Draft Cleanup Action Plan
GE South Dawson Street
Seattle, Washington

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List of Acronyms

1, 1, 1,-TCA (TCA)	1, 1, 1-trichloroethane
AS	air sparging
bgs	below ground surface
CAP	Cleanup Action Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
COC	contaminant (or "constituent") of concern
CPS	construction plans and specifications
CVOCs	Chlorinated Volatile Organic Compounds
CULs	cleanup levels
CWA	Federal Water Pollution Control Act – Clean Water Act
DCE	1, 1-dichloroethene
EAB	enhanced anaerobic bioremediation
Ecology	Washington State Department of Ecology
EDR	engineering design report
EISB	enhanced in situ bioremediation
EPA	U.S. Environmental Protection Agency
EPI	Environmental Partners, Inc.
EPC	exposure point concentration
FFS	focused feasibility study
GAC	granular active carbon
GE	General Electric
GPM	gallons per minute
IAL	immediate action level
IPIMAL	inhalation pathway interim measure action level
ISCO	in situ chemical oxidation
ISVE	in situ vapor extraction
$KMnO_4$	potassium permanganate
mg/kg	milligrams per kilogram
µg/L	micrograms per liter
$µg/m^3$	micrograms per cubic meters

MCL	Maximum Contaminant Levels (Clean Water Act)
MSL	mean sea level
MTCA	State of Washington Model Toxics Control Act (Chapter 70.015D RCW)
NA	not applicable
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
PCE	tetrachloroethene
RCRA	Resource Conservation and Recovery Act (42 U.S.C. § 6901 et. seq.). In Washington State, Ecology has been authorized to enforce RCRA requirements through the Washington State Hazardous Waste Management Act (Chapter 70.105 RCW) and associated regulations.
RCW	Revised Code of Washington
ROI	radius of influence
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
VC	vinyl chloride
VCP	Voluntary Cleanup Program
VIM	vapor intrusion mitigation
VOCs	volatile organic compounds
WAC	Washington Administrative Code

1.0 Introduction

As required by the Washington Administrative Code (WAC) 173-340-380, the Washington State Department of Ecology (Ecology) is issuing this Cleanup Action Plan (CAP) for a cleanup action to be conducted by General Electric (GE) at the General Electric Aviation Div. Facility (hereinafter Facility or Site). The terms "site" and "facility" as used throughout this document are synonymous, and refer to the terms as they are defined under the Model Toxics Control Act (MTCA), Chapter 70.105D.020(5) and MTCA's implementing regulations, WAC 173-340-200. As currently understood by Ecology, this Site includes the 220 South Dawson Street Property, and those locations where contamination from the 220 South Dawson Street Property have come to be located. This includes properties directly north of the 220 South Dawson Street Property, and properties impacted downgradient. The approximate site boundaries are shown in figure 1-2.

1.1 Purpose of the Cleanup Action Plan

This CAP presents the cleanup action for the former GE Facility. The CAP provides a summary of the rationale to select the cleanup action, the cleanup standards to be achieved, the planned approach to achieve cleanup, the expected restoration timeframe, and a cost estimate of the cleanup action. This CAP also provides a brief summary of the results of GE's remedial investigation/feasibility (RI/FS) study work and the considered remedial alternatives.

A comment period has been established to allow the public an opportunity to review the draft CAP and submit comments to Ecology. Once the comment period closes Ecology will consider all comments received before finalizing the CAP. In addressing the comments Ecology may need to propose a revised CAP to the public before finalizing the document. If Ecology substantially revises the CAP, Ecology would seek public comment on the revised CAP.

The CAP is intended to meet Corrective Action requirements under the Resource Conservation and Recovery Act (RCRA), Hazardous Waste Management Act, Chapter 70.105 RCW, and Dangerous Waste Regulations, WAC 173-303-646 (collectively hereinafter Corrective Action Requirements), as well as the requirements of MTCA and its implementing regulations (Chapter 173-340 WAC). The Department of Ecology, Hazardous Waste and Toxics Reduction (HWTR) Program is overseeing compliance with these requirements for this Facility.

The combination of actions summarized below has been developed to constitute the most permanent, practicable cleanup action for the Site. Ecology has made the preliminary determination that this cleanup action meets the threshold requirements of WAC 173-340-360 to:

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

This combination of actions also meets the requirements of WAC 173-340-360 to:

- Use permanent solutions to the maximum extent practicable.
- Provide for a reasonable restoration timeframe.

- Consider public concerns.

In brief, the principal features of the cleanup action at the Site are the implementation of permanganate in-situ chemical oxidation (ISCO) treatments at the Site and concurrent optimized hydraulic control at 2nd Avenue South as shown in Figure 6-1 and discussed in more detail in Section 6. A monitoring program will be implemented to confirm the effectiveness of the ISCO treatment and optimized hydraulic control.

There will be on-going operation and maintenance of the 220 S. Dawson Street vapor intrusion mitigation system until indoor air cleanup standards are achieved. Institutional controls, including financial assurances, will also be in place to help ensure the long-term operation and maintenance of the final remedial system.

1.1.1 Human Health and Environmental Concerns: Contamination at the Site poses a threat to human health and the environment, which is thus the subject of this CAP. The main human health and ecological concerns are briefly described below. There are also additional chemicals of concern not described here that are included in the cleanup level tables (see Table 4-1), which include arsenic, petroleum as diesel and heavy oil, and 1,4 dioxane.

- Chlorinated solvent contaminated soil presents a potential dermal, ingestion and inhalation exposure to construction workers, utility workers, and employees that work below grade in the chlorinated solvent release areas of the 220 S. Dawson Street property.

  Likewise chlorinated solvent contaminated groundwater presents a potential dermal, ingestion and inhalation exposure to construction workers, utility workers, and employees that work below grade.

- Chlorinated solvent contamination in groundwater poses a potential ingestion, dermal, and inhalation exposure if groundwater is extracted for above ground use, though at this time the groundwater is not being used for potable purposes.

- Chlorinated solvent contaminated groundwater has the potential to migrate to the Duwamish River resulting in the consumption of impacted fish as well as ecological receptor exposure.

- Chlorinated solvent contaminated groundwater site wide and chlorinated solvent contaminated soils at the 220 S. Dawson Street building have the potential to produce indoor air contamination above cleanup levels in buildings located above or near the contaminated soil or groundwater without proper operation of an adequate optimized groundwater hydraulic control system, operation of the 220 S. Dawson Street building vapor intrusion mitigation system, and institutional controls to prevent building work that could exacerbate the vapor intrusion pathway. Chlorinated solvent contaminated groundwater also has the potential to create indoor air contamination above cleanup levels in new or existing buildings near or directly above the contaminated groundwater if the underlying groundwater contamination increases.

1.2 Purpose and Organization

The purpose of this CAP is to describe Ecology's cleanup action for the Site, consistent with WAC 173-340-380 of MTCA and with Corrective Action Requirements. The CAP provides the following information:

- Brief site description and background (Section 2)
- Brief summary of remedial investigation and current environmental conditions (Section 3)
- Cleanup requirements applicable to the Site, including cleanup levels, point of compliance and other federal, state, and local requirements (Section 4)
- Brief summary description of the remedial alternatives evaluated in the Focused Feasibility Study (FFS) and Ecology rationale for selection of the cleanup alternative (Section 5)
- A description of the selected cleanup action (Section 6)
- Financial Assurance and Cost Estimate Requirements (Section 6)
- Description of the schedule for implementation of the cleanup action (Section 7)
- List of the references cited in this report (Section 8).

This CAP will be incorporated in either a judicially-approved Consent Decree (if negotiated), or an Ecology-issued administrative order. As part of the design phase of the cleanup, a draft Engineering Design Report (EDR), Construction Plans and Specification Report, and other deliverables will be prepared for Ecology review and approval. The draft EDR will contain design details on the Ecology cleanup action, as well as Compliance Monitoring Plans. Following Ecology approval of the EDR the cleanup action will be implemented.

2.0 Site Description and Background

2.1 Site Location and Use History

The Site is located within the Northwest Quarter of Section 20, Range 4 East, Township 24 North, of the U.S. Geological Survey, Seattle South, Washington, 7.5-minute quadrangle (Figure 1 -1). The Site is defined by the extent of contamination caused by the release of hazardous substances at the Site. The Site is generally described in the site location map, Figure 1-2. The ground surface is approximately 15 feet above mean sea level (MSL) and generally slopes to the west at a gradient of 1 to 3 feet per mile. There is no apparent topographic relief across the Site.

The 220 South Dawson Street Property is occupied by a building that was originally constructed in 1949. The building is surrounded by asphalt pavement. GE occupied the premises in 1949 and began the manufacture and repair of equipment used in aircraft in 1959.

The General Electric Aviation-Dawson (GEA/D) manufacturing facility is an interim status dangerous waste storage facility and operated its dangerous waste container storage unit from the time its Part A application was filed in August 1980 until 1989. However, from 1989 through early 1994 dangerous wastes were only accumulated for less than 90 days in the container storage area. The dangerous waste storage area was used to store various solvents, petroleum products and acids including TCE, 1,1,1-TCE, and PCE. These solvents, along with their breakdown products and impurities (cis-1,2 dichloroethylene, trans-1,2 dichloroethylene, 1,1-dichloroethylene, vinyl chloride, 1,4-dioxane) and arsenic are the primary contaminants for the cleanup.

The RCRA closure procedures for the dangerous waste storage area were three-fold: (1) remove any contaminated asphalt in the storage area, (2) remove any contaminated soils which exceed the clean closure performance standard defined in the May 1994 closure plan submittal and (3) perform confirmatory soil sampling to ensure that the clean closure performance standards were met.

Manufacturing operations ceased in 1994, and GE continued to use the property for office and warehouse space until it sold the property to new owners in 1996. Since 1996, the building has been used for various warehousing operations by the new owners and/or their tenants.

GE completed closure of its dangerous waste storage unit in 1995. However, in addition to the closure requirements described above, MTCA and Corrective Action Requirements also mandate that GE conduct an investigation and cleanup of the Site. That cleanup is the subject of this CAP, which will satisfy both MTCA and HWMA Corrective Action Requirements.

2.2 Surrounding Land Use

The Site, which lies within the Duwamish industrial corridor, is zoned General Industrial 2 (IG2) and is within the Urban designation of the Shoreline District Overlay (U/85) (City of Seattle 2008 zoning maps: (http://www.seattle.gov/dpd/Research/Zoning_Maps/default.asp). Land uses in the Duwamish industrial corridor are predominantly light industrial (e.g., manufacturing and ware-housing) with some commercial businesses, occasional residences, and vacant lots. The adjacent properties and properties between the Site and Slip 1 of the Lower Duwamish Waterway (Slip 1 is approximately 1,600 feet from the 220 South Dawson Street building, Figure 1-1) are currently used or zoned for industrial purposes, which in the City of Seattle allows for some commercial use. Immediately south of the Site (cross-gradient), two residences are located between industrial operations. At the time of this plan, one of the residences appeared to be abandoned.

Directly to the north of the 220 South Dawson Street property is the McKinstry building. Immediately west (and downgradient) are the Iridio building at 5050 1st Avenue South and a lot with a recently demolished building at 5033 1st Avenue South. These properties are known to be above the chlorinated solvent groundwater plume resulting from spills and leaks at the 220 South Dawson Street property.

The Duwamish Valley is an area known to be the subject of multiple historic releases. As of June 2006, there were 76 MTCA and/or Corrective Action sites, 8 Voluntary Cleanup Program (VCP) sites, 15 leaking underground storage tank sites (UST), 18 sites with registered USTs, and 1 active Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site in the vicinity of the Site. Most of these sites have contaminated groundwater. In addition, the King County Department of Health reports that numerous landfills were historically located in the Duwamish industrial corridor, including at least one within 1,500 feet of the 220 South Dawson Street property. The locations and boundaries of some of the landfills in the Duwamish area, as well as the years of operation and the types of wastes accepted, are not known.

3.0 Remedial Investigation Summary

The FFS as revised and approved by Ecology provides a comprehensive discussion of the nature and extent of contamination at the Site that support Ecology's selection of the final remedy (AECOM 2008; Ecology 2008/2009a/2009b). This section provides a brief summary of the nature and extent of contamination at the Site supporting Ecology's selection of the final remedy

For discussion-only purposes in this CAP, the Site is described as the on-property area and the off-property area. The on-property area includes the 220 S Dawson Street property, which contains the former GE building. The off-property area includes all other areas of the Site besides the 220 South Dawson Street property. The approximate Site boundaries are shown on Figure 1-2).

3.1 Investigative and Remedial History

3.1.1 Investigative History

Releases occurred to the subsurface soils and groundwater from past GE operational practices at the former GE 220 S. Dawson Street facility or released from the aquifer as a result of changes in geochemical conditions resulting from those releases.

Chlorinated volatile organic compounds (CVOCs) are in soil, shallow groundwater, and soil gas/vapors at the former GE building on the 220 South Dawson Street property. The CVOCs found at the Site include PCE, TCE, 1,1,1-TCA, 1,1-dichloroethene (DCE), cis-1,2 dichloroethene, trans-1,2-dichloroethene, vinyl chloride (VC). Elevated arsenic and 1,4 dioxane are also in groundwater.

Quarterly groundwater monitoring has been performed since 1997. The groundwater monitoring events include collecting samples from monitoring wells located upgradient, crossgradient, and downgradient of contaminated groundwater areas.

In 2001, Environmental Partners, Inc. (EPI), conducted investigations at the adjacent property (Liberty Ridge, formerly Western Cartage located at 5050 1st Avenue South) which is downgradient of the 220 South Dawson Street property to characterize soil and groundwater contamination (EPI 2001). EPI designed their investigation to focus on the most probable contaminant source areas beneath the Liberty Ridge building and no on-property TCE sources were identified. Results of the EPI investigation generally confirmed the groundwater quality data collected during the GE quarterly groundwater monitoring events showing low levels of CVOCs in groundwater consistent with contaminant migration from sources at the 220 South Dawson Street property. The EPI investigation results did not reveal any contaminant sources other than those sources associated with GE's historic activities at the 220 South Dawson Street property. GE began sampling several of the EPI wells as part of its quarterly monitoring program in February 2004.

An initial evaluation of the indoor air, at the former GE building located at 220 South Dawson Street, was conducted in 2004 using models to predict the expected indoor air volatile concentrations based on known volatile contaminant concentrations in the underlying groundwater. Ecology did not agree with modeling parameters and analysis, and thus did not approve the model results. Pursuant to the 2002 Agreed Order, in December 2005, GE collected subslab vapor, indoor and ambient air samples to evaluate the conditions within the GE building. Three additional rounds of indoor and ambient air sampling were conducted in 2006 and 2007. Pursuant to the results of the indoor air sample data and a subsequent 2007 Agreed Order between Ecology and GE, GE installed a subslab depressurization system in June 2007 and confirmation indoor and ambient air sampling was conducted in November 2007 (AECOM 2008). Monthly and annual checks on the vapor intrusion mitigation (VIM) system have been required up until the time of this Cleanup Action Plan.

In 2006 an evaluation of the indoor air and potential exposure conditions performed at the former Interior Environments buildings located at 5033 1st Avenue South, downgradient of the former GE building indicated no unacceptable excess cancer exposure risk above 1EE-05, the basis Ecology used to determine if an interim action (such as the installation of a vapor intrusion mitigation system) would be necessary. (RETEC 2006). Ecology notes that this evaluation was not intended to determine compliance with the groundwater and indoor air cleanup levels where an individual excess cancer risk of 1EE-06 per constituent and total excess cancer risk of 1EE-05 is required.

3.1.2 Interim Actions

In 1995 and 1996 an independent interim action for soil was conducted in the on-property area (220 South Dawson Street), which included CVOC contaminated soil removal. GE excavated over 3,000 tons of soil from the areas shown on Figure 3-1. Most of the soils above the water table with concentrations above 1995 MTCA residential /unrestricted criteria protection of groundwater were removed. Excavation and removal of CVOC contaminated soils exceeding the 1995 cleanup levels and below the water table was not planned nor performed. Small volumes of contaminated soils exceeding the 1995 cleanup levels in the unsaturated zone remain in inaccessible areas beneath the building's structural footings, near a transformer and beneath a utility pole (Area 1, Area 7, and Area 9, as shown on Figure 3-1 (Dames & Moore 1996). The current MTCA unrestricted chlorinated solvent constituent soil and groundwater cleanup levels in this CAP are lower than the cleanup values in 1995. Therefore, there are currently more on-property contaminated soils requiring remediation under this CAP than estimated in 1996. Additionally, unknown volumes of contaminated soil remain below the water table in the saturated zone. An independent interim action groundwater recovery system (which includes groundwater extraction and discharge) was designed and constructed in 1996 and began operating in August 1996. Groundwater was recovered from two wells (RW-1 and RW-2, shown on Figure 3-1) on the downgradient side of the 220 South Dawson Street property with the objective of containing and recovering contaminated groundwater beneath the property. This work was not reviewed or approved by Ecology; however, Ecology does believe it has significantly reduced off-property (beyond 2nd Avenue South) migration of the chlorinated solvent groundwater plume.

In 2002 Ecology and GE entered into an Agreed Order to complete the contaminated groundwater investigation, investigate indoor air contamination via the vapor intrusion pathway, and continue operation of the current groundwater extraction system with the addition of a source area pumping well, RW-3. In August 2003 the groundwater recovery system was modified as required in the 2002 MTCA Agreed Order (Ecology 2002). A new recovery well (RW-3) was added and pumping locations and pumping rates were modified. The objective of this modified groundwater recovery system was to better contain and recover contaminated groundwater, focusing on the source area in the northern portion of the property. RW-2 and RW-

3 groundwater recovery wells are designed to operate at a combined rate of 16 gallons per minute (gpm) with discharge to King County sewer. GE is required to implement recovery well operating and maintenance procedures to maintain RW-2 and RW-3 pumping rates as close to their design rates, 6.0 gpm and 10.0 gpm, respectively. GE continues to operate the RW-2/RW-3 groundwater extraction system.

Based on the results of indoor air sampling showing unacceptably elevated TCE indoor concentrations (excess cancer risk above 1EE-05) in the 220 South Dawson Street building, Ecology and GE entered into an Agreed Order in 2007 requiring GE to operate and maintain a VIM system at the 220 S. Dawson Street building

3.2 Geology

The Site lies in a depositional basin referred to as the Duwamish Trough. The basin holds up to approximately 200 feet of sediments deposited by the Duwamish River (deltaic, estuarine, and alluvial) and volcanic lahar deposits. The Duwamish Trough is bounded and floored by bedrock consisting of sedimentary rock and limited volcanic intrusive rocks. The recent alluvium filling the trough includes sands and silts deposited by the Duwamish River and its tributaries. In the vicinity of the Site, the mudflows have not been encountered, and the lower alluvial deposits consist typically of fine sands and silts with shells. This alluvial sequence grades upward from estuarine to a more river-dominated depositional sequence, with complexly interbedded sand, silt, and gravel (Fabritz, Massman and Booth 1998). In the late 1800s and early 1900s, during development of Seattle, the tide flat and flood plain were reclaimed for development through channelization of the Duwamish River and placement of fill. In many cases, the contact between fill and native soils is difficult to discern as the fill used is similar to the native soil.

Site investigation work has extended to a maximum depth of 65 feet below ground surface (feet bgs), approximately one-quarter to one-third of the total depth of the alluvial valley deposits. This upper 65 feet of the approximately 200-foot valley deposits is interpreted to be equivalent to the river-dominated sequence of interbedded sand, silt and gravel (Fabritz, Massman and Booth 1998). However, in the vicinity of the Site, the stratigraphic sequence consists predominantly of sand and silty sand. Gravel has not been encountered and silt beds within the native alluvium are limited and generally not continuous. Site boring logs show relatively uniform silty sand and sand with thin discontinuous silt layers extending to a depth of 57 feet bgs. Deeper borings suggest that the interval between the 30- to 50-foot depths contains some thin discontinuous silt layer.

3.3 Hydrogeology

According to the *Duwamish Basin Groundwater Pathways Conceptual Model Report*, regionally the Duwamish River Valley is considered “a single, large aquifer system” due to the “singular nature of its geologic origin and its location within a valley bounded both laterally and vertically by walls comprised of bedrock, silts, and dense glacially overridden strata” (Duwamish Study, 1998). Investigations associated with the GE Site have focused on the uppermost 65 feet of this approximately 200-foot thick aquifer. Terms used in this report such as “shallow” and “deep” groundwater refer only to the portion of the aquifer studied and are not meant to imply that it is the “deep” portion of the whole aquifer in the greater Duwamish Valley.

For the purposes of the Site RI/FS, three aquifer zones (intervals) were defined in the upper 65 feet of the regional aquifer. The shallow zone of the aquifer is defined as the top of the water table down to approximately 20 feet bgs. The term “intermediate zone” is defined as the aquifer zone from 20 to approximately 40 feet bgs. The term “deep zone” of the aquifer is defined as the aquifer zone below 40 to approximately 65 feet bgs.

3.3.1 Groundwater Elevations and Gradients

Groundwater occurs under unconfined conditions in the aquifer zones beneath the affected properties. Groundwater is generally encountered between 7 and 11 feet bgs. Water levels varied seasonally by between 1.0 and 1.5 feet, with highest water levels measured in February and lower levels measured in August.

Overall groundwater flow is from the east to the west and slightly southwest. Flow directions in the vicinity of pumping wells RW-2 and RW-3 vary, as these are influenced by the ongoing groundwater recovery. The overall flow direction is consistent with the measured groundwater flow direction prior to the installation of the recovery system. Horizontal hydraulic gradients generally range from 0.0003 to 0.002 feet/feet in the shallow aquifer zone.

Vertical hydraulic gradients between shallow and intermediate as well as between intermediate to deep aquifer zone are small, generally range from +0.01 to -0.005 ft/ft. The water level elevation differences between different aquifer zones are generally less than 0.05 feet. A slightly downward hydraulic gradient is generally observed during the raining season, probably due to infiltration recharge occurred at unpaved ground surfaces.

3.3.2 Groundwater Recharge and Discharge

The Duwamish Study (1998) estimates that infiltration recharge on the eastern side of the Duwamish Valley is generally less than 10 inches per year. The Site (in particular near 220 S. Dawson Street) is currently capped with asphalt and concrete, however, historically the extent of this coverage was not as complete.

Groundwater recharge to the Site is primarily lateral flow from the eastern side of the Duwamish Valley. Limited infiltration recharge may also occur through bare ground surfaces or leaky storm water lines. Groundwater discharge occurs as lateral flow to the west toward the Duwamish waterway. No surface water ponds or wetlands exist at the vicinity the Site.

3.3.3 Aquifer Hydraulic Characteristics

Two pumping tests were conducted in May 1996 and August 2003 to characterize aquifer hydraulic properties. Aquifer hydraulic properties estimated from the pumping test data indicate that the shallow aquifer zone is relatively homogeneous and fairly conductive. Transmissivity values estimated by GE (RETEC 2007) range from 2,700 to 7,400 feet^2/day. Additional pumping test data analysis conducted by Ecology (2008a) estimated transmissivity values at the Site ranging from 2,800 to 14,000 feet^2/day. Assuming the shallow aquifer zone thickness of 15 feet, hydraulic conductivity will range from 185 to 930 feet/day.

3.4 Nature and Extent of Contaminated Media

The primary contaminants of concerns (COCs) for soil, groundwater and vapor, as defined in the 2008 Agreed Order, include: TCE, 1,1,1-TCA, PCE, cis-1,2- dichloroethene (cis-1,2 DCE), trans-1,2-dichloro-ethylene, 1,1-dichloroethene, VC, arsenic, petroleum hydrocarbons as diesel and heavy oil, and 1,4-dioxane. Arsenic and 1,4-dioxane are not volatile substances and are not considered potential vapor intrusion COCs.

Releases occurred to the subsurface soils and groundwater from past GE operational practices at the former GE 220 S. Dawson Street facility or released from the aquifer as a result of changes in geochemical conditions resulting from those releases. Chemical data and other characterization information collected during site investigations have delineated the extent of contaminated groundwater, soil, and air at the Site. The following subsections provide an overview of the information presented in the above-referenced documents.

The source area of the TCE, 1,1,1-TCA and TPH groundwater and soil contamination is the north section of the 220 South Dawson Street property where spillage and leakage of TCE, 1,1,1-TCA and petroleum hydrocarbon products occurred as a result of using chlorinated solvent degreasers and cutting machinery; leakage and spills of TCE and 1,1,1- TCA solvent product and RCRA waste; and leakage and spills of machine oils and engine oils within the north section of the building. The quantity of the solvent products spilled and leaked to subsurface and absorbed to vadose soil was unknown. Some of the contaminated vadose zone soil was excavated but approximately 100 cubic yards remained because of building foundation stability concerns. Chlorinated solvents and petroleum hydrocarbons migrated through the vadose soils into the groundwater (approximately 7-10 feet below ground surface). The solvent and petroleum hydrocarbon products may have spread during the vertical infiltration through the vadose zone because of discontinuous thin layers of silt. The chlorinated VOC and petroleum hydrocarbon contaminants adsorbed onto the organic contents of soil will become a secondary source of the contamination. Absorbed soil concentrations and dissolved groundwater concentrations do not indicate the presence of dense aqueous phase liquid (DNAPL) at the Site.

Migration of chlorinated solvents and petroleum hydrocarbon products in groundwater are mainly through the dissolved phase. Fate and transport of dissolved contaminants are primarily controlled by groundwater advection, dispersion/diffusion, retardation due to sorption, and degradation (reductive dechlorination). Reductive dechlorination of PCE and TCE by natural attenuation (NA) processes may have occurred at the Site, but effectiveness of the NA has not been determined. Dissolved chlorinated VOC plumes have spread and migrated under the southern portion of the 220 S. Dawson Street building, and the southern portion of the McKinstry building (to the north), and westwardly past First Avenue South. The dissolved CVOC plume continued to migrate westwardly and vertically, and in the downgradient area near First Ave S, to a depth of approximately 45 to 55 feet bgs most likely through groundwater advection and dispersion. The current groundwater extraction system serves to reduce the footprint of the chlorinated solvent contaminated groundwater plume beneath the 220 South Dawson Street building and reduce the spreading via dispersion of groundwater contamination to the north and migration via advection westerly beyond the 220 South Dawson Street property. The groundwater extraction system has also reduced the footprint for vapor intrusion in buildings above the on-property and off-property groundwater plume. Ecology’s data analysis shows complete hydraulic containment of the on-property groundwater plume is not achieved; however, there is significant mass flux reduction to off-properties.

3.4.1 Soil

Following the interim action soil removal, described in Section 3.1.2, above, it is estimated that less than 100 cubic yards of chlorinated solvent contaminated soil remain above the water table in the inaccessible areas beneath the building and electrical poles located adjacent to the building. The amount of chlorinated solvent contaminated soil below the water table that exceeds current cleanup standards is currently unknown. However, because the actions selected in this CAP should remediate the contaminated saturated zone soils as further explained in Section 6.0, Ecology has determined that further investigation into the soil volume in the saturated zone is unnecessary at this time. Soil results collected during the 1995/6 independent interim action are summarized below.

TPH-Diesel and Heavy Oil Range – The Method A Cleanup Level for TPH gasoline without benzene is 100 mg/kg. TPH detected at the Site was in the heavy oil range (with a MTCA Method A Cleanup Level of 2,000 mg/kg). Only post-excavation samples in Areas 1 and 9 were above 100 mg/kg. A limited amount of inaccessible soil with TPH concentrations exceeding 100 mg/kg was left in place along the north and west side-walls at the northwestern corner of Area 1 (concentrations ranged from 167 to 356 mg/kg). The building foundations prohibited further excavation in Area 1. Soil with TPH concentrations exceeding 100 mg/kg was also left in place in Area 9 along the east and south side-walls (the maximum concentration detected was 10,900 mg/kg). At the time, soil was inaccessible in this area because of an active transformer and an adjacent power pole. Excavation areas are shown on Figure 3-1.

