limits in these samples exceed the PCUL of 0.00027 mg/kg. Reporting limits for eight out of 57 vadose samples are greater than the maximum PQL of 0.005 mg/kg in the PQL Compendium. As in vadose soil, the data set is useful in establishing that relatively higher concentrations of TCE in saturated soil appear to be limited to GP6 and GP11. This is corroborated by the groundwater data for TCE as discussed in Section 9.7 below.

9.2.2. TCE in Shallow and Deep Groundwater

TCE has been sampled in shallow and deep groundwater in the same monitoring wells as was discussed for chromium in Section 9.1.2 (i.e., wells MW1 through MW11 during seven to 12 sampling events spanning 2005 to 2020).

Review of the TCE data in shallow groundwater (Table 3-3) and deep groundwater (Table 3-4) indicates the following (see Figure 9-3).

Shallow Groundwater:

- Shallow monitoring well MW5 located just downgradient of the former chromic acid plating tanks and the well nearest the former TCE tank contains elevated concentrations of TCE. The concentration trend is downward from 22.1 µg/L in 2005 to 3.3 µg/L in 2020 (the PCUL is 0.7 µg/L).
- Shallow monitoring well MW6 has been sampled 11 times with no detected PCUL exceedances of TCE. However, the reporting limit for TCE exceeded the PCUL during most sampling events.

There were no other detected exceedances of the TCE PCUL in any other shallow groundwater monitoring wells during any other events. Reporting limits often exceeded the PCULs. However, the exceedances were typically less than five times the PCUL, summarized as follows:

The reporting limits for 85 non-detected results from the shallow wells during 2005 – 2020 included the following.

- 1 µg/L in 62 samples (less than five times the PCUL of 0.7 µg/L).
- 5 to 10 µg/L in 23 samples (greater than five times the PCUL of 0.7 µg/L).

Deep Groundwater:

- There have been no PCUL detections of TCE in deep groundwater monitoring wells MW1, MW7, and MW9 during any sampling events with reporting limits at 1 µg/L or less.
- Additional deep groundwater monitoring wells are needed north of MW7 and in other areas of the site. These additional wells will be installed and sampled as discussed in Section 9.7 below.

9.2.3. Summary of TCE in Soil and Groundwater

There are elevated concentrations of TCE in soil at GP6 located within the area of the former chromic acid plating tanks. and north of the area at GP11. The vadose soil sample slightly exceeds the PCUL at boring GP14 located between GP6 and GP11. TCE concentrations in soil are much lower elsewhere on the site. Additional soil sampling for TCE and associated degradation products will be completed as discussed in Section 9.7 below.

Shallow groundwater at MW5 just downgradient of the former chromic acid plating tank area contains elevated TCE in shallow groundwater. However, TCE does not appear to have been transported in shallow groundwater beyond the property boundary, with the caveat that the reporting limits in shallow groundwater at MW6 have exceeded the PCUL in most sampling events. The shallow groundwater sampling events span timeframes including immediately after Precision Engineering ceased chromium plating activities

(i.e., 2005) through 2020. Additional sampling for TCE and degradation products in shallow groundwater will be completed as discussed in Section 9.7 below. There have been no deep groundwater TCE exceedances. However, additional deep groundwater wells are needed north of MW7 and in other areas of the site. Additional deep wells (and shallow wells) are included in this plan as discussed further in Section 9.7 below.

9.3. Petroleum Hydrocarbons

Diesel- and oil-range petroleum hydrocarbons have been sampled in vadose and saturated soil at the same depths and generally in the same locations as chromium and TCE as shown in Figure 9-1. Gasoline-range petroleum hydrocarbons (and/or HCID) have been analyzed in soil less frequently in comparison. Gasoline-range petroleum hydrocarbons (and/or HCID) were analyzed in soil samples collected in borings GP1 through GP11, SB15 through SB19, and hand augers HA1 and HA2.