CVOCs – The sample detection limit for the 1995-6 independent excavation for TCE was 0.05 mg/kg. TCE above the 1995 cleanup level applicable at the time of the removal (0.398 mg/kg), was left in place beneath the footing of a load-bearing exterior wall and in the north-central side wall (maximum values of TCE detected at 1.16 mg/kg) and the north-eastern side wall (maximum values of TCE detected a 0.67 mg/kg in Area 7. Residual TCE in soils in the former underground storage tank area (Area 8) are also present (just north of MW-5) at 15.3 mg/kg. All post-excavation samples in Area 7 were below PCE cleanup levels that were applicable at the time of sampling (0.086 mg/kg). The sample detection limit for the 1996 excavation for PCE was 0.05 mg/kg. One floor soil sample from Area 7 at 10 feet bgs reported a value of 0.06 mg/kg (sample ID S-7-34). All other samples were reported to be at or below the laboratory detection limit of 0.06 mg/kg. As indicated earlier, the current TCE soil cleanup levels (protective of indoor air and groundwater cleanup levels) have decreased since the 1995-6 independent action. The TCE soil cleanup level under this CAP is 0.044 µg/L for protection of groundwater only. TCE soil cleanup levels under this CAP for the protection of indoor air are evaluated per Section 4.2 of this CAP. Excavation areas are shown on Figure 3-1.

- **Inorganic –** Confirmation sampling of Areas 1 through 12 produced inorganic concentrations consistently below the applicable cleanup level for soil. The cleanup levels for arsenic, cadmium, and lead were at or below the current MTCA Method A or B standards for unrestricted land use. Barium was excavated to a cleanup level of 112 mg/kg. Barium does not have a MTCA Method A soil cleanup level; the MTCA Method B standard for barium is 16,000 mg/kg. Based on the 1996 reports, soil in the excavated areas does not contain inorganics above the current MTCA Method A or B soil cleanup levels. Excavation areas are shown on Figure 3-1.

3.4.2 Groundwater

The monitoring well network is shown on Figure 1-2 and includes the following wells. Wells were initially installed in 1992 and 1994 as part of an independent action. Subsequently, additional groundwater wells were installed under the 2002 Ecology-GE Agreed Order:

- **Shallow (Water Table) Wells –** MW-1 through MW-13, MW-21S and EPI-MW -3S and -4S, are all screened across the water table, to a total depth of 15 to 20 feet bgs

- **Intermediate Wells –** MW-8M, -14M, -15M, -16M, -17M, -18M, -19M, and -20M are all screened from approximately 20 to 30 feet bgs. EPI-MW-2D, -3D and -4D are all screened 25 to 30 feet bgs

- **Deep Wells –** MW-14D, -15D -16D, -17D, and -18D are all screened from 45 to 55 feet bgs.

Groundwater is routinely analyzed for CVOCs including: TCE, PCE, 1,1-Dichlororethene, 1,1-DCA,1,1,1-TCA, cis-1,2-DCE, trans-1,2-dichloroethene, and VC. Several groundwater samples were analyzed for 1,4 dioxane and arsenic.

Groundwater cleanup levels are discussed in Section 4. Ecology has determined that shallow zone groundwater, which includes the water at the water table to 20 feet bgs will be expected to meet cleanup levels that are protective of indoor air, surface water receptors- area-specific consumption of fish, and ecological receptors. These cleanup levels are referred to as “shallow site-specific MTCA Method B cleanup levels. Groundwater in the “intermediate” and “deep” aquifer zones (all groundwater below 20 feet) will be expected to meet cleanup levels that are protective of surface water receptors- area-specific consumption of fish, and ecological receptors. These cleanup levels are referred to as “deeper site-specific MTCA Method B cleanup levels.” Figures 3-2 through 3-8 provide plan and cross section views of the current CVOC distribution.

3.4.2.1 Shallow Zone Groundwater

Trichloroethylene – Chlorinated degreaser solvent used at the 220 S. Dawson Street facility. TCE is present at concentrations above the shallow site-specific MTCA Method B cleanup level (6.6 µg/L) in the following shallow wells, MW-1, MW-2, MW-3, MW-4, MW-6, MW-7, MW-8S, MW-11, MW-21S, EPI-MW-3S and EPI-MW-4S. TCE concentrations detected above the cleanup level range from a minimum value of 6.7 µg/L (MW-2, 1993) to a maximum value of 720 µg/L (MW-1, 1992). Figures 3-3a and b show TCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

Cis-1,2-Dichloroethylene – A degradation product of TCE. The shallow site-specific MTCA Method B cleanup level for cis-1,2 DCE is 590 µg/L. The cis-1,2-DCE concentrations detected range from a minimum value of 210 µg/L (MW-8S, 8/12-1998 and 6/8-1999) to a maximum value of 370 µg/L (MW-8S, 1994). Figures 3-4a and b show cis-1, 2-DCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

1,1,1-Trichloroethane – Chlorinated degreaser solvent used at the 220 S. Dawson Street facility. The shallow site-specific MTCA Method B cleanup level for 1,1,1-TCA is 11 µg/L. Exceedance of this cleanup level has been detected in well MW-1, MW-2, MW-4, MW-5, MW-6, MW-7 and historically at MW-8S.1,1,1-TCA concentrations detected above the cleanup level range from a minimum value of 12 µg/L (MW-4, 2004, 2005, 2006; MW-7, 2002) to a maximum value of 2600 µg/L (MW-1, 1992). Figure 3-5 shows 1,1,1-TCA concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

1,1-Dichlororethene – A degradation product of 1,1,1-Trichloroethane. The shallow site-specific MTCA Method B cleanup level for 1,1-DCE is 3.2 µg/L. 1,1-DCE concentrations detected above the cleanup level range from a minimum value of 3.3 µg/L (MW-4, 2001) to a maximum value of 360 µg/L (MW-6, 1995). Figure 3-6 shows DCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

1,1-Dichloroethane – No shallow site-specific MTCA Method B cleanup level exists for 1,1-DCA.

Vinyl Chloride – A degradation product of trichloroethene and cis-1,2-DCE. VC was detected above the shallow site-specific MTCA Method B cleanup level of 1.0 µg/L in well MW-4, MW-6, MW-7, and MW-8S of the shallow wells. VC concentrations detected above the cleanup level range from a minimum value of 1.1 µg/L (MW-6,1997) to a maximum value of 8.6 µg/L (MW-8S (duplicate),1997). Figure 3-7 shows vinyl chloride concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

Tetrachloroethylene – A product that is frequently found with trichloroethene solvents. The shallow site-specific MTCA Method B cleanup level for PCE is 3.3 µg/L. Concentrations above this cleanup level were detected in wells: MW-1, MW-4, and MW-6 historically. PCE concentrations detected above the cleanup level range from a minimum value of 3.4 µg/L (MW-1; 2002) to a maximum value of 22 µg/L (MW-1, 1992). Figure 3-8 shows PCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

Trans-1,2-Dichloroethylene – A degradation product of trichloroethene. The shallow site-specific MTCA Method B cleanup level for trans-1,2-Dichloroethylene is 163 µg/L. No trans-1,2-Dichloroethylene concentrations in shallow wells exceeded this cleanup level.

Arsenic – The shallow site-specific MTCA Method B cleanup level (based on natural background) for Arsenic is 5 µg/L. Dissolved arsenic was detected in groundwater above the cleanup level in groundwater collected from well MW-6, MW-13, EPI-MW-3S, and EPI-MW-4S. Dissolved arsenic is likely a result of the locally geochemically reduced shallow aquifer conditions that accompany the degradation of trichloroethene. Arsenic concentrations detected above the cleanup level range from a minimum value of 5 µg/L (MW-6, 2003 and MW-13, 2003 and 2004) to a maximum value of 26 µg/L (EPI-MW-4S, 2008).

1,4-Dioxane – A chemical stabilizer that is mixed in small concentrations with trichloroethene and 1,1,1-trichloroethane. The shallow site-specific MTCA Method B cleanup level for 1,4-Dioxane is 69 µg/L. 1,4-dioxane was not found above the 1.0 µg/L reporting limits in the shallow zone groundwater and does not exceed the MTCA Method B cleanup level in any of the shallow wells.

3.4.2.2 Intermediate and Deep Zone Groundwater

Trichloroethylene – The deeper site-specific MTCA Method B cleanup level for TCE is 30 µg/L. Concentrations above this cleanup level have been detected in the following intermediate and deep wells: MW-14M, MW-15M, MW-15D, and EPI-MW-2D. TCE concentrations detected above the cleanup level range from a minimum value of 36 µg/L (MW-15D, 2010) to a maximum value of 150 µg/L (MW-15M, 2005). Figures 3-3a and b show TCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

Cis-1,2-Dichloroethylene – The deeper site-specific MTCA Method B cleanup level for cis-1,2-DCE is 450 µg/L, this cleanup level is not exceeded in any intermediate or deep wells. The maximum cis-1,2-dichloroethene concentration in groundwater was 110 µg/L (EPI-MW-2D, 2012). Figures 3-4a and b show 1,2-DCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

1,1,1-Trichloroethane – The deeper site-specific MTCA Method B cleanup level for 1,1,1-TCA is 11 µg/L, and showed no concentrations in intermediate or deep wells above the reporting limits (0.1 to 10 µg/L). Figure 3-5 shows 1,1,1-TCA concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

1,1-Dichlororethene – The deeper site specific MTCA Method B cleanup level for 1,1-DCE is 3.2 µg/L. Concentrations above this cleanup level were detected in the following intermediate and deep wells: MW-14M, EPI-MW-2D and EPI-MW-3D. The maximum 1,1-DCE concentration in groundwater was 33 µg/L (EPI-MW-2D, 2009). Figure 3-6 shows 1,1-DCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

1,1-Dichloroethane – No deeper site-specific MTCA Method B cleanup level exists for 1,1-DCA.

Vinyl Chloride – The deeper site-specific MTCA Method B cleanup level for VC is 2.4 µg/L. The maximum detection in intermediate or deep wells is at EPI-MW-2D, detected at 1.6 µg/L (November 2004). Figure 3-7 shows VC concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

Tetrachloroethylene – The deeper site-specific MTCA Method B cleanup level for PCE is 3.3 µg/L. No detected concentrations in intermediate or deep wells currently exceed this cleanup level. The maximum PCE concentration in groundwater was 0.046 µg/L (MW-14D, 2008). Figure 3-8 shows PCE concentrations measured in February 2008, after 12 years of operation of the groundwater extraction system.

Trans-1,2-Dichloroethylene – The deeper site-specific MTCA Method B cleanup level for trans-1,2-Dichloroethylene is 590 µg/L. The highest detected value of this compound is 50 µg/L (EPI-MW-2D, 2012), which is below the 590 µg/L cleanup level.

Arsenic – The deeper site-specific MTCA Method A cleanup level (based on natural background) for Arsenic is 5 µg/L. The maximum Arsenic concentration was 6 µg/L (totals, MW-14D, 2003) and 4 µg/L (filtered, MW-14D, 2003).

1,4-Dioxane – The deeper site-specific MTCA Method B cleanup level for 1,4-Dioxane is 69 µg/L. The maximum concentration of 1,4-dioxane found was 27 µg/L (MW-17D, 2005). The cleanup level has not been exceeded in any of the intermediate or deep wells.

3.4.3 Vapor

3.4.3.1 Subslab Vapor

Subslab samples were collected in the December 2005 sampling event (Table 3-1). Both 1,1,1-TCA and TCE were consistently detected in subslab samples. 1,1,1-TCA concentrations ranged from 15 to 6,900 µg/m^3, but were well below the interim action derived screening level of 220,500 µg/m^3. TCE concentrations ranged from 44 to 3,700 µg/m^3, exceeding the interim action derived screening level of 22 µg/m^3. Ecology used a site specific sub-slab vapor screening level equal to 100 times the Method B indoor air cleanup levels effective at that time to determine if an interim action (such as installation of a vapor intrusion mitigation system) was required prior to implementation of the final cleanup. Ecology notes that the sub-slab vapor screening level for determining if an “interim action” vapor intrusion mitigation system installation is required is not identical (and a higher threshold concentration) than sub-slab vapor concentrations used in the MTCA cleanup level analysis for the Site.

3.4.3.2 Indoor Air

Between 2005 and 2007, five rounds of indoor air samples were collected at the former GE building, located at 220 South Dawson Street. Indoor air samples collected resulted in TCE detections (up to 0.515 µg/m^3 TCE) above the applicable MTCA Method B cleanup levels and the site-specific interim action levels in several areas of the building (Table 3-2). At the time interim action levels were established at a total excess cancer risk of 1EE-05. Based on the result of the indoor air sampling data, Ecology required that GE install a subslab depressurization system (see Section 3.1.1).

After the installation of the subslab depressurization system, ambient air and indoor air samples were collected on in November 2007. TCE was detected in all indoor samples with the exception of IA-3. TCE indoor air concentrations corrected for ambient air detections ranged from 0.04 µg/m^3 (IA-5) to 0.50 µg/m^3 (IA-4)[1]. Sub-slab negative pressure data collected on two occasions (2007, 2009) since installation of the VIM system indicate a downward pressure gradient across the 220 South Dawson Street floor slab. Based on these results and the current use of occupants in the building, additional interim actions were not required. System performance monitoring will continue to assess that the VIM system is operating as designed, and other monitoring will be conducted as described in Section 6.0. At the immediate downgradient and newly constructed building owned by Liberty Ridge, LLC located at 5050 1st Avenue South, above the off-property groundwater plume, indoor air engineering controls were estimated and conservative modeling was conducted to predict concentrations of TCE in the building indoor air. Modeling was approved by Ecology and showed predicted indoor air concentrations below applicable interim action screening levels (based on a total excess cancer risk of 1EE-05).

Indoor and ambient air samples collected from the former Interior Environments building located at 5033 1st Avenue South showed no CVOCs were detected above the reporting limits (0.19-0.22 µg/m^3). The results were satisfactory to Ecology to determine that an interim action (vapor intrusion mitigation system installation) was not required. Ecology notes that the indoor air screening level for determining if an “interim action” vapor intrusion mitigation system installation is required is a higher threshold concentration than the indoor air cleanup level established for the Site. Shallow zone groundwater (protective of indoor air cleanup levels) and indoor air cleanup standards must ultimately be met in order to meet the cleanup requirements of this CAP.

3.5 Exposure Assessment

This section identifies potential human and ecological exposures to contaminated media at the Site. As the Site is located in a highly urbanized, industrial area, exposure pathways for terrestrial ecological receptors are not complete and are not considered further. WAC 713-340-7491(1)(b). Contaminated media include soil, groundwater, and indoor air.

Current and Future Exposure Pathways:

Direct contact with soil – In this exposure pathway, we must evaluate whether a receptor could come in direct contact with soil containing COCs. COCs exceeding cleanup levels in soil at the 220 South Dawson Street property that remained in place after a site-wide excavation. Remaining

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[1] TCE concentrations detected in indoor air are estimates due to lack of upwind ambient air TCE concentrations data for the sampling period.

contaminated soils are located at the contamination source areas where chemicals were released on the 220 South Dawson Street property. Additionally, the former GE on-property area located at 220 South Dawson Street is completely paved with asphalt or concrete. Therefore, under the current land uses and activities, the future complete exposure pathway scenario is limited to construction or utility worker (including excavation) contact with the soils during future construction or maintenance activities. Exposure routes include dermal contact, incidental ingestion, and inhalation. If the land use and activities were to change, additional potential exposure pathways would exist.

Non-potable Groundwater – In this exposure pathway, we must evaluate whether a receptor could come in direct contact with CVOC-affected groundwater (one example is if an excavation is extended below the water table). Direct contact with CVOC-affected groundwater is a future complete exposure scenario for a construction worker, utility worker, or tenant that withdraws contaminated groundwater for non-drinking water purposes. Exposure routes could include dermal contact, incidental ingestion, and inhalation.

Groundwater as a drinking water source – In this exposure pathway, we must evaluate whether a CVOCs could migrate from the source via groundwater to a drinking water well, where it could be used for residential consumption The City of Seattle has an ordinance restricting use of groundwater as a drinking water source in this industrial area of Seattle. Drinking water wells are not lawfully authorized. However, if these zoning laws were to be changed in the future, this exposure pathway could be completed. The current non-potability determination is premised at least in part on this prohibition.

Vapor intrusion to indoor air – In this exposure pathway, we must evaluate whether CVOCs would volatilize from soil and groundwater and migrate through the unsaturated zone via vapor gas and enter the indoor or ambient air. A receptor could then inhale the CVOC-contaminated air. Prior to the implementation of the air mitigation interim action at the former GE building, concentrations measured in selected indoor air samples in the 220 South Dawson Street building were higher than the MTCA Method B cleanup levels and separately established interim action screening concentrations established for the Site. Based on these detected concentrations, without adequate hydraulic control and operation of the VIM system, this exposure pathway is complete for soil and shallow groundwater. In addition, the potential pathway is complete for CVOC vapor intrusion into (a) new constructed buildings (without mitigation systems) near or above the CVOC groundwater plume, (b) the 220 S. Dawson Street property if tenants could choose to not operate their existing mitigation system, or (c) existing buildings without mitigation systems if shallow CVOC groundwater concentrations increase above current levels or new vapor intrusion pathways are created within those existing buildings.

Consumption of fish and aquatic ecological exposure – In this exposure pathway, we must evaluate whether CVOCs that are dissolved in groundwater would migrate via groundwater 690 feet to Slip 1 or other entry points of the Duwamish Waterway (measured from the furthest downgradient portion of the plume), where they would be released to the surface water environment. Potential receptors are the ecological organisms in the waterway and human receptors that catch and consume potentially CVOC-contaminated fish. Current sampling data shows that the CVOC-contaminated groundwater does not extend to the waterway and this pathway is not currently complete. The westernmost detected concentrations (demonstrated by the results from MW-16M and MW-16D) are 690 feet from Slip 1 of the waterway. However, persistent elevated CVOC concentrations near the leading edge of the plume indicate that there is a future potential for downgradient plume migration to the river at concentrations above or below the groundwater cleanup levels. Therefore this is a future potentially complete pathway for ecological and human receptors.

4.0 Cleanup Standards and Immediate Action Levels

This section describes the principal regulatory considerations for Site cleanup and specifies the performance standards that the cleanup must meet. Cleanup levels and points of compliance for each contaminated environmental media are provided in Table 4-1. The rationale for these cleanup standards is provided in the following subsections.

Under the MTCA Cleanup Regulations, there are specific minimum requirements for cleanup actions, WAC 173-340-360(2). All cleanup actions must meet these threshold requirements.

- Protect Human Health and the Environment and ensure the cleanup actions achieve cleanup levels (Table 4.1) at the standard point of compliance.
- Comply with Cleanup Standards and Applicable State and Federal Laws
- Provide for Adequate Compliance Monitoring to ensure human health and the environment are protected during the construction, operation and maintenance activities; to confirm that the actions have attained cleanup levels at the point of compliance; and confirm long-term effectiveness of the cleanup action.

Additionally, all cleanup actions must meet these additional requirements:

- The cleanup action must be permanent to the maximum extent practicable.
- Provide for a reasonable restoration timeframe.
- Consider public comments.

Ecology carefully considered these minimum requirements when selecting the cleanup action for the GE Site from among alternatives, technologies, and information presented in the Focused Feasibility Study (FFS). Ecology subsequently modified and then approved the FFS (Ecology 2009b). Through this draft CAP, Ecology is hereby making the preliminary determination that this cleanup action plan meets the minimum requirements for a cleanup found in WAC 173-340-360.

4.1 Groundwater Cleanup Levels and Points of Compliance

Under MTCA and where groundwater is not a current drinking water source or has a low future probability for use as a drinking water source as defined by WAC 173-340-720(2), the groundwater cleanup levels may be defined under WAC 173-340-720(6). In the case of this Site cleanup, the groundwater cleanup levels must be protective of both the vapor intrusion pathway and the surface water cleanup levels based on the consumption of fish/aquatic exposure pathway.

4.1.1 CVOCs, semi-volatiles and metals

Per the requirements of WAC 173-340-720(2) and (6), the groundwater cleanup levels for TCE, PCE, VC, 1,1,1-TCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE, arsenic, TPH-heavy oil, TPH-diesel, and 1,4-dioxane at the Site need to be based on the lower of the following:

- Surface water concentrations that are protective of consumption of fish. The criteria for consumption of fish must consider Asian Pacific Islander (API) consumption rates as previously defined by Ecology (Ecology 2008/2009). These are MTCA Method B surface water cleanup levels, adjusted for API fish ingestion pathway.

- Surface water concentrations protective of ecological receptors.

- Groundwater concentrations that are protective of Method B air cleanup levels.

  - Groundwater concentrations that are protective of construction/utility/site worker direct contact and inhalation. As discussed in the FFS and the associated Ecology comment letters, cleanup levels for protection of construction/utility/site worker direct contact are higher than other cleanup levels for other pathways. Therefore, these construction/utility/site worker based cleanup levels are considered met if the other more stringent cleanup levels for other required pathway receptors are met. (AECOM 2008; Ecology 2008/2009)

- Concentrations established by applicable federal and state laws.

- For the case of arsenic, groundwater cleanup levels are based background as defined by the MTCA Method B cleanup levels.

As discussed above, the vapor intrusion exposure pathway is only complete for shallow zone groundwater. Based on site-specific conditions, shallow zone groundwater has been defined as that groundwater between the water table and 20 feet below bgs. Under normal current and likely future groundwater conditions, the intermediate and deep aquifer zone groundwater does not mix with shallow zone groundwater in sufficient quantities to create a complete pathway from the intermediate and deep aquifer zone to indoor air. GE will need to ensure institution controls are in place to prevent mixing of the intermediate and deeper contaminated aquifer zones with the shallower contaminated aquifer zone , The site cleanup levels for shallow zone groundwater (water table to 20 feet) are the lower of groundwater cleanup levels protective of indoor air cleanup levels, concentrations established by applicable federal and state laws, and surface water cleanup levels protective of API fish consumption and ecological aquatic criteria. In most cases, groundwater cleanup levels protective of indoor air, as calculated using the PSC-Georgetown inhalation pathway interim measure action levels (IPIMALs[2]) are lower than API surface water, other federal/state criteria and ecological aquatic criteria, therefore are the shallow site-specific MTCA Method B groundwater cleanup levels.

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[2] Ecology is approving the same concentrations used as the PSC Georgetown groundwater IPIMALs for the shallow GW CUL (for further discussion see Ecology's July 13, 2009 response letter). These IPIMALs were the result of an empirical study correlating groundwater VOC data with indoor air VOC data, that then attempted to develop a mathematical relationship between the two (an "attenuation factor"). Ecology believes these are applicable to the GE site because the two cleanup sites lie above the same aquifer, have similar vadose zone characteristics, and share the same COCs (chlorinated volatile contaminants such as PCE, TCE, 1,1,1-TCA, and decomposition products of each). Based on Ecology's current understanding, Ecology does not believe there are significant geological differences in the vadose zones at the PSC-G and GE sites.

The site groundwater cleanup levels for intermediate and deeper zone groundwater (below 20 feet bgs) are the lower of groundwater surface water cleanup levels for API fish consumption, other federal/state criteria, and ecological aquatic criteria (Ecology 2009a).
For the shallow, intermediate and deeper zones of the aquifer, the standard point of compliance applies and is defined as throughout the Site groundwater.

4.1.2 TPH

TPH in the heavy oil range (TPH-heavy oil) and diesel (TPH-diesel) remains in the saturated and unsaturated soil zones at selected locations at the former GE building, located at 220 South Dawson Street. It is unlikely that the TPH-heavy oil and TPH-diesel soil and groundwater cleanup levels to drive site cleanup actions because ISCO chemicals are expected to treat both the chlorinated solvent contaminants and TPH in groundwater. However, TPH groundwater cleanup levels are required under the MTCA for this Site cleanup. The MTCA Method A unrestricted groundwater cleanup level for TPH-heavy oil and TPH-diesel of 500 µg/L each applies to the shallow, intermediate, and deeper zones of the aquifer, throughout the groundwater. Compliance will be evaluated by collecting groundwater samples in or immediately downgradient of the TPH contamination (standard point of compliance).

4.2 Soil Cleanup Levels and Point of Compliance

4.2.1 CVOC

The MTCA requires that soil cleanup levels for TCE, PCE, VC, 1,1,1-TCA, 1,1-DCE, cis-1,2-DCE, trans-1,2-DCE and 1,4-dioxane at the Site need to be based on the lower of the following:

- Concentrations protective of indoor air as determined based on soil concentrations protective of leaching to groundwater at concentration where groundwater would exceed cleanup criteria for indoor air (based on area-specific IPIMAL as discussed in Section 4.1.1).
- Concentrations protective of indoor air as a result of direct volatilization of chlorinated solvent constituents in the vadose zone with those volatiles migrating into buildings above.
- Concentrations established by applicable federal and state laws.
- Concentrations protective of site/utility/construction worker direct contact and inhalation. The Site is located in a commercial and industrial zoned area.

The site-specific soil cleanup levels protective of groundwater and indoor air are the lowest of these criteria.

Therefore, soil cleanup levels protective of groundwater and indoor air are the site-specific MTCA Method B soil cleanup levels. The standard point of compliance applies and is defined as the soils throughout the Site from the ground surface to the uppermost ground water saturated zone (e.g., from the ground surface to the uppermost water table), WAC 173-340-740(6)(c).

In order for the subsurface soil contamination to be considered protective of indoor air in current and future building scenarios (different building uses or new construction) in the specific context of this Site, thus meeting the soil cleanup level requirements of WAC 173-340-740(3)(c)(iv)(B), the measured and sustained sub-slab vapor concentrations must be less than an action level set at 33 times the MTCA Method B indoor air cleanup levels.[3] If indoor air cleanup levels are met for this building, without the VIM system operating, and sub-slab vapor concentrations for volatile CVOCs consistently meet this 33 times indoor air action level, Ecology does not anticipate a need for further institutional controls to address the soil to indoor air pathway. If indoor air cleanup levels are met for the current building, without the VIM system operating, but sub-slab vapors remain above the 33 times MTCA Method B indoor air cleanup level, additional action(s) must be implemented. These actions may include one or more of the following:

- Implement contingent remedial measures (e.g., vapor extraction) to remediate sources of sub-slab vapor for the purpose of protecting the indoor air pathway. This approach would be proposed by GE or Ecology for approval prior to implementation;
- Implement institutional controls to ensure that, for example: a) future changes to the building do not lead to vapor intrusion (VI) impacts leading to exceedances of the indoor air cleanup standard, b) new construction or property activities in the future do not create a new, or exacerbate an existing VI exposure pathway, and/or (c) routine indoor air sampling in the existing, new construction or renovated building is in place to ensure future protectiveness. If Ecology determines that indoor air is again contaminated above MTCA Method B indoor air cleanup levels, Ecology will determine if contaminated subsurface soils must be removed and/or sub-slab depressurization system must be restarted or installed.

At the time indoor air and shallow groundwater cleanup levels are attained, either Ecology or GE may revisit the 33 times sub-slab vapor to indoor air attenuation factor described in Section 4.2.1 and Section 6.0. If, at that time, EPA or Washington State Guidance provides a new or revised 95th percentile sub-slab vapor to indoor air attenuation factor for the Site, either Ecology may choose, or GE may recommend, using this attenuation factor in place of the 33 times attenuation factor to determine if soil contamination has met cleanup levels protective of indoor air.

As discussed in the FFS and the associated Ecology comment letters, criteria for protection of construction/utility/site worker direct contact and inhalation are higher than other cleanup levels for other pathways. Therefore, these construction/utility/site worker based cleanup levels are considered met if the other more stringent cleanup levels for other required pathway receptors (such as the soil to groundwater and soil to indoor building air cleanup levels) are met.

4.2.2 TPH

TPH in the heavy oil and diesel range remains in the unsaturated and saturated zones at selected locations at the former GE building, located at 220 South Dawson Street. It is unlikely that the TPH soil and groundwater cleanup levels to drive site cleanup actions. However, TPH soil cleanup levels are required under the MTCA for this Site cleanup. The MTCA unrestricted Method A soil cleanup level for TPH-heavy oil and TPH-diesel is based on protection of the TPH groundwater cleanup level defined in Section 4.1.2 above. The standard point of compliance applies and is defined as the soils throughout the Site, WAC 173-340-740(6)(b).

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[3] This is based on the 95% Upper confidence limit on sub-slab to indoor air attenuation factors calculated in the USEPA Vapor Intrusion Database, Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings, March 2012.

4.3 Indoor Air Cleanup Levels, Immediate Action Levels, and Points of Compliance

Ecology has established cleanup levels and immediate action levels to protect human receptors

4.3.1 Cleanup Levels and Point of Compliance

Indoor air cleanup values are based on the lower of concentrations established by applicable federal and state laws, and MTCA Method B indoor air cleanup levels for unrestricted land use. The point of compliance for indoor air is the indoor air throughout the Site. Indoor air cleanup levels based on Method B cleanup levels are the most stringent and therefore the cleanup levels (refer to Table 4-1)

4.3.2 Indoor Air Immediate Action Level

Ecology has established a site specific indoor air immediate action level[4] (IAL) as the level that must immediately be met in indoor air to protect human health while the cleanup is progressing. At this time, based on operation of the two groundwater recovery wells, current groundwater contaminant concentrations and current building use/design, Ecology does not foresee the need for indoor air assessments in other buildings near and/or above the CVOC groundwater contamination. Should Ecology determine that IALs have been exceeded or that site conditions have changed during the remedial action (e.g., significantly increasing groundwater concentrations in areas where sufficient vapor mitigation has not been implemented, new vapor intrusion pathways introduced, etc.), Ecology may require an indoor air assessment and installation of a vapor intrusion mitigation system (VIM).

Table 4-1 Summary of Applicable Cleanup Levels and Points of Compliance for the Site

	Soil	Groundwater		Indoor Air	Indoor Air
	MTCA Method B (mg/kg)	Shallow[5] Site-Specific MTCA Method B (µg/L)	Deeper[6] Site-Specific MTCA Method B (µg/L)	MTCA Method B ($\mu g/m^3$)	Immediate Action Level ($\mu g/m^3$)
Trichloroethylene	0.044	6.6	30	0.37	1.30
Tetrachloroethylene	0.035	3.3	3.3	2.5	8.74
Vinyl Chloride	0.006	1	2.4	0.28	0.98
cis-1,2 dichloroethylene	2.95	590	450	none[7]	none[7]
trans 1,2 dichloroethylene	0.89	163	590	3.8	13.3

[4] The IAL is based on a typical working exposure, which assumes: 10 hour work day, 5 work days per week, and 50 work weeks per year. The establishment of this IAL serves as a protective interim measure, and does not substitute for the MTCA requirements to meet the Method B indoor air cleanup level at the Site through implementation of the Ecology selected remedy in a reasonable restoration timeframe.
[5] Defined as the "shallow zone" or the top of the water table down to approximately 20 feet bgs.
[6] Defined as both the "intermediate" and "deep" zones of groundwater from approximately 20 to 65 feet bgs.
[7] No toxicity data available

1,1-Dichloroethylene	0.023	3.2	3.2	12.74	44.52
1,1,1-Trichloroethane	0.09	11	11	332	1125
1,4-Dioxane	NA	69	69	NA	NA
Arsenic	NA	5	5	NA	NA
TPH-Heavy Oil Range TPH-Diesel Range	2000*	500	500	NA	NA
Point of Compliance	Standard Point of compliance for all media	Standard Point of compliance Water table to 20 feet bgs	Standard Point of compliance Below 20 feet bgs	Standard Point of compliance Indoor air throughout the Site	NA (see section 4.3.2 above)

Notes:

NA – Not applicable
µg/L – micrograms per liter
µg/m^3 – micrograms per cubic meters
mg/kg – milligrams per kilogram
bgs – below ground surface

4.4 Applicable State and Federal Laws

MTCA requires that all cleanup actions comply with applicable state and federal laws (WAC 173-340-360(2), WAC 173-340-710 and RCW 70.105D.090. Under MTCA, all cleanup actions conducted shall comply with applicable state and federal laws. The term "applicable state and federal laws" includes legally applicable requirements and those requirements that the department determines, based on consideration of the criteria in WAC 173-340-710(4), are relevant and appropriate requirements. Legally applicable requirements include those cleanup standards, standards of control, and other environmental protection requirements, criteria, or limitations adopted under state or federal law that specifically address a hazardous substance, cleanup action, location or other circumstances at the site.

Table 4-2 Applicable State and Federal Laws

Law/Regulation	Requirements
Federal Water Pollution Control Act Clean Water Act (CWA) 40 CFR 100-149 Washington State Water Quality Standards for Surface Waters WAC 173-201A Washington State Underground Injection Program, Chapter 173-218 WAC	Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and establishes standards for the protection of surface water quality. The cleanup action will comply with these regulations through the implementation of best management practices and a water quality monitoring program. The installation of the ISCO injection wells shall meet all applicable regulations of the UIC Program
National Pretreatment Standards (40 CFR 403) Metro District Wastewater Discharge Ordinance	Establishes pretreatment requirements for discharge to a municipal sewer. For water discharged to the Metro sanitary or combined sewer system, all conditions of the current permit must be met under future actions, or a new permit must be obtained.
Resource Conservation and Recovery Act (RCRA) (40 CFR 260 – 268) Washington Dangerous Waste Regulations (WAC 173-303)	Establishes requirements for identification of Dangerous Wastes based on whether or not the waste contains a listed waste, or if it displays a dangerous waste characteristic, for example by the Toxicity Characteristic Leaching Procedure. These regulations may be applicable for the storage, treatment, and disposal of the excavated/extracted material.
Solid Waste Handling Standards (RCW 70.95; WAC 173-350)	Establishes the requirements for solid waste management and disposal.
Clean Air Act, National Emissions Standards for Hazardous Air Pollutants (NESHAPs) (40 CFR 61) State Emission Standards for Hazardous Air Pollutants (WAC 173-400-075)	Establishes emission standards as well as ambient air quality standards. These requirements may be applicable to releases of hazardous air pollutants from remedial actions.

Relevant and appropriate requirements include those cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site.

The currently identified permits and approvals applicable to this CAP will be listed in an exhibit to either a judicially-approved Consent Decree (if negotiated), or an Ecology-issued administrative order.

Substantive Requirements: The currently identified substantive requirements of procedurally exempt permits or approvals will be listed in an exhibit to either a judicially-approved Consent Decree (if negotiated), or an Ecology-issued administrative order.

5.0 Cleanup Alternatives

GE's FFS included a screening and evaluation of potential remedial technologies. Based on the screening of technologies, six proposed alternatives were evaluated under WAC 173-340-360. They include:

Alternative 1 – Optimized Hydraulic Control, Soil Vapor Extraction combined with Air Sparge (SVE/AS), Subslab Depressurization System, and Institutional Controls

Alternative 2 – Optimized Hydraulic Control, *In situ* Chemical Oxidation, Subslab Depressurization System, and Institutional Controls

Alternative 3 – Optimized Hydraulic Control, Enhanced Anaerobic Bioremediation, Subslab Depressurization System, and Institutional Controls

Alternative 4 – SVE/AS, and Institutional Controls

Alternative 5 – *In situ* Chemical Oxidation, Subslab Depressurization System, and Institutional Controls

Alternative 6 – Enhanced Anaerobic Bioremediation, Subslab Depressurization System, and Institutional Controls.

In developing the CAP, Ecology additionally considered an alternative that, while not identical to any of the six alternatives considered by GE, is based largely on Alternative 2 with some modifications. Ecology will refer to this alternative as **Modified Alternative 2**.

5.1 Alternative 1 – Optimized Hydraulic Control, Soil Vapor Extraction/Air Sparging and Subslab Depressurization System[8]

The technologies included in Alternative 1 are optimized hydraulic control (containment and groundwater extraction), soil vapor extraction/air sparging (SVE/ AS), the continued operation of the existing subslab depressurization system, and institutional controls.
An alternative that includes SVE/AS was selected because it is proven to be an effective technology for the treatment of TCE at other sites with similar contaminants. Alternative 1 includes:

[8] In the early FFS remedy alternative evaluation Ecology agreed with GE that this technology has the potential to result in slightly longer restoration timeframes than in-situ chemical oxidation (ISCO) or enhanced anaerobic bioremediation (EAB). However, the restoration timeframe would not be so much longer as to immediately eliminate the technology from consideration. Ecology did not further comment nor require GE to revise the FFS sections on Alternative #1 to incorporate additional supporting data or information on restoration timeframe, threshold criteria, or other details of the alternative 1 because Ecology agreed to further narrow the scope of the final FFS to GE's preferred ISCO with and without optimized hydraulic control technology, therefore more full evaluation of Alternative #1 was not required. A full evaluation of ISCO with and without optimized hydraulic control is included in the FFS report and further explained in later section of this CAP.

- Optimizing the existing pump and discharge system
- Installation of a SVE/AS system (at the on-property and off-property areas)
- The continued operation of the subslab depressurization system
- Institutional controls.

5.1.1 Optimized Hydraulic Control

Currently groundwater is recovered from two extraction wells (RW-2 and RW-3) and extracted contaminated groundwater is discharged to King County sewerage treatment system. In an effort to increase the performance of the current hydraulic control system, in a phased approach, the existing recovery wells will be abandoned and replaced with two new recovery wells installed along the western side of the former GE building, shown on Figure 5-2.

5.1.2 Soil Vapor Extraction/Air Sparging

Conceptually, Alternative 1 includes 2 phases of treatment. During Phase 1 both on-property and off-property areas will be targeted, using 2 separate skid mounted catalytic oxidizers. For the on-property area, Alternative 1 includes an SVE system that consists of lateral wells installed in the alley (between MW-1 and MW-4). The lateral wells will be installed approximately 6 feet bgs between MW-1 and MW-4, Figure 5-1 shows the proposed well network. Lateral wells are proposed to increase coverage in the shallow zone using a small above ground foot print. The SVE system will be plumbed to a thermal catalytic oxidizer with a granular active carbon (GAC) bags or scrubbers to treat the extracted vapor before release into the atmosphere (as required by the permits). The current paved alley will remain as is; the pavement serves as a cover to minimize volatile emissions escaping, to minimize short circulation within the SVE network, and to minimize the height of the top of the wet, or saturated, soil zone by minimizing infiltration. The AS system is proposed to be paired with the SVE system to remove COCs from the saturated zone, installed in close proximity to the SVE system, operating under the same electric power system and control devices. It is assumed that the space for the treatment unit could be rented from the current property owners. The on-property area system is expected to run for 36 months, based on the potential contaminated soils under the building footings and based on data from similar sites. The exact duration of the operation of the SVE/AS system may change after monitoring data are collected during implementation.

Due to the extent of contaminated groundwater in the off-property area, and based on the major roadway (1st Avenue South) separating MW-14 and MW-15, two separate SVE/AS treatment systems are proposed. The first treatment system will be operated during the on-property area, Phase 1 of this Alternative. Phase 1 includes treatment associated with MW-14; Phase 2 includes treatment of the MW-15 area. Similar to the on-property area, a skid-mounted treatment unit will be installed on the east side of 1st Avenue South and will target the MW-14 well cluster. Vertical SVE wells, which have been proven effective as deep as 300 feet, will be installed near and around MW-14. Vertical SVE wells are proposed extending to approximately 8 feet bgs; AS wells are proposed to extend to approximately 45 feet bgs. Six SVE wells will be placed along the center line of the plume, as shown on Figure 5-1. The placement of the treatment unit will be determined in final design, but mostly likely will require access negotiations to enable the rental of a portion of the parking lot. GE will work with local building owners and Ecology to balance the best possible location with the least amount of disturbances to local business.

Conceptually, Phase 2, which will start after the termination of Phase 1, will target the off-property area on the west side of 1st Avenue South. The same SVE/AS system will be installed in the vicinity of MW-15. The well network is similar to the wells proposed for the MW-14 treatment area, as shown on Figure 5-1. Phase 2 is expected to run for 36 months (the time frame is based on performance at similar sites). The design details may change after monitoring data are collected during implementation.

A revised groundwater and indoor air and subslab vapor sampling monitoring plans will be included in the EDR.

5.1.3 Subslab Depressurization System

Alternative 1, includes the operation of the existing subslab depressurization system, which was installed in August 2007 and subsequently modified in 2009 to minimize vapor intrusion from the subslab into the former GE building, located at 220 South Dawson Street. No modifications are planned to the depressurization system unless Ecology determines that its effectiveness has diminished to the point where an IAL is triggered or improvements are needed to help meet indoor air cleanup levels in a reasonable timeframe. Figure 5-3 shows the existing subslab depressurization system configuration.

The subslab depressurization system will continue to operate at the same time as the ISCO treatments and performance monitoring and will be terminated when concentrations inside the former GE building reach the Method B indoor air cleanup levels for indoor air, subject to the requirements stated in Section 4.2.1.

5.1.4 Institutional Controls

Institutional controls shall be included to protect human health and the environment from exposure to contaminated soil which is located beneath the building foundations. Institutional controls for soil will identify areas that exceed soil cleanup levels and ensure that these contaminated soils are managed in a manner protective of human health and the environment if the building is removed, renovated or the area is excavated.

Institutional controls shall used included to protect human health and the environment from exposure to contaminated groundwater above potable cleanup levels and contaminated indoor air above Method B cleanup levels.

5.2 Alternative 2 – Optimized Hydraulic Control, *In situ* Chemical Oxidation, Subslab Depressurization System, Institutional Controls

The technologies included in Alternative 2 are optimized hydraulic control (containment and groundwater extraction), *in situ* chemical oxidation, continued operation of the existing subslab depressurization system, and institutional controls. The use of potassium

permanganate was selected because of its rapid degradation of TCE, ease of application method, and because this results in degradation of TCE without accumulation of daughter chemicals of 1.2-DCE and VC.
Alternative 2 includes:

- A phased approach for eventually relocating the existing groundwater extraction wells. The phasing and design of the on-site ISCO injections with the timing of moving both groundwater extraction wells shall consider (1) maximal optimization of the effectiveness of on-site hydraulic control and (2) as ISCO injection proceed near/adjacent to the groundwater recovery wells, minimize any possible interferences between ISCO contact with subsurface chlorinated solvent contaminants AND the operation of the groundwater extraction wells, and (3) consideration of the potential for unacceptable vapor intrusion in the 220 South Dawson Street building, McKinstry buildings to the north, and other nearby buildings. The timing of when each of the extraction wells is relocated is based on the results of the phase 1-small scale ISCO treatment, phase 2 and/or possibly subsequent injections.
- Optimizing the hydraulic control (pump and discharge) system;
- Phased approach for ISCO treatments (at the on-property and off-property areas);
- The continued operation of the subslab depressurization system with maintenance and optimization as necessary;
- Institutional controls
- Groundwater, soil, indoor air and sub-slab vapor monitoring as required in Section 6.0.

5.2.1 Optimized Hydraulic Control

Alternative 2 includes the optimized hydraulic control elements presented in Alternative 1.

5.2.2 *In Situ* Chemical Oxidation

The following equations show the chemical equation for the complete reaction of TCE and vinyl chloride with potassium permanganate:

- $2KMnO_4 + C_2HCl_3 \rightarrow 2CO_2 + 2MnO_2 + 3Cl^- + H^+ + 2K^+$
- $10KMnO_4 + 3C_2H_3Cl \rightarrow 6CO_2 + 10MnO_2 + 10K^+ 3Cl^- + 7OH^- + H_2O$.

Where:

- TCE = C_2HCl_3
- Potassium Permanganate = $KMnO_4$
- Vinyl Chloride = C_2H_3Cl.

The details of exact ISCO injection sequencing and location/depth; ISCO oxidant dosing, groundwater monitoring locations; and other design/implementation details will be defined in the Ecology approved EDR.

The implementation of Alternative 2 is proposed to occur in a phased approach; Phase 1 includes a bench scale test followed by a small scale ISCO treatment. The purpose of Phase 1 is to gather additional information regarding the radius of influence, destruction efficiency, and oxidant demand for the site. Phase 2 includes a full scale treatment in the entire on-property and off-property areas, and Phase 3 focuses on any remaining areas that required additional treatment. The data collected during each ISCO treatment phase will be used to inform and revise as needed the design of all subsequent ISCO treatment phases. The approximate ISCO injection and observation well locations are shown in Figure 5-2. Each ISCO treatment phase shall be performed in accordance with Ecology approved plans.

Depending on the results of the monitoring after the third ISCO treatment phase, Ecology may determine that additional ISCO treatment phases and monitoring is required to target any residual TCE, CVOCs and TPH remaining above the cleanup levels. As such, those work plans shall be submitted to Ecology for review and approval, prior to implementation.

5.2.3 Subslab Depressurization System

Alternative 2 includes the vapor mitigation systems elements presented in Alternative 1.

5.2.4 Institutional controls

Alternative 2 includes the institutional control elements presented in Alternative 1.

5.3 Modified Alternative 2 – Optimized Hydraulic Control, In-Situ Chemical Oxidation, Sub-Slab Depressurization System, and Institutional Controls

The main difference between this alternative and Alternative 2 as defined in the Feasibility Study is that under this alternative, Ecology would be willing to consider turning one or more groundwater extraction wells off before meeting the groundwater cleanup standards after completing one small scale ISCO injection and bench scale test and two full scale ISCO injections phases, provided that GE can demonstrate at that time that the requirements for a MTCA cleanup action will continue to be met, as described in more detail in Section 6. Other main modifications from the original Alternative 2 include:

a. Allows ISCO treatments to begin with the optimized groundwater hydraulic control system in its current location, with phased groundwater extraction well relocation during future ISCO treatments in order to optimize treatment.

b. Prior to each Ecology Five Year review, GE shall prepare and submit a WAC 173-340-720(2)(b) and (d) groundwater potability analyses report to Ecology for review and approval to confirm the original potability analysis which supports this CAP.

5.4 Alternative 3 – Optimized Hydraulic Control, Enhanced Anaerobic Bioremediation and Subslab Depressurization System[9]

The technologies included in Alternative 3 are optimized hydraulic control (containment and groundwater extraction) enhanced bioremediation, the continued operation of the existing subslab depressurization system, and institutional controls.

An alternative that includes bioremediation was selected because it is technically feasible, has been proven to be an effective technology for the treatment of TCE at similar sites and it can target a large area without disturbing aboveground structures. Alternative 3 includes:

- Optimizing the existing pump and discharge system
- Electron donor injection into the on-property and off-property areas
- The continued operation of the subslab depressurization system
- Institutional controls.

5.4.1 Optimized Hydraulic Control

Alternative 3 includes the optimized hydraulic control elements presented in Alternative 1.

5.4.2 Enhanced Anaerobic Bioremediation

The enhanced bioremediation portion of Alternative 3 includes the injection of a combination of soluble and slow-release (or insoluble) electron donors. This combination of electron donors allows for a larger treatment area. The soluble donors release high concentrations of hydrogen and intermediate volatile organic acids (which ferment to hydrogen) downgradient of the injection wells. Slow-release electron donors ferment near the injection well, resulting in a continuous supply of hydrogen and intermediate volatile organic acids moving downgradient with groundwater flow. The proposed[10] soluble donor selected for Alternative 3 is sodium lactate, and the proposed slow-release electron donor selected is vegetable oil emulsion. A yeast extract will be added to the injection slurry to enhance bacterial growth.

The required injection slurry volume needed for injection and the required injection network varies at each site. The implementation of Alternative 3 is proposed in a phased

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[9] In the early FFS remedy alternative evaluation stages, Ecology stated that it believed this technology was a feasible technology for the site cleanup. However, Ecology and GE did not further evaluate or explore the details of this alternative or how to optimize the Alternative 3 to incorporate additional supporting data or information on restoration timeframe, threshold criteria, or other details of the Alternative 3 because Ecology agreed to further narrow the scope of the final FFS to the GE's preferred ISCO with and without optimized hydraulic control technology, therefore further full evaluation of Alternative #3 was not required. A full evaluation of ISCO with and without optimized hydraulic control is included in the Ecology modified and approved FFS report and further explained in later section of this CAP.

[10] The final selected soluble and insoluble donors may change based on availability and effectiveness; the proposed donors presented in this FFS are used for costing purposes. Final selected donors will be similar (in terms of donor properties) to these proposed.

approach; Phase 1 includes a small scale injection to evaluate the natural bacteria conditions, evaluate the effectiveness of the selected donors, estimate the ROI, determine the injection slurry volume, and evaluate the effects of the hydraulic recovery system. Injection and monitoring during Phase 1 is limited to the on-property area; the data collected during Phase 1 will be applied to both the on-property and off-property areas during Phase 2.
Conceptually, Phase 1 includes an initial evaluation of the microbial counts in the groundwater from the on-property and off-property area. This CAP assumes that natural bacteria are present in sufficient numbers and type. If results of the microbial counts dispute this assumption, the injection will include electron donors, yeast, and bacterial augmentation. After results are evaluated, Phase 1 will include the installation of injection wells located in the on-property area. Five injection wells are proposed on 10-foot centers, installed 30 feet upgradient of MW-1, as shown on Figure 5-4. All injection wells will be installed outside of the footprint of the existing buildings. On-property area injection locations will be screened across two intervals: the water table to 4 feet below the water table, and 12-16 feet bgs. Chemical data will be collected from monitoring wells and used to determine the effectiveness of the injection by evaluating CVOC concentrations. Based on the results of Phase 2, the remaining TCE concentrations will be targeted in the third phase of injection. After Phase 3, it may be necessary to apply additional injection compounds or adjust the treatment to target any potential byproducts that may be present. Additional treatment could target VC, as this is a byproduct that can result from incomplete degradation.

Phase 1 will also include a tracer study to better understand groundwater movement within the treatment area. Sodium bromide will be dissolved into the injection solution and delivered across the treatment area. Regular bromide samples will be collected in the nearest downgradient wells (MW-4, MW-6, MW-8M, and MW-8S) until breakthrough of bromide is observed.

Phase 2 includes injection of electron donors in both the on-property and off-property areas. Injection in the on-property area includes the same network used in Phase 1, plus an additional 8 injection wells, on 10-feet centers located within the alley and upgradient of MW-1. All injection wells will be installed outside of the footprint of the existing buildings. Similar to Phase 1, on-property area injection locations will be screened across two intervals: the water table to 4 feet below the water table, and 12-16 feet bgs. Injection depths and the total number of injection wells may be altered depending on the results of the Phase 1.

The pump and discharge system will remain on during each phase of injection.
The off-property area will include 10 injection wells on 10-foot centers located around monitoring wells MW-14M/D and MW-15M/D. Figure 5-4 shows the configuration of the off-property area injection wells, which will include 5 injection wells located around well MW-14M/D and 5 wells located around MW-15M/D. Off-property area injection locations will be screened at two intervals: 20-24 feet bgs, and 26-30 feet bgs. Injection depths and the total number of injection wells may be altered depending on the results of Phase 1. All injection wells will be installed outside of the footprint of the existing buildings.

Phase 3 includes subsequent injections. The extent of Phase 3 will be dependent on the results of Phase 2. For the purpose of this CAP, a general cost estimate is included for

Phase 3, assuming that the injection volume will be 30% of the Phase 2 volume, cover the same injection network, and not include any well construction.

Monitoring will be performed during and after injections (a full monitoring schedule will be developed as part of the final design). Temporary observation wells may be installed to monitor injection flow rates at the off-property area. Existing monitoring wells will be used to monitoring flow paths and trends during and after injection.

5.4.3 Subslab Depressurization System

Alternative 3 includes the subslab depressurization system elements presented in Alternative 1.
Methane produced by methanogenic aquifer conditions (induced by electron donor amendment) has the potential to migrate to enclosed spaces located below ground and adjacent to the treatment zone. No basements, tunnels, or below grade location exist onsite; thus, the production of methane is unlikely considering site conditions and will not be monitored. In the event that building owners/tenants request air monitoring, monitoring will occur during the performance monitoring. If methane is detected (at or near 20% of the lower explosive limit [LEL]) at any location, the area will be vented to prevent methane buildup and eliminate any potential explosive risk.

5.4.4 Institutional Controls

Alternative 3 includes the institutional control elements presented in Alternative 1.

5.5 Alternative 4 – Soil Vapor Extraction/ Air Sparging

The technologies included in Alternative 4 are SVE/AS, the continued operation of the existing subslab depressurization system, and institutional controls.
Alternative 4 includes:

- Installation of a SVE/AS system (at the on-property and off-property areas)
- The continued operation of the subslab depressurization system
- A revised groundwater monitoring program
- Institutional controls.

5.5.1 SVE/AS System

Alternative 4 includes the SVE/AS elements presented in Alternative 1.

5.5.2 Institutional Controls

Alternative 4 includes the institutional controls elements presented in Alternative 1.

5.6 Alternative 5 – *In Situ* Chemical Oxidation, Subslab Depressurization System and Institutional Controls

The technologies included in Alternative 5 are oxidation (using $KMnO_4$), the continued operation of the existing subslab depressurization system, and institutional controls.

- *In situ* chemical oxidation injection (at the on-property and off-property areas)
- The continued operation of the subslab depressurization system
- A revised groundwater monitoring program
- Institutional controls.

5.6.1 *In Situ* Chemical Oxidation

Alternative 5 includes the *in situ* chemical oxidation elements presented in Alternative 2. The recovery wells will be turned off when injections are initiated. Recovery wells will remain and will be used, as necessary to reduce chemical travel time during injection only (based on the results of Phase 1) or to prevent any unacceptable downgradient plume migration identified based on monitoring results. Recovery well locations will be evaluated during remedial design to assess whether one or both wells should be relocated to optimize potential risk management. Injection and performance monitoring location and frequency will be finalized during remedial design, (locations shown on Figure 5-6).

5.6.2 Subslab Depressurization System

Alternative 5 includes the subslab depressurization system elements presented in Alternative 1.

5.6.3 Institutional Controls

Alternative 5 includes the institutional controls elements presented in Alternative 1.

5.7 Alternative 6 – Enhanced Anaerobic Bioremediation, Subslab Depressurization System and Institutional Controls

The technologies included in Alternative 6 are enhanced anaerobic bioremediation, the continued operation of the existing subslab depressurization system, and institutional controls.

- Electron donor injection into the on-property and off-property areas
- The continued operation of the subslab depressurization system
- Institutional controls.

5.7.1 Enhanced Anaerobic Bioremediation

Alternative 6 includes the enhanced bioremediation elements presented in Alternative 3. This alternative does not include the optimization of the recovery wells; recovery wells RW-2 and RW-3 will remain in the current locations. Alternative 6 includes recirculation of the injection solution in the on-property area. The recirculation allows for longer contact time, increased hydraulic control during injection, and a more effective distribution of the treatment solution. The recirculation will be implemented with a small scale mobile unit; using a small scale treatment trailer will minimize site disturbances, reduce risk (pre-assembled control panel with built-in safety features) and allow for flexibility during injection. Injection rates and discharges can be controlled with the computer interface. The existing recovery well, RW-3, will be retrofitted for the recirculation process. RW-2 may also be used during Phase 2 depending on performance during Phase 1.

Similar to Alternative 5, this alternative also includes the flexibility to turn on the pump and discharge system for use as containment in the on-property area, if conditions in the groundwater unit change significantly. Changing aquifer conditions could include the mobilization of metals or the production of incomplete degradation byproducts.

Figure 5-7 provides a summary of the proposed design.

5.7.2 Subslab Depressurization System

Alternative 6 includes the subslab depressurization system elements presented in Alternative 1.

5.7.3 Institutional Controls

Alternative 6 includes the institutional controls elements presented in Alternative 1. Alternative 6 introduces “recirculation of the injection solution” in the On-Site Area. However, the assessment by GE had insufficient information for Ecology to fully understand the technical principals/concepts and benefits/disadvantages associated with a recirculation system. It is unclear, for example, how and when existing extraction wells RW-3 and RW-2 would be “retrofitted” into the recirculation operation. Ecology was unable to fully evaluate the threshold criteria (WAC 173-340-360(2)(a)) and other requirements (WAC 173-340-360(2)(b)) for this alternative. Due to a lack of optimized hydraulic control (for the reasons previously stated by Ecology as required), however, Ecology would not select this option as the final remedy. Thus, Ecology saw no reason to provide further comment on this section and Ecology eliminated this alternative from further consideration.