9.3.1. Petroleum Hydrocarbons in Vadose and Saturated Soil

Review of TPH data in the vadose soil (Table 3-3) and saturated soil (Tables 3-4) indicates the following[5] (see Figure 9-2):

- Gasoline-range organics (GRO) have not been detected in any analyzed soil samples. However, the data are limited as compared to DRO and ORO. Additional testing for GRO (if detected by HCID) is warranted.
- DRO and/or ORO have been detected at concentrations greater than the PCULs (2,000 mg/kg for both vadose and saturated soil) in four locations including the following.
  - Boring GP21. Petroleum hydrocarbons were not detected in the vadose soil sample. DRO and ORO were detected at a total concentration of 25,170 mg/kg in the saturated soil sample.
  - Boring SB5. There was no vadose soil sample collected in this boring. DRO and ORO were detected at a total concentration of 2,740 mg/kg, respectively, in the saturated soil sample.
  - Boring SB3. DRO and ORO were detected at a total concentration of 22,000 mg/kg in the vadose soil sample. The saturated sample was non-detect for both DRO and ORO.
  - Hand Auger HA2. DRO and ORO were detected at a total concentration of 3,806 mg/kg in the upper vadose sample collected at 0.5 feet bgs. DRO and ORO were detected at a total concentration of 482.8 mg/kg in the deeper vadose sample collected at 1.5 feet bgs. There was no saturated sample collected in this boring.

9.3.2. Petroleum Hydrocarbons in Shallow and Deep Groundwater

DRO and ORO have been analyzed for in shallow and deep groundwater samples in the same monitoring wells as was discussed for chromium and TCE above (i.e., wells MW1 through MW11 during seven to 12 sampling events spanning 2005 to 2020). A limited number of samples have been analyzed for GRO. Additional sampling and analysis for GRO is warranted (HCID with follow up).

[5] HCID results are often reported as "ND" in the summary tables; a review of the laboratory deliverables confirms that the HCID RLs were all less than the PCULs of 30 mg/kg for GRO and 2,000 mg/kg for DRO and ORO.

Review of the DRO and ORO data in shallow groundwater samples (Table 3-3) and deep groundwater samples (Table 3-4) indicates the following (see Figure 9-3).

Shallow Groundwater:

TPH has been detected above PCULs in several shallow wells during multiple sampling events including MW6, MW2, MW10, and MW8. The PCUL for DRO and ORO in shallow and deep groundwater is 500 µg/L. The results for these wells are summarized as follows.

- **Well MW6**. DRO and/or ORO exceeded the PCULs in eight and 10 sampling events, respectively, out of a total of 12 sampling events. The DRO concentration trend is downward from 2,640 µg/L in 2005 to about 400 to 600 µg/L (slightly below to above the 500 µg/L PCUL) in 2020. The ORO concentration trend is also downward from 3,960 µg/L in 2005 to about 1,000 µg/L in 2020.
- **Well MW2**. DRO only exceeded the PCUL during the first sampling event in 2005 with results of the remaining sampling events below the PCUL over the last 15 years. ORO has exceeded the PCUL in nine out of 12 sampling events with concentrations ranging between 375 to 1,130 µg/L with no clear trend.
- **Well MW10**. DRO slightly exceeds the PCUL in two out of seven sampling events at concentrations of 540 and 650 µg/L. ORO exceeds in five out of seven events with concentrations ranging from 230 to 1,290 µg/L.
- **Well MW8**. DRO and ORO only exceed the PCUL during the first sampling event in 2005 with results of the remaining sampling events below the PCUL. However, the total concentration of DRO and ORO exceeds the PCUL in seven out of 11 events, ranging in concentration from 425 to 820 µg/L.

Deep Groundwater:

- DRO and ORO results are below PCUL in each sampling event with the exception of one slight exceedance of the sum of DRO and ORO in MW9 in 2019 when the sum of DRO and ORO was 530 µg/L.