5.8 Summary of Rationale for Selected Cleanup Action

For purposes of remedy selection, this section compares only Alternative 2(unmodified or modified) and Alternative 5. This is because early in the remedy screening process, Ecology agreed to GE’s request to use in-situ chemical oxidation (ISCO) as the sub-surface treatment chemical as opposed to enhanced anaerobic bioremediation (EAB) or soil vapor extraction plus air sparging (SVE/AS). Based on initial evaluations, Ecology believed that all three technologies (EAB, ISCO and SVE/AS) with optimized hydraulic control could be an effective Site remedy that could be designed and optimized to meet the requirements of WAC 173-340-360. Ecology did not comment nor require GE to revise the final FFS sections on Alternatives #1, #3, #4 and #6 to incorporate Ecology's comment to explore the details of how to optimize these alternatives under a more complete FS analysis. Ecology agreed to further reduce the scope of the final FFS to the MTCA analysis of alternatives that included GE's preferred use of ISCO with and without optimized hydraulic control. Therefore, the detailed remedy selection analysis in the final FFS was further screened to focus primarily on evaluating the need for optimized hydraulic control concurrent with ISCO treatment (Alternative 2) versus ISCO treatment without optimized hydraulic control (Alternative 5).

5.8.1 Threshold Requirements-Initial Assessment of Alternatives

Cleanup actions selected under MTCA must comply with several basic requirements. This evaluation was completed by first conducting an initial assessment of whether each proposed cleanup alternative met all the threshold (minimum) requirements for cleanup actions required by the MTCA cleanup regulations. Alternatives that do not comply with these criteria are not acceptable cleanup actions under MTCA. Alternatives that pass this initial assessment were evaluated based on the additional criteria of WAC 173-340-360(2)(b). WAC 173-340-360(2)(a) states that any cleanup action must meet the following four threshold requirements:

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

5.8.1.1 Protect Human Health and the Environment and Comply with Cleanup Standards

Ecology determined that optimized hydraulic control is a necessary component to protect human health and comply with cleanup standards. Alternative 2 (unmodified or modified) adequately protect human health and the environment by reducing the footprint of the on-property chlorinated solvent groundwater plume so that the vapor intrusion mitigation (VIM) system operates effectively at the 220 South Dawson Street property to reduce the indoor air contaminant concentrations to acceptable and below interim action levels. The optimized hydraulic control system also prevents the migration of contaminated groundwater to other adjacent or downgradient properties and thus minimizes the potential for adversely contaminating building indoor air above cleanup levels and/or immediate action levels (IALs). The use of optimized hydraulic control to cut off the chlorinated solvent plume along 2nd Avenue South, is important for effective on- and off-property ISCO treatment in meeting the cleanup standards. Hydraulic control prevents additional chlorinated solvent contaminated groundwater from migrating beyond 2nd Avenue and creates a smaller and more treatable groundwater plume footprint east of 2nd Avenue South by preventing plume expansion. ISCO treatment on a further expanded and diluted plume would remove less contaminant mass in the groundwater, thus making the treatments less effective.

GE has expressed concerns about negative impacts of the optimized hydraulic control system on ISCO injections. However, in Ecology's opinion, operation of the optimized hydraulic control system during ISCO treatments is not expected to negatively impact the effectiveness of the ISCO treatments for the following reasons: (1) the Ecology capture zone analysis (CZA) indicates that there is a very limited radius of influence (ROI) around recovery wells; (2) ISCO injection zones of influence are typically no more than 25-30 feet in highly conductive aquifers; (3) we expect the reagent travel distance from the injection well toward the recovery wells to be no more than 7.5 feet before it is completely consumed (this is based on the AECOM's stated groundwater flow velocity range of 0.3 – 1.5 ft/day and the stated maximum ISCO chemical lifespan in the aquifer of five days); and (4) the cleanup action will require moving the operating recovery well RW-3 further west (near 2nd Avenue South) after the ISCO injections proceed from the east to the west side of the alley. For these reasons, the distance between ISCO injection wells and recovery wells is too far to result in ISCO short-circuiting.

The use of institutional controls under Alternative 2 (unmodified or modified) for residual chlorinated solvent and petroleum hydrocarbon vadose zone soil contamination provide further protection by informing the current building owner of hazards and limiting activities that may result in exposures to chemicals at the Site.

Optimized hydraulic control is necessary to meet the threshold requirements of WAC 173-340-360(2)(a)(i) and (ii): protect human health and the environment AND comply with cleanup standards. Under Alternative 2 (unmodified or modified), GE may turn off one or more groundwater extraction wells after the cleanup standards are met. Modified Alternative 2 may allow for turning off one or more extraction wells after completing a small scale ISCO treatment and two full-scale ISCO treatments, but only if GE can demonstrate at that time that the requirements of WAC 173-340-360(2) will continue to be met. Alternative 5 allows additional CVOC groundwater contamination to expand vertically and laterally at the 220 South Dawson Street property and allows additional CVOC groundwater contamination to migrate off-property. Under Alternative 5, the current 220 South Dawson Street building VIM system will be under-designed for a widening groundwater plume with higher TCE groundwater concentrations (which we expect to occur when the optimized hydraulic control system is shut off). Cross gradient (McKinstry) and downgradient buildings will also be threatened by vapor intrusion if underlying TCE groundwater concentrations increase. Alternative 5 does not meet the threshold criteria of (i) protection of human and the environment and (ii) compliance with cleanup standards by allowing unfavorable Site conditions that Alternative 2 (unmodified or modified) with optimized hydraulic control, as discussed above, is designed to prevent. In fact, the only practicable means of modifying Alternative 5 to meet these threshold criteria is to add the optimized hydraulic control and other criteria that would, in fact, essentially transform it into Alternative 2 (unmodified or modified) .

5.8.1.2 Comply with Applicable Laws

Not including Federal and State cleanup laws, Alternatives 2 (modified and unmodified) and 5 comply with other applicable state and federal laws.

5.8.1.3 Provide for Compliance Monitoring

Alternative 2 (unmodified or modified) meets the compliance monitoring requirements. Alternative 5 complies with compliance monitoring requirements, although the remedy does not meet the threshold requirements of Section 5.8.1.1.

5.8.1.4 Summary of Initial Assessment of Alternatives

Under Alternative 2 (unmodified or modified),ISCO treatment with concurrent optimized hydraulic control meets the threshold requirements of WAC 173-340-360(2)(a)(i) *protect human health and the environment, (b) comply with cleanup standards, (c) comply with applicable state and federal laws, and (d) provide for compliance monitoring.* Ecology's August 14, 2008 and July 13, 2009 letters to GE also explain this conclusion. ISCO treatments without optimized hydraulic control (alternative 5) do not meet the threshold requirements and therefore this remedial alternative is eliminated from consideration as the final remedy.[11]

5.8.2 Additional Criteria

Only Alternative 2 (unmodified or modified) meets the threshold criteria and therefore pass through to the evaluation for "other requirements" in WAC 173-340-360(2)(b). Under MTCA (WAC 173-340-360(2)(b)), when selecting from alternatives that meet the threshold requirements, the selected action must also address the following three criteria:

- Use permanent solutions to the maximum extent practicable
- Provide a reasonable restoration time frame
- Consider public concerns.

5.8.2.1 Use Permanent Solutions to the Maximum Extent Practicable

Under Alternative 2 (unmodified or modified), ISCO treatment with concurrent optimized hydraulic control uses permanent solutions to contain and chemically destroy CVOCs from groundwater at the Site. Pursuant to WAC 173-340-360(3)(d), only Alternative 2 (unmodified or modified) meets threshold criteria. Therefore, there is no need for a detailed disproportionate cost analysis to select the most "permanent to the maximum extent practicable" alternative from among two or more alternatives that meet threshold criteria. The use of optimized hydraulic control results in a permanent remedy by containing the on-property chlorinated solvent contaminated groundwater plume during ISCO groundwater treatments and not allowing further expansion and dilution of the CVOC groundwater plume on-property and off-property (west of 2nd Avenue South) Because this remedy is fully permanent for the existing land use, with the exception of subsurface contaminated soil that remains underneath or near the 220 South Dawson Street building (for which costs of a fully permanent solution would be grossly

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[11] For purposes of full discussion and vetting of the issues with GE during the feasibility study, Ecology engaged in some analysis comparing Alternatives 2 and 5 against the detailed disproportionate cost analysis criteria found in WAC 173-340-360(3)(e). See Ecology comment letter dated July 13, 2009. However, this detailed analysis is ultimately unnecessary as part of Ecology's final remedy selection, both because Ecology and GE have agreed to a permanent remedy for the existing land use (except for a small amount of remaining soil contamination for which a more active remedy would be clearly disproportionate), and because in Ecology's opinion Alternative 5 does not meet threshold criteria.

disproportionate – see further discussion below), Ecology has determined that Alternative 2 (unmodified or modified) use permanent solutions to the maximum extent practicable.

Groundwater Contamination: For chlorinated solvent contaminated groundwater, Alternative 2 (unmodified or modified) are permanent remedies because they both utilize ISCO groundwater treatments that are designed to chemically destroy the organic contaminants in groundwater.

Contaminated Soils: ISCO treatments are expected to treat TPH and CVOC contaminated soil below the water table in order to meet groundwater cleanup standards. Residual subsurface vadose zone chlorinated solvent and petroleum hydrocarbon soil contamination near and under the building will not be removed. Areas with TPH and CVOC contaminated soils on the east side of the building will be paved. Areas of TPH and CVOC contaminated soils remaining underneath the footprint of the 220 South Dawson Street building will remain capped by a concrete floor.

Subject to the conditions described in Section 6.0, paragraph 13, Ecology has determined that the incremental costs of removing this remaining contaminated soil are grossly disproportionate and far exceed the incremental degree of benefit achieved by leaving those remaining contaminated soils in place. Institutional controls and groundwater monitoring shall be in place to protect human health and the environment. Those institutional controls are further explained in Section 6.0.

5.8.2.2 Provide a Reasonable Restoration Time Frame

The expected restoration time frame for Alternative 2 (unmodified or modified) are considered reasonable based on the estimates provided in the Ecology modified and approved FFS report. GE estimates that the cleanup will take 6 years (ISCO treatment and post-treatment monitoring) assuming only one small scale ISCO treatment and two full-scale ISCO treatments are required.
Ecology understands that the estimated restoration time frame for Alternative 2 (unmodified or modified) are based on similar sites and previous experience; however, a site-specific restoration time frame will be revised after the cleanup action system is operating and contaminant response to treatment can be better evaluated. Initial data will be collected to evaluate the performance of the cleanup action on groundwater, soil and vapor concentrations at the conclusion of Phases 1 and 2 to revise the projected restoration time frame. Ecology will continue to evaluate moving forward whether the restoration timeframe remains reasonable.

5.8.2.3 Consider Public Concerns

Public review comments were received several times previously (for example, pertaining to the vapor intrusion exposures to building tenants and during Ecology review of the draft focused feasibility study) and will be invited as part of the review process for this CAP, as required under WAC 173-340-380.

Alternative 2 (unmodified or modified) meets the concerns voiced by the tenants and owners of buildings located above the chlorinated solvent contaminated groundwater plume. During Ecology discussions with GE on the need to install the vapor intrusion mitigation (VIM) at the 220 South Dawson Street building, Ecology received comments from Mason Supply Company on their concurrence to install the VIM system. The Mason Supply business communicated to Ecology its concerns regarding CVOC vapor intrusion into its offices and they supported the installation of the vapor intrusion mitigation system. Alternative 2 (unmodified or modified) requires the concurrent operation of the existing vapor intrusion mitigation system at the 220 South Dawson Street property.

During the Ecology comment on the draft FFS report, the owners of the buildings at 5033 and 5050 1st Avenue South (Liberty Ridge, LLC as represented by its environmental consultant, Environmental Partners, Inc) provided comments[12] on the draft FFS and revised draft FFS reports. These comments stated a clear preference for maintaining optimized hydraulic control over the chlorinated solvent groundwater plume during on-property ISCO treatments and post-injection monitoring. Liberty Ridge, LLC states that eliminating hydraulic control of the on-property CVOC groundwater plume presents an unacceptable risk to Liberty Ridge due to the spread of additional contamination onto its downgradient property. Liberty Ridge, LLC disagrees that the current hydraulic control system is effective in preventing the CVOC groundwater plume from migrating off-property and recommends that the system be “enhanced”. Liberty also states that if hydraulic control is eliminated, it will not be readily possible to recover spreading groundwater contaminants by restarting the groundwater recovery wells. Alternative 2 (unmodified or modified) meets this public concern as it requires concurrent operation of an optimized hydraulic control system during ISCO treatment.

Liberty Ridge, LLC expressed its preference for SVE/AS as the treatment technology with optimized hydraulic control (Alternative 1) versus ISCO with optimized hydraulic control. SVE/AS, as discussed in previous sections above, was not selected as the in-situ treatment component for the final site remedy. Ecology believes both SVE/AS and ISCO treatment systems could be effective technologies for the Site. However, as explained in Section 5.1, the burden of proof that would be needed to justify the selection of this remedy was not fully met in the FS, and ultimately Ecology agreed with GE’s preference to use ISCO (with optimized hydraulic control) as the treatment technology.

Ecology will also consider any additional public comments received during the public comment on this draft CAP.

5.9 Selecting the Preferred Alternative

The Ecology selected remedy is Modified Alternative 2. The Ecology selected final remedy meets the threshold requirements under WAC 173-340-360(2)(a), is permanent to the maximum extent practicable, allows for reasonable restoration timeframe and considers public concerns. After careful consideration, Ecology has determined that Modified Alternative 2 is the most practical and efficient method of implementing ISCO treatment and monitoring at the Site. Although both utilize optimized hydraulic control concurrent with ISCO treatment, Modified Alternative 2 offers more implementation flexibility than Alternative 2.

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[12] Technical memorandums from Environmental Partners, Inc. dated August 25, 2008 and November 17, 2008

6.0 Ecology Final Site Cleanup Action –Modified Alternative 2

Ecology has selected Modified Alternative 2 as the cleanup action for the Site. Modifications and additional details to Alternative 2 (Figure 6-1) that form Modified Alternative 2, the Ecology selected cleanup action are described in detail in this section. The approximate Site boundaries are shown on Figure 6-1. The Ecology selected final cleanup action summary points includes the elements of Alternative 2 AND the following:

1. Submit a draft Engineering Design Report (EDR), Construction Plans and Specifications (CPS), and Operation and Maintenance Plans (OMP) which meet the requirements of WAC 173-340-400.

2. The current recovery system will operate in its current location, with optimized groundwater extraction rates to maximize the capture of the chlorinated solvent groundwater plume and minimize migration of the plume to off-properties, during the start of ISCO treatments in and near the source area (alley). Propose optimized groundwater extraction rates as part of the EDR submitted to Ecology for review and approval.

3. Relocation of Optimized Hydraulic Control System: Propose the timing and relocated optimized hydraulic control system including the final pumping rate, well locations, and the phased timing and specific details of the abandonment and replacement of the hydraulic control system as ISCO injections proceed from the east end of the alley to the west end. Evaluate a range of new pumping rates and may include a higher rate than the current design based on the initial ISCO operation results. Groundwater extraction flow rates for the relocated recovery wells will be based on an optimization evaluation to maximize the capture of the chlorinated solvent groundwater plume and minimize migration of the plume to off-properties. The groundwater extraction well relocation will occur in a phased manner to maximize the effectiveness of the ISCO treatment. As ISCO treatments proceed closer to RW-3, relocate this extraction well near the east side of 2nd Avenue South. RW-1 will remain intact and maintained for potential future use in the event Ecology requires that it be used to optimize hydraulic control over the on-property contaminated groundwater plume.

4. ISCO treatment shall consist of one small scale ISCO treatment and at least 2 full scale phases and possibly more depending on the results of each phase. The phase 1 small scale ISCO treatment, baseline monitoring, protection monitoring, performance monitoring, engineering design, construction and implementation work shall also be a component of the EDR for Ecology review and approval.

   Conceptually, Phase 1 will be limited to the vicinity around monitoring well MW-1, which is located in the eastern portion of the alley. Phase 1 uses a combination of conventional and temporary monitoring wells for injection locations. Because of space constraints within the footprint of the alley, temporary injection and monitoring wells are probable within this location. In areas outside of the alley, conventional injection wells will be installed; these conventional injection wells will also be used for future injections. On-property area injections will include the area inside the alley extending to the east towards monitoring well MW-5 and other areas as appropriate. Separate injection locations will are expected for shallow and intermediate depths (e.g., screened at 9-13 and 16-20 feet bgs). Observation wells, used to evaluate the performance of the injection locations, will likely be screened at 9-13, 16-20, and 24-28 feet bgs. Figure 6-2 shows the likely proposed injection and observation wells (including depths and lateral treatment areas).

During injection, the $KMnO_4$ radius of influence[13] (ROI) will be estimated colorimetrically to identify distribution to the observation wells. Field data will be collected daily for the first 5 days after each injection. It is anticipated that after 5 days the $KMnO_4$ will be consumed. If $KMnO_4$ remains additional field data will be collected prior to collecting analytical parameters. During Phase 1, concentrations of $KMnO_4$ are expected to range between 1.0% and 3.0%. Based on previous experience, this range of concentrations is expected to be sufficient to overcome oxidant demand of the aquifer media and the concentration of CVOC and TPH by several orders of magnitude. This concentration range allows for a range of injection concentrations (between 1.0% and 3.0%) to be evaluated during Phase 1.

5. Prior to conducting Phase 1, a baseline data set will be generated. Groundwater will be collected from select observation wells and nearby existing monitoring wells and analyzed for CVOCs, metals (potassium, iron, manganese, arsenic [total and dissolved]), cadmium, chromium, nickel, selenium, chloride and general water quality parameters.

6. After completion of the Phase 1 small scale ISCO treatment, submit a Phase 1 ISCO treatment and performance monitoring summary report to Ecology for review and approval. This report will include at a minimum, tabulated groundwater chemical data, groundwater elevation contour figures, groundwater contaminant concentration contour figures, narrative discussion of the results of the ISCO treatment, recommendations for the next phase of ISCO treatments, problems encountered and how resolved.

7. After Ecology written approval of the Phase 1 report, submit a Phase 2 ISCO full scale treatment and performance monitoring work plan for Ecology review and approval. At a minimum, the work plan shall use previous ISCO data from earlier phases to propose injection locations and depths, ISCO concentrations, injectant volumes, monitoring locations and depth intervals or other design parameters to maximum the effectiveness of these additional ISCO treatments.

   On-property area injection locations are planned to be screened across two intervals: 9-13 and 16-20 feet bgs. At this time, off-property area injection locations are planned to be screened at three approximate intervals: shallow

[13] Refer to previous Ecology comments on the standard operating procedure (SOP) for measurement of permanganate colorimetrically in the Ecology November 21, 2007 letter to GE.

interval (20 - 24 feet bgs), intermediate interval (26-30 feet bgs), and deeper interval (51-55 feet bgs). Ecology will determine the need to inject at intervals between 30 and 50 feet bgs after Phase 1 ISCO treatment and monitoring data is analyzed. Injection locations proposed on the east side of the Liberty Ridge Buildings (formally the Western Cartage building) are planned to be screened across the shallow interval. At this time, suggested injection locations are shown on figure 6-1. GE has thus far proposed only two injection points on 2nd Avenue South. Ecology may require additional injection locations, based on the results of the Phase 1 ISCO treatment and monitoring results.

During Phase 2, chemical data will be collected from monitoring wells and evaluated to estimate the effectiveness of the ISCO treatment by evaluating CVOC and TPH concentrations and field measurements. Ecology may require the installation of new monitoring wells to evaluate the effectiveness of the Phase 2 ISCO treatment.

8. After completion of the Phase 2 work, submit a Phase 2 full scale ISCO treatment and performance monitoring summary report to Ecology for review and approval. This report will include at a minimum, tabulated groundwater chemical data, groundwater elevation contour figures, groundwater contaminant concentration contour figures, narrative discussion of the results of the ISCO treatment, recommendations for the next phase of ISCO treatments, problems encountered and how resolved.

9. After Ecology written approval of the Phase 2 full scale report, unless Ecology determines cleanup standards have been met in groundwater and indoor air, submit a Phase 3 ISCO treatment and performance monitoring work plan for Ecology review and approval. At a minimum, the work plan shall use previous ISCO data from earlier phases to propose injection locations and depths, ISCO concentrations, injectant volumes, monitoring locations and depth intervals or other design parameters to maximum the effectiveness of these additional ISCO treatments. At this time, suggested injection locations are shown on figure 6-1.

10. After completion of the Phase 3 full scale work, submit a Phase 3 full scale ISCO treatment and performance monitoring summary report for Ecology review and approval. This report will include at a minimum, tabulated groundwater chemical data, groundwater elevation contour figures, groundwater contaminant concentration contour figures, narrative discussion of the results of the ISCO treatment, recommendations for the next phase of ISCO treatments, problems encountered and how resolved.

11. After Ecology written approval of the Phase 3 full scale report unless Ecology determines that cleanup standards have been met in groundwater and indoor air, submit to Ecology a work plan for additional ISCO treatment for Ecology's review and approval. At a minimum, the work plan shall include revised analysis of the restoration timeframe, injection locations and depths, ISCO concentrations, injectant volumes, monitoring locations and depth intervals or other design parameters to maximum the effectiveness of the ISCO treatment.

12. After completion of any additional phase ISCO treatment work, submit a treatment and performance monitoring summary report to Ecology for review and approval. This report will include at a minimum, tabulated groundwater chemical data, groundwater elevation contour figures, groundwater contaminant concentration contour figures, narrative discussion of the results of the ISCO treatment, recommendations for the next phase of ISCO treatments, problems encountered and how resolved.

13. In order for the subsurface soil contamination to be considered protective of indoor air in current and future building scenarios in the context of this site, thus meeting the soil cleanup level requirements of WAC 173-340-740(3)(c)(iv)(B), the measured and sustained sub-slab vapor concentrations must be less than an action level set at 33 times the indoor air cleanup levels. If indoor air cleanup levels are met for the current building without the VIM system operating, but sub-slab vapors remain above the 33 times indoor air cleanup level, GE shall implement the steps identified in Section 4.2.1.

14. Prior to each Ecology Five Year review, prepare and submit WAC 173-340-720(2)(b) and (d) groundwater potability analyses to confirm the original potability analysis which supports this CAP. At the same time, submit to Ecology for review and approval, a plan to perform routine follow-up notifications with on- and off-property owners and tenants to ensure that the institutional controls are understood and upheld.

15. Ecology also is willing to consider, the possibility of turning the one or more of the groundwater extraction wells off before meeting the groundwater cleanup standards, pursuant to the terms of this paragraph. Ecology will only consider this possibility, after the completion of the bench scale test, small scale ISCO treatment and two full scale injections. In considering such a plan, Ecology would evaluate whether turning off the one or more of the groundwater extraction wells is likely to result in unacceptable impacts at the Site, whether the optimized groundwater extraction system is interfering unnecessarily with ISCO performance, and the overall effectiveness of continuing ISCO treatments with all the wells on versus turning one or more wells off. Ecology would evaluate the plan against applicable regulatory criteria, as needed to meet the minimum cleanup requirements specified in WAC 173-340-360(2). The work plan shall evaluate the possibility of turning one or more pumps off for short and/or long durations before meeting cleanup standards against the unacceptable impact criteria and other Ecology evaluative criteria listed above. If Ecology does not approve the work plan, the cleanup shall continue to operate all of the groundwater extraction wells in accordance with this Cleanup Action Plan until Ecology determines that groundwater cleanup standards are met based on ISCO treatment and performance monitoring.

16. Monitoring
Implement monitoring in accordance with WAC 173-340-410. The objective of monitoring is to confirm that human health and the environment are adequately protected; acceptable ongoing effectiveness of the treatment and groundwater containment and eventually that cleanup levels are achieved at the points of compliance, and also to confirm the long-term effectiveness of cleanup actions at

the Site. The EDR will contain discussions on duration and frequency of monitoring; the trigger for contingency response actions; and the rationale for terminating monitoring.

WAC 173-340-410 requires three general types of compliance monitoring: 1) protection monitoring, 2) performance monitoring, and 3) confirmational monitoring. The following subsections describe how these monitoring requirements will be met in implementing the Ecology cleanup action.

The three types of compliance monitoring required at the Site are:

Protection Monitoring: The purpose of protection monitoring is to confirm that human health and the environment are adequately protected during implementation of the cleanup action. Monitoring for this purpose will include personal monitoring of workers during construction. It will also include groundwater, indoor air, and sub-slab vapor sampling during implementation to make sure on and off-site receptors are protected and that wastes generated are properly disposed of.

Performance Monitoring: The purpose of performance monitoring is to confirm that the cleanup action effectively attains its objectives and is in compliance with the CAP. Performance monitoring plans are submitted as part of each subsequent phase 1, 2, and 3 (and for any additional phases) ISCO treatment plans.

The frequency of the routine sampling and the details of all monitoring shall be included in the phased ISCO treatment and monitoring work plans. Performance monitoring will include at a minimum:

- Routine indoor air samples shall be collected in addition to routine negative pressure field extension testing conducted to verify progress of the cleanup action and eventual attainment of cleanup levels. Routine negative pressure field extension testing at the 220 South Dawson Street building is also required to confirm effectiveness of the VIM system.
- Sub-slab vapor samples will be collected with the first indoor air sampling event. Subsequently, sub-slab vapor samples shall be collected under the following circumstances to determine attainment of the sub-slab vapor action level of 33 times the MTCA Method B indoor air cleanup level:
    - Indoor air samples indicated that indoor air exceeds the MTCA Method B indoor air cleanup level;
    - Structural changes to the building are proposed, including building renovation or replacement; or
    - Relief is requested from a requirement to maintain institutional controls, as described in Section 4.2.1.
- Monitoring quantity and concentrations of contaminants in extracted groundwater discharged to the King County sanitary sewer.

- Routine groundwater elevation and chemical analysis to verify progress of the cleanup action and eventual attainment of cleanup levels at the standard point of compliance. Following each phased ISCO treatment, at least two additional rounds of analytical parameters (analyzed for the same list of parameters as the baseline) will be collected to assess changes in water quality and reduction of CVOC concentration (and therefore mass). In addition, samples will be pulled from downgradient wells to measure the arrival time of un-reacted $KMnO_4$ against predicted arrival time. Ecology expects a minimum post injection monitoring period of 3 to 6 months, required to evaluate *in situ* chemical oxidation effectiveness, for each phase of the ISCO treatment.
- Monitoring groundwater discharge flow rates and contaminant concentrations for compliance with any King County discharge authorization or permit.
- Revised Long-term Operation, Inspection, Maintenance, and Monitoring Plan (O&M Plan)

Confirmation Monitoring: The purpose of confirmational monitoring is to confirm the long-term effectiveness of the cleanup action once cleanup standards have been achieved. This monitoring will include long-term groundwater monitoring at the Site and in groundwater bounding the Site. Confirmation monitoring will also include indoor air and soil vapor sampling.

17. Financial Assurance
    Maintain financial assurance sufficient to cover all costs for construction and implementation of the final CAP, and post cleanup monitoring at the Site in compliance with WAC 173-340-64620(1) and WAC 173-340-440(11).

18. Other Institutional Controls:
    Institutional controls shall comply with the requirements of WAC 173-340-440 and shall:

    a. restrict withdrawal of groundwater at the Site;
    b. prevent subsurface activities that mix the contamination in the intermediate and
    c. deeper zone groundwater with contamination in the shallow zone groundwater;
    d. restrict future activities which have the potential to exacerbate the vapor intrusion pathway;
    e. restrict subsurface activities conducted within the soil and groundwater contaminated areas.

GE will make a good faith effort to secure an environmental covenant (in a form that has been approved by Ecology and that is consistent with WAC 173-340-440) on all the properties associated with the Site before seeking Ecology approval to resort to other legal or administrative mechanisms to meet institutional control requirements.

7.0 Contingent Remedy

Should Ecology determine that the Ecology Final Site Cleanup Action –Modified Alternative 2, with optimized or not-optimized hydraulic control will not achieve the Site cleanup levels in a reasonable timeframe, GE shall implement a contingent remedy, as approved by Ecology, under the process below.

GE shall continue to operate and maintain the optimized or not-optimized hydraulic control system in accordance with the approved Modified Alternative 2 EDR O&M plan or as stated in Exhibit C Scope of Work, Paragraph 3 if the Modified Alternative 2 EDR O&M plan is not approved.

GE shall continue to implement Groundwater hydraulic and chemical monitoring in accordance with the approved Modified Alternative 2 EDR Groundwater Monitoring Plan, SOPs, and QAPP or as stated in Exhibit C Scope of Work, Paragraph 2 if the Modified Alternative 2 EDR is not approved.

GE shall operate and maintain the vapor intrusion mitigation system in accordance with the approved Modified Alternative 2 EDR plan or as stated in Exhibit C Scope of Work, Paragraph 1 if the Modified Alternative 2 EDR plan is not approved .

1. Within 45 days after Ecology determination that the Ecology Final Site Cleanup Action –Modified Alternative 2, ISCO with optimized or not-optimized hydraulic control, will not achieve the Site cleanup levels in a reasonable timeframe, GE shall submit a summary technical memorandum to present all of the results of the bench scale tests, ISCO pilot testing, and following injections for Ecology review and approval.

2. GE shall resubmit a revised summary technical memorandum within 30 days following receipt of Ecology comments. GE shall revise the technical memorandum per Ecology comments.

3. Within 45 days of Ecology approval of this summary technical memorandum, GE shall submit to Ecology a contingent remedy technical memorandum that includes possible contingent remedy options for implementation. The contingent remedy technical memorandum shall include (a) Optimized Hydraulic Control, Enhanced Anaerobic Bioremediation, Subslab Depressurization System and Institutional Controls (dCAP Section 5.4, Alternative 3) with optimized hydraulic control for at least the first two full scale on- and off-property injections; (b) Optimized Hydraulic Control, Soil Vapor Extraction/Air Sparging, Subslab Depressurization System and Institutional Controls (dCAP Section 5.1, Alternative 1) with optimized hydraulic control until cleanup levels are achieved; (c) monitored natural attenuation with optimized hydraulic control (on-property source control) until cleanup levels are achieved (d) optimized groundwater extraction and treatment system for groundwater treatment and hydraulic control, and (e) other viable treatment technologies, not included above but applicable to the site, as required by Ecology or recommend by GE. The technical memorandum shall evaluate these contingent remedy options under the threshold criteria of WAC 173-340-360(2) (a)

and the “other requirements” under WAC 173-340-360(2) (b) and (b) recommend a contingent remedial action to Ecology. Any decision to turn-off one or more groundwater extraction wells under contingent remedy option (a) shall be justified by meeting all cleanup levels or using the criteria in Section 6.0, paragraph 15, as applied to the contingent remedy.

4. Ecology will select the contingent remedy based on review of the contingency remedy technical memorandum and consideration of public comment on the contingency remedy technical memorandum.

5. Upon Ecology selection of the contingency remedy, GE shall submit a revised EDR/CPS/O&M plan with schedule for design and implementation for Ecology review and approval within 60 days.

6. GE shall resubmit a revised EDR/CPS/O&M plan and schedule for design and implementation within 45 days following receipt of Ecology comments. GE shall revise the EDR/CPS/O&M plan per Ecology comments.

GE shall implement the Ecology approved EDR/CPS/O&M plan in accordance with the Ecology approved schedule for design and implementation.

8.0 References

Dames & Moore 1996. *Independent Interim Remedial Action of Soils – GE Plant 1 Facility*. Dames and Moore. December 1996

Duwamish Study, 1998. *Duwamish Basin Groundwater Pathways Conceptual Model Report.* City of Seattle Office of Economic Development and the King Country Office of Budget and Strategic Planning in April 1998.

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Figures

Table 3-1 Vapor Intrusion Study Sub-Slab Sample Results - 220 South Dawson Street Building

		Chemical Name	1,1,1-TCA	1,1-DCA	1,1-DCE	Chloroform	cis-1,2-DCE	PCE	TCE	Vinyl Chloride
Location ID	Sample Date	Sample ID								
Indoor Air Samples (µg/m³)										
IA-1	12/5/2005	IA-1-1205	0.18	< 0.13	< 0.063	< 0.15	< 0.12	0.38	0.28	< 0.04
IA-2	12/5/2005	IA-2-1205	< 0.19	< 0.14	< 0.068	< 0.17	< 0.14	0.38	0.27	< 0.044
IA-2 (dup)	12/5/2005	IA-20-1205	< 0.18	< 0.13	< 0.064	< 0.16	< 0.13	0.38	0.28	< 0.041
IA-3	12/5/2005	IA-3-1205	< 0.18	< 0.14	< 0.067	< 0.16	< 0.13	0.43	0.34	< 0.043
IA-4	12/5/2005	IA-4-1205	< 0.18	< 0.13	< 0.064	< 0.16	< 0.13	0.42	**0.56**	< 0.041
IA-5	12/5/2005	IA-5-1205	0.38	< 0.14	< 0.068	< 0.17	< 0.14	0.45	**0.71**	< 0.044
IA-6	12/5/2005	IA-6-1205	< 0.18	< 0.13	< 0.064	< 0.16	< 0.13	0.46	**0.44**	< 0.041
Upwind Ambient Samples (µg/m³)										
AA-1	12/5/2005	AA-1-1205	< 0.18	< 0.14	< 0.067	< 0.16	< 0.13	0.46	0.2	< 0.043
AA-5	12/5/2005	AA-5-1205	< 0.17	< 0.13	< 0.063	< 0.15	< 0.12	0.4	0.19	< 0.04
Average Upwind for Indoor Air Correction			*0*	*0*	*0*	*0*	*0*	*0.43*	0.195	*0*
Down/Crosswind Ambient Samples (µg/m³)										
AA-2	12/5/2005	AA-2-1205	< 0.17	< 0.13	< 0.063	< 0.15	< 0.12	0.38	0.18	< 0.04
AA-3	12/5/2005	AA-3-1205	< 0.17	< 0.13	< 0.063	< 0.15	< 0.12	0.37	0.18	< 0.04
AA-4	12/5/2005	AA-4-1205	< 0.17	< 0.13	< 0.063	< 0.15	< 0.12	0.34	< 0.17	< 0.04
Corrected Indoor Air Results (Indoor Air minus Ambient) (µg/m³)										
IA-1	12/5/2005	IA-1-1205	0.18	< 0.13	< 0.063	< 0.15	< 0.12	-0.05	0.085	< 0.04
IA-2	12/5/2005	IA-2-1205	< 0.19	< 0.14	< 0.068	< 0.17	< 0.14	-0.05	0.075	< 0.044
IA-2 (dup)	12/5/2005	IA-20-1205	< 0.18	< 0.13	< 0.064	< 0.16	< 0.13	-0.05	0.085	< 0.041
IA-3	12/5/2005	IA-3-1205	< 0.18	< 0.14	< 0.067	< 0.16	< 0.13	0	0.145	< 0.043
IA-4	12/5/2005	IA-4-1205	< 0.18	< 0.13	< 0.064	< 0.16	< 0.13	-0.01	0.355	< 0.041
IA-5	12/5/2005	IA-5-1205	0.38	< 0.14	< 0.068	< 0.17	< 0.14	0.02	**0.515**	< 0.044
IA-6	12/5/2005	IA-6-1205	< 0.18	< 0.13	< 0.064	< 0.16	< 0.13	0.03	0.245	< 0.041
Indoor Air Cleanup Level			322	none	12.74	0.11	none	2.5	0.37	0.28

Table 3-1 Vapor Intrusion Study Sub-Slab Sample Results - 220 South Dawson Street Building

Location ID	Sample Date	Sample ID	1,1,1-TCA	1,1-DCA	1,1-DCE	Chloroform	cis-1,2-DCE	PCE	TCE	Vinyl Chloride
Sub-slab Vapor Samples (µg/m³)										
V-1	12/6/2005	V-1-1205	6,900	23	< 15	< 18	< 15	< 25	**1,600**	< 9.5
V-1 (resamp	12/7/2005	V-10-1205	6,900	24	< 14	< 18	< 14	< 24	**1,600**	< 9.2
V-2	12/6/2005	V-2-1205	1,600	< 3.5	< 3.4	< 4.2	< 3.4	< 5.8	**44**	< 2.2
V-3	12/7/2005	V-3-1205	15	< 3	< 2.9	< 3.6	< 2.9	< 5	**240**	< 1.9
V-4	12/7/2005	V-4-1205	270	< 2.9	< 2.8	< 3.5	< 2.8	19	**350**	< 1.8
V-5	12/6/2005	V-5-1205	700	250	< 11	**19**	480	< 19	**3,700**	< 7.1
IA CUL x 33 (cross-slab alpha)			10,626	none	420	3.63	none	82.5	12.21	9.24
Alpha Factor (Indoor/Sub-slab)										
IA-1/V-1			*0.00003*	*0.00283*	*NA*	*NA*	*NA*	*NA*	*0.00005*	*NA*
IA-1/V-1 (resample)			*0.00003*	*0.00271*	*NA*	*NA*	*NA*	*NA*	*0.00005*	*NA*
IA-2/V-2			*0.00006*	*NA*	*NA*	*NA*	*NA*	*NA*	*0.00170*	*NA*
IA-2 (dup)/V-2			*0.00006*	*NA*	*NA*	*NA*	*NA*	*NA*	*0.00193*	*NA*
IA-3/V-3			*0.00600*	*NA*	*NA*	*NA*	*NA*	*NA*	*0.00060*	*NA*
IA-4/V-4			*0.00033*	*NA*	*NA*	*NA*	*NA*	*-0.00053*	*0.00101*	*NA*
IA-5/V-5			*0.00054*	*0.00028*	*NA*	*0.00447*	*0.00015*	*NA*	*0.00014*	*NA*
Groundwater Samples (µg/L)										
MW-1	11/17/2005	MW-1-1105	11	< 0.6	0.12	< 0.6	< 0.6	1.8	24	< 0.02
MW-4	11/14/2005	MW-4-1105	12	7.2	3.4	< 0.6	< 0.6	2.3	40	0.032
MW-6	11/17/2005	MW-6-1105	< 0.2	0.4	0.12	< 0.2	< 0.2	0.026	2.1	< 0.02
MW-6 (dup)	11/17/2005	MW-6A-1105 (dup)	< 0.2	0.5	0.13	< 0.2	< 0.2	0.025	2.0	< 0.02
MW-7	11/17/2005	MW-7-1105	< 0.2	0.4	0.3	< 0.2	0.5	< 0.020	3.8	< 0.02
MW-8	11/14/2005	MW-8S-1105	< 0.2	2.0	0.7	< 0.2	12	< 0.020	12	0.04

Notes:
Sub-slab vapor samples analyzed by Method TO-15 SIM
Indoor and ambient air samples analyzed by Method TO-15
Groundwater samples analyzed by Method 8260 and Method 8260 SIM
Bolded values indicates an exceedance of indoor air cleanup level or sub-slab vapor concentration protective of indoor air cleanup level (refer to Sections 4.2 and 4.3)
Alpha factors calculated using 1/2 detection limit for non-detects in indoor air.

Table 3-2 Summary of Vapor Intrusion Indoor Air and Ambient Air Sample Results - 220 South Dawson Street Building

Location ID / Indoor Air Samples (µg/m³)	1,1,1-TCA 12/5/2005	8/21/2006	11/9/2006	2/19/2007	3/13/2007	11/2/2007	11/5/2007
IA-1	0.18	0.21	< 0.18	< 0.18	NS	0.19	NS
IA-2	< 0.19	NS	NS	NS	NS	NS	NS
IA-2 (duplicate)	< 0.18	NS	NS	NS	NS	NS	NS
IA-3	< 0.18	0.17	< 0.18	< 0.18	NS	NS	< 0.18
IA-4	< 0.18	0.21	< 0.17	< 0.18	NS	NS	< 0.17
IA-4 (duplicate)	NS	NS	< 0.18	< 0.2	NS	NS	< 0.14
IA-5	0.38	0.21	0.32	0.37	NS	0.19	NS
IA-5 (duplicate)	NS	0.18	NS	NS	NS	NS	NS
IA-6	< 0.18	NS	NS	NS	NS	NS	NS
IA-7		NS	NS	NS	< 0.19	NS	< 0.16
Alley Trailer	NS	NS	NS	NS	NS	NS	< 0.16
Ambient Samples (µg/m³)							
AA-1	< 0.18	< 0.18	< 0.17	< 0.18	NS	NS	< 0.15
AA-3	< 0.17	< 0.18	< 0.16	< 0.18	< 0.17	NS	< 0.15
AA-5	< 0.17	NS	NS	NS	NS	NS	NS
AA-2	< 0.17	< 0.18	< 0.16	< 0.18	NS	0.19	NS
AA-4	< 0.17	< 0.18	< 0.17	< 0.16	NS	0.22	< 0.14
Average Upwind for Indoor Air Corr	0	0	0	0	0	0	0
Corrected Indoor Air Results (Indoor Air minus Ambient) (µg/m³)							
IA-1	0.18	0.21	< 0.18	< 0.18	NS	0.19	NS
IA-2	< 0.19	NS	NS	NS	NS	NS	NS
IA-3	< 0.18	0.17	< 0.18	< 0.18	NS	NS	< 0.18
IA-4	< 0.18	0.21	< 0.17	< 0.18	NS	NS	< 0.17
IA-5	0.38	0.21	< 0.32	0.37	NS	0.19	NS
IA-6	< 0.18	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	< 0.19	NS	< 0.16
Method B Indoor Air Cleanup Level	*322*						

Location ID / Indoor Air Samples (µg/m³)	Chloroform 12/5/2005	8/21/2006	11/9/2006	2/19/2007	3/13/2007	11/2/2007	11/5/2007
IA-1	< 0.15	< 0.16	< 0.16	< 0.16	NS	< 0.15	NS
IA-2	< 0.17	NS	NS	NS	NS	NS	NS
IA-2 (duplicate)	< 0.16	NS	NS	NS	NS	NS	NS
IA-3	< 0.16	0.16	< 0.16	< 0.16	NS	NS	< 0.16
IA-4	< 0.16	0.16	< 0.15	< 0.16	NS	NS	< 0.15
IA-4 (duplicate)	NS	NS	< 0.16	< 0.16	NS	NS	0.14
IA-5	< 0.17	< 0.16	< 0.13	< 0.18	NS	< 0.16	NS
IA-5 (duplicate)	NS	< 0.16	NS	NS	NS	NS	NS
IA-6	< 0.16	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	< 0.17	NS	0.16
Alley Trailer	NS	NS	NS	NS	NS	NS	< 0.15
Ambient Samples (µg/m³)							
AA-1	< 0.16	< 0.16	< 0.15	0.16	NS	NS	< 0.13
AA-3	< 0.15	< 0.16	< 0.15	0.16	< 0.15	NS	< 0.12
AA-5	< 0.15	NS	NS	NS	NS	NS	NS
AA-2	< 0.15	< 0.16	< 0.14	*0.16*	NS	< 0.15	NS
AA-4	< 0.15	< 0.16	< 0.15	0.15	NS	0.14	< 0.12
Average Upwind for Indoor Air Corr	0	0	0	0	0	0	0
Corrected Indoor Air Results (Indoor Air minus Ambient) (µg/m³)							
IA-1	< 0.15	< 0.16	< 0.16	< 0.16	< 0.18	< 0.15	NS
IA-2	< 0.17	NS	NS	NS	NS	NS	NS
IA-3	< 0.16	0.16	< 0.16	< 0.16	0 0	NS	< 0.16
IA-4	< 0.16	0.16	< 0.15	< 0.16	0 0	NS	< 0.15
IA-5	< 0.17	< 0.16	< 0.13	< 0.18	0 0	< 0.16	NS
IA-6	NS	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	< 0.17	NS	0.16
Method B Indoor Air Cleanup Level	*0.11*						

Location ID / Indoor Air Samples (µg/m³)	cis-1,2-DCE 12/5/2005	8/21/2006	11/9/2006	2/19/2007	3/13/2007	11/2/2007	11/5/2007
IA-1	< 0.12	< 0.13	< 0.13	< 0.13		< 0.12	NS
IA-2	< 0.14	NS	NS	NS	NS	NS	NS
IA-2 (duplicate)	< 0.13	NS	NS	NS	NS	NS	NS
IA-3	< 0.13	< 0.12	< 0.13	< 0.13	NS	NS	< 0.13
IA-4	< 0.13	< 0.13	< 0.12	< 0.13	NS	NS	< 0.12
IA-4 (duplicate)	NS	NS	< 0.13	< 0.13	NS	NS	< 0.1
IA-5	< 0.14	< 0.13	< 0.11	< 0.14	NS	< 0.13	NS
IA-5 (duplicate)	NS	< 0.13	NS	NS	NS	NS	NS
IA-6	< 0.13	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	< 0.14	NS	< 0.12
Alley Trailer	NS	NS	NS	NS	NS	NS	< 0.12
Ambient Samples (µg/m³)							
AA-1	< 0.13	< 0.13	< 0.12	< 0.13	NS	NS	< 0.11
AA-3	< 0.12	< 0.13	< 0.12	< 0.13	< 0.12	NS	< 0.1
AA-5	< 0.12	NS	NS	NS	NS	NS	NS
AA-2	< 0.12	< 0.13	< 0.12	< 0.13	NS	< 0.12	NS
AA-4	< 0.12	< 0.13	< 0.12	< 0.16	NS	< 0.1	< 0.1
Average Upwind for Indoor Air Corr	0	0	0	0	0	0	0
Corrected Indoor Air Results (Indoor Air minus Ambient) (µg/m³)							
IA-1	< 0.12	< 0.13	< 0.13	< 0.13	NS	< 0.12	NS
IA-2	< 0.14	NS	NS	NS	NS	NS	NS
IA-3	< 0.13	< 0.12	< 0.13	< 0.13	NS	NS	< 0.13
IA-4	< 0.13	< 0.13	< 0.12	< 0.13	NS	NS	< 0.12
IA-5	< 0.14	< 0.13	< 0.11	< 0.14	NS	< 0.13	NS
IA-6	NS	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	< 0.14	NS	< 0.12
Method B Indoor Air Cleanup Level	*none*						

Location ID / Indoor Air Samples (µg/m³)	Vinyl Chloride 12/5/2005	8/21/2006	11/9/2006	2/19/2007	3/13/2007	11/2/2007	11/5/2007
IA-1	< 0.04	< 0.041	< 0.04	< 0.043	< 0.13	< 0.04	NS
IA-2	< 0.044	NS	NS	NS	NS	NS	NS
IA-2 (duplicate)	< 0.041	NS	NS	NS	NS	NS	NS
IA-3	< 0.043	< 0.039	< 0.04	< 0.043	< 0.13	NS	< 0.04
IA-4	< 0.041	< 0.041	< 0.04	< 0.041	< 0.12	NS	< 0.04
IA-4 (duplicate)	NS	NS	< 0.04	< 0.041	< 0.13	NS	< 0.03
IA-5	< 0.044	< 0.041	< 0.03	< 0.047	NS	< 0.042	NS
IA-5 (duplicate)	NS	< 0.041	NS	NS	NS	NS	NS
IA-6	< 0.041	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	< 0.045	NS	< 0.04
Alley Trailer	NS	NS	NS	NS	NS	NS	< 0.04
Ambient Samples (µg/m³)							
AA-1	< 0.043	< 0.043	< 0.04	< 0.041	NS	NS	< 0.03
AA-3	< 0.04	< 0.042	0.04	< 0.041	NS	NS	< 0.03
AA-5	< 0.04	NS	NS	NS	< 0.04	NS	NS
AA-2	< 0.04	< 0.043	< 0.04	< 0.041	NS	< 0.04	NS
AA-4	< 0.04	< 0.043	< 0.04	< 0.039	NS	< 0.033	< 0.03
Average Upwind for Indoor Air Corr	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corrected Indoor Air Results (Indoor Air minus Ambient) (µg/m³)							
IA-1	< 0.04	< 0.041	< 0.04	< 0.043	NS	< 0.04	NS
IA-2	< 0.044	NS	NS	NS	NS	NS	NS
IA-3	< 0.043	< 0.039	< 0.04	< 0.043	NS	NS	< 0.04
IA-4	< 0.041	< 0.041	< 0.04	< 0.041	NS	NS	< 0.04
IA-5	< 0.044	< 0.041	< 0.03	< 0.047	NS	< 0.04	NS
IA-6	< 0.041	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	< 0.045	NS	< 0.04
Method B Indoor Air Cleanup Level	*0.28*						

Location ID / Indoor Air Samples (µg/m³)	PCE 12/5/2005	8/21/2006	11/9/2006	2/19/2007	3/13/2007	11/2/2007	11/5/2007
IA-1	0.38	0.22	< 0.23	< 0.22	NS	0.74	NS
IA-2	0.38	NS	NS	NS	NS	NS	NS
IA-2 (duplicate)	0.38	NS	NS	NS	NS	NS	NS
IA-3	0.43	0.29	0.67	< 0.23	NS	NS	< 0.22
IA-4	0.42	0.22	< 0.21	< 0.22	NS	NS	0.22
IA-4 (duplicate)	NS	NS	< 0.22	< 0.22	NS	NS	< 0.17
IA-5	0.45	0.22	0.28	0.25	NS	0.71	NS
IA-5 (duplicate)	NS	0.22	NS	NS	NS	NS	NS
IA-6	0.46	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	0.57	NS	< 0.2
Alley Trailer	NS	NS	NS	NS	NS	NS	< 0.21
Ambient Samples (µg/m³)							
AA-1	0.46	< 0.23	< 0.21	< 0.22	NS	NS	0.2
AA-3	0.37	0.27	< 0.21	< 0.22	1.8	NS	< 0.18
AA-5	0.4	NS	NS	NS	NS	NS	NS
AA-2	0.38	< 0.23	< 0.2	< 0.22	NS	0.7	NS
AA-4	0.34	< 0.23	< 0.21	0.26	NS	0.9	< 0.18
Average Upwind for Indoor Air Corr	0.41	0.12 [1]	0.00	0.00			0.00
Corrected Indoor Air Results (Indoor Air minus Ambient) (µg/m³)							
IA-1	-0.03	0.03	< 0.23	< 0.22	NS	0.74	NS
IA-2	-0.03	NS	NS	NS	NS	NS	NS
IA-3	0.02	0.10	0.67	< 0.23	NS	NS	< 0.22
IA-4	0.01	0.03	< 0.21	< 0.22	NS	NS	0.22
IA-5	0.04	0.03	0.28	0.25	NS	0.71	NS
IA-6	0.05	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS		NS	< 0.20
Method B Indoor Air Cleanup Level	*2.5*						

Location ID / Indoor Air Samples (µg/m³)	TCE 12/5/2005	8/21/2006	11/9/2006	2/19/2007	3/13/2007	11/2/2007	11/5/2007
IA-1	0.28	1.3	0.2	< 0.17	NS	0.5	NS
IA-2	0.27	NS	NS	NS	NS	NS	NS
IA-2 (duplicate)	0.28	NS	NS	NS	NS	NS	NS
IA-3	0.34	0.29	< 0.18	0.24	NS	NS	< 0.17
IA-4	0.55	5.2	1.7	0.35	NS	NS	0.6
IA-4 (duplicate)	NS	NS	1.7	0.37	NS	NS	0.54
IA-5	0.71	1.2	1	0.99	NS	0.45	NS
IA-5 (duplicate)	NS	0.96	NS	NS	NS	NS	NS
IA-6	0.44	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS	0.26	NS	0.33
Alley Trailer	NS	NS	NS	NS	NS	NS	0.16
Ambient Samples (µg/m³)							
AA-1	0.2	< 0.18	< 0.17	< 0.17	NS	NS	0.14
AA-3	0.18	< 0.18	< 0.16	< 0.17	< 0.17	NS	< 0.14
AA-5	0.19	NS	NS	NS	NS	NS	NS
AA-2	0.18	< 0.18	< 0.16	< 0.17	NS	0.41	NS
AA-4	< 0.17	< 0.18	< 0.17	< 0.16	NS	0.67	0.14
Average Upwind for Indoor Air Corr	0.19	0.00	0.00	0.00		0.41	0.14
Corrected Indoor Air Results (Indoor Air minus Ambient) (µg/m³)							
IA-1	0.09	1.3	0.2	0.17	NS	0.09 [2]	NS
IA-2	0.08	NS	NS	NS	NS	NS	NS
IA-3	0.15	0.29	< 0.18	0.24	NS	NS	< 0.03
IA-4	0.36	5.2	1.7	0.35	NS	NS	[illegible]
IA-5	0.52	1.2	1	0.99	NS	0.04 [2]	NS
IA-6	NS	NS	NS	NS	NS	NS	NS
IA-7	NS	NS	NS	NS		NS	0.19
Method B Indoor Air Cleanup Level	*0.37*						

Notes:

1. Average PCE concentration in ambient air calculated using 1/2 detection limit for non-detect result.

2. Sample results are estimate due to a lack of upwind ambient air TCE concentrations data for the sampling peroid.

NS - Location was not sampled

[illegible]

During the November 2006 Sampling event no COCs were detected in the Ambient air.