9.3.3. Summary of TPH in Soil and Groundwater

There are elevated concentrations of DRO and/or ORO in soil located in the southeast portion of the property in three borings, and in one ditch sample at HA2. Additional soil sampling for TPH (including further confirmation of GRO concentrations) is needed and is planned as discussed in Section 9.7 below.

Shallow groundwater along the southern portion of the eastern property boundary contains elevated DRO and/or ORO. Additional sampling for TPH in shallow groundwater is needed and is planned as discussed in Section 9.7 below. There has been one small TPH exceedance in deep groundwater. However, additional deep groundwater wells are needed north of MW7 and in other areas of the site. Additional deep wells (and shallow wells) are included in this plan as discussed in Section 9.7 below.

No groundwater samples have been analyzed for TPH with acid/silica gel treatment (SGT), despite the observations of peat and other organics in boring logs. Soil and/or groundwater samples may be analyzed with and without SGT for comparison purposes.

9.4. Volatile Organic Compounds

VOCs have been sampled in vadose soil at boring locations GP1 through GP11, and hand auger locations HA1 and HA2. VOCs have been sampled in saturated soil in boring locations GP1 through GP11, MW9, MW11, and SB1 through SB19. VOCs have been sampled in shallow and deep groundwater in the wells during multiple sampling events, similar to but with slightly less frequency than sampling described above for chromium, TCE and TPH.

9.4.1. VOCs in Vadose and Saturated Soil

Review of VOC data from vadose soil samples (Table 3-3) indicates no detections of any VOCs in vadose soil on the Precision Engineering property except for TCE, as previously discussed in Section 9.2.1. Review of VOC data in saturated soil (Table 3-4) indicates detections of TCE and breakdown product cis-1,2-DCE, as well as a single detection of benzene at GP1. Methylene chloride is a common laboratory contaminant that has been detected in multiple soil samples onsite and offsite, with blank contamination reported in four of the samples. Reporting limits for about half of the VOCs reported as not detected exceed the PCULs.

9.4.2. VOCs in Shallow and Deep Groundwater

Review of shallow and deep groundwater data indicates that only TCE has been detected in shallow groundwater in only well MW5 as discussed in Section 9.2.2.

Reporting limits for VOCs in groundwater often exceed the PCULs.

9.4.3. Summary of VOCs in Soil and Groundwater

Samples collected from three boring locations will be selected for full suite soil VOC analyses, with a vadose and saturated sample analyzed at each location (i.e., total of six samples) as discussed during meetings between GeoEngineers and Ecology in January 2022. 1,4-dioxane will be included in the chemical analyses.

Groundwater samples will be analyzed for full suite VOCs, including 1,4-dioxane.

9.5. Polycyclic Aromatic Hydrocarbons

Fewer PAH data in soil exist compared to other COIs. Vadose soil samples have been analyzed for PAHs at boring locations GP18, GP19, GP20, GP29, GP30, GP31, and HA1 and HA2. Saturated soil sampling and analysis was also performed at GP20, GP21, GP30, and GP31. No individual PAH exceeds a PCUL in vadose and saturated soil samples. The cPAH TEQ has always exceeded the PCULs in vadose or saturated soil because the PCULs are very low at 0.00031 mg/kg and 0.000016 mg/kg, respectively. The result is that a single detection of any individual cPAH will cause the cPAH TEQ PCUL to be exceeded.

PAHs were either not detected or were detected at concentrations less than PCULs in the shallow groundwater samples, except for benzo(a)anthracene and naphthalene in MW2 during one event for each analyte out of a total of eight sampling events. The benzo(a)anthracene concentration was an estimated 0.031 µg/L that exceeded the PCUL of 0.00016 µg/L. The naphthalene concentration was 2.9 µg/L that exceeded the PCUL of 1.4 µg/L (and therefore total naphthalenes also exceeded the PCUL). Reporting limits for cPAHs in shallow and deep groundwater often exceed the PCULs. However, the PCULs will likely need to be adjusted upward based on achievable PQLs. The RLs for cPAHs were generally less than the maximum PQLs in the PQL Compendium of 0.1 µg/L.