1,1,1-TCA- 1,1,1-Trichloroethane

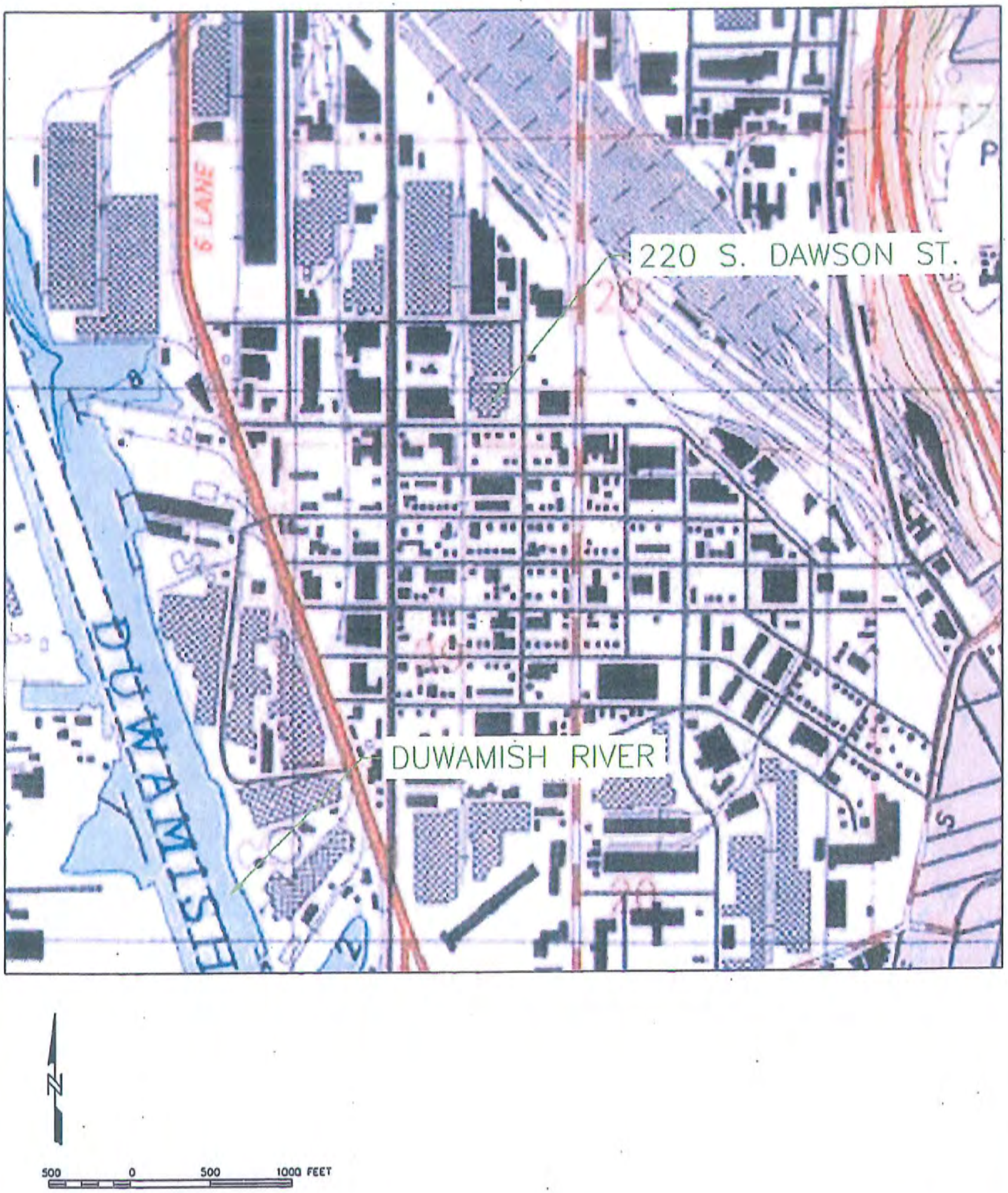
1,1-DCA- 1,1-Dichloroethane - all detections ND, not included in this table

1,1-DCE- 1,1-Dichloroethylene all detections ND, not included in this table

1,2-DCE- cis 1,2-Dichloroethylene

PCE- Tetrachloroethylene

TCE- Trichloroethylene



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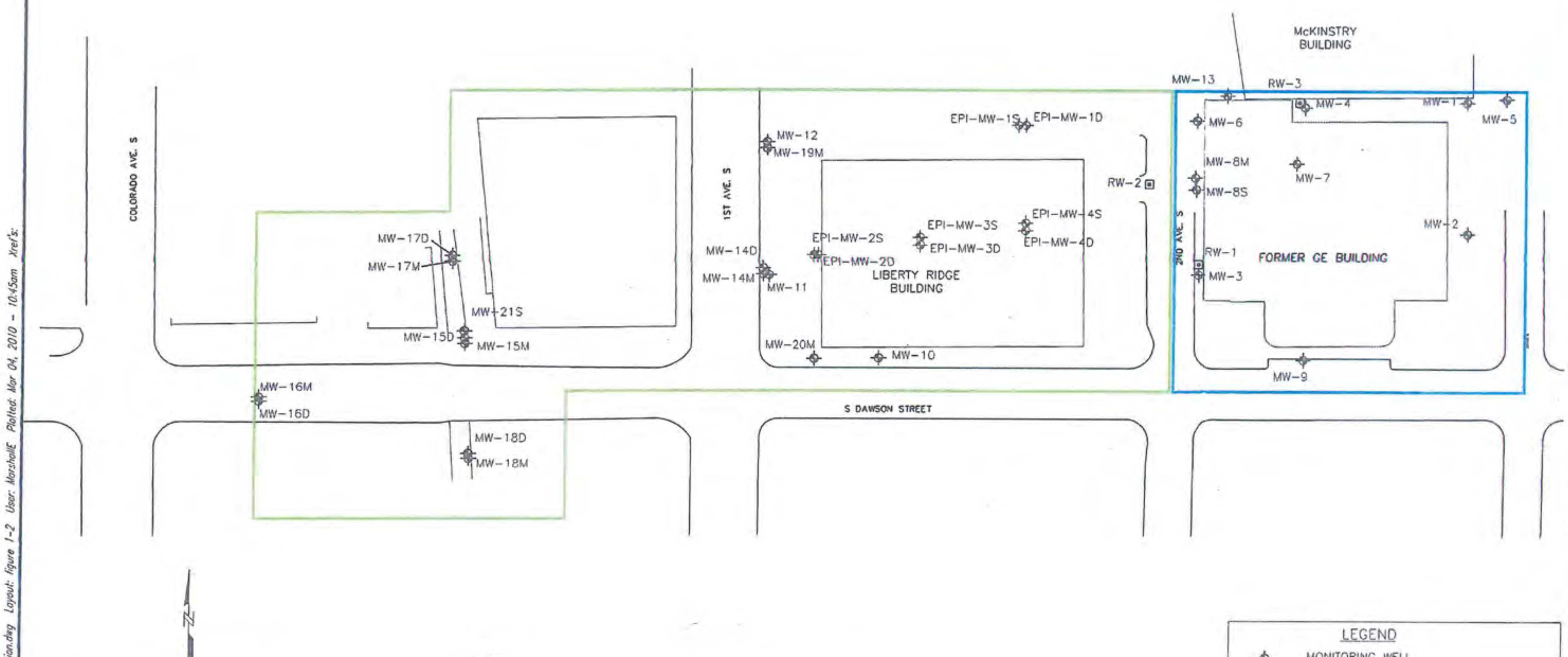
AECOM

GE - S. DAWSON STREET 60137026-740	VICINITY MAP	
DATE: 03/05/10	DRWN: E.M./SEA	FIGURE 1-1



50 0 100

SCALE IN FEET

NOTES:

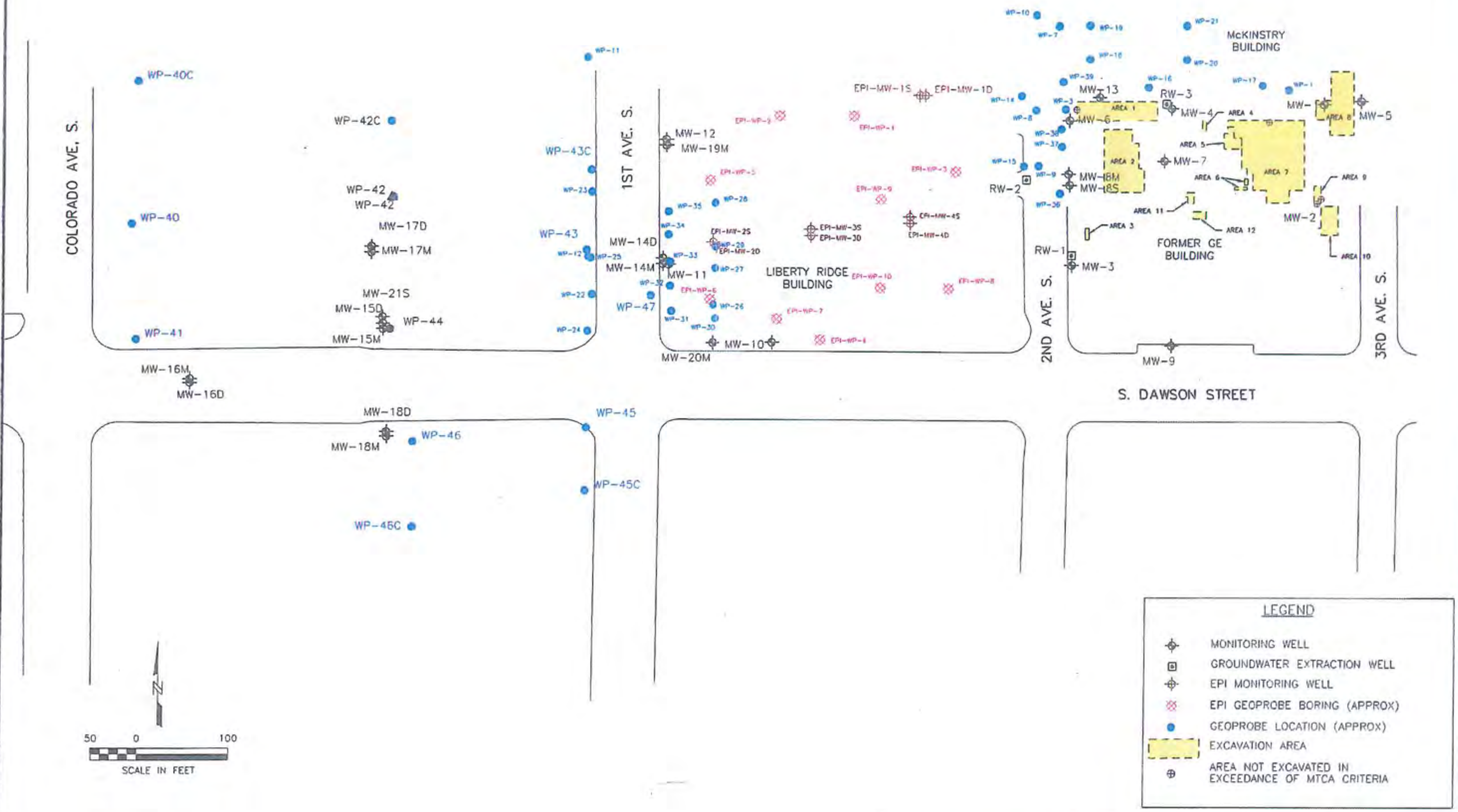
1. MONITORING WELLS MW-8, MW-14S, MW-15S, AND MW-16S HAVE BEEN RENAMED MW-8S, MW-14M, MW-15M, AND MW-16M.
2. ON-PROPERTY AND OFF-PROPERTY AREAS WERE DETERMINED BASED ON TCE CONCENTRATIONS IN THE GW PLUME. THESE AREAS HAVE ONLY BEEN ASSIGNED TO ASSIST WITH THE SELECTION OF A FINAL REMEDY AS PART OF THE DRAFT FOCUSED FEASIBILITY STUDY.

LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

AECOM

GE - S. DAWSON STREET 60137026-740	SITE LOCATION MAP
DATE: 03/04/10 DRWN: E.M./SEA	FIGURE 1-2



AECOM

GE - S. DAWSON STREET

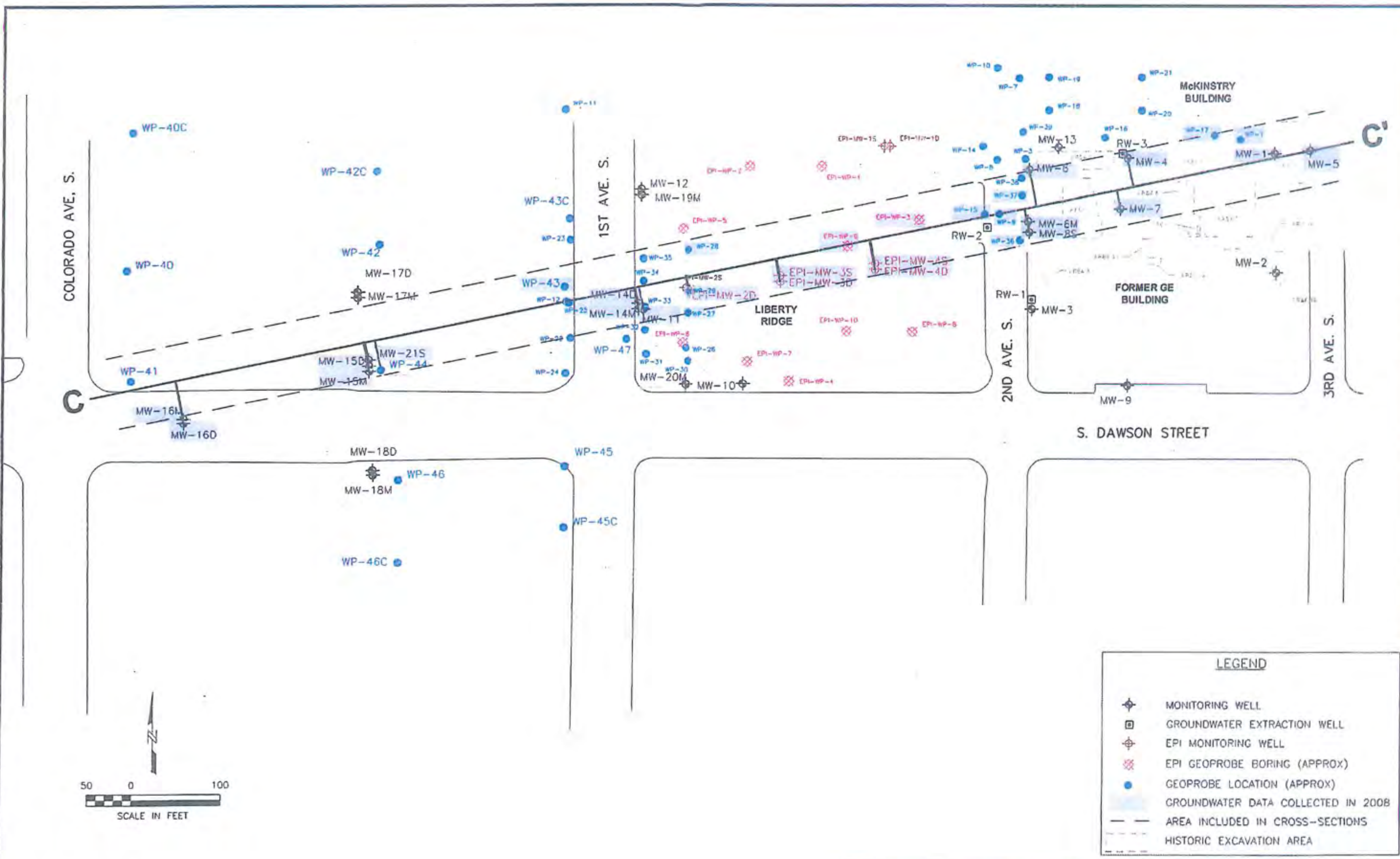
60137026-740

DATE: 02/23/10 | DRWN: E.M./SEA

PREVIOUS INVESTIGATIONS LOCATION MAP

FIGURE 3-1

File: M:\GE-S.Dawson\DCAP\actions-activities.dwg Layout: FIGURE 3-1 User: MarshallE Plotted: Feb 23, 2010 - 8:23am Xref's:



AECOM

GE-S. DAWSON STREET

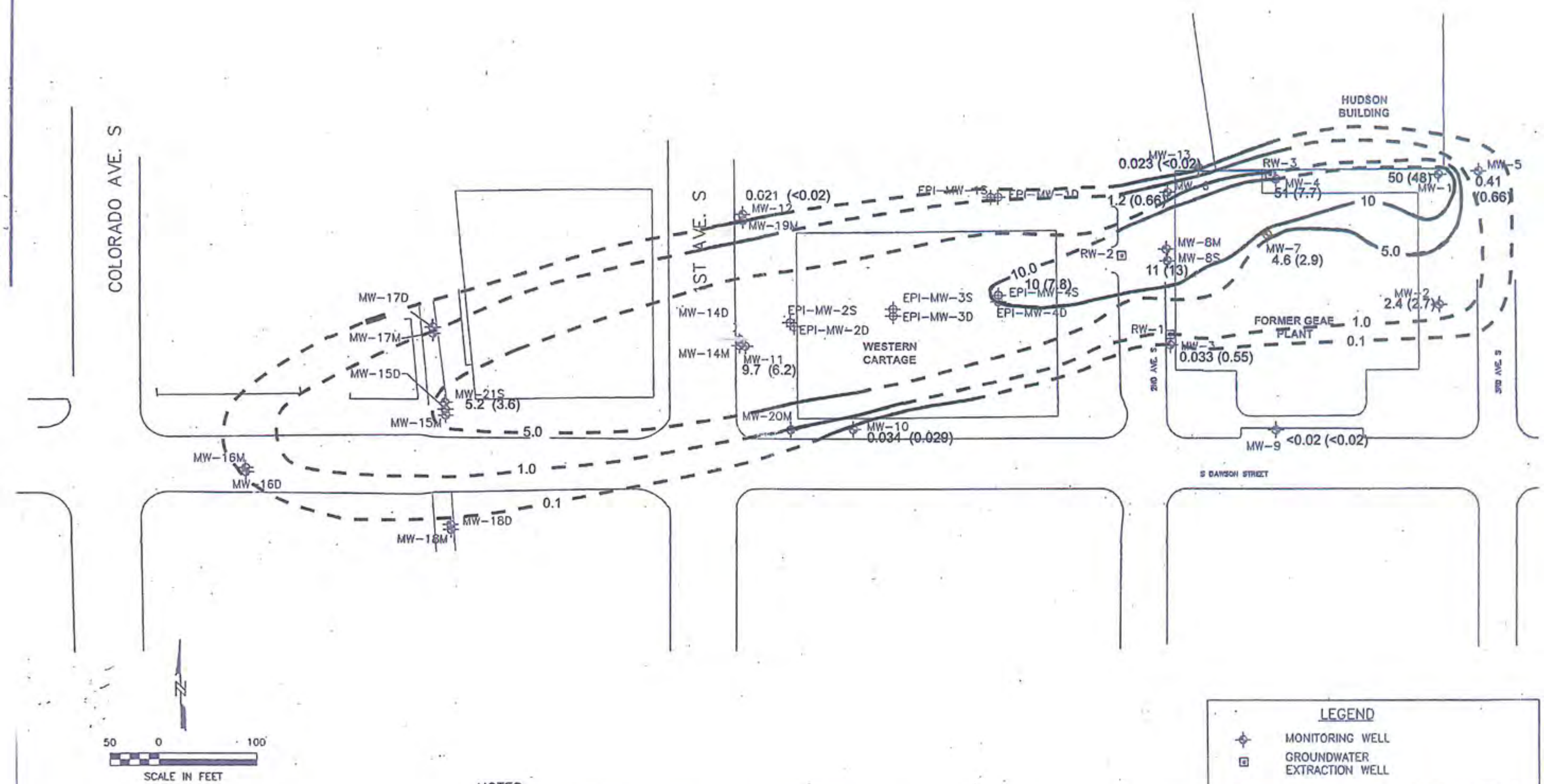
60137026-740

DATE: 02/17/10 | DRWN: E.M./SEA

2008 CROSS SECTION LOCATION MAP

FIGURE 3-2

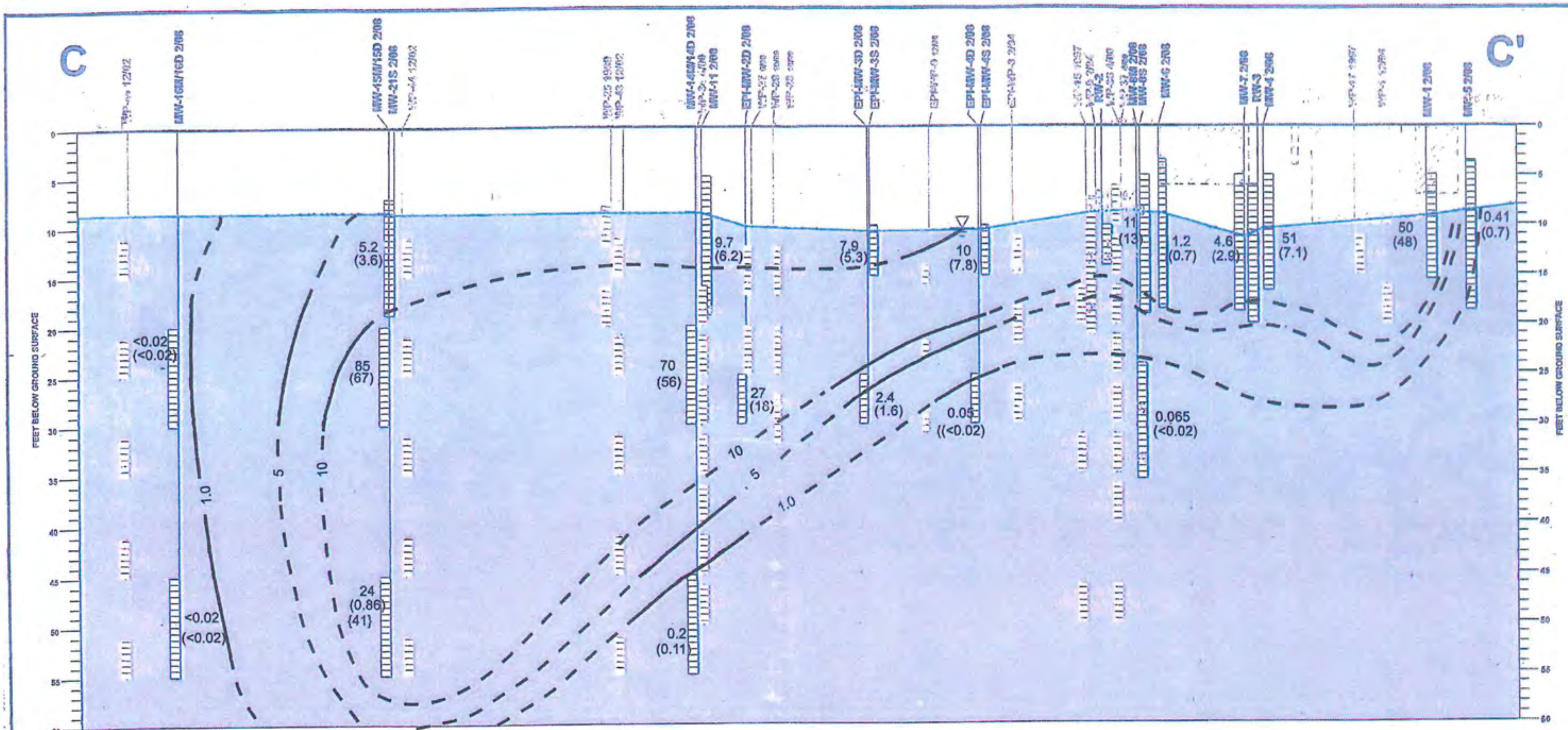
File: M:\GE-S.Dawson\OCAP\x005_(feb_2008).dwg Layout: FIG 3-2 User: MarshallE Plotted: Feb 23, 2010 - 8:25am Xref's:



NOTES:

1. Locations are approximate
2. Concentrations in ( ) are data from the February 2010 sampling event

GEAE - S. DAWSON STREET	TCE Concentrations in Groundwater February 2008 Shallow Aquifer Zone
Date: 02/10/11 | WDOE | Figure 3-3a	



Notes:
1. Concentrations in ( ) are data from the February 2010 sampling event
2. Concentrations in { } are data from June 2010

LEGEND

WELL SCREEN

4.7 CONCENTRATION (ug/L) [2/10 data are in ( )]

MW-1 8/06 MONITORING WELL SAMPLE DATE

WATER TABLE (February 2008)

100 ISOPLETH LINE OF EQUAL CONCENTRATION (DASHED WHERE INFERRED)

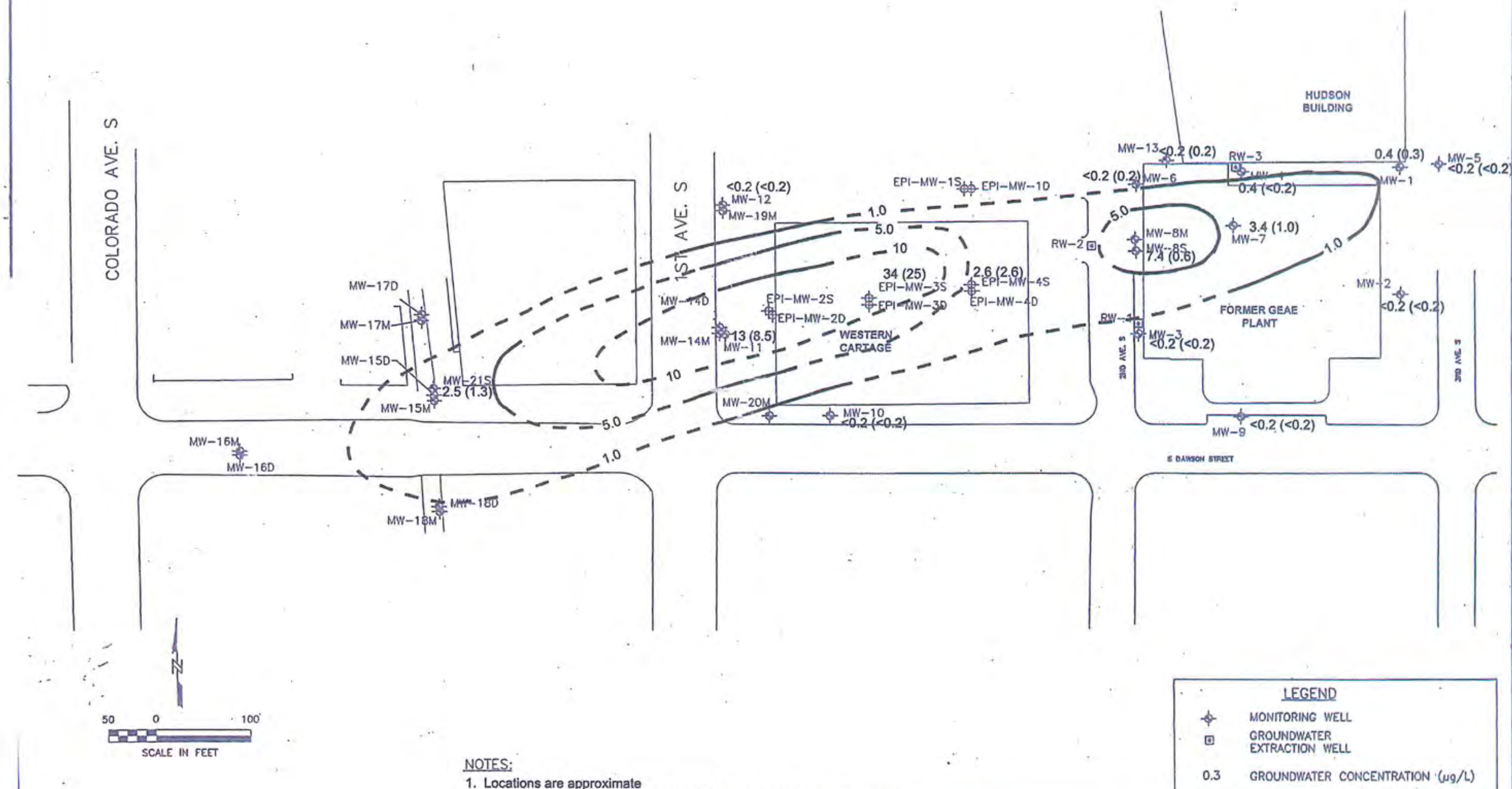
HISTORIC EXCAVATION

50 0 100

HORIZONTAL SCALE IN FEET

VERTICAL EXAGGERATION 1:10

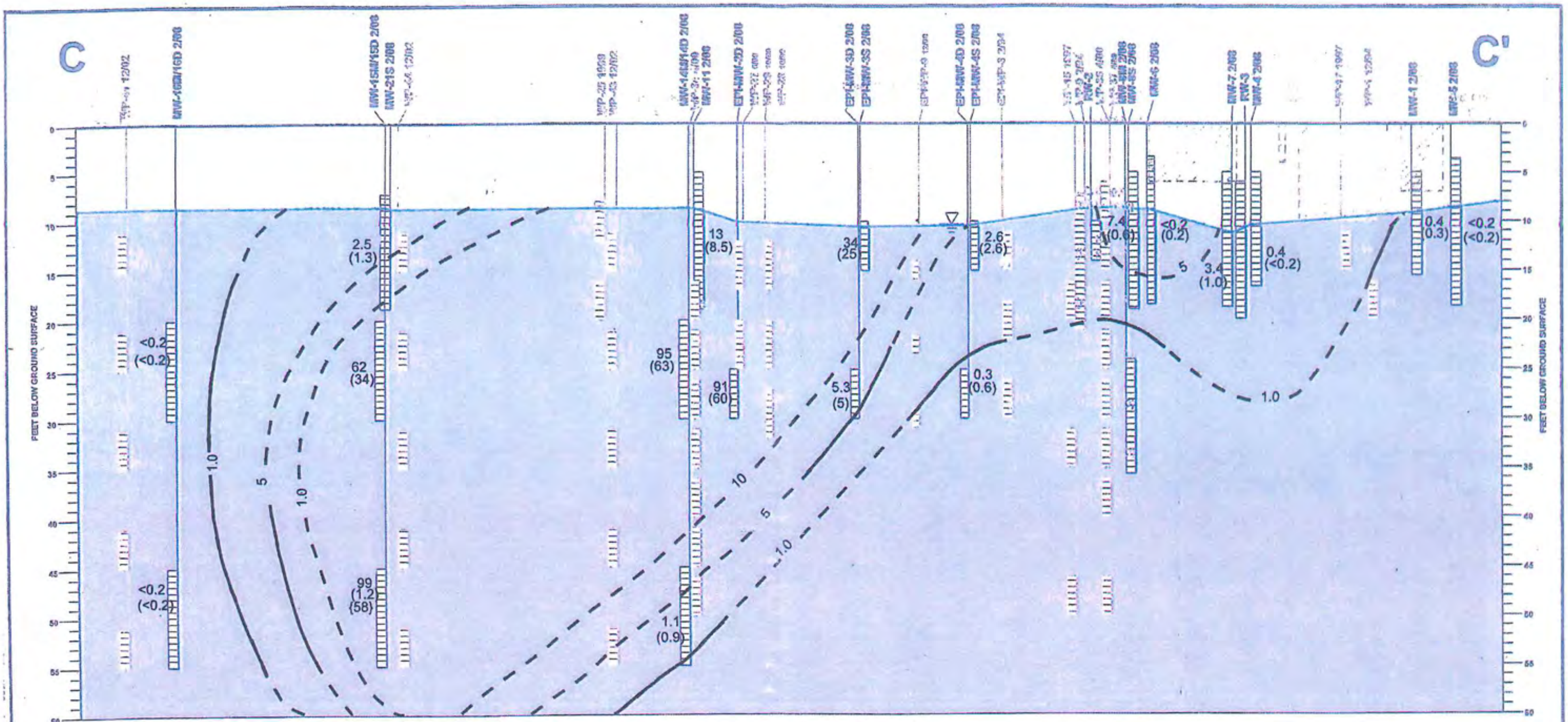
GE - S. DAWSON STREET	February 2008 Cross Section TCE Concentrations
02/10/11 | WDOE | Figure 3-3b	