PAHs have either been not detected or detected at concentrations less than the PCULs in the deep groundwater samples, except for indeno(1,2,3-cd) pyrene in upgradient well MW1 and downgradient well MW7 on the same event in 2006, and also dibenzo(a,h)anthracene in MW7 from that sampling event. These detections caused the cPAH TEQ PCUL to also be exceeded in those wells during that 2006 sampling event. The concentrations of the two cPAHs were reported as estimates that ranged from 0.029 to 0.039 µg/L.

There are no known sources of PAHs at the site[6], which is likely why PAH concentrations in soil and groundwater have been non-detect or frequently below PCULs (when including consideration for background and PQL).

Soil collected at a few boring locations will be selected for PAH analyses as discussed during the meetings between GeoEngineers and Ecology in January 2022. The PAH analysis will primarily focus on potential fill soils but also include a vadose sample and saturated sample to be analyzed at each targeted boring location.

Groundwater samples will be analyzed for PAHs.

9.6. Other COIs

Ecology requested several soil samples be analyzed for constituents with little or no prior data. Specifically, Ecology requested several borings have a vadose and a saturated soil sample analyzed for full suite PCBs and SVOCs. Ecology also requested several borings have a vadose and saturated sample analyzed for PFAS. The samples will be collected as described below.

9.7. On Property Scope of Work – Soil Borings and Monitoring Wells

The drilling and sampling scope of work for Tier 1 soil and groundwater sampling to be completed by April 22, 2022 is summarized in Tables 9-1 and 9-2 for soil and groundwater, respectively, and is shown on Figure 9-5. The locations shown on Figure 9-5 should be considered approximate and may be adjusted based on the building configuration, refusal during drilling, and/or the presence of utilities. If drilling refusal occurs in a boring, an attempt to advance another boring approximately 5 feet away will be performed. If refusal is met a second time, no additional borings will be planned. Drilling will be performed using direct push, hollow stem auger, and/or sonic drill rigs (see SAP/QAPP).

Another phase of drilling may be necessary after review of the data obtained during Tier 1.

9.8. Off-Property Sampling

Off property sampling will be evaluated after reviewing Tier 1 results.

[6] Petroleum hydrocarbons would be a suspected source, however review of the vadose and saturated soil data indicate PAHs are low or not-detected even in several samples containing elevated concentrations of DRO and/or ORO. Offsite fill would be a suspected source, however it is most likely that the fill on the eastern portion of the property originated as soil that was cut from the western portion of the property.

9.9. Utility Locate

A public and private utility locate will be conducted prior to subsurface exploration and monitoring well installation. A contractor will attempt to locate on- and off-Property utilities during the private locate, including the orientation of any water and sewer mains or laterals. Sampling locations may be adjusted based on information obtained from the utility locates.

9.10. Geophysical Survey

A geophysical survey was performed under subcontract to MFA in June 2021 to assess the concrete thickness and potential presence of rebar in the building slab. Concrete thickness ranged from 2.5 inches to 11 inches, with most areas being 5 to 6 inches thick. Spacing between rebar was observed to be 6 to 12 inches apart.

A geophysical survey was performed under subcontract to MFA in November 2021 to identify potential USTs in the boiler room area of warehouse 1 (i.e., the southern portion of warehouse 1). Small anomalies were identified, however no definitive USTs were identified.

9.11. Stormwater System Cleanout and Inspection

A contractor will clean out the stormwater pipes and other drainage structures (e.g., catch basins) on the Property to conduct a video inspection to assess their condition, including identifying cracks or joints that could allow infiltration of surrounding contaminated soil and/or groundwater. Conditions allowing soil or groundwater to enter the stormwater system could indicate a potential pathway for Site contaminants to reach the LDW (see Section 4.6).

9.12. Soil Sampling

Soil samples will be collected from the borings and monitoring well installations (Table 9-1). Shallow borings will be advanced to about 15 feet bgs, with deeper borings advanced to approximately 20 feet or refusal. Shallow monitoring well installations for collection of soil and groundwater will be advanced to the bottom of the shallow WBZ (approximately 15 to 20 feet bgs). Deep monitoring well installations for collection of soil and groundwater will be advanced to the top of the advance outwash underlying the deep WBZ (approximately 40 feet bgs).

At each boring and monitoring well, at least one soil sample will be collected from the vadose zone (i.e., unsaturated soil no deeper than approximately 4 feet bgs) and at least one sample will be collected from the saturated zone (deeper than 4 feet bgs) for analysis. A capillary fringe sample (i.e., damp to wet soil above the shallow WBZ, anticipated at depths of approximately 5 to 7 feet bgs) will also be collected for analysis if field screening indicates potential contamination at the capillary fringe.

Table 9-1 includes a text description of the purpose(s) of each soil boring. The table also includes two columns called “purpose: bound” and “purpose: analytes,” as discussed with Ecology. The “purpose: bound” column indicates which borings are attempts to bound contamination observed in previously-performed borings. The “purpose: analytes” column indicates that soil samples from borings SB29, SB33, MW-14 and MW-15 will include analysis for analytes with little or no prior data (i.e. PFAS in vadose and saturated soil, and full suite SVOCs and PCBs in vadose and saturated soil as requested by Ecology). The borings SB29, SB33, MW-14, and MW-15 were selected because they are in or near the former chromic

acid plating tanks area that tends to be where higher concentrations of COIs in soil and groundwater have been observed.

Soil in the sampling devices including but not limited to samples collected for analysis, will be screened in the field, using a photoionization detector and water sheen screening. Visual observations will be recorded. If there is visual evidence of contamination (e.g., staining, sheen, or free product) the sampling depths in this plan may be altered and/or additional samples may be collected. It is GeoEngineers health and safety protocol to not screen soil using odor as a screening tool, however if odors are generally apparent in the breathing zone, the odors will be recorded at the approximate depths where they occur, as well as where they stop occurring at deeper depths as applicable. Soil sample collection will be conducted using the methods and protocol outlined in the SAP/QAPP (see Appendix I).

9.13. Groundwater Sampling

Groundwater will be collected under low-flow sampling conditions from existing and newly installed shallow and deep monitoring wells (see Table 9-2 and the SAP/QAPP in Appendix I). Ten-foot-long well screens will be the default screened interval installed in monitoring wells, unless geologic information warrants shorter or longer screens. The screen bottoms will be consistent with the bottom depth of the observed shallow/deep WBZ. The screened interval for shallow wells MW12 and MW18 will be installed where the top of the well screen will be above the water table observed at time of drilling to the extent possible (i.e. also in accordance with legal requirements for surface sealing). New monitoring wells will be developed before sampling. A single groundwater sampling event will be conducted following the installation and development of the monitoring wells during tier 1. During the monitoring event, a round of groundwater level measurements from all wells will be recorded on the same day. The need for and frequency of additional groundwater sampling from the monitoring well network will be determined following review of the data collected under this plan.

9.14. Analytical Methods

On-Property soil and groundwater samples will be analyzed as indicated in Tables 9-1 and 9-2, respectively.

For the soil and groundwater analytical methods discussed below, see the SAP/QAPP for details, including reporting limits needed for comparison of results to PCULs).

The need for off-Property analyses will be evaluated based on review of Tier 1 results.

9.14.1. Soil

The chemical analyses to be performed on soil samples from Tier 1 borings is summarized in Table 9-1. At least one vadose and one saturated soil sample will be analyzed from each planned boring SB20 through SB33 and MW12 through MW18 for the following list of analytes:

- Metals including arsenic, cadmium, total chromium, copper, lead, mercury, nickel, selenium, thallium and zinc by EPA method 6020B and hexavalent chromium by method 7196A.
- TCE and degradation products (1,1-DCE, cis- and trans-1,2-DCE, and vinyl chloride) by 8260D.
- Petroleum hydrocarbons. Most soil samples will be analyzed by HCID as shown in Table 9-1, with follow up by NWTPH-Gx and/or NWTPH-Dx if HCID indicates a detection(s).

Selected soil samples will be analyzed for the following:

- EPH/VPH by methods NWTPH-EPH and NWTPH-VPH. At least three samples in the southeastern portion of the property will be analyzed for EPH/VPH in samples that have TPH concentrations exceeding 1,000 mg/kg.
- SVOCs—PAHs by EPA 8270E selected ion monitoring (SIM).
- 1,2,4-trichlorobenzene; 1,2-, 1,3-, and 1,4-dichlorobenzene; and hexachlorobutadiene by EPA 8260D.
- Full suite VOCs and 1,4-dioxane by EPA 8260D.
- Full suite SVOCs by EPA 8270E.
- PCB Aroclors by EPA 8082A.
- PFAS by EPA 537.1 Modified.

9.14.2. Groundwater

The chemical analyses to be performed on groundwater samples collected from existing monitoring wells MW1 through MW11, and planned wells MW12 through MW18, is summarized in Table 9-2. The groundwater samples will be analyzed for the following:

- Metals including arsenic, cadmium, total chromium, copper, lead, nickel, selenium, thallium and zinc by EPA methods 6020; hexavalent chromium by 7196A; and mercury by 1631E. Metals will be analyzed for total and dissolved metals. Dissolved metals will be field filtered.
- Petroleum hydrocarbons. The samples will be analyzed by HCID and NWTPH-Dx. The samples will be analyzed without SGT. Selected samples may also be analyzed with SGT. Samples will be analyzed by NWTPH-Gx if there are any gasoline-range detections by HCID.
- VOCs including 1,4-dioxane by EPA 8260D.
- PAHs-SIM by EPA 8270E-SIM.

Samples from selected wells will have the following additional analyses performed:

- EPH/VPH by methods NWTPH-EPH and NWTPH-VPH.
- PCBs by EPA 8082A.
- Full suite SVOCs by EPA 8270E.
- PFAS by 537.1 Modified.

Selected wells will be analyzed for the following geochemical parameters:

- Total organic carbon by EPA 5310.
- Nitrate as nitrogen and sulfate by EPA 300.0.
- Dissolved manganese by EPA 6020.

Geochemical parameter testing will also be conducted in the field, including using a field test kit to test for ferrous iron (total fraction). Dissolved oxygen, pH, and oxidation reduction potential will be measured and recorded in each well.

9.15. Monitoring Well Survey

A surveying contractor will conduct a survey of newly installed monitoring wells to obtain the 0.01-foot vertical accuracy needed for measuring point elevations. Monitoring well measuring points will be used to record field measurements of groundwater levels to use in potentiometric surface contouring that will inform identification of hydraulic gradients and inferred groundwater transport directions.

10.0 PROJECT MANAGEMENT PLAN

The following describes the roles of key personnel on the project.

10.1. Key Project Personnel

Garrett Leque and Terry McPhetridge will manage the project for GeoEngineers.

10.2. Schedule

The following is the schedule of deliverables included in the AO and as revised by subsequent communications between the Client or consultant, and Ecology for this plan and the fieldwork proposed herein:

Task	Due Date
Submit draft plan to Ecology	February 9, 2022
Submit final plan	Within 10 days of receipt of comments from Ecology, assuming comments are minimal
Complete fieldwork	Within 90 days of approval of final plan

11.0 LIMITATIONS

We have prepared this Work Plan for the Precision Engineering Site. Dick Morgan may distribute copies of this report to his authorized agents and regulatory agencies as may be required for the Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for conducting remedial investigations in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Any electronic form, facsimile or hard copy of the original document (email, text, table, and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix L, Report Limitations and Guidelines for Use, for additional information pertaining to use of this report.

12.0 REFERENCES

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