NOTES:

1. Locations are approximate
2. Concentrations in ( ) are data from the February 2010 sampling event

GEAE - S. DAWSON STREET	cis-1,2-DCE Concentration in Groundwater February 2008 (Shallow Aquifer Zone)
Date 2/10/11 · WDOE · Figure 3-4a	



LEGEND

WELL SCREEN

4.7 CONCENTRATION (ug/L)

MW-1 MONITORING WELL
SAMPLE DATE

WATER TABLE (February 2008)

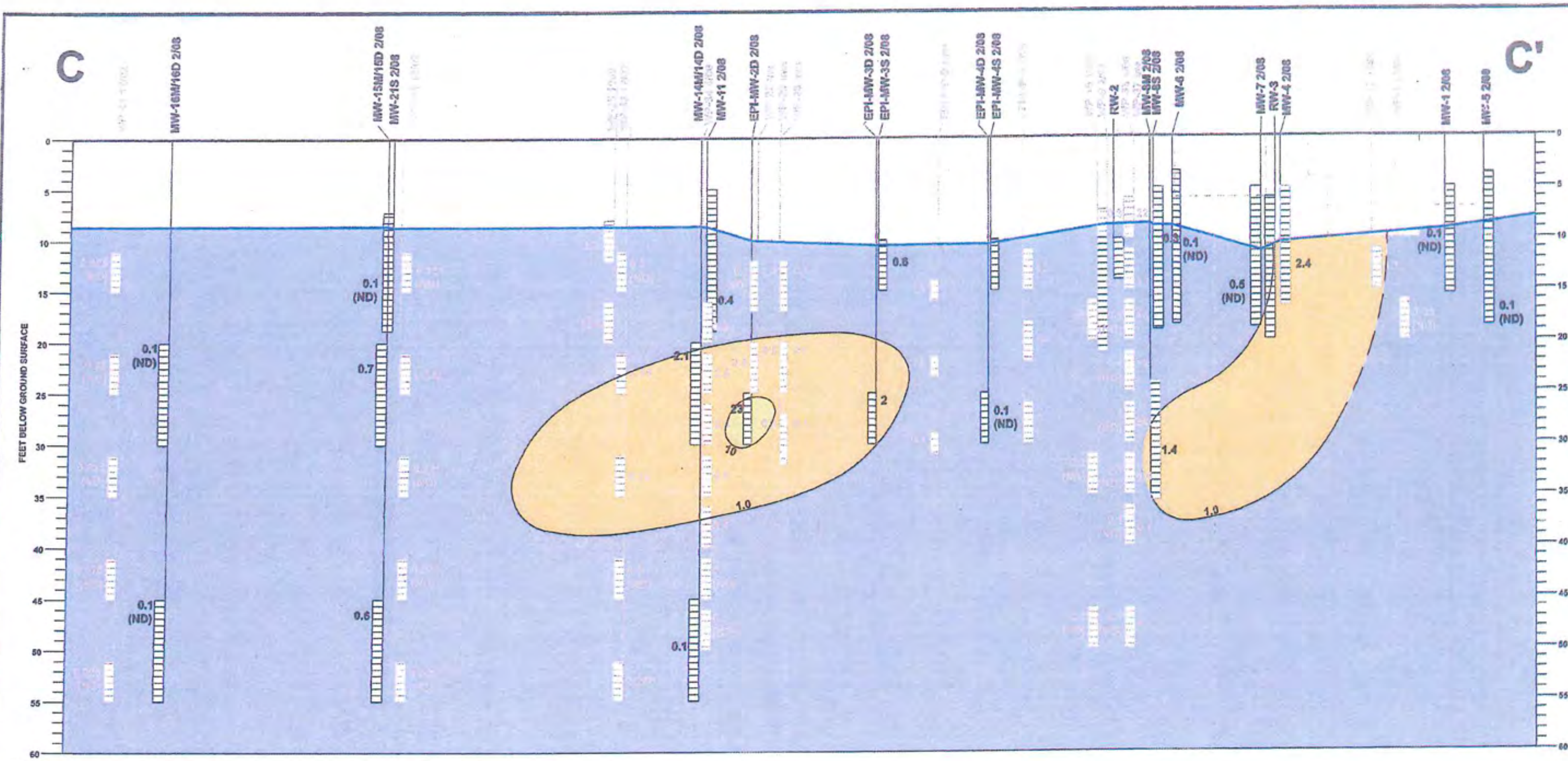
100 ISOPLETH LINE OF EQUAL CONCENTRATION (DASHED WHERE INFERRED)

HISTORIC EXCAVATION

Notes:
1. Concentrations in ( ) are data from the Fegraury 2010 sampling event
2. Concentrations in { } are data from the May 2010 sampling event

50 0 100
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION 1:10

GE - S. DAWSON STREET	February 2008 Cross Section cis-1,2-dichloroethylene
2/10/11 WDOE Figure 3-4b	



NOTES:

FOR RESULTS BELOW THE LABORATORY DETECTION LIMIT, 1/2 OF THE LABORATORY DETECTION LIMIT WAS USED.

WATER TABLE ELEVATION BASED ON FEB. 2008 GAUGING EVENT.

VERTICAL EXTENT OF CONCENTRATION IS BASED ON HISTORIC CONCENTRATIONS BELOW THE LABORATORY DETECTION LIMIT.

1,1-DCE CONCENTRATION (ug/L)

- <1
- 1-10
- 10-100
- >100

LEGEND

- WELL SCREEN
- 4.7 CONCENTRATION (ug/L)
- MW-1 8/06 MONITORING WELL SAMPLE DATE
- WATER TABLE
- 100 ISOPLETH LINE OF EQUAL CONCENTRATION (DASHED WHERE INFERRED)
- HISTORIC EXCAVATION

50 0 100

HORIZONTAL SCALE IN FEET

VERTICAL EXAGGERATION 1:10

AECOM

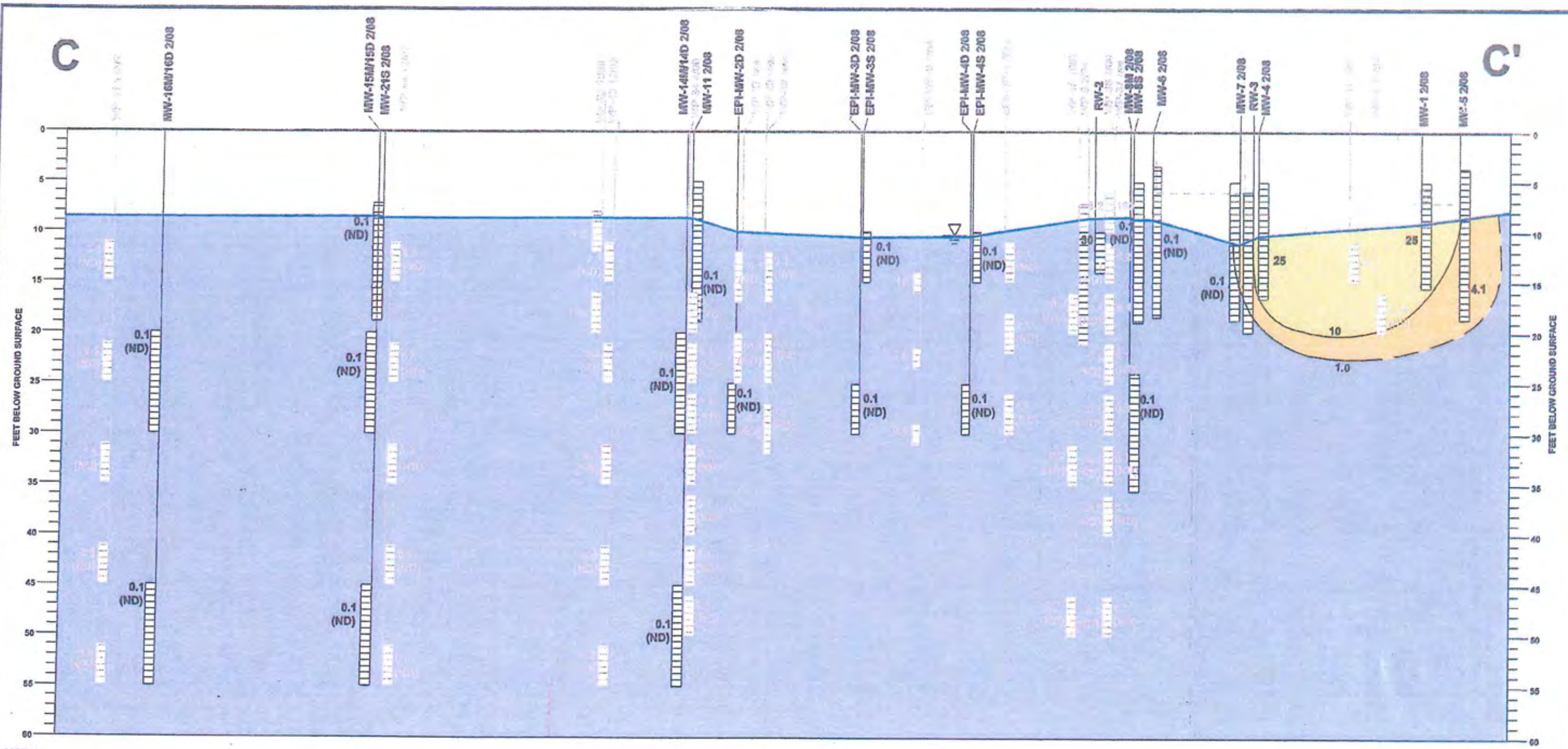
GE - S. DAWSON STREET

60137026-740

DATE: 02/17/10 DRWN: E.M./SEA

FEBRUARY 2008 CROSS SECTION 1,1-DICHLOROETHENE

FIGURE 3-5



NOTES:

FOR RESULTS BELOW THE LABORATORY DETECTION LIMIT, 1/2 OF THE LABORATORY DETECTION LIMIT WAS USED.

WATER TABLE ELEVATION BASED ON FEB. 2008 GAUGING EVENT.

VERTICAL EXTENT OF CONCENTRATION IS BASED ON HISTORIC CONCENTRATIONS BELOW THE LABORATORY DETECTION LIMIT.

1,1,1-TCA CONCENTRATION (ug/L)

- <1
- 1-10
- 10-100
- >100

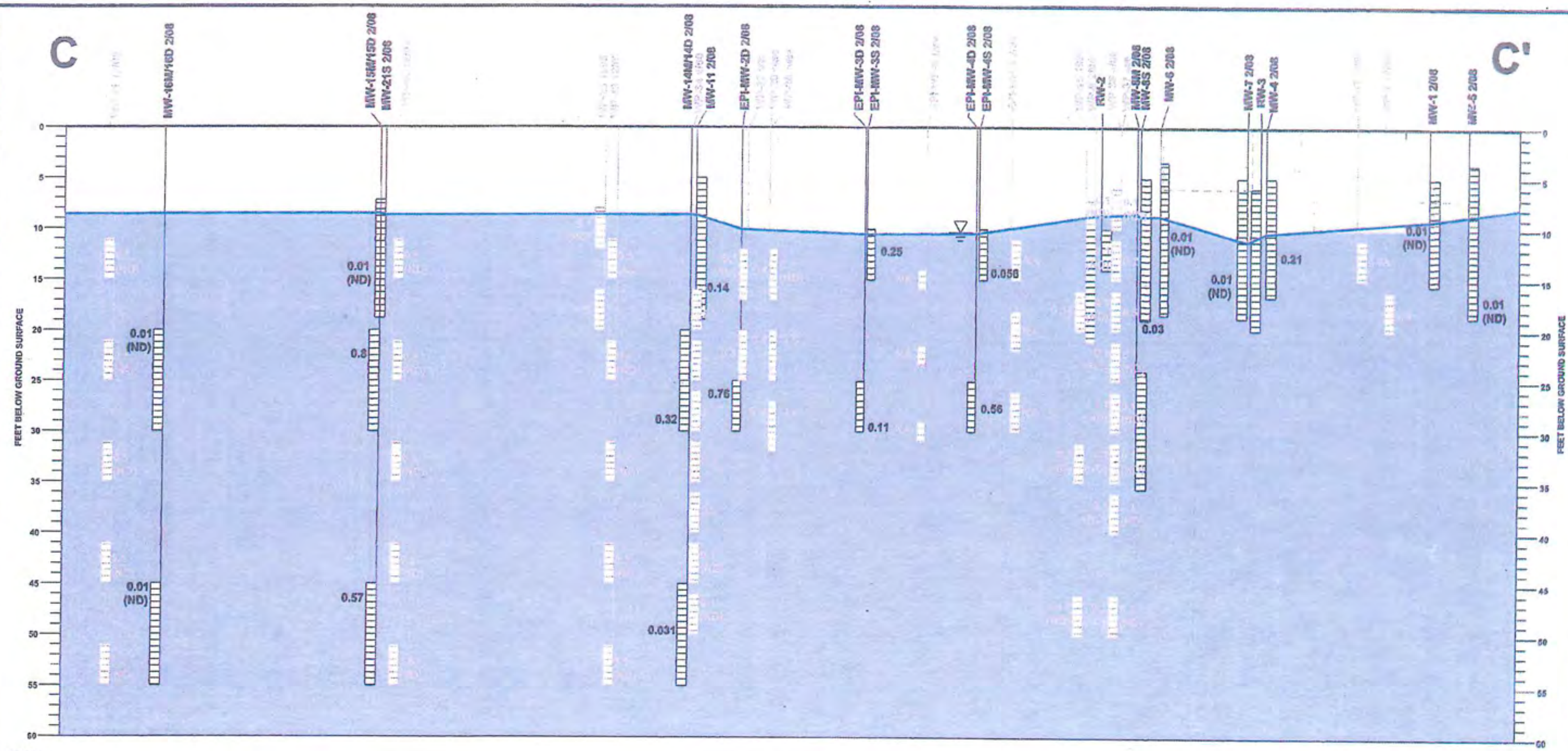
LEGEND

- WELL SCREEN
- 4.7 — CONCENTRATION (ug/L)
- MW-1 8/06 — MONITORING WELL SAMPLE DATE
- WATER TABLE
- 100 — ISOPLETH LINE OF EQUAL CONCENTRATION (DASHED WHERE INFERRED)
- HISTORIC EXCAVATION

50 0 100
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION 1:10

AECOM

GE - S. DAWSON STREET 60137026-740	FEBRUARY 2008 CROSS SECTION 1,1,1-TRICHLOROETHANE
DATE: 02/17/10 DRWN: E.M/SEA	FIGURE 3-6



NOTES:

FOR RESULTS BELOW THE LABORATORY DETECTION LIMIT, 1/2 OF THE LABORATORY DETECTION LIMIT WAS USED.

WATER TABLE ELEVATION BASED ON FEB. 2008 GAUGING EVENT.

VERTICAL EXTENT OF CONCENTRATION IS BASED ON HISTORIC CONCENTRATIONS BELOW THE LABORATORY DETECTION LIMIT.

EPI HISTORIC GEOPROBES WERE NOT INCLUDED ON THIS ANALYSIS, VALUES FOR VINYL CHLORIDE WERE NOT REPORTED

VC CONCENTRATION (ug/L)

- <1
- 1-10
- 10-100
- >100

LEGEND

- WELL SCREEN
- 4.7 CONCENTRATION (ug/L)
- MW-1 8/06 MONITORING WELL SAMPLE DATE
- WATER TABLE
- 100 ISOPLETH LINE OF EQUAL CONCENTRATION (DASHED WHERE INFERRED)
- HISTORIC EXCAVATION

50 0 100
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION 1:10

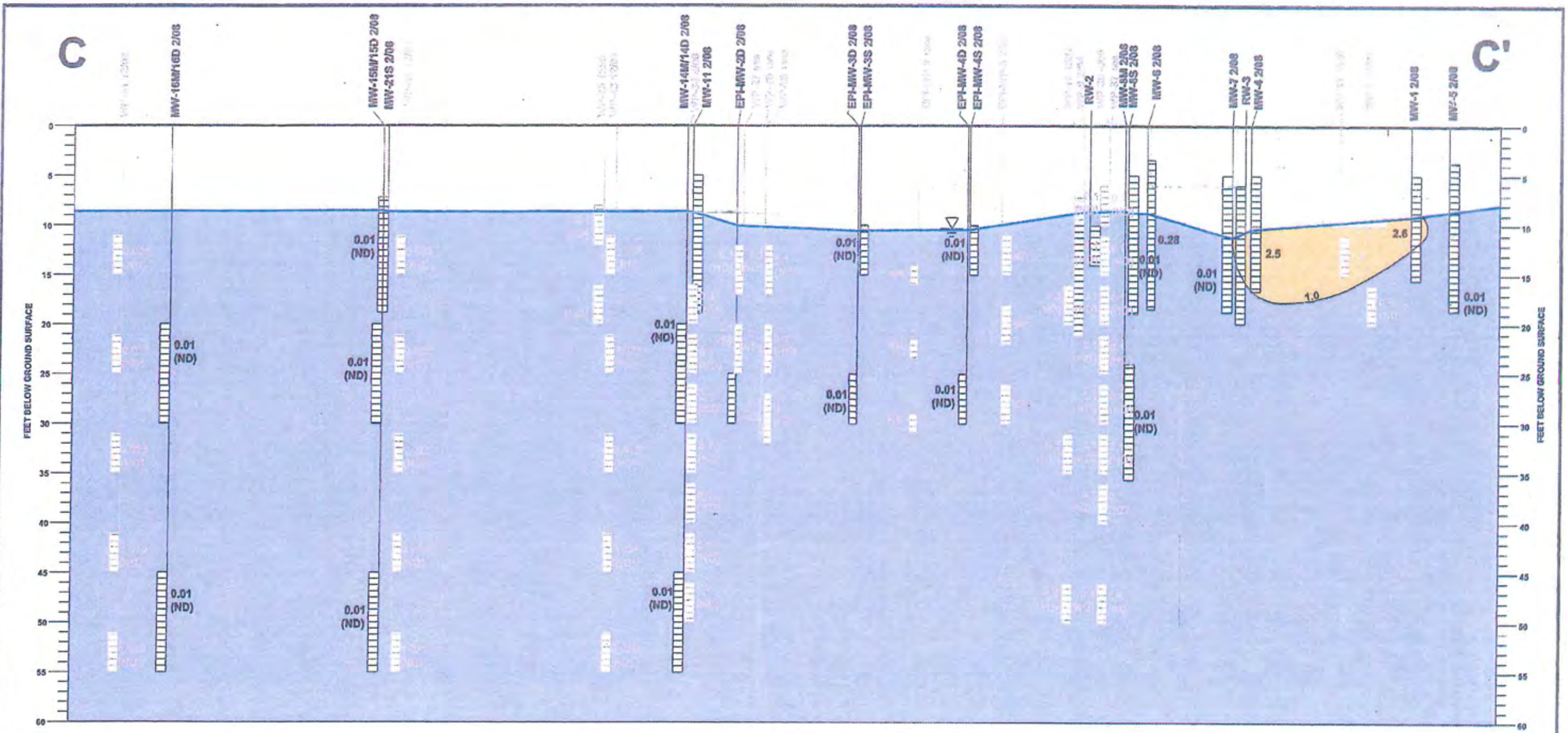
AECOM

GE - S. DAWSON STREET
60137026-740

FEBRUARY 2008 CROSS SECTION
VINYL CHLORIDE

DATE: 02/17/10 | DRWN: E.M./SEA

FIGURE 3-7



NOTES:

FOR RESULTS BELOW THE LABORATORY DETECTION LIMIT, 1/2 OF THE LABORATORY DETECTION LIMIT WAS USED.

WATER TABLE ELEVATION BASED ON FEB. 2008 GAUGING EVENT.

VERTICAL EXTENT OF CONCENTRATION IS BASED ON HISTORIC CONCENTRATIONS BELOW THE LABORATORY DETECTION LIMIT.

TETRACHLOROETHENE CONCENTRATION (ug/L)

- <1
- 1-10
- 10-100
- >100

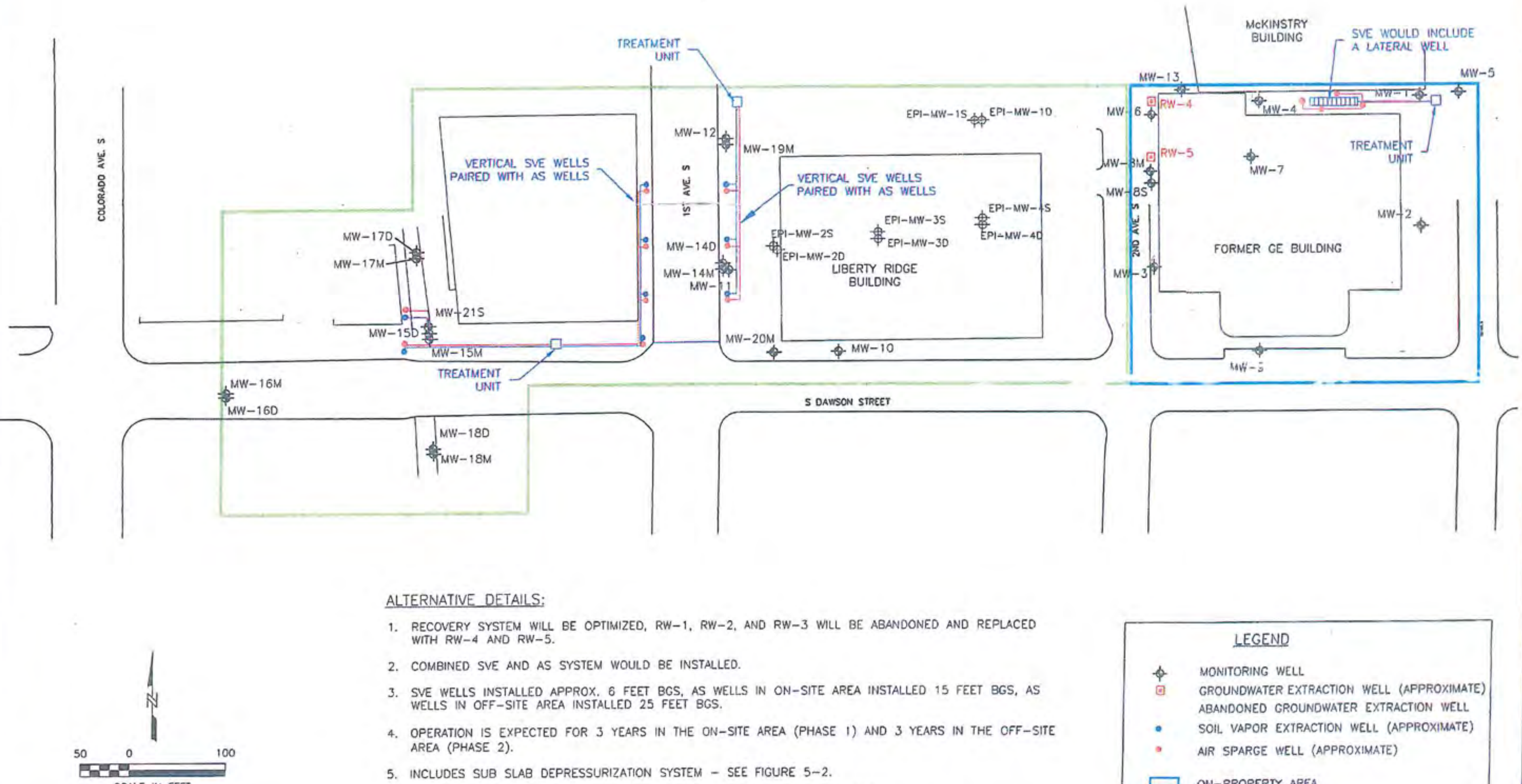
LEGEND

- WELL SCREEN
- 4.7 CONCENTRATION (ug/L)
- MW-1 8/08 MONITORING WELL SAMPLE DATE
- WATER TABLE
- 100 ISOPLETH LINE OF EQUAL CONCENTRATION (DASHED WHERE INFERRED)
- HISTORIC EXCAVATION

50 0 100
HORIZONTAL SCALE IN FEET
VERTICAL EXAGGERATION 1:10

AECOM

GE - S. DAWSON STREET 60137026-740	FEBRUARY 2008 CROSS SECTION TETRACHLOROETHENE
DATE: 02/17/10 DRWN: E.M./SEA	FIGURE 3-8



ALTERNATIVE DETAILS:

1. RECOVERY SYSTEM WILL BE OPTIMIZED, RW-1, RW-2, AND RW-3 WILL BE ABANDONED AND REPLACED WITH RW-4 AND RW-5.
2. COMBINED SVE AND AS SYSTEM WOULD BE INSTALLED.
3. SVE WELLS INSTALLED APPROX. 6 FEET BGS, AS WELLS IN ON-SITE AREA INSTALLED 15 FEET BGS, AS WELLS IN OFF-SITE AREA INSTALLED 25 FEET BGS.
4. OPERATION IS EXPECTED FOR 3 YEARS IN THE ON-SITE AREA (PHASE 1) AND 3 YEARS IN THE OFF-SITE AREA (PHASE 2).
5. INCLUDES SUB SLAB DEPRESSURIZATION SYSTEM - SEE FIGURE 5-2.
6. PERFORMANCE MONITORING WILL INCLUDE VAPOR AND GROUNDWATER SAMPLES

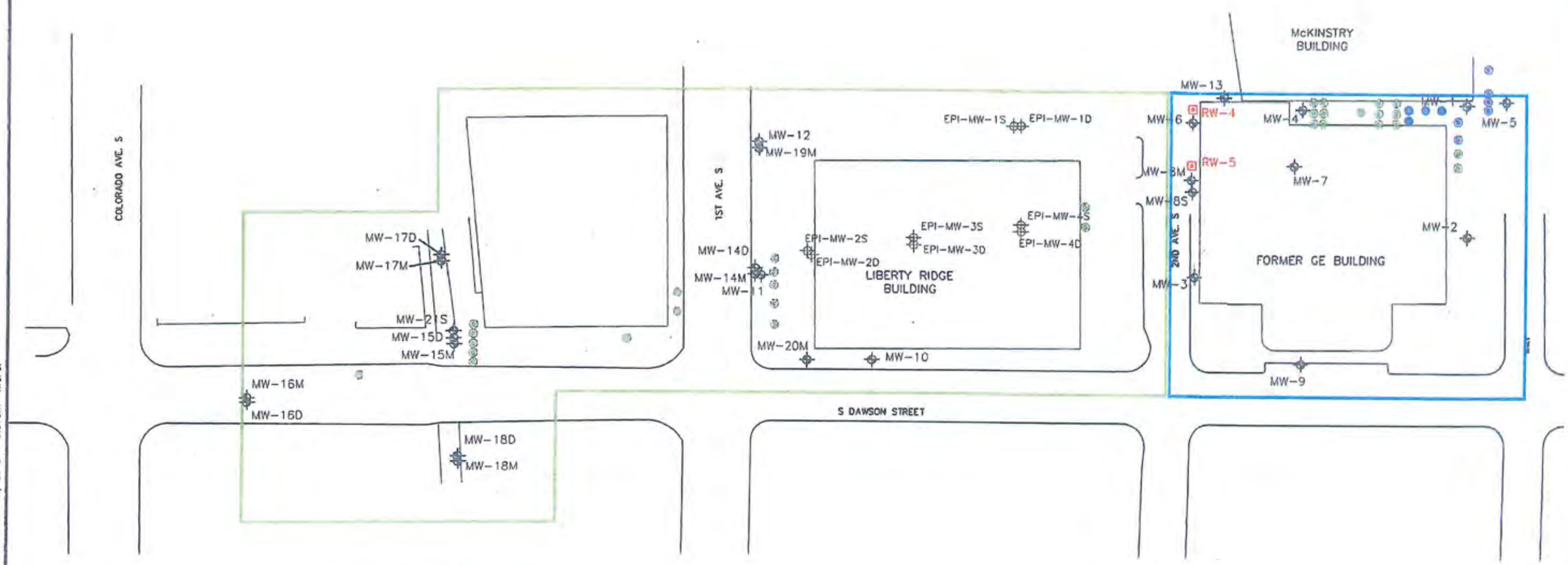
LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL (APPROXIMATE)
- ABANDONED GROUNDWATER EXTRACTION WELL
- SOIL VAPOR EXTRACTION WELL (APPROXIMATE)
- AIR SPARGE WELL (APPROXIMATE)
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

AECOM

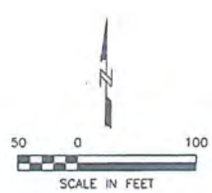
GE - S. DAWSON STREET 60137026-740	ALTERNATIVE 1
DATE: 3/4/10 DRWN: E.M./SEA	FIGURE 5-1

File: M:\GE-S.Dawson\DOAP\ALT_1.dwg Layout: FIGURE 5-1 User: MarshallE Plotted: Mar 04, 2010 - 9:05am Xref's:



ALTERNATIVE DETAILS:

1. RECOVERY SYSTEM WILL BE OPTIMIZED, RW-1, RW-2, AND RW-3 WILL BE ABANDONED AND REPLACED WITH RW-4, RW-5.
2. 1 TO 4% POTASSIUM PERMANGANATE INJECTED IN ON-SITE AND OFF-SITE INJECTION POINTS.
3. ON-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 9 TO 13 FEET BGS AND 16 TO 20 FEET BGS.
4. OFF-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 20 TO 24, 26 TO 30, AND 51 TO 55 FEET BGS.
5. OPERATION IS EXPECTED TO BE 3 PHASES, 6 MONTHS APART, FOR A TOTAL OF 3 YEARS.
6. INCLUDES SUB SLAB DEPRESSURIZATION SYSTEM – SEE FIGURE 5-2
7. PERFORMANCE MONITORING WILL INCLUDE VAPOR AND GROUNDWATER SAMPLES



LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL (APPROXIMATE)
- ABANDONED GROUNDWATER EXTRACTION WELL
- PHASE 1 INJECTION POINT (APPROXIMATE)
- PHASE 1 OBSERVATION POINT (APPROXIMATE)
- PHASE 2 AND 3 INJECTION POINT (APPROXIMATE)
- PHASE 2 AND 3 OBSERVATION POINT (APPROXIMATE)
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

File: M:\GE-S.Dawson\DCAP\ALT_2.dwg Layout: FIGURE 5-2 User: MarshallE Plotted: Mar 04, 2010 - 9:07am Xref's:

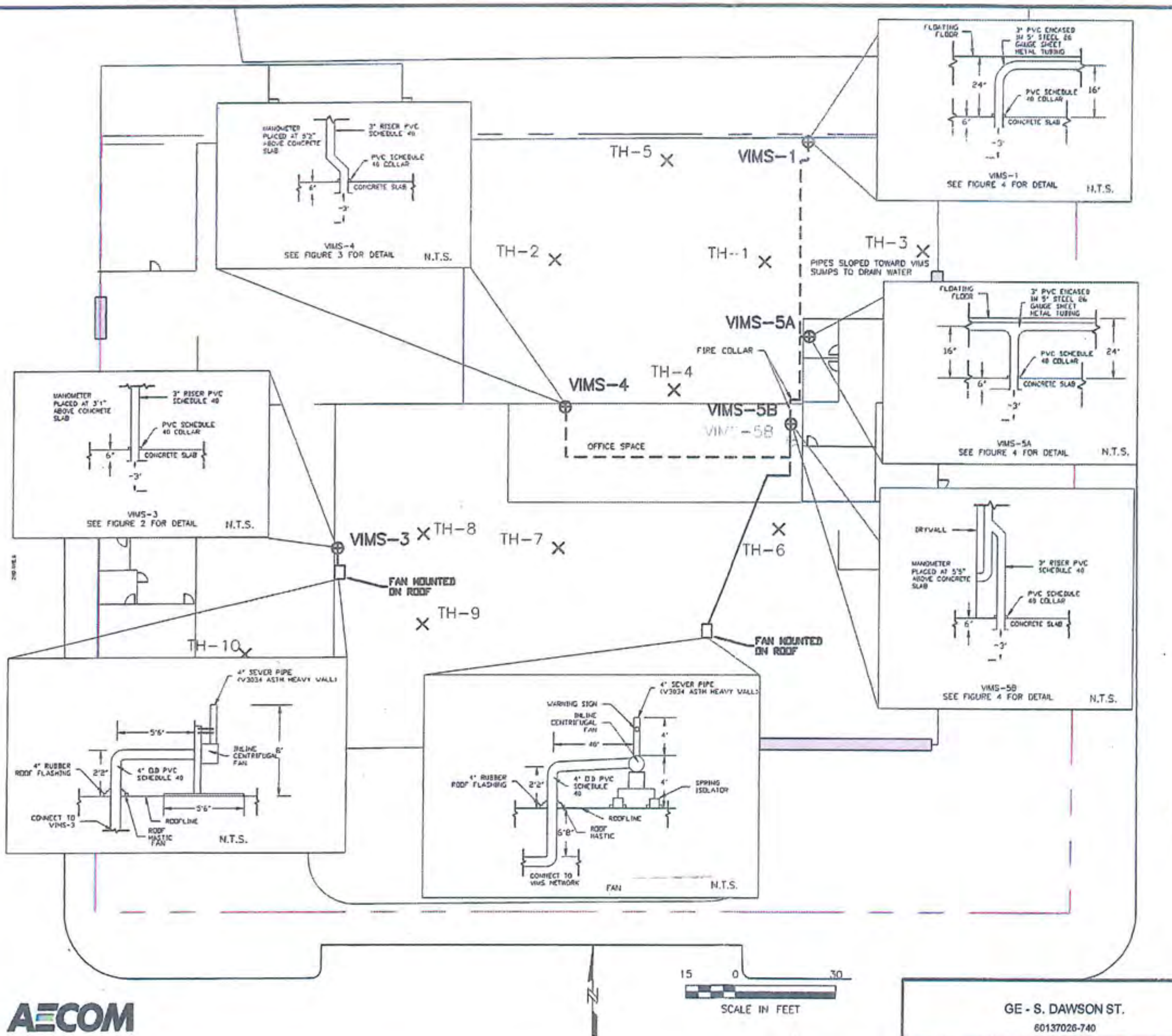
AECOM

GE - S. DAWSON STREET
60137026-740

DATE: 3/4/10 | DRWN: E.M./SEA

ALTERNATIVE 2

FIGURE 5-2



NOTES:

1. ALL 4" SEWER PIPE IS V3034 ASTM HEAVY WALL WITH THE EXCEPTION OF THE EXTERNAL FAN PIPING. PLEASE SEE INSERT FOR DETAILS.
2. ALL PIPING ELEVATIONS ARE MEASURED FROM THE TOP OF THE CONCRETE FLOOR.
3. ALL RISER PIPES TERMINATE AT THE FLOOR COLLAR.
4. LOCATIONS ARE APPROXIMATE.
5. N.T.S. = NOT TO SCALE
6. ELECTRICAL BOX FOR VIMS-1,4,5A, AND 5B IS LOCATED UPSTAIRS IN THE ELECTRICAL ROOM ON THE NORTHEASTERN INTERIOR ROOM OF THE HUDSON BAY WAREHOUSE.
7. ELECTRICAL BOX FOR VIMS-3 IS LOCATED IN THE NORTHERN ROOM ON THE SOUTHERN WALL OF THE MASON SUPPLY WAREHOUSE

LEGEND

— · — · —	PROPERTY LINE
— — —	INTERIOR PIPING
———	EXTERIOR PIPING
⊕	SUMP LOCATION
⊕ (light)	FORMER SUMP LOCATION
▭	BAY DOOR OPENING
×	APPROXIMATE TEST HOLE LOCATION

AECOM

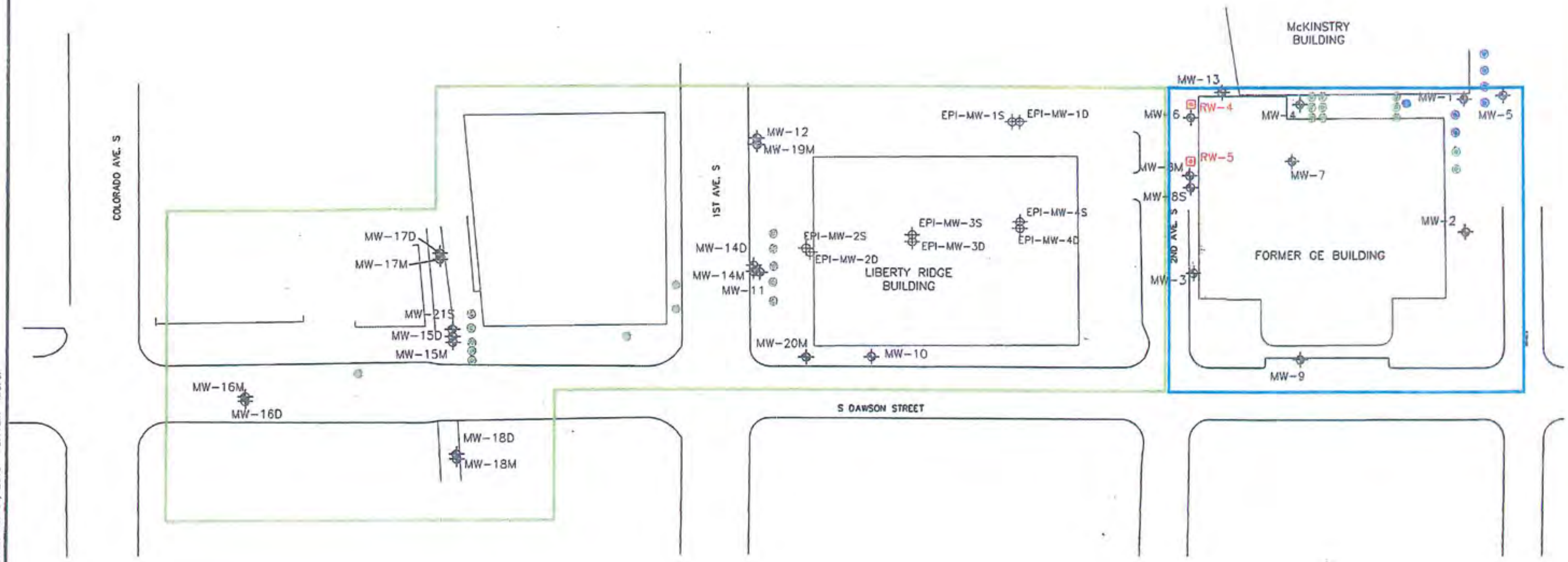
GE - S. DAWSON ST.
60137026-740

DATE: 3/4/10 | DRWN: E.M./SEA

SUB-SLAB DEPRESSURIZATION SYSTEM FORMER GE BUILDING

FIGURE 5-3

File: M:\GE-S.Dawson\OCAP\Sub Slab Depressurization System.dwg Layout: FIG 5-3 User: MarshallE Plotted: Mar 04, 2010 - 9:10am Xref's:



ALTERNATIVE DETAILS:

1. RECOVERY SYSTEM WILL BE OPTIMIZED. RW-1, RW-2, AND RW-3 WILL BE ABANDONED AND REPLACED WITH RW-4, RW-5.
2. SOLUBLE AND INSOLUBLE ELECTRON DONORS INJECTED IN THE ON-SITE AND OFF-SITE INJECTION POINTS.
3. ON-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 4 FEET BELOW WATER TABLE AND 12 TO 16 FEET BGS.
4. OFF-PROPERTY INJECTION POINTS ARE SCREENED AT 20 TO 24 AND 26 TO 30 FEET BGS.
5. INCLUDES SUB SLAB DEPRESSURIZATION SYSTEM – SEE FIGURE 5-2.
6. PERFORMANCE MONITORING WILL INCLUDE VAPOR AND GROUNDWATER SAMPLES

N

50 0 100
SCALE IN FEET

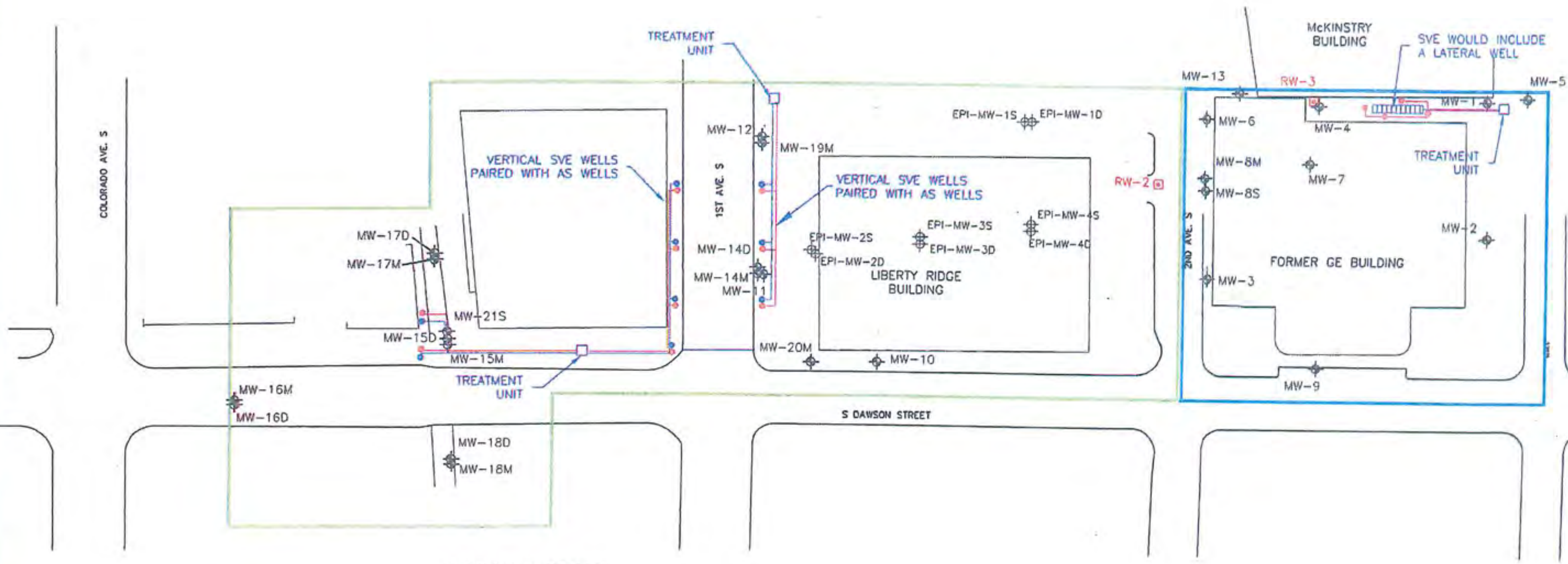
LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL (APPROXIMATE)
- ABANDONED GROUNDWATER EXTRACTION WELL
- PHASE 1 INJECTION POINT (APPROXIMATE)
- PHASE 1 OBSERVATION POINT (APPROXIMATE)
- PHASE 2 AND 3 INJECTION POINT (APPROXIMATE)
- PHASE 2 AND 3 OBSERVATION POINT (APPROXIMATE)
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

AECOM

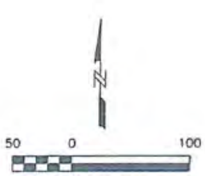
GE - S. DAWSON STREET 60137026-740	ALTERNATIVE 3
DATE: 3/4/10 DRWN: E.M./SEA	FIGURE 5-4

File: M:\GE-S.Dawson\DCAP\ALT_3.dwg Layout: FIGURE 5-4 User: MarshallE Plotted: Mar 04, 2010 - 9:11am Xref's:



ALTERNATIVE DETAILS:

1. COMBINED SVE AND AS SYSTEM WILL BE INSTALLED.
2. SVE WELLS INSTALLED APPROX. 6 FEET BGS, AS WELLS IN ON-SITE AREA INSTALLED 15 FEET BGS, AS WELLS IN OFF-SITE AREA INSTALLED 25 FEET BGS.
3. OPERATION IS EXPECTED FOR 3 YEARS IN THE ON-SITE AREA (PHASE 1) AND 3 YEARS IN THE OFF-SITE AREA (PHASE 2).
4. INCLUDES SUB SLAB DEPRESSURIZATION SYSTEM - SEE FIGURE 5-2.
5. PERFORMANCE MONITORING WILL INCLUDE VAPOR AND GROUNDWATER SAMPLES



SCALE IN FEET

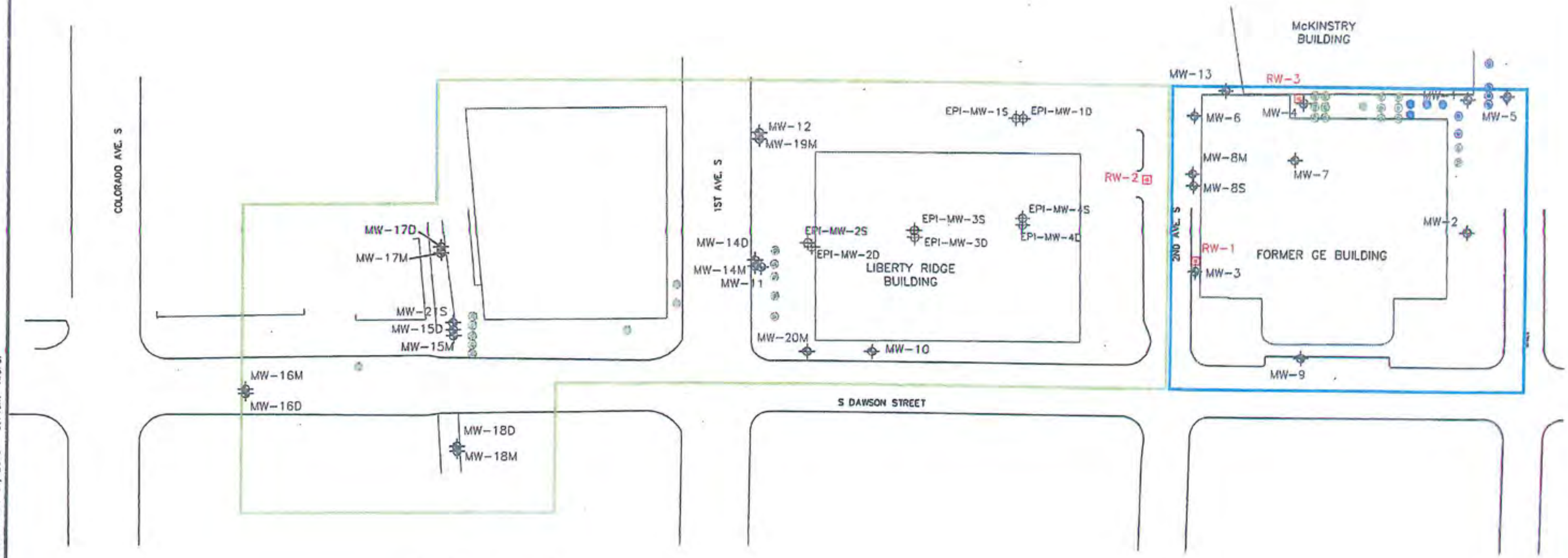
LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL
- SOIL VAPOR EXTRACTION WELL (APPROXIMATE)
- AIR SPARGE WELL (APPROXIMATE)
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

AECOM

GE - S. DAWSON STREET 60137026-740	ALTERNATIVE 4
DATE: 3/4/10 DRWN: E.M./SEA	FIGURE 5-5

File: M:\GE-S.Dawson\OCAP\ALT_4.dwg Layout: FIGURE 5-5 User: MarshallE Plotted: Mar 04, 2010 - 9:12am Xref's:



ALTERNATIVE DETAILS:

1. RECOVERY SYSTEM WILL BE ABANDONED AFTER PHASE 3 OF INJECTION. THE RECOVERY SYSTEM WILL NOT OPERATE BETWEEN INJECTIONS.
2. 1 TO 4% POTASSIUM PERMANGANATE INJECTED IN ON-SITE AND OFF-SITE INJECTION POINTS.
3. ON-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 9 TO 13 FEET BGS AND 16 TO 20 FEET BGS.
4. OFF-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 20 TO 24, 26 TO 30, AND 51 TO 55 FEET BGS.
5. OPERATION IS EXPECTED TO BE 3 PHASES, 6 MONTHS APART, FOR A TOTAL OF 3 YEARS.
6. INCLUDES SUB SLAB DEPRESSURIZATION SYSTEM – SEE FIGURE 5-2
7. PERFORMANCE MONITORING WILL INCLUDE VAPOR AND GROUNDWATER SAMPLES

50 0 100
SCALE IN FEET

LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL
- PHASE 1 INJECTION POINT (APPROXIMATE)
- PHASE 1 OBSERVATION POINT (APPROXIMATE)
- PHASE 2 AND 3 INJECTION POINT (APPROXIMATE)
- PHASE 2 AND 3 OBSERVATION POINT (APPROXIMATE)
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

AECOM

GE - S. DAWSON STREET
60137026-740
DATE: 3/4/10
DRWN: E.M./SEA

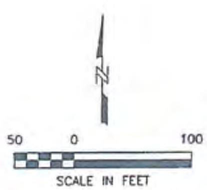
ALTERNATIVE 5

FIGURE 5-6

File: M:\GE-S.Dawson\DOAP\ALT_5.dwg Layout: FIGURE 5-6 User: MarshallE Plotted: Mar 04, 2010 - 9:14am Xref's:

ALTERNATIVE DETAILS:

1. RECOVERY SYSTEM WILL BE ABANDONED AFTER PHASE 3 OF INJECTION. THE RECOVERY SYSTEM WILL NOT OPERATE BETWEEN INJECTIONS. IN THE ON-SITE AREA GROUNDWATER WILL BE RECIRCULATED DURING INJECTIONS.
2. SOLUBLE AND INSOLUBLE ELECTRON DONORS INJECTED IN THE ON-SITE AND OFF-SITE INJECTION POINTS.
3. ON-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 4 FEET BELOW WATER TABLE AND 12 TO 16 FEET BGS.
4. OFF-PROPERTY INJECTION POINTS ARE SCREENED AT 20 TO 24 AND 26 TO 30 FEET BGS.
5. INCLUDES SUB SLAB DEPRESSURIZATION SYSTEM – SEE FIGURE 5-2.
6. PERFORMANCE MONITORING WILL INCLUDE VAPOR AND GROUNDWATER SAMPLES.



LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL
- PHASE 1 INJECTION POINT (APPROXIMATE)
- PHASE 1 OBSERVATION POINT (APPROXIMATE)
- PHASE 2 AND 3 INJECTION POINT (APPROXIMATE)
- PHASE 2 AND 3 OBSERVATION POINT (APPROXIMATE)
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

AECOM

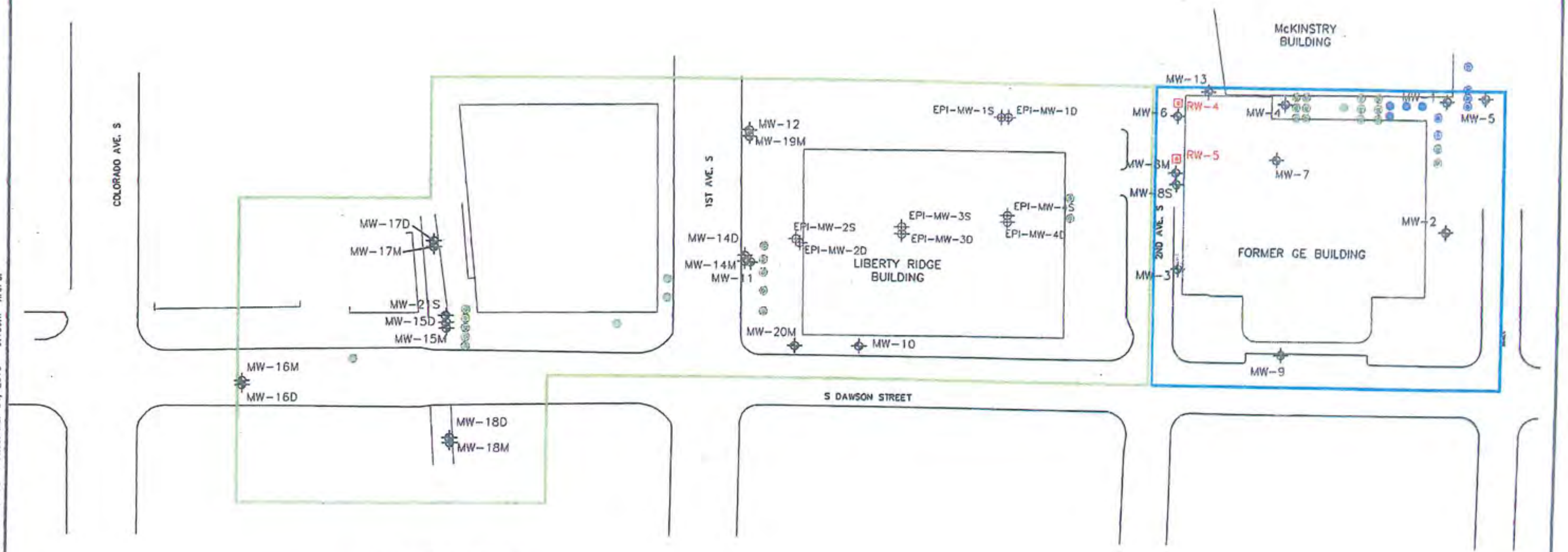
GE - S. DAWSON STREET
60137026-740

DATE: 3/4/10 | DRWN: E.M./SEA

ALTERNATIVE 6

FIGURE 5-7

File: M:\GE-S.Dawson\DCAP\ALT_6.dwg Layout: FIGURE 5-7 User: MarshallE Plotted: Mar 04, 2010 - 9:15am Xref's:



ALTERNATIVE DETAILS:

1. RECOVERY SYSTEM WILL BE OPTIMIZED, RW-1, RW-2, AND RW-3 WILL BE ABANDONED AND REPLACED WITH RW-4, RW-5.
2. 1 TO 4% POTASSIUM PERMANGANATE INJECTED IN ON-SITE AND OFF-SITE INJECTION POINTS.
3. ON-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 9 TO 13 FEET BGS AND 16 TO 20 FEET BGS.
4. OFF-PROPERTY AREA INJECTION POINTS ARE SCREENED AT 20 TO 24, 26 TO 30, AND 51 TO 55 FEET BGS.
5. OPERATION IS EXPECTED TO BE 3 PHASES, 6 MONTHS APART, FOR A TOTAL OF 3 YEARS.
6. INCLUDES SUB SLAB DEPRESSURIZATION SYSTEM - SEE FIGURE 5-2
7. PERFORMANCE MONITORING WILL INCLUDE VAPOR AND GROUNDWATER SAMPLES

LEGEND

- MONITORING WELL
- GROUNDWATER EXTRACTION WELL (APPROXIMATE)
- ABANDONED GROUNDWATER EXTRACTION WELL
- PHASE 1 INJECTION POINT (APPROXIMATE)
- PHASE 1 OBSERVATION POINT (APPROXIMATE)
- PHASE 2 AND 3 INJECTION POINT (APPROXIMATE)
- PHASE 2 AND 3 OBSERVATION POINT (APPROXIMATE)
- ON-PROPERTY AREA
- OFF-PROPERTY AREA

50 0 100
SCALE IN FEET

AECOM

GE - S. DAWSON STREET
60137026-740
DATE: 3/4/10 DRWN: E.M./SEA

SELECTED SITE CLEANUP ACTION

FIGURE 6-1

File: M:\GE-S.Dawson\DCAP\selected-site-cleanup.dwg Layout: FIGURE 6-1 User: MarshallE Plotted: Mar 04, 2010 - 9:16am Xref's: