Lower Duwamish Waterway
RM 3.7-3.9 East
Early Action Area 6

Summary of Existing Information and Identification of Data Gaps

Prepared for

Washington State Department of Ecology
Toxics Cleanup Program
300 Desmond Drive
Lacey, Washington 98504

Prepared by

Science Applications International Corporation
18912 North Creek Parkway, Suite 101
Bothell, WA 98011

May 2008

Table of Contents

Page

List of Acronyms ..... **iv**

1.0 Introduction **1**
1.1 Background and Purpose 1
1.2 Report Organization 2
1.3 Scope of Report 2

2.0 Early Action Area 6 ..... **4**
2.1 Site Description 4
2.2 Chemicals of Concern in Sediment 5
2.2.1 Sediment Investigations 5
2.2.2 Contaminants of Concern 6
2.3 Potential Pathways to Sediment 7
2.3.1 Direct Discharges via Outfalls 8
2.3.2 Surface Runoff (Sheet Flow) 9
2.3.3 Groundwater Discharges 9
2.3.4 Bank Erosion 10
2.3.5 Atmospheric Deposition 10
2.3.6 Spills to the LDW 10

3.0 Potential for Sediment Recontamination from Outfalls **11**
3.1.1 Public Storm Drain/EOF 11
3.1.2 Private Stormwater Outfalls 11
3.1.3 Data Gaps 12

4.0 Potential for Sediment Recontamination from Adjacent Properties **13**
4.1 Boeing Isaacson 13
4.1.1 Physical Setting 14
4.1.2 Current Operations 14
4.1.3 Historical Operations 15
4.1.4 Environmental Investigations and Cleanups 22
4.1.5 Potential for Sediment Recontamination 32
4.1.6 Data Gaps 34
4.2 Boeing Thompson 36
4.2.1 Physical Setting 37
4.2.2 Current Operations 37
4.2.3 Historical Operations 39
4.2.4 Historical Stormwater Discharges 43
4.2.5 Environmental Investigations and Cleanups 45
4.2.6 Potential for Sediment Recontamination 46
4.2.7 Data Gaps 48

5.0 Potential for Sediment Recontamination from Upland Properties **50**
5.1 King County International Airport 50
5.1.1 Current Operations 50
5.1.2 Historical Operations 52

5.1.3 United Parcel Service (UPS) Boeing Field 52
5.1.4 Caliber Inspection, Inc. 53
5.1.5 GSM, Inc. 54
5.1.6 Ameriflight, Inc. (Hangar 5) 55
5.1.7 Federal Express Perimeter Rd. 56
5.1.8 Hangar Holdings, Inc. (Vulcan, TAG Aviation, Former Shell Oil) 57
5.1.9 Western Metal Products, Inc. 59
5.1.10 Galvin Flying Services 60
5.1.11 Galvin Flying Services / Clay Lacy Aviation 61
5.1.12 Nordstrom, Inc. 62
5.1.13 DHL Express (ABX Air, Airborne Express) 62
5.1.14 Airwest Repair Services (Airwest Sales & Services, Bicknell) 63
5.1.15 BAX Global, Inc. 64
5.1.16 Clay Lacy Aviation (Gateway USA, Flight Center, Flightcraft Inc. Seattle) 65
5.1.17 Wings Aloft / Southeast "T" Hangars 66
5.1.18 Aeroflight National Charter Network (Seattle Air Corp., BFI Holdings) 67
5.1.19 Federal Drug Enforcement Administration 69
5.1.20 South Seattle Community College (SSCC) Aviation Department 69
5.1.21 Other Facilities at KCIA 70
5.2 Potential for Sediment Recontamination 71
5.3 Data Gaps 73

6.0 Summary of Data Gaps 74
6.1 Stormwater Discharge 74
6.1.1 King County Slip 5 SD/City of Seattle EOF 74
6.1.2 Boeing Isaacson 74
6.1.3 Boeing Thompson 74
6.1.4 KCIA 75
6.2 Groundwater Discharge 76
6.2.1 Boeing Isaacson 76
6.2.2 Boeing Thompson 76
6.3 Bank Erosion/Leaching 77
6.3.1 Boeing Isaacson 77
6.3.2 Boeing Thompson 77

7.0 References 78

Appendix A Sediment Sampling Data
Appendix B Aerial Photographs
Appendix C Selected Historical Data, Boeing Isaacson and Thompson Properties

Figures

Figure 1. Lower Duwamish Waterway Source Control Areas
Figure 2. EAA-6 Adjacent Properties
Figure 3. Central KCIA Stormwater Drainage Basin
Figure 4. Slip 5 Fill History
Figure 5. Former Slip 5 Location and General Groundwater Flow Direction
Figure 6. EAA-6 Sediment Sampling Locations
Figure 7. Stormwater System, Boeing Thompson and Isaacson Properties
Figure 8. Timeline of Property Ownership and Investigations/Cleanups at Boeing Isaacson Property
Figure 9. Isaacson Property Layout and Groundwater Sampling Locations, 1983
Figure 10. Current Groundwater Monitoring Wells, Boeing Thompson and Isaacson Properties
Figure 11. EAA-6 Upland Properties

Tables

Table 1. Sediment Samples Collected Near EAA-6
Table 2. Chemicals Above Screening Levels in Surface Sediment, Early Action Area 6
Table 3. Chemicals Above Screening Levels in Subsurface Sediment, Early Action Area 6
Table 4. CSO/EOF Discharges to the Lower Duwamish Waterway
Table 5. Arsenic Concentrations in Groundwater, Boeing Isaacson and Boeing Thompson
Table 6. KCIA Tenants – Slip 5 Drainage Basin

List of Acronyms

ARFF	Aircraft Rescue Fire Fighting
AWQC	Ambient Water Quality Criteria
BEHP	bis(2-ethylhexyl)phthalate
Bgs	below ground surface
BMP	best management practice
CB	catch basin
COC	chemical of concern
CSCSL	Confirmed and Suspected Contaminated Sites List
CSL	Cleanup Screening Level
DMR	Discharge Monitoring Report
DW	dry weight
EAA	Early Action Area
ECHO	Enforcement Compliance and History Online
Ecology	Washington State Department of Ecology
EE/CA	Engineering Evaluation/Cost Analysis
EMF	Electronics Manufacturing Facility
EOF	Emergency Overflow
EP	Extraction Procedure
EPA	U.S. Environmental Protection Agency
ERTS	Environmental Report Tracking System
FAA	Federal Aviation Administration
FBO	fixed base operations
FSD	Facility/Site Database
GIS	Geographic Information System
IAA	Industrial Auto Auctions
KCIA	King County International Airport
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
LUST	leaking underground storage tank
MCL	Maximum Contaminant Level
MTCA	Model Toxics Control Act
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
NWRO	Northwest Regional Office, Washington Department of Ecology
OC	organic carbon
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RM	river mile
SAIC	Science Applications International Corporation
SCAP	Source Control Action Plan
SIC	Standard Industrial Classification

List of Acronyms (Continued)

SMS	Sediment Management Standards
SPCC	Spill Prevention, Control and Countermeasures
SPU	Seattle Public Utilities
SQS	Sediment Quality Standard SSCC South Seattle Community College
SVOC	semivolatile organic compound
SWPPP	Stormwater Pollution Prevention Plan
TCE	trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
TOC	total organic carbon
TRI	Toxics Release Inventory
TSD	Treatment, Storage, and Disposal
UST	underground storage tank
VOC	volatile organic compound
VCP	Voluntary Cleanup Program
WQS	Water Quality Standards

1.0 Introduction

1.1 Background and Purpose

This *Summary of Existing Information and Identification of Data Gaps* report (Data Gaps report) pertains to Early Action Area 6 (EAA-6), one of several source control areas identified as part of the overall cleanup process for the Lower Duwamish Waterway (LDW) Superfund site (Figure 1). It summarizes readily available information regarding properties in the EAA-6 drainage basin. The purpose of this Data Gaps Report is to:

- Identify chemicals of potential concern in sediments within the EAA-6 source control area;
- Evaluate potential contaminant migration pathways to EAA-6 sediments;
- Identify and describe potential adjacent or upland sources of contaminants that could be transported to EAA-6 sediments;
- Identify critical data gaps that should be addressed in order to assess the potential for recontamination of LDW sediments and the need for source control; and
- Determine what, if any, effective source control is already in place.

The LDW was added to the U.S. Environmental Protection Agency (EPA) National Priorities List in September 2001 due to chemical contaminants in sediment. The key parties involved in the LDW Superfund site are the Lower Duwamish Waterway Group (LDWG; comprised of the city of Seattle, King County, the Port of Seattle, and The Boeing Company), EPA, and the Washington State Department of Ecology (Ecology). LDWG is conducting a Remedial Investigation/Feasibility Study (RI/FS) for the LDW Superfund site.

Data collected during the Phase 1 Remedial Investigation (RI; Windward 2003a) were used to identify locations that could be candidates for early cleanup action. Seven candidate early action sites were identified (Windward 2003b); EAA-6 is one of these seven sites, and is located at River Mile (RM) 3.7 to 3.9, as measured from the southern tip of Harbor Island (Figure 1).

Ecology is the lead agency for source control for the LDW Superfund site. Source control is the process of finding and eliminating or reducing releases of contaminants to LDW sediments, to the extent practicable. The goal of source control is to prevent sediments from being recontaminated after cleanup has been undertaken.

The LDW Source Control Strategy (Ecology 2004) describes the process for identifying source control issues and implementing effective controls for the LDW. The basic plan is to identify and manage potential sources of sediment recontamination in coordination with sediment cleanups. Source control will be achieved by using existing administrative and legal authorities to perform inspections and require necessary source control actions.

The strategy is based primarily on the principles of source control for sediment sites described in EPA's *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites* (EPA 2002), and the Washington State Sediment Management Standards (SMS; WAC 173-340-370([7] and WAC 173-204-400). The Source Control Strategy involves developing and

implementing a series of detailed, area-specific Source Control Action Plans (SCAPs). Several areas, generally defined by stormwater drainage basins, have been identified and prioritized for SCAP development as described in the *Lower Duwamish Waterway Source Control Status Report, 2003 to June 2007* (Ecology 2007c).

Before developing a SCAP, Ecology prepares a Data Gaps Report for the source control area. Findings from the Data Gaps report are reviewed by LDW stakeholders and are incorporated into the SCAP. This process helps to ensure that the action items identified in the SCAP will be effective, implementable, and enforceable. As part of the source control efforts for EAA-6, Ecology requested Science Applications International Corporation (SAIC) to prepare this Data Gaps report.

1.2 Report Organization

Section 2 provides background information on EAA-6, including location, physical characteristics, chemicals of potential concern, and potential pathways by which contaminants may reach sediments. Sections 3 through 5 describe potential sources of contaminants, including adjacent and upland properties, and data gaps that must be addressed in order to develop a SCAP for the site. Section 6 provides a summary of data gaps, and Section 7 lists the documents reviewed during preparation of this report.

Information presented in this report was obtained from the following sources:

- Ecology Northwest Regional Office (NWRO) Central Records
- Washington State Archives
- EPA files
- Seattle Public Utilities (SPU) Business Inspection reports
- Ecology Underground Storage Tank (UST) and Leaking Underground Storage Tank (LUST) lists
- Ecology Facility/Site Database (FSD)
- Washington Confirmed and Suspected Contaminated Sites List (CSCSL)
- EPA Enforcement and Compliance History Online (ECHO)
- EPA Envirofacts Warehouse
- King County Geographic Information Systems (GIS) Center Parcel Viewer and Property Tax Records
- GIS shape files produced by SPU

1.3 Scope of Report

This report documents readily available information relevant to potential sources of sediment recontamination at EAA-6, including outfalls, adjacent properties, and upland properties.

Adjacent and upland properties located within the EAA-6 drainage basin include Boeing Isaacson, Boeing Thompson, and the central portion of King County International Airport

(KCIA). This report does not identify or assess the possibility of migration of contaminants from sources outside of the EAA-6 drainage basin[1].

Air pollution is a potential source of contaminants to EAA-6 sediments with origins outside of the EAA-6 drainage basin. Although limited discussion of atmospheric deposition is provided in Section 2, the scope of this report does not include an assessment of data gaps pertaining to the effects of air pollution on EAA-6 sediments. Because air pollution is a concern for the wider LDW region, Ecology will review work being conducted by the Washington State Department of Health and planned by the Puget Sound Partnership regarding atmospheric deposition. Ecology is planning to hire a contractor to develop options and recommendations for addressing data gaps related to air pollution.

Information presented in this report is limited to EAA-6, direct discharges to EAA-6, and potential adjacent and upland contaminant sources. It does not assess the potential for recontamination from capped sediments if this remedial option is selected. Source control with regard to contaminated sediments left in place will be important to address as part of the remedial action selection process for EAA-6.

Chemical data have been compared to relevant regulatory criteria and guidelines, as appropriate. The level of assessment conducted for the data reviewed in this report is determined by the source control objectives. The scope of this Data Gaps report does not include data validation or analysis that exceeds what is required to reasonably achieve source control.

[1] The area referred to in this report as the EAA-6 drainage basin is actually a sub-drainage of the LDW drainage basin, and is defined by stormwater collection systems and outfalls. In other words, the area from which stormwater drains to EAA-6 is defined as the EAA-6 drainage basin.

2.0 Early Action Area 6

EAA-6 is located along the eastern side of the LDW Superfund Site between 3.7 and 3.9 miles from the southern tip of Harbor Island (Figure 1). The EAA-6 source control area includes two properties that are located directly adjacent to EAA-6: Boeing Isaacson and Boeing Thompson (Figure 2). These properties are bounded by Jorgensen Forge Corporation (Jorgensen Forge) to the north, East Marginal Way S. and KCIA to the east, and Kenworth Motor Corporation/Insurance Auto Auctions (IAA), also known as the former PACCAR site, to the south.

The source control area includes the central portion of KCIA; stormwater from this area drains to EAA-6 through a 48-inch public storm drain outfall (Figure 3). This public storm drain outfall also serves as an emergency overflow (EOF) for Pump Station 45 on the city of Seattle's sanitary sewer system.

2.1 Site Description

General background information on the LDW is provided in the Phase 1 RI Report (Windward 2003a), which describes the history of dredging/filling and industrialization of the Duwamish River and its environs, as well as the physiography, physical characteristics, hydrogeology, and hydrology of the area.

EAA-6 is located adjacent to a former tidal marsh area that was reclaimed when the Duwamish River was straightened and channelized to form the current LDW in the late 1800s and early 1900s. Available information indicates that a meander of the Duwamish River once flowed in a west-to-east direction between the current Boeing Isaacson and Thompson properties before continuing its generally northward flow direction (ERM 2000a). Extensive dredge and fill efforts in the early 1900s placed the LDW channel in its present position west of the Boeing Isaacson and Boeing Thompson properties. A portion of the former river channel formed Slip 5 as shown in Figure 4.

A hydrologic survey map of a 1907 flood episode indicates that land use in the area at that time consisted of a race track, located immediately south of Slip 5, pasture land, a brewery, hop fields, and a few homes. Bissell Lumber Company occupied the Boeing Thompson site to the south of Slip 5 from the 1920s through approximately 1945 (Foster 1945). In about 1941, the United States Navy utilized the property just north of Boeing Isaacson (currently known as the Jorgensen Forge property) and constructed steel melting, forging, and fabricating facilities that were then known as Isaacson Iron Works Plant No. 2 (Dames & Moore 1983). The Isaacson Steel Company purchased the plant in the 1950s and expanded the steel fabrication facility to what is now the Boeing Isaacson property during the 1950s and 1960s (Landau 1988a). The Boeing Company purchased the Thompson property in 1957 and the Isaacson property in 1984.

Filling in of portions of Slip 5 occurred between the 1930s and the mid-1960s (Figure 4). By about 1966, Slip 5 was completely filled as part of site development at Boeing Thompson (Dames & Moore 1983). Reportedly, the fill material consisted of silty sand with significant amounts of slag, fire bricks, and miscellaneous construction materials (ERM 2000a).

Groundwater in the vicinity of EAA-6 is unconfined and generally flows toward the LDW and the former Slip 5 (Figure 5), with water levels ranging from 11 to 12 feet below ground surface (Landau 1988a). Groundwater is influenced by the tidal cycle of the LDW, with tidal effects observed at a distance of at least 700 feet from the waterway. Fluctuations in groundwater levels in wells closest to the LDW have been observed to be as much as 4 feet (ERM 2000a). Conductivity ranges from 72 umhos/cm upgradient of the source control area to 1,779 umhos/cm near the LDW (ERM 2000a). Total dissolved solids in groundwater are estimated to range from 3.96 to 968 mg/L.

Bottom sediment composition is variable throughout the LDW, ranging from sands to mud. Typically, the sediment consists of slightly sandy silt with varying amounts of organic detritus. Coarser sediments are present in nearshore areas adjacent to storm drain discharges (Weston 1999); finer-grained sediments are typically located in remnant mudflats and along channel side slopes. Sediments in the EAA-6 area generally consist of over 60 percent fines (dry weight [DW]), except for coarser sediments near the public storm drain outfall. Sediments in this area are 20 to 40 percent fines immediately adjacent to the outfall, and 40 to 60 percent fines downstream of the outfall (Windward 2003a). Total organic carbon (TOC) ranges from <1 to 3 percent in this area (Windward 2003a).

2.2 Chemicals of Concern in Sediment

Results of sediment sampling at EAA-6 are provided in Appendix A; sampling locations are identified in Table 1. Chemical results above SMS values are summarized in Tables 2 and 3. Sampling locations are shown in Figure 6.

2.2.1 Sediment Investigations

Sediment samples have been collected from the vicinity of EAA-6 as part of the following investigations:

- **Boeing Site Characterization (Exponent 1998, as cited in Windward 2003a)**

  Six surface sediment samples were collected within EAA-6 during Boeing site characterization activities conducted in October 1997 (Table 1). One of these samples (R30) was superseded by a later sample in the same location (LDW-SS119). Samples were analyzed for metals, semivolatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs). Arsenic, polycyclic aromatic hydrocarbons (PAHs), phthalates, and PCBs were detected at concentrations above Sediment Quality Standard (SQS) values.

- **Duwamish Waterway Sediment Characterization Study (NOAA 1998)**

  Seven surface sediment samples were collected near the Boeing Isaacson and Boeing Thompson properties during September through November, 1997 (Table 1). These samples were analyzed for PCBs. PCBs were detected in all seven of the samples, with total PCB concentrations ranging from 0.087 to 0.69 mg/kg DW (5.3 to 53 mg/kg organic carbon [OC]). PCBs in five of the samples exceeded the SQS value for total PCBs of 12 mg/kg OC.

- **EPA Site Inspection, Lower Duwamish River (Weston 1999)**

Three surface sediment and two subsurface sediment samples were collected from EAA-6 sediments in August 1998 as part of EPA's Site Inspection. One of the surface sediment samples (DR187) was superseded by a later sample (LDW-SS115). Samples were analyzed for SVOCs, metals, PCBs as Aroclors and congeners, dioxins/furans, and TOC. PAHs, phthalates, and total PCBs were detected at concentrations above the SQS values. In addition, dioxins were detected in a sample collected at the mouth of the public storm drain outfall (sample location DR187, Figure 6).

- **LDW Phase 2 Remedial Investigation, Round 1, 2, and 3 Sediment Sampling (Windward 2005a, 2005b, 2007b)**

  Ten surface sediment samples were collected during three rounds of sampling for the Phase 2 RI in 2005/2006. All samples were analyzed for the SMS list of chemicals. Arsenic, PAHs, phthalates, benzoic acid, and total PCBs were detected above SQS values.

- **LDW Phase 2 RI Subsurface Sediment Sampling (Windward 2007a)**

  Seven sediment samples were collected from two coring locations in 2006. Samples were analyzed for metals, SVOCs, and PCBs. Arsenic, PAHs, bis(2-ethylhexyl)phthalate (BEHP), benzyl alcohol, dibenzofuran, and total PCBs were detected above SQS values.

2.2.2 Contaminants of Concern

A contaminant of concern (COC) is defined in this report as a chemical that is present at concentrations above regulatory criteria in EAA-6 sediments, and is therefore of particular interest with respect to source control. These COCs are the initial focus of the evaluation of potential contaminant sources.

The Washington Sediment Management Standards (SMS; Chapter 173-204 WAC) establish marine Sediment Quality Standard (SQS) and Cleanup Screening Level (CSL) values for some chemicals that may be present in sediments. The SQS values correspond to a sediment quality level that will result in no adverse effects on biological resources and no significant human health risk. CSLs represent minor adverse effects levels used as an upper regulatory threshold for making decisions about source control and cleanup.

A chemical was identified as a COC for EAA-6 if it was detected in surface or subsurface sediment at concentrations above the SQS and/or CSL. A comparison of sample results to the SQS and CSL values is provided in Appendix A, and those chemicals that were detected at concentrations above their respective SQS/CSL values are listed in Tables 2 and 3. For non-polar organics, the measured dry weight concentrations were OC-normalized to allow comparison to the SQS/CSL.

Additional contaminants may be present in soil, groundwater, stormwater, or stormwater solids at concentrations above regulatory criteria and/or soil-to-sediment or groundwater-to-sediment screening levels. While not currently considered COCs in sediment, these chemicals may warrant further investigation, depending on site-specific conditions, to evaluate the likelihood that they will lead to exceedance of marine sediment CSLs. These additional contaminants are discussed as appropriate in Sections 3 through 5.

COCs for EAA-6 are listed below. Shaded chemicals exceeded both the SQS and CSL in one or more samples. In general, COCs were present in sediment samples at concentrations only slightly above the SQS or CSL values; the greatest exceedances were observed for arsenic at locations LDW-SS114 (surface sediment) and LDW-SC50a (subsurface sediment), along the Boeing Isaacson shoreline (Figure 6).

Chemical of Concern (COC)	Surface Sediment		Subsurface Sediment	
	> SQS	> CSL	> SQS	> CSL
Metals				
Arsenic	●	●	●	●
PAHs				
Acenaphthene	●		●	
Benzo(a)anthracene	●			
Benzo(a)pyrene	●	●		
Benzo(b)fluoranthene	●			
Benzo(g,h,i)perylene	●	●	●	
Benzo(k)fluoranthene	●			
Benzofluoranthenes (total)	●	●		
Chrysene	●		●	
Dibenzo(a,h)anthracene	●	●		
Fluoranthene	●		●	
Fluorene	●			
Indeno(1,2,3-cd)pyrene	●	●	●	
Phenanthrene	●		●	
Total HPAH	●			
Total LPAH	●			
Phthalates				
Bis(2-ethylhexyl)phthalate	●	●	●	●
Butyl benzyl phthalate	●			
Other SVOCs				
Benzoic acid	●	●		
Benzyl alcohol			●	●
Dibenzofuran	●		●	
PCBs				
PCBs (total)	●		●	●

2.3 Potential Pathways to Sediment

Transport pathways that could contribute to the recontamination of EAA-6 sediments following remedial activities include direct discharges via outfalls, surface runoff (sheet flow) from adjacent properties, bank erosion, groundwater discharges, air deposition, and spills directly to the LDW. These pathways are described below, and are discussed in more specific detail in Sections 3 through 5.

2.3.1 Direct Discharges via Outfalls

Direct discharges may occur from public or private storm drain systems, combined sewer overflows (CSOs), and emergency overflows (EOFs).

Some areas of the Lower Duwamish Waterway are served by combined sewer systems, which carry both stormwater and municipal/industrial wastewater in a single pipe. These systems were generally constructed before about 1970 because it was less expensive to install a single pipe rather than separate storm and sanitary systems. Under normal rainfall conditions, wastewater and stormwater are conveyed through this combined sewer pipe to a wastewater treatment facility. During large storm events, however, the total volume of wastewater and stormwater can sometimes exceed the conveyance and treatment capacity of the combined sewer system. When this occurs, the combined sewer system is designed to overflow through relief points, called CSOs. The CSOs prevent the combined sewer system from backing up and creating flooding problems.

Untreated municipal/industrial wastewater and stormwater can potentially be discharged through CSOs to the LDW during these storm events. The city of Seattle owns and operates the local sanitary sewer collectors and trunk lines, while King County owns and operates the larger interceptor lines that transport flow from the local systems to the West Point Wastewater Treatment Plant (WWTP). The City's CSO network has its own National Pollutant Discharge Elimination System (NPDES) permit; the County's CSOs are administered under the NPDES permit established for the West Point WWTP.

An EOF is a discharge that can occur from either the combined or sanitary sewer systems that is not necessarily related to storm conditions and/or system capacity limitations. EOF discharges typically occur as a result of mechanical issues (e.g., pump station failures) or when transport lines are blocked; pump stations are operated by both the City and County. Pressure relief points are provided in the drainage network to discharge flow to an existing storm drain or CSO pipe under emergency conditions to prevent sewer backups. EOF events are not covered under the City's or County's existing CSO wastewater permits.

CSO/EOF outfalls that discharge to the LDW are listed in Table 4. Of the County CSO outfalls along the LDW, the Michigan CSO, S. Brandon Street CSO, and Hanford No. 1 (discharging via the City's Diagonal Avenue S. CSO/SD) outfalls had the highest average combined sewer overflow volumes between 1999 and 2005. Annual stormwater discharge volumes are usually substantially higher than annual CSO discharge volumes because storm drains discharge whenever it rains, and CSOs only discharge during storm events that exceed the system capacity. Annual stormwater discharges to the LDW have been estimated at approximately 4,000 million gallons per year (mgy) compared to less than 65 mgy from the county CSOs and less than 10 mgy from the city CSOs (Windward 2007c)[2].

To minimize the frequency and volume of CSO events, the County utilizes different CSO control strategies to maximize system capacity. An automated control system manages flows through the King County interceptor system so that the maximum amount of flow is contained in pipelines

[2] It should be noted that stormwater discharges are regulated under a separate NPDES permit.

and storage facilities until it can be conveyed to a regional wastewater treatment plant for secondary treatment. In some areas of the system, where flows cannot be conveyed to the plant, the flows are sent to CSO treatment facilities for primary treatment and disinfection prior to discharge. County CSOs discharge untreated wastewater only when flows exceed the capacity of these systems (King County 2007).[3].

As a result, some areas of the CSO drainage basins may discharge to different outfalls at different times, depending on the route that the combined stormwater/wastewater has taken through the County conveyance system. Furthermore, some industrial facilities in the LDW basin may discharge stormwater to a separated system and industrial wastewater to a combined system, or a conveyance that begins as a separated system may discharge to a combined system further downstream along the flow path.

When preparing a Data Gaps report for a source control area, all properties that potentially discharge to that source control area (whether through a CSO/EOF or a separated storm drain) are identified to the extent that the boundaries of the drainage basin are known. However, for areas where drainage basins overlap, a property review is performed only if the property has not already been included in a previously published Data Gaps report. Exceptions include situations where contaminants may be transported to the current source control area via a transport pathway that was not applicable for the earlier evaluation.

Three outfalls are present in the EAA-6 area, including one publicly-owned outfall and two private outfalls. The publicly-owned outfall, referred to in this report as the Slip 5 outfall, discharges storm drainage from 237 acres of the central portion of KCIA (KCIA Drainage Basin 2), including aircraft maintenance and fueling areas. In addition, the outfall serves as an EOF for Pump Station 45 on the city of Seattle's sanitary sewer system. The two private outfalls are owned by Boeing and discharge stormwater from the Boeing Thompson and Isaacson properties. Contaminants discharged via these outfalls could directly affect sediments.

2.3.2 Surface Runoff (Sheet Flow)

In areas lacking collection systems, spills or leaks on properties adjacent to the LDW could flow directly over impervious surfaces or through creeks and ditches to the waterway. While the Boeing Thompson property is served by a stormwater drainage system, most of the Boeing Isaacson property is not (Figure 7).

2.3.3 Groundwater Discharges

Contaminants in soil resulting from spills and releases to adjacent (and possibly upland) properties may be transported to groundwater and subsequently be released to the LDW. Seeps have been sampled along the LDW shoreline near the northern property boundary of Boeing Isaacson (southern end of the Jorgensen Forge property). Copper was detected in a seep water sample at a concentration above the marine chronic water quality standard (WQS). In addition, arsenic contamination of groundwater has been documented in this area since the early 1980s.

[3] City CSOs are generally smaller and flows are not treated prior to discharge.

2.3.4 Bank Erosion

The banks of the LDW shoreline are susceptible to erosion by wind and surface water, particularly in areas where banks are steep. Shoreline armoring and the presence of vegetation reduces the potential for bank erosion. Contaminants in soils along the banks of EAA-6 could be released directly to sediments via erosion. A wooden bulkhead is located along the boundary between the Boeing Thompson/Isaacson properties and the waterway; rock and rubble fill material have been placed behind the bulkhead. Very little erodable soil material is present in this area.

2.3.5 Atmospheric Deposition

Atmospheric deposition occurs when air pollutants enter the LDW directly or through stormwater. Air pollutants may be generated from point or non-point sources. Point sources include industrial facilities, and air pollutants may be generated from painting, sandblasting, loading/unloading of raw materials, and other activities, or through industrial smokestacks. Non-point sources include dispersed sources such as vehicle emissions, aircraft exhaust, and off-gassing from common materials such as plastics. Air pollutants may be transported over long distances by wind, and can be deposited to land and water surfaces by precipitation or particle deposition. None of the properties within the EAA-6 source control area are currently regulated as point sources of air emissions.

Air traffic at KCIA may result in significant emissions, but this relates to operations at the entire airfield and lies outside the scope of this report. While contaminants originating from nearby properties and streets may be transported through the air and deposited at EAA-6 or in areas that drain to the LDW, this transport mechanism is not likely to result in sediment concentrations above local background levels. The atmospheric deposition pathway is therefore not evaluated further in this Data Gaps report. Additional information on recent and ongoing atmospheric deposition studies in the LDW area is summarized in the LDW Source Control Status Report (Ecology 2007c and subsequent updates); Ecology will continue to monitor these efforts.

2.3.6 Spills to the LDW

Near-water and over-water activities have the potential to impact adjacent sediments from spills of material containing contaminants of concern. No over-water activities are currently conducted in this area, and near-water spills at the Boeing Thompson property would be contained within the site stormwater system. The Boeing Isaacson property is currently vacant.

3.0 Potential for Sediment Recontamination from Outfalls

A 48-inch public (King County) storm drain/EOF outfall drains to the LDW at the location of the former Slip 5, and two private outfalls drain stormwater from the Boeing Thompson property (Figure 2). The public outfall is located immediately adjacent to the northern Boeing Thompson outfall.

3.1.1 Public Storm Drain/EOF

Stormwater from approximately 237 acres of the central portion of KCIA (KCIA Drainage Basin 2) is pumped to a 48-inch King County outfall (Boeing 1988b), referred to in this report as the Slip 5 Outfall. The Central KCIA stormwater drainage basin is shown in Figure 3. The lift station that pumps stormwater from KCIA Outfall #2 to the 48-inch storm drain pipe is located east of the Boeing Isaacson and Thompson properties, on the east side of East Marginal Way S.

The Slip 5 outfall also serves as an EOF for Pump Station 45 on the city of Seattle's sanitary sewer system (King County & SPU 2005). Pump Station 45 has not overflowed since 2000, when the City started maintaining pump station records.

In addition, stormwater may enter this storm drain from a catch basin (CB-39) on the Boeing Thompson property, located just before the terminus of the storm drain at the LDW (Figure 7; Boeing 2001).

At the time this Data Gaps report was prepared, no recent inline stormwater solids sampling had been conducted along this storm drain line. Stormwater solids were reportedly collected within this system as part of the Elliott Bay Action Program in the mid-1980s, however results were not available in the files reviewed during preparation of this Data Gaps report.

In the past, the Slip 5 outfall drained to the head of Slip 5 at the approximate location shown in Figure 9. In approximately 1966, prior to filling of Slip 5, the Boeing Company extended the 48-inch diameter storm sewer along the southern edge of the Isaacson property out to the LDW (Dames & Moore 1983). In 1990, in anticipation of redevelopment of the Isaacson parcel, the storm drain line was moved to its current location, as shown in Figure 3.

Facilities located within this stormwater drainage basin, and the potential for contaminants in stormwater from these facilities to reach the LDW, are discussed in Section 5, Potential for Sediment Recontamination from Upland Properties.

3.1.2 Private Stormwater Outfalls

Two private outfalls discharge stormwater from the Boeing Thompson site to EAA-6 (Figure 3). An outfall of unresolved origin is reportedly located near the Boeing Isaacson/Jorgensen Forge property boundary; this outfall is not shown on a stormwater system map provided by Boeing (Figure 7). These outfalls are described in more detail in Section 4.1 below.

3.1.3 Data Gaps

Information needed to assess the potential for sediment recontamination associated with the Slip 5 Outfall/EOF is listed below:

- No data is available about concentrations of COCs in storm drain solids and stormwater near the outfall.
- If contaminants are present at concentrations of potential concern near the outfall, then source tracing samples are needed to identify potential source(s) of the contaminants. Storm drain solids data from the 48-inch storm drain line near the lift station at KCIA Outfall #2, through the Boeing Isaacson property, and from CB-39 on the Boeing Thompson property are needed.
- Results of storm drain sampling by the Elliott Bay Action Program should be reviewed to identify additional contaminants that may be of concern in stormwater.
- Additional data gaps related to potential infiltration of contaminants in groundwater to the 48-inch public storm drain line are described in Section 4.1.6 for the Boeing Isaacson property.

4.0 Potential for Sediment Recontamination from Adjacent Properties

Two properties are located adjacent to EAA-6: Boeing Isaacson and Boeing Thompson. While these two properties are separate parcels, many of the documents reviewed (e.g., the Boeing Thompson Pollution Prevention Plan) cover both properties. In addition, some groundwater monitoring reports discuss results for wells located on both parcels. To further complicate matters, the Isaacson-Thompson property boundary was adjusted in 2001. Therefore, documents written prior to 2001 show the property line further to the south. The current property boundary is depicted on most of the figures in this report, except for Figure 9, which shows the historical Boeing Isaacson property layout. Overlaps and discrepancies are documented as appropriate in Sections 4.1 and 4.2 below.

4.1 Boeing Isaacson

Facility Summary: Boeing Isaacson	
Address	8625 East Marginal Way S. 8541 East Marginal Way S.
Property Owner	The Boeing Company
Tax Parcel No.	0001600014
Parcel Size	9.84 acres (428,482 sq.ft.)
Facility/Site ID	1138721 (Boeing Isaacson Property) 2218 (Boeing Isaacson Thompson)
SIC Code	Not listed
EPA ID No.	WAD980836159 (inactive)
NPDES Permit No.	SO3000148
UST/LUST ID No.	None

The Boeing Isaacson property is located along the east side of the LDW, at approximately RM 3.7 to 3.8, as measured from the southern tip of Harbor Island. The property is rectangular, about 9.8 acres, and is situated between the LDW on the west and East Marginal Way on the east; the property is bordered on the south by the Boeing Thompson property and on the north by the Jorgensen Forge property (ERM 2000a; Landau 2007). The current parcel boundary is shown in Figure 2. Land use in the vicinity of the Boeing Isaacson property is industrial.

The Boeing Company purchased this property from the Isaacson Steel Company on March 14, 1984. King County tax records list the parcel as currently vacant (industrial). The parcel was originally 12.29 acres in size (ERM 2000c), however a property boundary adjustment was recorded on November 8, 2001, which moved the southern Isaacson property line north to its current location, reducing the size of this parcel by 2.45 acres (City of Tukwila 2001). No structures are currently present on this property.

Boeing Isaacson is listed in Ecology's Facility/Site Database under two names: Boeing Isaacson Property (FS ID No. 1138721), located at 8625 East Marginal Way S., and Boeing Isaacson Thompson (FS ID No. 2218), located at 8541 East Marginal Way S. The property is listed on Ecology's CSCSL under both names. An independent Remedial Action was conducted at the Boeing Isaacson property between April 6, 2000 and December 5, 2002 for metals contamination in soil and groundwater. The Boeing Isaacson Thompson site is listed in Ecology's database as "awaiting a Site Hazard Assessment." Site discovery was documented on March 1, 1988. The Boeing Isaacson and Thompson properties are jointly covered under an industrial stormwater general permit, No. SO3000148, which was originally issued on December 22, 1993 and has been extended to May 2008. The facility does not currently have an air operating permit or a King County waste discharge permit or authorization.

4.1.1 Physical Setting

The Boeing Isaacson property is located in an area of extensive fill placed during the re-channelization of the Duwamish River in the early 1900s. The topography is relatively flat, with the exception of the soil cap area (see Section 4.1.3 below), which is characterized by elevation differences of up to 5 feet (ERM 2000a).

Upper soils vary from 5 to 15 feet in thickness, and are composed of man-made fill either imported or dredged from the adjacent waterway. The fill materials consist predominantly of sand and silty sand. Along the western and southern margins of the property, slag and fire brick materials have been encountered at depths ranging from 1.5 to 15 feet below the existing ground surface (Dames & Moore 1983). Fill soils above and between the slag generally consist of brown to black sand, silty sands, and silty gravels. The fill is underlain by a deep deposit of alluvial soils that were laid in place by the Duwamish River.

Groundwater elevations range from 10 to 15 feet below ground surface (bgs), however they vary significantly with tidal fluctuations in the LDW and season.

4.1.2 Current Operations

This property is currently vacant; the former 373,000-square foot Isaacson Steel Company buildings (shown as Former Isaacson Facility Building 14-05 on Figure 9) have been removed and the site is completely paved with asphalt and concrete slabs (Landau 2007). The concrete is a remnant of former steel mill operations and consists primarily of slab-on-grade, spread footings, and at least 20 large foundations that supported overhead cranes used during the active steel mill operations (ERM 2000a). A portion of the property is currently used for vehicle parking associated with Boeing Thompson operations.

The property also contains seven catch basins that drain to the Boeing Thompson storm drain system, and five storm drain manholes that are connected to the 48-inch KCIA storm drain line as shown in Figure 7. In addition, six edge drains are located along the shoreline. The purpose, function, and configuration of the edge drains are unclear.

An outfall of unresolved origin is reportedly located near the Boeing Isaacson/Jorgensen Forge property boundary (Windward 2007c); this outfall is not shown on a stormwater system map provided by Boeing (Figure 7). No additional information about this outfall was available.

Three groundwater monitoring wells are present on the Boeing Isaacson property, as shown on Figure 10: I-200 (upgradient), and I-104 and I-203 (downgradient). Two additional downgradient wells are located on the Boeing Thompson property: I-205 and I-206.

4.1.3 Historical Operations

This section summarizes the property ownership, land use, and regulatory activities at the Boeing Isaacson property between 1929 and 2001. Figure 8 presents a timeline showing property ownership and site investigations/cleanups from the late 1920s to the present. Details regarding environmental investigations and cleanups conducted during this period are presented in Section 4.1.4.

Prior to 1929, land use in this area consisted of pasture land, a brewery, hop fields, several homes, and a race track, which was located immediately south of Slip 5 (Dames & Moore 1983). Appendix B provides aerial photos of the property and its surroundings from 1936 to 2004.

Duwamish Lumber Company

A historical review of Sanborn Fire Insurance Maps from 1904 to 1946 indicates that in 1929, the Duwamish Lumber Company operated a sawmill directly north of Slip 5 (Ecology, No Date). The facility included lumber storage areas, a crane track and trestle, and a conveyer area. Slip 5 is identified as the Duwamish River Slough in these maps. The Bissell Lumber Company operated to the south of Slip 5 (the current Boeing Thompson property), as shown in the 1936 aerial photograph (Appendix B).

Isaacson Iron Works/U.S. Navy

In 1941, the U.S. Navy constructed steel melting, forging, and fabricating facilities, known as Isaacson Iron Works Plant No. 2, just north of the current Boeing Isaacson site. Portions of the Boeing Isaacson property were used to store scrap metal prior to being melted down (Dames & Moore 1983). Between 1943 and 1945, a galvanizing plant was constructed in the northeast corner of the property. As shown in a 1946 aerial photo, this galvanizing plant was the only building within the current Boeing Isaacson property lines (Appendix B). It was dismantled in 1967 and the area was later occupied by Steel Fabrication Bay 14 (Figure 9).

Mineralized-Cell Wood Preserving Company

According to a 1945 survey of pollution sources in the Duwamish-Green River drainage area, the Mineralized-Cell Wood Preserving Company was located to the south of the Isaacson Iron Works at that time, presumably on the current Boeing Isaacson parcel (Foster 1945). This facility is not apparent in the 1946 aerial photo of the property. This company employed a patented process in which a solution of arsenic and sulfate salts of copper and zinc was heated and applied to the base of logs under pressure. A precipitating agent was used to set the chemicals and thus harden the wood. The storage tanks in which the solution was heated were washed twice daily.

Any sludge or remaining chemicals were drained onto the ground. Supply tanks containing fuel oil occasionally overflowed during filling, however the oil seeped into the ground and reportedly did not drain directly into the LDW. According to Foster (1945), no chemicals reached the waterway except those that leached out of the wood when the poles were shipped by water. It is likely that operations at this facility resulted in contamination of soil with arsenic, copper, and zinc.

Isaacson Steel Company

The Isaacson Steel Company purchased the Isaacson Iron Works plant in the 1950s and expanded the steel fabrication facility to what is labeled as Building 14-05 in Figure 8 during the 1950s and 1960s (Landau 1988a). A 1956 aerial photo indicates the degree of site development at that time and shows filling in portions of Slip 5 (Appendix B). The fill reportedly consisted of both common fill material and slag/fire brick material, and was used to extend the site area at the main elevation to a distance of 20 to 50 feet beyond the south face of Bays 1, 2, and 5 through 10 (Dames & Moore 1983). Plant expansion and development continued into the 1960s. The building consisted of a series of interconnected metal-sided buildings (Landau 1988a). A 1961 aerial photo shows completion of Bay 2, the addition of Bay 1 and extension of Bays 3 and 4, and construction of other small structures. Appendix C-2 includes a map showing the Isaacson Steel Company structures.

Additional fill was also placed within Slip 5 during this time, and a bulkhead was constructed along the LDW and backfilled to reclaim an additional 50 feet of land between the waterway and the Isaacson Steel property line (Dames & Moore 1983). The fill placed in Slip 5 reportedly consisted of slag waste and soil; land reclamation along the LDW was primarily comprised of imported soil from offsite sources but may have also included slag, fire brick, and material dredged from Slip 5 (Dames & Moore 1983). In approximately 1966, Slip 5 was completely filled as part of site development of the Boeing Thompson property.

The Isaacson operation consisted primarily of structural steel fabrication and supply; the former site layout is shown in Figure. Isaacson Corporation operated the zinc galvanizing operation near the northeast corner of the property through 1967. Until its sale in 1965 to the Earle M. Jorgensen Company, the Isaacson Corporation also operated the steel manufacturing facilities on the adjacent parcel to the north (Wicks 1983).

During the period 1972 to 1973, Isaacson Steel Company made several efforts to reduce the amount of pollutants entering the waterway via the storm drain (Dames & Moore 1983). Traces of lubricating oil used with a friction cutting saw in Bay 3 may have entered the LDW via the introduction of cooling water into the storm drain system. Corrective action was taken to reduce additional pollution. In the painting area near Bays 12 and 13, the water-air wash system used to prevent paint solids from being exhausted into the atmosphere was disconnected from the storm sewer. Commercial waste disposal companies were subsequently used to dispose of water containing significant amounts of paint solids.

The Isaacson Corporation conducted a soil remedial action in 1984. Because it was conducted during and after purchase of the property by The Boeing Company, this remedial action is described with the Boeing Isaacson facility below.

Boeing Isaacson

In March 1984, Boeing purchased the Isaacson property to construct additional office and manufacturing facility space. Boeing used Building 14-05 for storage of miscellaneous parts, tools, and other material (Boeing 1988b). The bays had been constructed with slab-on-grade concrete or asphalt floors, with some dirt floors (Landau 1988a). Environmental investigation and remedial actions were conducted at the site from 1983 through 1991 to address elevated concentrations of arsenic in soil and groundwater as summarized below and detailed in Section 4.1.4. Structures on the property were demolished as part of a plan to expand the Boeing Thompson facility in 1989.

The following subsections provide a summary of activities at the property between 1984 and 2001; a timeline of these activities is provided in Figure 8. Detailed information on investigations and cleanups performed during this period is provided in Section 4.1.4.

Initial Evaluations and Soil Removal

Prior to the purchase, Boeing conducted Phase 1 and 2 site evaluations at the Isaacson Steel property in August 1983 to evaluate its potential purchase. Chemical analyses of soil and groundwater performed during Phase 1 investigations identified arsenic, zinc, and total carbon in samples taken from borings located near the sites of a steam cleaning rack and sump and a transformer rack (Dames & Moore 1983). Additional sampling was conducted by Patrick H. Wicks in October and December 1983 for the Isaacson Corporation, which confirmed the presence of arsenic, lead, and zinc in soil and groundwater at the property (Wicks 1983).

In January 1984, Isaacson Corporation submitted a remedial action plan to Ecology and requested "advice" (Isaacson 1984a).[4] Ecology responded in February 1984, indicating that the proposed excavation of arsenic and lead hot spots is "a reasonable approach" (Ecology 1984a). Ecology indicated that analytical verification would be required to demonstrate that the pockets of "high level material" have been suitably removed, however with a satisfactory outcome of the necessary analyses, the area could be made acceptably "clean" (Ecology 1984a). Further correspondence from Isaacson indicated that the remedial work would be performed during the summer of 1984 (Isaacson 1984b). In a letter dated June 29, 1984, Ecology stated that if this work is not completed in a timely manner, appropriate actions would be initiated by Ecology to compel Isaacson to comply with applicable statutes and regulations. The letter further states that Ecology would take enforcement action if they were not satisfied with the execution or completion of the cleanup (Ecology 1984c).

The initial remedial program was completed in late August 1984; Ecology indicated verbally that additional sampling and analysis was appropriate and perhaps additional excavation would be required (Isaacson 1984b). Subsequently, additional soil samples were collected and analyzed, and a final remedial plan was prepared (*Report on Remedial Project and Recommendations for Project Completion at Isaacson Corporation Property, October 1984*[5]). The remediation was

[4] The remedial action plan was not present in the files reviewed by SAIC during preparation of this Data Gaps report.
[5] This document was not present in the files reviewed by SAIC during preparation of this Data Gaps report.

completed in early November 1984. The area between Buildings 14-05 and 14-01 (Thompson Bldg.) was paved (Landau 1988a).

A November 20, 1984 letter from Ecology to Isaacson Corporation indicated that additional sampling would be required at the property because arsenic levels remained high in several locations. Isaacson Corporation strenuously objected to this in a December 1984 letter (Isaacson 1984b), in which they stated that all remedial work had been completed in accordance with plans submitted to and discussions held with Ecology staff.

According to a December 1984 letter from Isaacson, Ecology had agreed to a 700 mg/kg arsenic cleanup level in soil (Isaacson 1984b).

In February 1985, Ecology prepared a conditional No Further Action (NFA) letter for soil; this letter was not found in the files reviewed during preparation of this Data Gaps report, however it reportedly identified the need for a deed restriction, and required Boeing to conduct groundwater monitoring and prepare annual reports presenting the results of this monitoring for two years (Ecology 2000b; Landau 1986). In October 1985, Landau Associates submitted a Groundwater Monitoring Plan to Boeing that outlined a program for continued monitoring of arsenic in groundwater. Based on groundwater monitoring completed in 1985 through 1987, Landau concluded that the site was unlikely to contribute enough arsenic to the LDW to cause exceedance of the chronic ambient water quality criteria (AWQC) (ERM 2000a).

Boeing applied for a NPDES stormwater discharge permit for this facility in April 1985 (Boeing 1985b). It is not known whether this permit was issued.

Proposed Site Redevelopment

In 1988, Boeing proposed to demolish Building 14-05, construct a new Building 14-09, which would be attached to a portion of the north side of Thompson Building 14-01, and pave the remaining area with roller-compacted concrete. The new building was to be used primarily for manufacturing. Pedestrian tunnels would be constructed and the 48-inch public storm drain would be rerouted along the property line on the north side of Building 14-05 (Landau 1988a). The proposed layout is shown in Appendix C-4. This building was never constructed.

To support construction of Building 14-09, Landau conducted a soil and groundwater investigation in May 1988, as described in Section 4.1.4 below. Ecology, in a letter dated May 10, 1988, concurred with the plan to pave the property as appropriate mitigation for the site, with the exceptions of Bay 13 and the area between Bay 11 and Bay 14 (identified as the Courtyard). The soil in these areas failed the Extraction Procedure (EP) Toxicity test and would need to be disposed of at a permitted hazardous waste disposal facility (Ecology 1988a). Boeing removed approximately 4,800 cubic yards of soils from Bay 13 and the Courtyard in the spring of 1989 (ERM 2000a; Boeing 1989, 1990a).

In December 1988, Boeing conducted a pilot demonstration study for extraction of arsenic from soil. The proposed treatment process involved mixing of soil with a dilute caustic solution to solubilize and extract the arsenic (Boeing 1988e). Boeing requested confirmation from Ecology that a Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal (TSD) permit would not be required for full-scale implementation, however Ecology apparently

concluded that Boeing would be required to obtain a permit for this activity (Ecology 1989b). No information on the success of the pilot demonstration was found in the files reviewed during preparation of this Data Gaps. No further implementation of this treatment process was conducted.

As part of a planned storm drain construction in late 1989 and early 1990, Boeing conducted extensive grid sampling of soil, as described in Section 4.1.4 below. The sampling program found arsenic concentrations above 200 mg/kg primarily in a strip about 70 feet wide and 1,300 feet long along the northern property boundary (Boeing 1990a). The arsenic-containing soils were generally located at depths between 3 feet and the water table (10 to 12 feet bgs). Arsenic concentrations at the 3- to 11-foot depth varied from <100 mg/kg to 25,000 mg/kg (Boeing 1990a). An estimated 20,000 to 40,000 cubic yards of arsenic-contaminated soil warranted remediation (Boeing 1990a).

Soil Remedial Actions

Boeing proposed a program of soil stabilization, capping, and long-term groundwater monitoring in 1990, as described in the *Thompson-Isaacson Site Soil Remedial Action Plan* (Boeing 1990c; Landau 1990). Ecology requested that pilot testing be conducted to determine the effectiveness of the process prior to conducting full-scale soil stabilization (ERM 2000a). Pilot testing was conducted in June 1991, under the "on-site treatment by generator" rule of the Washington dangerous waste regulations (Ecology 1991a, 1991b). The pilot tests demonstrated that the process was effective in stabilizing the arsenic-contaminated soils (Boeing 1991a, 1991b; Ecology 1991c).

Approval for conducting the large scale soil remediation program was given by Ecology in July 1991 (Ecology 1991c). The actions were conducted between August and November 1991, including excavation of approximately 35,000 tons of soil, on-site treatment using a physical and chemical stabilization process, and placement of the treated soil in the ground beneath a polyethylene cap and asphalt cover (Landau & GeoEngineers 1992, Boeing 1992a). The soil cap area comprised a mound that was characterized by elevation differences of up to 5 feet above the surrounding grade (ERM 2000d).

A target cleanup level of 200 mg/kg arsenic was selected, which was the Model Toxics Control Act (MTCA) Method A industrial cleanup level for arsenic at that time[6]. After the soil removal action, arsenic in excess of 200 mg/kg remained along the north wall of the excavation (ERM 2000a), ranging from 200 mg/kg to approximately 2,000 mg/kg (ERM 2000a). Further soil removal would have compromised the integrity of the storm drain line in that location. An asphalt cap with a polyethylene liner was installed and institutional controls prohibiting access to this portion of the site were implemented (ERM 2000a).

Compliance monitoring for groundwater quality was conducted between 1991 and 1996 (Landau 1991; ERM 2000a). Based on a statistical analysis of groundwater data from the property, Boeing concluded that the downgradient monitoring wells on the Isaacson property (I-104s and I-203s) were in compliance with the freshwater chronic AWQC for arsenic based on protection

[6] The current MTCA industrial cleanup level for arsenic in soil is 88 mg/kg (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx)

of aquatic life (190 ug/L for trivalent arsenic), however well I-206s on the adjacent Thompson property was not (see Section 4.2 for additional information on the Thompson property) (ERM 2000a).

A 1996 groundwater investigation at the Boeing Thompson property (GeoEngineers 1996, as cited in ERM 2000a) concluded that Boeing Isaacson is not the source of arsenic in well I-206(s). The GeoEngineers report was not available for review during preparation of this Data Gaps report and therefore this conclusion could not be validated.

No Further Action (NFA) Requests

In April 2000, Boeing submitted a conceptual proposal for an NFA determination at the Boeing Isaacson property (ERM 2000a). Boeing requested that the property be included in Ecology's Voluntary Cleanup Program (VCP), with technical oversight from Ecology staff. Boeing requested the NFA in consideration of the extensive soil remediation activities that had been conducted in 1991 and Boeing's plans for redevelopment of the site as an active commercial/industrial property (ERM 2000a). Boeing also made the following assertions:

- The costs of additional remediation to achieve clean closure for the site are substantial and disproportionate to the incremental degree of risk reduction that would be achieved;
- Implementation of deed restrictions, institutional controls, and groundwater monitoring to minimize human health and environmental risk is compatible with the commercial/industrial redevelopment plans;
- Precedent for the NFA determination has been established in the Duwamish Industrial Area through the application of the Maximum Beneficial Use criteria for groundwater as a recharge source to the LDW.

In a May 16, 2000 response to Boeing's proposal, Ecology determined that an appropriate cleanup level for arsenic in groundwater would be 0.14 ug/L, based on protection of human health from consumption of contaminated marine organisms, and that this cleanup level must be achieved at the point where groundwater flows into the LDW as depicted by the existing monitoring wells located along the shoreline (I-104s and I-203s) (Ecology 2000b). Ecology stated that the following additional information was needed: a contingency response action plan to address arsenic-impacted groundwater; and additional water level measurements to more clearly evaluate groundwater flow dynamics at the site. In addition, Ecology expressed concern about the possible co-mingling of arsenic-impacted groundwater with tidal fluctuations between the Boeing Thompson and Isaacson sites.

During a meeting on June 7, 2000, Ecology indicated that a soil NFA was appropriate, and requested additional information to support the preparation of a deed restriction (ERM 2000c). Before a groundwater NFA request could be granted, additional site studies would be required. In a July 24, 2000 meeting, Ecology agreed to consider an alternative cleanup level for groundwater based on a site-specific risk assessment (ERM 2000d). Boeing agreed to conduct a human health risk assessment and additional hydrogeologic site characterization, including groundwater flow and discharge analyses, a tidal study, and collection of additional data on aquifer characteristics (ERM 2000b).

In November 2000, Boeing submitted supporting information for a soil NFA determination (ERM 2000c). Boeing planned to level the mound of stabilized soil (generated during the 1991 soil remediation efforts), grade the area, and redistribute the stabilized soil throughout the site.

Also in November 2000, Boeing submitted a report summarizing the hydrogeologic investigation results and the site-specific human health risk assessment for groundwater at the Boeing Isaacson property (ERM 2000d). Results indicated that groundwater flow at the property is characterized by an unconfined, tidally-influenced aquifer in silt and fine sand native soils and fill materials with local variations in permeability. These variations are most apparent near the LDW shoreline, in the area of greatest tidal fluctuation. Groundwater flow across the site is generally west to west-southwest, with some flow deflection toward the axis of the former Slip 5. Arsenic distribution in groundwater was generally consistent with a former source in the northeastern quadrant of the site. However, significant attenuation of arsenic concentrations was apparently occurring as groundwater approaches the shoreline (ERM 2000d).

The human health risk assessment derived groundwater action levels based on human health risks from consumption of contaminated seafood. The action levels of 8,330 ug/L and 1,109 ug/L for recreational and subsistence anglers, respectively (ERM 2000d), were based on site-specific consumption rate estimates and the fraction of inorganic arsenic likely to be present in seafood.

Boeing also proposed to establish a long-term groundwater quality monitoring program to complement a groundwater NFA determination, consisting of three years of semi-annual sampling of two wells and two piezometers (ERM 2000d).

In response to the November 2000 soil NFA supporting information report (ERM 2000c), Ecology stated that leveling and grading by redistributing the stabilized soil throughout the site is unacceptable (Ecology 2001). Boeing would need to evaluate other pathways of exposure, such as direct contact and ingestion and leaching to groundwater, in the context of the MTCA regulations and cleanup standards. Ecology was concerned that crushing of the encapsulated material would increase the surface area of arsenic-contaminated soils, which would therefore be more vulnerable to attack and breakdown by the elements. Further, proposed landscaping at the site would provide recharge point sources for infiltration of water, and the proposed pile-driven foundation concept could ultimately introduce arsenic-impacted soils to greater depths, thereby further contaminating the site.

Ecology indicated that arsenic-stabilized soils that are excavated during construction should be disposed appropriately and the excavation pit backfilled with clean soil material. If Boeing addressed these concerns, Ecology agreed to issue an opinion letter that the site investigation appears to meet minimum requirements to protect human health and the environment, which would allow redevelopment of the property to proceed. Ecology's NFA determination would be issued at a later date after the submittal of a final report containing empirical data of confirmation soil samples after the excavation and removal of re-crushed arsenic-stabilized soil, of stormwater control measures, of groundwater compliance monitoring results, stamped engineering maps/reports, etc. (Ecology 2001).

With regard to the November 2000 groundwater NFA supporting information (ERM 2000d), Ecology did not agree with Boeing's assumptions with respect to target risk level,

bioconcentration factor, inorganic arsenic percentage, and seafood consumption rates. Based on the concentration of arsenic in the upgradient (background) well, Ecology indicated that a remediation level of 2.7 ug/L would be acceptable (Ecology 2001).

On February 6, 2001, a meeting was held to discuss the status of the NFA requests between Ecology, Boeing, and Boeing contractors ERM and Exponent (ERM 2001). Boeing pointed out that about 400 Toxicity Characteristic Leaching Procedure (TCLP) samples had been analyzed for the post-treatment soil and all had passed. Ecology stated that TCLP is not adequate to evaluate the soil-to-groundwater pathway, and that soil would need to be retested after simulating actual conditions (e.g., breaking up cohesive soil into its granular state). Boeing offered to provide a work plan for an evaluation of leaching from treated soils.

Ecology concurred that stabilized soils can be used on the site if they do not provide a pathway to groundwater (ERM 2001). However, Ecology indicated that they would not issue a separate NFA determination for soil and groundwater if one medium (soil) is contributing to contamination of the other (groundwater).

No additional activity with respect to the soil and groundwater NFA requests is documented in the files reviewed for this Data Gaps report. According to Ecology's site manager for Boeing Isaacson, Ecology did not approve the NFA determinations and Boeing is no longer participating in the Voluntary Cleanup Program for this property (O'Brien 2007).

Spills

April 1987**.** A Boeing-owned asphalt truck working near Building 14-05 spilled approximately 10 gallons of Chevron Heat Transfer Oil #1 onto the pavement. Approximately 1 to 2 gallons of oil reached a nearby catch basin and passed through the storm sewer to the LDW. Absorbent pads were placed in the catch basin, and the visible sheen on the LDW was confined to a small area. An absorbent boom was laid around the spill area and was left in place to absorb the remaining oil (Boeing 1987).

No other information on spills associated with this property was found in the files reviewed during preparation of this Data Gaps report.

4.1.4 Environmental Investigations and Cleanups

Environmental investigations and cleanups were conducted at the site from 1983 to 1991 to address elevated concentrations of arsenic detected in soil and groundwater. Groundwater monitoring activities were conducted routinely between 1991 and 2007. The most recent groundwater monitoring event took place in September 2007 (O'Brien 2007).

Phase I and II Site Evaluation, Isaacson Steel Property (1983)

In August 1983, Boeing conducted Phase I and II site evaluations at the Isaacson Steel property to evaluate its potential purchase. The Phase I evaluation included drilling of eight soil borings to depths ranging from 2.0 to 11.5 feet and one boring to approximately 25 feet. The deep boring was completed as a groundwater monitoring well. Chemical analysis of 10 selected soil samples and one groundwater sample were conducted for metals; PCBs, TOC, and oil & grease were

analyzed for selected samples (Dames & Moore 1983). Sampling results are provided in Appendix C-1.

Chemical analyses of soil and groundwater performed during Phase I investigations identified very high concentrations of arsenic, zinc, and TOC in samples taken from borings located near the sites of a steam cleaning rack and sump and a transformer rack. In addition, high concentrations of certain heavy metals (barium, chromium, lead, nickel, and zinc) were found in the near-surface fill that overlies the natural material in the southern and western margins of the site (Dames & Moore 1983).

Based on the results of the Phase I sampling, supplemental sampling was conducted in late August 1983 to determine the extent and source of the contamination. Thirteen soil borings were drilled, including four borings around the steam cleaning rack where high concentrations were detected during Phase I, four borings along the margins of the property to the south to evaluate the extent and concentration of contaminants in fill soils, two borings inside the building as controls, and three borings on the Boeing Thompson property to the south of the Isaacson Steel site. Groundwater monitoring wells were installed in two of the borings, one near the sump for the steam cleaning rack and the other near the former location of Slip 5. Groundwater samples and a water sample from the 48-inch diameter outfall on the LDW were also analyzed. Samples were tested for metals; selected samples were also tested for PCBs and organics (Dames & Moore 1983).

The following contaminants were detected at elevated concentrations in soil[7]:

- PCBs: <0.2 to 9.7 mg/kg DW
- Arsenic: 3.1 to 2,880 mg/kg
- Cadmium: 0.03 to 16 mg/kg
- Chromium: 1.3 to 1,170 mg/kg
- Lead: 1.3 to 1,170 mg/kg
- Mercury: <0.03 to 4.3 mg/kg
- Nickel: 7.0 to 2,030 mg/kg

The highest concentrations of arsenic were found near Bays 11 and 14 (Figure 9). In addition, the steam cleaning sump contained 94,950 mg/kg zinc and 350,000 mg/kg oil & grease.

Groundwater concentrations of several contaminants were also elevated:

- Arsenic: 19 to 41 ug/L
- Barium: 28 to 310 ug/L
- Chromium: 20 to 130 ug/L
- Lead: 1 to 95 ug/L

[7] Contaminants in soil and groundwater are identified as "elevated" if they exceed current MTCA Method A or B Cleanup Levels for unrestricted land use, as listed in Ecology's CLARC database at https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx

A water sample was collected from the 48-inch stormwater outfall; arsenic (8 ug/L), lead (23 ug/L), and antimony (17 ug/L) exceeded current MTCA groundwater cleanup levels.

According to Dames & Moore (1983), virtually all elevated contaminant concentrations could be correlated to two principal sources: a “hot spot” around the steam cleaning rack and sump, and materials used to fill the western and southern site margins (Dames & Moore 1983). Additional investigations were recommended to determine the source of arsenic. Maps and figures associated with this document were not present in the files reviewed during the preparation of this Data Gaps report.

Wicks Investigation (1983)

Patrick H. Wicks was retained on behalf of the Isaacson Corporation to evaluate the previous Dames & Moore (1983) study, and to conduct additional soil and groundwater sampling. Samples were analyzed for chemicals deemed of concern at the property based on the Dames & Moore evaluations, namely arsenic, chromium, copper, lead, zinc, and nickel. Wicks concluded that because the groundwater samples collected by Dames & Moore were not field filtered prior to being placed in the acid-fixed sample bottles, results from that study were not representative of in-situ groundwater quality (Wicks 1983).

Seven new groundwater monitoring wells (I-1 through I-7) were installed; soil samples were collected from borings and test pits during installation of the monitoring wells. Groundwater samples were collected from the seven new (I-1 through I-7) and three existing (No. 7, 12, 20) monitoring wells in October 1983 and again in December 1983. Sampling locations are shown in Figure 9 and results are provided in Appendix C-2. The following elevated concentrations were observed:

- Arsenic: 14 to 9,200 ug/L
- Lead: 2 to 30 ug/L
- Zinc: 27 to 14,000 ug/L

Arsenic concentrations exceeded the EPA Drinking Water Maximum Contaminant Level (MCL) of 50 ug/L in seven of the 10 wells. The highest concentrations of arsenic were found in wells I-2, I-1, and 12; these locations are near the steam cleaning pit and are just west of the former galvanizing plant (shown as Bay 14 on Figure 9). The highest zinc concentrations were found in this same area. Wicks identified the steam cleaning sump/rack, slag and other wastes from the Isaacson operation (steel manufacturing waste, paint wastes, galvanizing plant wastes), and fills and waste materials placed on the property prior to its purchase by Isaacson as probable sources of arsenic and zinc.

A detergent (Fist, supplied by Pace National Corporation) was used at the steam cleaning area from the early 1970s to the 1980s; this product reportedly did not contain heavy metals (Wicks 1983). Earlier detergent cleaners may have contained arsenic. Zinc in lubricating and hydraulic oils associated with equipment washed at the steam cleaning area may be the source of zinc in the steam cleaning sump sludge (Wicks 1983).

Water level measurements indicated that in the eastern portion of the property, the groundwater gradient is relatively constant (about 0.0009 feet per foot) and flows from east to west. In the western portion of the property, however, the groundwater flow direction in the shallow aquifer near the LDW appears to fluctuate with the tide. At low tide, groundwater flows toward the northwest (i.e., toward the river), while at high tide the groundwater flow is toward the south-southeast (i.e., away from the river) (Wicks 1983). Water table gradients on the western portion of the property ranged from approximately 0.001 to 0.004 feet per foot, more than four times higher than those found on the eastern portion of the property.

Initial Remedial Action (1984)

An initial remedial action, consisting of removal of 500 cubic yards of soil from arsenic hot spots, was conducted during August through November 1984 (ERM 2000a). Results of these remedial actions were presented in *Report on Remedial Project and Recommendation for Project Completion at Isaacson Corporation Property, Seattle, Washington*[8] (Wicks 1984b, as cited in Landau 1988a). No additional information was available regarding this remedial action.

Groundwater Monitoring (1985-1987)

Landau conducted groundwater monitoring at the Boeing Isaacson site from 1985 through January 1987. Sampling locations and results are presented in Appendix C-3.

In 1985, Landau repaired and replaced damaged groundwater monitoring wells and conducted semi-annual sampling of the monitoring wells for total and dissolved arsenic. Samples were collected at wells I-3, I-7, and B-12 in June 1985; these wells plus I-6, I-8, and I-104 were sampled in December 1985 (Landau 1986). Dissolved arsenic concentrations ranged from <5 to 1,200 ug/L; total arsenic ranged from 12 to 2,400 ug/L (Landau 1986). The highest concentrations were found at well I-105, located downgradient (to the west) of the former steam cleaning area (Figure 9).

In February 1986, a tidal groundwater level assessment was conducted (Landau 1987). Fluctuations in groundwater levels in response to tides were observed over 1,000 feet away from the LDW. During low tide, groundwater flow direction was generally west to northwest, with a gradient within the area of tidal influence of 0.0049 feet per foot. During high tide, there was a general groundwater flow reversal away from the LDW on the western portion of the site, with a gradient of 0.0018 feet per foot. The average water table gradient was 0.0016 feet per foot towards the LDW. Rising-head permeability tests were conducted at three wells; permeabilities ranged from 0.0036 feet per minute to 0.76 feet per minute, with an average permeability of 0.28 feet per minute (Landau 1987).

In July 1986 and January 1987, groundwater samples were collected from wells I-3, I-6, I-7, I-8, I-104, I-105, and B-12. Samples were analyzed for total and dissolved arsenic. Concentrations of dissolved arsenic ranged from <5 to 4,300 ug/L; total arsenic ranged from <5 to 4,700 ug/L (Landau 1987). The highest concentrations were again found at well I-105, located downgradient (to the west) of the former steam cleaning area.

[8] This document was not found in the files reviewed during preparation of this Data Gaps report.

An assessment of arsenic migration was also conducted. Based on groundwater data obtained over a period of four years (1983 to 1986), Landau determined that arsenic is migrating slowly toward the LDW. The average annual flux of arsenic to the LDW was conservatively estimated as 59 pounds per year[9], with a resulting increase in arsenic concentration in the LDW of 0.02 ug/L (Landau 1987). Landau recommended that groundwater monitoring be terminated, and that additional sampling be conducted if onsite construction should occur in the future.

Landau concluded that, because of adsorption by soil and subsequent dilution in the LDW, the Boeing Isaacson property was unlikely to contribute significant arsenic to the LDW to cause exceedance of either the saltwater or freshwater chronic ambient water quality criteria (ERM 2000a).

Building 14-09 Thompson-Isaacson Site Investigation (1988)

In 1988, Landau conducted soil and groundwater investigations at the Isaacson and Thompson properties to support the planned construction by Boeing of a manufacturing facility at the site, designated as Building 14-09.

Soil samples were collected at 44 exploration locations, eight of which were completed as monitoring wells (Landau 1988a). Sampling locations are shown in Appendix C-4. All soil samples were analyzed for arsenic, and a subset of soil samples was analyzed for other metals, EP Toxicity, and PCBs. Soil samples collected within the area of former Slip 5 were also analyzed for cyanide, volatile organic compounds (VOCs), SVOCs, and pesticides.

Arsenic was detected at elevated concentrations in soil at depths to 15 feet, with concentrations ranging up to 4,120 mg/kg (Landau 1988a). For comparison, the current MTCA cleanup level for arsenic in industrial soil is 88 mg/kg[10]. The majority of arsenic exceedances occurred at depths between 4 and 12 feet along an east-west transect near the northern portion of the site, which includes the steam cleaning rack and sump area.

Groundwater samples were collected from the eight new wells plus seven pre-existing monitoring wells (Appendix C-4). The wells were screened at two depths: shallow (near the water table to a maximum depth of 30 feet), and intermediate (30 to 50 feet below ground surface) (Landau 1988a). Samples were analyzed for dissolved metals; in addition, wells within the former Slip 5 were analyzed for VOCs, SVOCs, and pesticides. Arsenic was found at concentrations ranging from 10 to 15,000 ug/L, well above the Washington background arsenic concentration of 5 ug/L[11] (Landau 1988a). Sampling results for chemicals other than arsenic were not available.

Additional soil samples were collected in June 1988 to better delineate the distribution of soil arsenic concentrations in selected portions of the Boeing Isaacson property (Landau 1988b). Samples were collected from three depths at 30 locations, as shown in Appendix C-4.

[9] Estimate assumes a cross-sectional area of 12,000 sq.ft., calculated based on a length perpendicular to groundwater flow and a conservative depth of 20 feet.
[10] From Ecology's Cleanup Levels and Risk Calculations (CLARC) Database at https://fortress.wa.gov/ecy/clarc/Reporting/ChemicalQuery.aspx
[11] From Ecology CLARC database: https://fortress.wa.gov/ecy/clarc/Reporting/ParameterQuery.aspx

Specifically, eight additional borings were drilled near Bay 13, and 22 borings were drilled near Bays 11, 12, and 14. Arsenic concentrations up to 9,180 mg/kg were detected near Bay 13; arsenic was detected up to 24,200 mg/kg near Bays 11, 12, and 14 (Landau 1988b). The highest concentrations at both areas were found in the 0- to 5-foot depth interval.

Soil Remedial Action (1988)

As a result of the 1988 Site Investigation (Landau 1988a, 1988b), approximately 4,800 cubic yards of soil were excavated from the location of Bay 13 and the area between Bay 11 and Bay 14 (identified as the Courtyard) (Landau 1989). Excavation locations are shown in Appendix C-5. Over 3,000 cubic yards of the excavated soil, containing arsenic at concentrations ranging from 400 to 5,000 mg/kg, were transported offsite to the hazardous waste landfill in Arlington, Oregon. The remaining soil was returned to the excavations after analytical verification of acceptable[12] arsenic concentrations (ERM 2000a).

Storm Drain Construction (1989-1990)

Extensive grid sampling of soil from over 90 test pit locations was conducted by Technical Dryer, Inc. for Boeing as part of a planned storm drain construction in late 1989 and early 1990 (Technical Dryer 1991; ERM 2000a). A total of 1,150 cubic yards of soil with an average arsenic concentration of 1,102 mg/kg were removed from the pipeline excavation for offsite disposal at a Class I landfill. An additional 3,980 cubic yards containing an average arsenic concentration of 99 mg/kg was retained onsite for backfill. Concrete and asphalt removed from the surface of the site was steam cleaned and disposed of at Mount Olivet Landfill for construction debris in Renton, Washington (Technical Dryer 1991). Large pieces of metal slag were encountered in some areas of the site; these were analyzed for EP Toxicity metals and subsequently disposed of at the King County Cedar Hills landfill. Sample locations and results are presented in Appendix C-6.

This investigation indicated that large quantities of arsenic-contaminated soil were still present in the northern portion of the Boeing Isaacson property. An estimated 20,000 to 40,000 cubic yards of additional material warranted remediation based on subsequent investigation work completed by Landau and Parametrix (ERM 2000a).

Soil Remedial Action (1991)

Boeing implemented a remedial action program at the Boeing Isaacson property in 1991 to address elevated concentrations of arsenic in soil. The arsenic distribution in soil at the Isaacson site was characterized during a series of pre-1991 investigations and interim remedial actions. The approximate extent of arsenic contamination is shown in Appendix C-6, Figures 11, 12, and 13 (ERM 2000a).

The remedial action plan for the site was outlined in a document entitled *Thompson-Isaacson Site Soil Remedial Action Plan* (Landau 1990). The remedial action program was conducted between August and November 1991, during which time approximately 35,000 tons of soil were

[12] An acceptable arsenic concentration was defined as 700 mg/kg based on a human health risk evaluation, as described in Landau 1989.

excavated and treated on site using a chemical and physical stabilization process. The treated soil was placed back in the ground beneath a polyethylene cap and asphalt cover. A brief description of the soil remediation and stabilization process is presented below; a detailed description of the remedial action can be found in the *Final Report, Thompson-Isaacson Site Full-Scale Soil Stabilization Program Summary Report, Volumes I through III* (Landau & GeoEngineers 1992).

Soil Excavation and Treatment

During the full-scale remedial action program, the arsenic-contaminated soil was removed systematically from the affected areas using traditional excavation methods (e.g., track hoes and dump truck transport). The performance goal during the excavation activities was to remove soils with arsenic concentrations in excess of the MTCA industrial soil cleanup standard of 200 mg/kg[13] based on field screening and laboratory analysis (ERM 2000a). Soil exceeding this compliance level was excavated for treatment that included: (1) screening of soil with particles greater than 0.75 inches, (2) soil treatment with polysilicate and cement in a pug mill unit via a hopper and scale conveyor, (3) conveyance to a curing area, and (4) spreading in a lay-down area to a depth of approximately 18 inches. Finally, prior to final placement, the soil was graded and turned so that the end product was in granular form (sand and gravel sizes), allowing potential future excavation and/or grading activities if necessary for future development.

During the period between August and November 1991, approximately 35,000 tons of soil was removed for treatment using an above-ground physical and chemical process designed to stabilize the arsenic concentrations in soil such that soils, after treatment, no longer displayed dangerous waste characteristics. The process involved mixing contaminated soil with a proprietary silicate compound mixture that was custom-blended for the site soil conditions. The mixing resulted in a set of very rapid reactions between the polysilicate materials and arsenic, producing a low solubility arsenic metasilicate matrix.

When the soil had sufficiently cured (36 hours), verification sampling of treated soil was performed to validate that the treated soil met TCLP performance criteria. The successful results of the TCLP testing were reported in Landau & GeoEngineers (1992).

Performance Monitoring Soil Sampling

During the soil removal action, GeoEngineers conducted extensive sidewall sampling within excavated areas to verify compliance with the MTCA industrial cleanup level of 200 mg/kg. Soil removal and sampling were conducted in the general vicinity of the affected areas. Confirmation sampling was conducted in a systematic fashion in accordance with the procedures outlined in the work plan. The soil samples were screened for arsenic by Technical Dryer Corporation. If screening detected arsenic concentrations above 175 mg/kg, the side wall of the subject excavation was excavated an additional 12 feet. Samples from the new sidewall were then resubmitted to Technical Dryer Corporation for screening. If screening detected arsenic concentrations below 175 mg/kg, the sample was submitted to Laucks Testing Laboratory for confirmational analysis using EPA Test Method 6010.

[13] The current MTCA cleanup level for arsenic in industrial soil is 88 mg/kg.

At the completion of the soil removal action, arsenic soil concentrations in excess of 200 mg/kg remained along the north wall of the remedial excavation. Arsenic concentrations in this area typically ranged from greater than 200 mg/kg up to approximately 2,000 mg/kg. Compliance with the arsenic soil cleanup level on the north side of the excavation was not achieved because further soil removal would have compromised the integrity of the existing storm drain line. As such, the northern extent of the arsenic concentrations in soil beyond the storm drain is unknown. In contrast to the north wall, arsenic concentrations in confirmation samples from the remainder of the excavation were within the 200 mg/kg performance criterion.

Landfilling and Capping

Treated soil removed from the curing area was placed back in the excavation. The backfilled area extended from sewer line manhole cover 2 to approximately 100 feet west of manhole cover 5 and approximately 80 feet south of the storm sewer line (Appendix C-7). After soil was placed, it was compacted as required for intended future use. The backfilled material was capped with a polyethylene liner and asphalt cover (Landau & GeoEngineers 1992). The asphalt cap was extended to cover the remaining parts of the site not covered by buildings due to the potential that minor, localized concentrations of arsenic remained in the soil outside the capped area.

Compliance Monitoring

As noted above, concentrations of arsenic in excess of 200 mg/kg remained along the north side of the remedial action area. To protect human health and the environment, access to this soil was limited by placement of an asphalt cap. Institutional controls were implemented to prohibit access to the site.

Groundwater Monitoring (1992-1996)

Groundwater monitoring was conducted at the Boeing Isaacson and Thompson properties as part of the overall site remedial action program described in the *Thompson-Isaacson Site Soil Remedial Action Plan* (Landau 1990) and in accordance with the *Thompson-Isaacson Site Groundwater Monitoring Program* (Landau 1991).

The five compliance wells range in depth from 25 to 29 feet below ground surface (bgs). With the exception of well I-203, well screens are approximately 10 feet in length. Well I-203 has a well screen length of approximately 15 feet. The tops of the well screens are approximately 12 to 15 feet bgs. The locations of the wells are shown in Figure 10. Appendix C-8, Figure 5, is a geologic cross-section across the Boeing Isaacson/Thompson properties parallel to the LDW shoreline; this figure shows that wells I-104 and I-206 are screened within native soils; wells I-203 and I-205 are screened partly in native soil and partly in fill material.

Data collected between 1991 and 1996 were compiled in a report titled *Evaluation of Groundwater Compliance Monitoring Program, Boeing Thompson-Isaacson Site* (GeoEngineers 1997, as cited in ERM 2000a). Based on a statistical analysis of groundwater data from the Boeing Isaacson property (i.e., calculation of 95 percent upper confidence limits), GeoEngineers concluded that the downgradient monitoring wells on the site, I-104(s) and I-203(s), were in compliance with the freshwater chronic ambient water quality criterion for arsenic (190 ug/L for

trivalent arsenic). Monitoring well I-206s on the adjacent Thompson property, however, exceeded this threshold.

Additional Groundwater Sampling (1999)

Groundwater samples were collected at the Boeing Isaacson property in December 1999 (ERM 2000a). The concentration of arsenic in the upgradient well (I-200) was 2 ug/L; the downgradient wells (I-104 and I-203) contained 150 to 160 ug/L arsenic.

Hydrogeologic Investigation and Human Health Risk Assessment (2000)

To further characterize hydrogeologic conditions at the site in support of Boeing's NFA request, ERM installed eight piezometers (PZ-1 through PZ-8) in August 2000 at locations shown in Appendix C-9. Subsurface soil samples were collected from the piezometer boreholes for lithologic logging and laboratory analysis for TOC and total iron. TOC ranged from 0.17 to 3.1 percent, and total iron ranged from 0.753 to 2.15 percent (ERM 2000d).

Single well hydraulic conductivity tests were conducted at the eight piezometers, including falling head and rising head tests. Aquifer hydraulic conductivity ranged from 1.52×10^{-4} centimeters per second (cm/sec) to 1.89×10^{-3} cm/sec, with an average hydraulic conductivity of 8.84×10^{-4} cm/sec.

Groundwater samples were collected from five existing monitoring wells (I-104, I-200, I-203 on the Boeing Isaacson property, and I-205 and I-206 on the Boeing Thompson property), and four piezometers (PZ-4, PZ-5, PZ-7, and PZ-8) in August and October 2000. Samples were analyzed for dissolved arsenic, TOC, total iron, and ferrous iron. Dissolved arsenic concentrations ranged from 2.7 ug/L at the background well (I-200) to 1,600 ug/L at well I-104 near the LDW (Appendix C-9). Concentrations of dissolved arsenic in the October sample were lower at wells I-104 and I-203 (Boeing Isaacson property) and significantly higher at well I-205 (on the Thompson property) than the corresponding samples collected in August.

A surface water sample was collected from a shoreline seep (Appendix C-9); the seep area emanated from within rock and rubble fill material beneath the wooden bulkhead forming the site boundary at an elevation of approximately -4 feet based on site survey data (ERM 2000d). The LDW stage at the time of sampling was approximately -7.5 feet, with a tidal stage of approximately 0.2 feet below mean low water. The seep flow was estimated at 5 gallons per minute from a generally horizontal area approximately 3 feet long. The seep sample was analyzed for dissolved arsenic, which was detected at a concentration of 7 ug/L (ERM 2000d).

A tidal survey was conducted. Water levels were recorded in site monitoring wells and piezometers from August 25 to 29, 2000 using data logging pressure transducers. Water levels were measured every 15 minutes in the wells, piezometers, and a stilling well in the Duwamish River (ERM 2000d). Tidal effects on groundwater elevations were noted across the entire study area. Minimal groundwater fluctuations were noted (approximately 0.5 feet) at the upgradient monitoring well, located approximately 1,330 feet from the LDW, but it did not exhibit the 12-hour cyclical tidal pattern observed at the other monitoring points. Significant tidal effects were attenuated approximately 400 feet from the LDW.

Groundwater flow across the site is generally west to west-southwest, with some flow deflection toward the axis of the former Slip 5. An average groundwater gradient of 0.004 was calculated.

A human health risk assessment was performed by Exponent, Inc. to derive a site-specific action level for arsenic in groundwater at the Boeing Isaacson property. The primary pathway of concern was identified as the consumption of fish and shellfish that might accumulate arsenic discharging to the LDW from groundwater; this pathway was used as the basis for a proposed groundwater action level. Proposed action levels of 8,330 ug/L and 1,109 ug/L were calculated for recreational and subsistence fishing scenarios based on the following assumptions:[14]

- target risk level of 10-5
- site-specific seafood consumption rates of 21 grams per day and 161 grams per day for recreational and subsistence anglers, respectively
- fractional intake of 0.2 to reflect a conservative estimate of the proportion of time that recreational anglers might collect seafood at this location
- proportion of total arsenic in seafood tissue that is in the form of inorganic arsenic is 1.4 percent
- bioconcentration factor of 1 (ERM 2000d).

Sump Removal and Soil Excavation (2006)

Boeing conducted an independent remedial action in 2006 to remove a below-grade, open-to-the-surface, 55-gallon drum that apparently was used as a sump along a former stormwater drainage line at this site (Boeing 2007; Landau 2007). The sump was discovered under a steel plate in the northeastern corner of the property during site reconnaissance activities in October 2006 (Landau 2007).

Two soil samples collected from the bottom of the sump in October 2006 indicated the presence of motor oil (2,200 to 2,700 mg/kg), PAHs (0.19 to 2.1 mg/kg), arsenic (60.1 to 72.4 mg/kg), cadmium (4.4 to 5.8 mg/kg), and lead (770 to 1,250 mg/kg) at concentrations above MTCA cleanup levels. Sample locations and results are presented in Appendix C-10. Based on these data, Boeing decided to remove the sump and excavate an additional 2 feet of soil surrounding the sump.

The remedial action included removal of the drum/sump along with approximately 8 cubic yards of soil for appropriate offsite disposal (Boeing 2007). Groundwater was not encountered to the maximum excavation depth of about 5 feet below grade (Boeing 2007). Three confirmation soil samples collected from the sump area excavation footprint indicated that analyte concentrations in soil at the limits of the excavation are below MTCA cleanup levels, except for arsenic. Arsenic concentrations ranged from 6.6 to 25.1 mg/kg in the confirmation samples; these concentrations are well below the 200 mg/kg remedial action goal established during previous remedial actions at Boeing Isaacson and only slightly higher than the MTCA Method A soil cleanup level for unrestricted land use of 20 mg/kg (Landau 2007). Boeing therefore concluded that no further action is warranted (Boeing 2007).

[14] Some of the assumptions used for this analysis are inconsistent with those selected for use in risk assessments planned or in progress at other sites in the LDW.

Groundwater Monitoring (2006 and 2007)

Groundwater monitoring was conducted during 2006 and 2007. Sampling of wells on the Boeing Thompson property is discussed in Section 4.2.4. In September 2007, samples from monitoring wells I-104, I-200, I-203, piezometer PZ-7, and a seep were analyzed for total dissolved arsenic. Arsenic concentrations in piezometer PZ-7 and the seep were 4 ug/L and 5 ug/L, respectively. The upgradient well I-200 contained 0.9 ug/L. Wells I-104 and I-203 (downgradient) contained 3,600 ug/L and 140 ug/L, respectively (Landau 2008b, as cited in McCrone 2008).

4.1.5 Potential for Sediment Recontamination

Past activities at the Boeing Isaacson property have resulted in soil and groundwater contamination.

Historical Contaminant Sources

The following potential contaminant sources associated with historical site use have been identified at the Boeing Isaacson property.

- **Fill Material**

  The fill placed in Slip 5 reportedly consisted of slag waste and soil; land reclamation along the LDW was primarily comprised of imported soil from offsite sources but may have also included slag, fire brick (which typically contained asbestos), and material dredged from the LDW (Dames & Moore 1983). Soil sampling conducted in 1983 identified high concentrations of metals in the fill material in the southern and western margins of the property.

- **Historical Releases from Mineralized-Cell Preserving Company**

  The Mineralized-Cell Preserving Company, which reportedly operated on the Boeing Isaacson site in the mid-1940s, used arsenic-containing solutions to treat and harden logs. Storage tanks were washed twice daily and sludge and remaining chemicals were reportedly drained onto the ground. This may have resulted in soil and groundwater contamination with arsenic and other metals such as copper and zinc.

- **Sump Near Former Location of Slip 5 Outfall**

  In the late 1950s or early 1960s, the Isaacson Steel Company installed a water/air wash system at the east end of Bay 12 (southeast of Bay 13 on Figure 9). The primary purpose of this system was to reduce exposure of employees to airborne paint. The system was comprised of a fan, scrubber, sump, several grates and underground tunnels through which airborne paint solvents and solids were drawn for scrubbing before discharge to the atmosphere (Wicks 1983). After its installation, water overflowing from the sump of this system discharged along the ground surface to an area south of the original end of the 48-inch storm drain (the eastern end of Slip 5). In 1967, after the storm sewer was extended to the LDW, sump overflow discharged into the storm drain until it was disconnected from the 48-inch line in 1971 (Wicks 1983).

- **Steam Cleaning Rack and Sump**
  A steam cleaning rack and sump were installed at the Isaacson Steel facility in 1970 or 1971 to eliminate drainage discharging from this area to the storm sewer (Figure 9). Cranes, forklifts, and other machinery were cleaned at this location; it was not used for process cleaning of steel products. The rack and sump consisted of a metal grate supported over a concrete-walled sump. One to two feet below the grate was a metal pan up to 12 inches deep, which was intended to capture sediment and large objects from the steam cleaning operations. The pan rested on a one-foot layer of sand with a one-foot layer of gravel below that. There was no seal beneath the gravel. Sludge that collected in and around the pan was removed when drainage became restricted, approximately every few years. Sludge was disposed by commercial disposal companies (Wicks 1983).

Ongoing Contaminant Sources

The Boeing Isaacson property is currently vacant. Portions of the site are used for parking for Boeing Thompson employees. No other potential pollutant sources associated with ongoing activities have been identified.

Potential Pathways to EAA-6 Sediments

The potential for sediment recontamination associated with this property is summarized by transport pathway below.

Stormwater Discharges

The Boeing Isaacson property is currently vacant, paved with concrete and/or asphalt, and does not have a stormwater drainage system. Seven catch basins located on this property connect to the Boeing Thompson Stormwater System (Figure 7), and may contribute contaminants to stormwater that discharges at the northern Boeing Thompson outfall. Six edge drains are located along the Boeing Isaacson shoreline; the function and configuration of these edge drains is unclear. Based on available information, it is not possible to determine whether stormwater discharge from Boeing Isaacson is a potential pathway of contaminants to EAA-6 sediments.

Groundwater Discharges

Historical activities at this property have resulted in contamination of soil and groundwater. Extensive remedial actions were conducted in 1984, 1988, and 1991 to remove and treat arsenic-contaminated soils. Concentrations of arsenic above 200 mg/kg remain on site along the northern portion of the excavation area, just to the south of the 48-inch storm drain line. Contaminants in soils may be transported to groundwater and subsequently to EAA-6.

Groundwater monitoring conducted between 1991 and 2007 has indicated the presence of arsenic at concentrations to 3,600 ug/L at the Boeing Isaacson property, significantly higher than the groundwater-to-sediment screening level of 370 ug/L[15] (Table 5), and groundwater at the site

[15] These screening levels were developed to assist in the identification of upland properties which may pose a potential risk of recontamination of sediments at Slip 4. The screening levels incorporate a number of conservative assumptions, including the absence of contaminant dilution and ample time for contaminant concentrations in soil,

flows toward the LDW. Arsenic has also been detected at elevated concentrations in groundwater at the adjacent Boeing Thompson property.

Sampling at Boeing Isaacson has focused on arsenic. However, investigations conducted in 1983 and 1988 identified lead (to 95 ug/L), silver (to 8.1 ug/L), and zinc (to 14,000 ug/L) at concentrations above groundwater-to-sediment screening levels[16]. Arsenic remediation activities may have resulted in reduction or elimination of the sources of these contaminants, however no information is available to support this conclusion.

Based on available information, the Boeing Isaacson property is considered a potential source of EAA-6 sediment recontamination via the groundwater discharge pathway.

Bank Erosion/Leaching

A wooden bulkhead is located along the boundary between the Boeing Isaacson property and the LDW. Rock and rubble fill material have been placed behind the bulkhead. Very little erodable soil material is present in this area. Bank erosion is believed to represent a less significant pathway for contaminants to the LDW than groundwater discharge. Given the documented soil contamination at this property, however, bank erosion can not be ruled out as a potential source of sediment recontamination.

Surface Runoff/Spills

The Boeing Isaacson property is paved and most of the site area is not connected to the Boeing Thompson stormwater system. Surface runoff to the LDW could potentially occur, however no industrial activities currently occur at the site. Therefore, there is a low potential for sediment recontamination associated with surface runoff and spills.

4.1.6 Data Gaps

Information needed to assess the potential for sediment recontamination associated with current or historical operations at the Boeing Isaacson property are listed below. Data gaps were identified for stormwater, groundwater, and bank erosion pathways to EAA-6 sediments.

Stormwater Discharges

- No information is available about the condition of the 48-inch county storm drain line that passes through the Boeing Isaacson property. Arsenic in soil and groundwater around this

sediment, and groundwater to achieve equilibrium. In addition, the screening levels do not address issues of contaminant mass flux from upland to sediments nor do they address the area or volume of sediment that might be affected by upland contaminants. Because of these assumptions and uncertainties, these screening levels are most appropriately used for one-sided comparisons. If contaminant concentrations in upland soil or groundwater are below these screening levels, then it's unlikely that they will lead to exceedance of marine sediment CSLs. However, upland concentrations that exceed these screening levels *may or may not* pose a threat to sediments; additional site-specific information must be considered in order to make such an assessment.

[16] Groundwater-to-sediment screening levels, based on CSLs in sediment, are 13 ug/L for lead, 1.5 ug/L for silver, and 76 ug/L for zinc (SAIC 2006).

pipe could be entering the storm drain line through gaps or holes in the piping, if any exist, and could subsequently be transported to the LDW and EAA-6 sediments.

- The purpose, function, and configuration of the edge drains along the Boeing Isaacson shoreline are unclear.
- No information is available regarding contaminant concentrations in catch basins that drain to the Boeing Thompson stormwater system (CB-10, CB-11, CB-12, CB15, CB-16, CB-34, and CB-35).
- No information is available on the source or status of the "outfall of unresolved origin" reportedly located near the Boeing Isaacson/Jorgensen Forge property boundary.

Groundwater Discharges

- Data on contaminant concentrations in subsurface soil near the former location of the Slip 5 outfall (Figure 9) is not available. These data are needed to evaluate the potential for historical releases of contaminants from the central KCIA storm drain system; if present, these may be transported to the LDW and EAA-6 sediments via groundwater.
- The extent of contaminated soil to the north of the 48-inch storm drain line is unknown. Contaminants in soil could enter the storm drain line through gaps or holes in the piping, and subsequently could be transported to the LDW.
- Arsenic has been detected in groundwater at the Isaacson property at concentrations up to 1,600 ug/L. Additional groundwater data are needed to determine whether residual historical contamination poses a risk of sediment recontamination via groundwater transport.
- In 1997, GeoEngineers conducted a statistical analysis of groundwater data at the Boeing Isaacson (and Thompson) properties; they calculated a 95 percent upper confidence limit and concluded that downgradient monitoring wells at the Boeing Isaacson site were in compliance with ambient water quality criteria. This analysis was not available for review at the time this Data Gaps report was prepared, and the groundwater data available for review were incomplete. Additional groundwater samples at the Boeing Isaacson property were collected in 2000 and 2007. Therefore, the validity of this conclusion needs to be evaluated.
- Soil and groundwater sampling at this property has focused on arsenic. However, investigations conducted in 1983 and 1988 identified lead (to 95 ug/L), silver (to 8.1 ug/L), and zinc (to 14,000 ug/L) at concentrations above groundwater-to-sediment screening levels[17]. Other metals may be associated with fill material used at the site. Arsenic remediation activities may have resulted in reduction or elimination of the sources of these contaminants, however no sampling has been conducted to determine whether this is the case.

Bank Erosion/Leaching

- No information is available regarding contaminant concentrations in bank soils.

[17] Groundwater-to-sediment screening levels based on CSLs are 13 ug/L for lead, 1.5 ug/L for silver, and 76 ug/L for zinc, as described in SAIC 2006.

4.2 Boeing Thompson

Facility Summary: Boeing Thompson	
Address	8701 East Marginal Way S. 8770 East Marginal Way S. 8811 East Marginal Way S.
Property Owner	The Boeing Company
Tax Parcel No.	000740-0033
Parcel Size	19.35 acres (842,675 sq.ft.)
Facility/Site ID	83767996 (Boeing Thompson) 4274402 (Boeing Thompson Site)
SIC Code	3721: Aircraft 3728: Aircraft Parts and Auxiliary Equipment
EPA ID No.	WAD980982912
NPDES Permit No.	SO3000148
UST/LUST ID No.	10410

The Boeing Thompson property is located along the east side of the LDW, at approximately RM 3.8 to 3.9, as measured from the southern tip of Harbor Island. The property is rectangular, approximately 19.35 acres in size, and is situated between the Duwamish River on the west and East Marginal Way S. on the east; the property is bordered on the south by the Kenworth Motor Corporation (Insurance Auto Auctions), also known as the former PACCAR site, and on the north by the Boeing Isaacson property (Figure 2). Land use in the vicinity of the Boeing Thompson property is industrial. Between 1984 and 2002, Boeing also owned a small (0.89-acre) rectangular parcel located across East Marginal Way S. (Tax Parcel No. 0001600019), which was considered part of the Boeing Thompson facility. This parcel was sold to the King County Museum of Flight Authority in April 2002, and was subsequently sold to King County in December 2003.

The Boeing Thompson property is listed in documents, permits, and databases under a variety of addresses, including 8701 East Marginal Way S., 8770 East Marginal Way S., and 8811 East Marginal Way S., in Tukwila, Washington.

Ecology's Facility/Site Database lists this property as Boeing Thompson Site (FS ID No. 4274402) at 8770 East Marginal Way S., as Boeing Isaacson Thompson (FS ID No. 2218) at 8541 East Marginal Way S., and as Boeing Thompson (FS ID No. 83767996) at 8701 East Marginal Way S. EPA's Envirofacts database lists this property at 8701 East Marginal Way S., under the name Boeing Military Airplanes Thompson Site. Boeing's Stormwater Pollution Prevention Plan (SWPPP) for this property lists the Thompson site address as 7755 East Marginal Way S. (which is the address for Boeing Plant 2). The plan also references the physical address of the Thompson site as 8701 East Marginal Way S.

4.2.1 Physical Setting

The Boeing Thompson property is located in an area of extensive fill placed as part of the re-channelization of the LDW, as described in Section 2.1. Boreholes drilled at this property found up to 1.5 feet of sand and gravel fill beneath the pavement; fill material consisting of silty sand to sandy gravel was encountered to depths ranging from 6.5 to 17.5 feet below ground surface. Grain size distribution in the fill material exhibited significant variability both laterally and vertically. The boreholes with the thickest fill layers were encountered within the area of the former Slip 5 (ERM 2000d). Fill materials encountered in these borings include bricks and slag material. Native soils below the fill consist primarily of fine sand and silty fine sand with scattered silt intervals. Wood fragments were commonly observed in the native soils, and organic sediments and peat were observed at some locations (ERM 2000d).

The topography is relatively flat, sloping less than one half of one percent toward the LDW, and the property is almost entirely paved (Boeing 2001). Groundwater generally flows to the west toward the LDW, and is affected by a regular pattern of diurnal fluctuations over most of the property due to tidal influences. Localized effects of fill heterogeneity are observed, especially near the LDW shoreline.

Groundwater elevation measurements in 1996 and 2000 indicated that groundwater may also flow from the former Slip 5 area to the south-southwest near the Boeing Thompson shoreline (i.e., toward the location of monitoring well I-206 and possibly the Kenworth Truck/IAA property to the south (see Appendix C-8, Figures 10 and 11); however, the accuracy of this interpretation is limited by the number and location of existing monitoring wells.

Significant tidal effects on groundwater have been observed in a 2000 study (ERM 2000d). Tidal efficiencies were generally greatest near the LDW, but efficiency values were extremely variable (0.93 to 37.84 percent). The tidal efficiency of 0.93 percent at well I-205 (shown on Figure 10) was believed to be an anomaly, due to possible equipment malfunction, aquifer heterogeneity, or seawall effects. Recorded groundwater elevation changes at this well exhibited patterns inconsistent with data from the other wells and piezometers in the vicinity.

4.2.2 Current Operations

As of December 31, 2007, industrial/manufacturing operations have reportedly been relocated from the Boeing Thompson site to other Boeing facilities, primarily the aircraft final assembly locations in Renton and Everett. It is not clear what activities are currently being conducted at the property. The following description of activities is based on the 2001 SWPPP (Boeing 2001), which is the most recent available description of operations at the Boeing Thompson property.

The property, operated by the Boeing Commercial Airplane Group, includes nine buildings where industrial operations and associated utilities and logistics are located. The majority of the area is composed of outdoor parking areas, storage areas and transportation lanes. Industrial activity consists of assembly of jet engines for Boeing commercial aircraft. Engines are brought to the facility directly from engine manufacturers by truck and are fitted with external hardware which is required for connection with electrical, mechanical, and fuel systems on Boeing commercial aircraft. The engines are then mounted on struts before being shipped offsite to the

Renton and Everett airplane assembly plants. Activities conducted at the site include testing, machining, and painting of engine sub-assemblies; these occur within Building 14-01 (Figure 9).

The storm drain system at the Boeing Thompson property consists of 81 catch basins, 23 storm drain manholes, and two oil-water separators. The structures drain through two active private outfalls to the Duwamish River (Figure 7). These outfalls are partially or entirely submerged during high tides. The 48-inch King County storm drain line receives drainage from one catch basin on the Thompson property.

Potential sources of stormwater pollution include:

- Outside materials and wastes stored in tanks, which includes a 550-gallon aboveground diesel storage tank on the western side of Building 14-02, a 240-gallon aboveground diesel storage tank on the northern side of Building 14-13, one 5,000-gallon aboveground storage tank on the western side of Building 14-01 for aqueous degreaser fluids that has never been used, and one 20,000-gallon underground diesel/heating fuel storage tank on the western side of Building 14-02 that was closed in place.
- Outside material stored in containers in the Material Storage Sheds near Building 14-03
- Outside waste stored in containers at the Waste Storage Area near Building 14-03.

The facility employs a variety of Best Management Practices (BMPs) to minimize the potential for releases of contaminants to the environment. Manufacturing occurs inside buildings. Outside material storage areas are covered and provided with spill containment, and are constructed to reduce the influx of windborne precipitation. Storage and maintenance of materials, wastes, and tanks is conducted in accordance with applicable regulations. A spill prevention, control and countermeasures (SPCC) plan, a hazardous waste management plan, and a hazardous materials management plan have been developed and implemented for the facility (Boeing 2001).

Wastes that have been stored onsite are listed below (Boeing 2001):

Heavy duty alkaline cleaner	Solvent/solvent product
Rags contaminated with hydraulic fluids, oils, petroleum distillates, and tributyl phosphate	Parts cleaner: tetrachloroethylene, methylene chloride, petroleum distillate
Rags contaminated with solvents/solvent products and sealants with lead	Absorbent materials and debris contaminated with hydrofluoric acid
Containers with paints and adhesives	Sludge contaminated with arsenic and PCBs
Hydraulic fluids and oils, petroleum solvents	Alkaline cleaners and wetting agent
Containers of sealant, resins, silica	Debris with cured paints and primers
Containers with residual sealant	Dust and debris from structural steel cleanup

Ecology's UST database lists two active underground tanks at this location: a used oil/waste oil tank and a heating fuel tank. In addition, a leaded gasoline tanks is listed as having been removed. According to Boeing's records, there are currently no active USTs at this property, although there were three USTs historically. One 1,000-gallon leaded gasoline UST was removed from the northwestern corner of Building 14-02 in January of 1990, one 20,000-gallon diesel/heating fuel UST was closed in place on the western side of Building 14-02 in December

2003, and one 4,000-gallon holding tank associated with an oil/water separator was removed from the eastern side of Building 14-03 in 1995 (McCrone 2008).

Several catch basins that drain the paved shoulder on the west side of East Marginal Way S. flow into the Boeing Thompson storm drain system near the main gate. This flow combines with other property runoff, passes through an oil-water separator, then discharges to the LDW at an outfall on the northern portion of the Boeing Thompson shoreline (Boeing 2001). There are no identified areas where stormwater runs onto the Boeing Thompson property from offsite.

Non-stormwater discharges from the Boeing Thompson property result from fire hydrant flushing, water line flushing, and irrigation drainage; these are not associated with industrial discharges and are not exposed to contaminants before discharge.

Merrill Creek Holdings, LLC, the owner of the property located immediately south of Boeing Thompson (the former Kenworth Truck Motor Corporation/IAA), has identified two drainage pipes that discharge to their property from the south wall of the Boeing Thompson property (O'Brien 2008). Boeing reports that one of these drainage pipes is a 12-inch perforated culvert pipe that drains groundwater and releases pressure from behind the concrete wall. This culvert pipe has no tie-ins with the Boeing Thompson storm drain system. The second pipe is identified as a foundation drain. Boeing is currently preparing a memorandum to document information about these two pipes. The two drainage pipes have a potential to discharge at the surface onto the Kenworth Truck/IAA property (O'Brien 2008).

The facility operates under an industrial stormwater general permit, No. SO3000148, which was originally issued on December 22, 1993 and has been extended to May 2008. A stormwater compliance inspection was conducted by Ecology on April 6, 2007, which indicated that the benchmark level for total zinc had been exceeded for the preceding three quarters, and that a Level 1 response was required (Ecology 2007e).

Boeing Thompson operates under EPA ID No. WAD980982912. The most recent hazardous waste compliance inspection was conducted by Ecology on March 2, 2006, and no compliance issues were identified (Ecology 2006e). The facility does not have an air operating permit or a King County waste discharge permit or authorization.

4.2.3 Historical Operations

In December 1917, Bissell Lumber Company applied to the U.S. Corps of Engineers for permission to dredge, construct a log chute, and install pilings in Slip 5. The permit was completed in March 1931. In 1929, according to a review of Sanborn Fire Insurance Maps (Ecology, No Date), the Bissell Lumber Company operated a sawmill on the south bank of Slip 5, which contained various conveyors, lumber transfer areas, and planning areas.

At that time, the Prestolite Company was located on East Marginal Way across from the Bissell Lumber Company. Structures included a carbide drum shed, a filling shed, a compressor and gas scrubber, offices, and a warehouse (Ecology, No Date). The Fisher Body Corporation's veneer factory was planned for construction directly south of the Bissell Lumber Company. Aerial

photos from the 1930s indicate the presence of log booms on the southern edge of Slip 5 and log rafts in the LDW along the property line extending to the south (Appendix B).

The Bissell Lumber Company discontinued operations in mid-1945 (Foster 1945). At this time, the facility had expanded slightly beyond its 1929 size (Ecology, No Date). A large fuel tank was located at the southern edge of the property. The location of the Prestolite Company was now occupied by Linde Air Products Company, with very little change in onsite structures and operations. An airplane repair and painting facility was located directly north of the Linde site. The planned location for the Fisher Body Corporation veneer factory was occupied by Kenworth Motor Truck Corporation's assembly plant; operations included paint spraying, carpentry, and parts storage.

In May 1952, the parcel was purchased by the Seattle Trust & Savings Bank (as Trustee). In September 1954, Puget Sound Bridge & Dredging Company requested a permit from the Corps of Engineers on behalf of Charles W. Thompson, to build a three tier timber bulkhead on the south side of Slip 5 to retain fill material dredged from the LDW. The permit was granted and the bulkhead was completed in January 1955. Aerial photos indicate that all buildings on the property were removed by 1956. In October 1956, the parcel was purchased by Parr Seattle Company; it was subsequently purchased by The Boeing Airplane Company in January 1957. Consolidated Freightways, Inc. had two leases on the property beginning in 1955; the end date of those leases is unknown.

Until 1981, the Boeing Thompson facility (Building 14-01) was used for plaster of paris mock-up and assembly of aircraft engines. In September 1981, the facility was expanded to include the 757 Fatigue Testing Facility (Ecology 1982e).

Prior to 1984, the Thompson site had a Metro Waste Discharge permit for a plating operation that was discontinued in 1984 (METRO 1990). Boeing submitted an application for a waste discharge permit in March 1990 (METRO 1990), however no industrial discharges were identified.

In September 1988, Boeing submitted a revised Notification of Dangerous Waste Activities (EPA ID No. WAD980982912) for the Thompson facility. The facility generated the following hazardous wastes in 1987 (Boeing 1988d):

Waste Description	**Dangerous Waste Number**	**Waste Quantity (pounds)**
Gasoline/water mixture	D001	1,336
Copper brush plating rinse water – contains copper sulfate, sulfuric acid, hydrochloric acid, pH<2	D002	454,198
Antifreeze – ethylene glycol and water	WT02	10,560
Paint booth wash water and sludge	WT02	245,073
Copper brush plating rinse water – 2<pH<12	WT02	80,578
Paint booth wash water and sludge, chrome contaminated	WT02, D007	209,418
Paint (latex, acrylic) contaminated cans, debris	WT02	6,016

Waste Description	Dangerous Waste Number	Waste Quantity (pounds)
Acid contaminated solids	WT02	170
Asbestos >10,000 ppm	WC01	3,190
Cans – Ignitable paint/adhesive/sealant/resin	D001	1,794
Concrete patch/asphalt patch	WT02	1,001
Epoxy resin/hardener	WT02	1,474
Arsenic contaminated dirt/debris	WT02, D004	1,084
Lab pack – flammable	D001, WL02	117
Lab pack – ORM-E	WL02	75
Lacquer thinner	D001	15
Methyl ethyl ketone	F005	381
Methyl ethyl ketone/paint mixture	F005	761
Mixed flammable solvents	D001	100
Oil contaminated rags/debris	WT02	338
Solvent contaminated rags/debris	WT02	21,643
Resin/adhesive	D001, WT02	459
Resin/resin kits	WT02	1,474
Sealant/sealant tubes	WT02	10,091
Small containers – paint/resin/sealant/adhesive	WT02, D006, D007, D008	209
Solvents/paint mixture	F003, F005, D007, D008	1,051

Approximately 79,604 pounds of products containing hazardous substances were used at the facility in 1990 (Boeing 1992c), including methyl ethyl ketone, toluene, copper sulfate, Jet Clean, Oxsolve, sealant (containing metals), ammonia, Freon, and paint. Approximately 1.7 million pounds of hazardous waste was generated at the facility in 1990.

EPA's Toxics Release Inventory (TRI) database lists the following releases from this facility in 1990, the most recent year for which data were available:

- Methyl ethyl ketone: 5,268 pounds fugitive air emissions, 750 pounds stack emissions, and 4,758 pounds off-site land disposal
- Toluene: 5,503 pounds fugitive air emissions, 7,768 pounds stack emissions, and 2,913 pounds off-site land disposal

In the early 1990s, the Thompson facility supported the B-2 bomber program; the facility was responsible for major assembly of the Out Board Section and Aft Center Section of the aircraft (Boeing 1992c). The operations included in major assembly included final priming and painting of parts; copper plating of parts for lightning protection; sealing and bonding to form section structures; and fuel systems testing. Hazardous substance use decreased to 35,677 pounds in 1993; hazardous waste generation decreased to 276,209 pounds in 1993 (Boeing 1994c) and to 12,250 pounds in 2007.

A letter to Boeing from Burlington Environmental in the Boeing Thompson file, dated May 21 1991, referred to Boeing's request for disposal of 25 pounds of unused Dearborn 711 product, which is designated as F027 (dioxin-containing waste) by EPA (Burlington Environmental 1991). The letter indicated that no incinerator permitted to destroy F027 wastes could be identified, and therefore the material could not be accepted for disposal. Ecology agreed with Boeing's plan to hold the material in a controlled product storage area at the Thompson site until a suitable reuse/treatment/disposal option could be found (Ecology 1992). Boeing records indicate that there was a shipment of F027 waste off-site in 1993; although details on the manifest differ from those cited above, it is likely that this was the same material referred to in the May 21, 1991 letter (McCrone 2008).

In 1993, B-2 bomber production was discontinued and the Boeing Defense and Space Group operations described above were discontinued. On May 1, 1994, the Boeing Commercial Airplane Group, Renton Division, assumed responsibility for the Thompson facility from the Boeing Defense and Space Group (Boeing 1994a).The facility was cleaned up and refurbished for occupancy by the Propulsion Systems Division (Boeing 1994c).

Ecology's LUST database lists one tank at this facility. Releases from a leaded gasoline tank (Release ID No. 2557) were documented; cleanup began in June 1995 and the tank was reported cleaned up in June 2000.

A Dangerous Waste compliance inspection was conducted by Ecology on August 5, 1997 (Ecology 1997). The facility was identified as a large quantity generator, with approximately 1,100 workers. Approximately 150 workers are engaged in engine systems assembly at the facility (SIC Code 3721). Processes generating waste were identified as application of sealant; cleaning; painting, tube-making; and small Alodine[18] coating (Ecology 1997). Waste streams include solvents, sealants, waste paint, absorbents, and paint filters. No issues of concern were identified.

Spills

August 1992**.** A spill was identified in August 1992 from the 1,000-gallon fiberglass oil collection/overflow tank associated with the three chamber oil/water separator, which was used during testing of Boeing 767 aircraft hydraulic systems (Boeing 1992b). The separator system and the overflow tank were supposed to be serviced/emptied on a regular basis. However, this system became inactive in 1983 and was removed from the servicing schedule. In 1992, Boeing personnel found the overflow tank overfilled and pumped it out; because the tank was overfilled, it is possible that hydraulic oil and/or surface oils from automobile traffic could have leaked into surrounding soils and groundwater. Boeing proposed and conducted an inspection of the suspected release as described in Section 4.2.5 below, and added the oil/water separator and spill containment tank to their Planned Maintenance Inspection program (Boeing 1992b).

June 1997**.** On June 18, 1997, Boeing discovered leakage from a cooling tower located on the roof of Building 14-14 at the Boeing Thompson site. The leak was estimated at about ½-gallon per minute. Water leaking from the cooling tower contained both a biocide and a corrosion

[18] Contains chromic acid, potassium ferricyanide, and hydrofluoric acid (

inhibitor. The biocide was Nalco 2818, which contained sodium hypochlorite. The corrosion inhibitor was Nalco 2826, which contained organophosphonate, polyglycol, and sodium polytriazole (Boeing 1997a). Boeing personnel stopped the flow of chemicals to the cooling tower as a short-term solution. By June 20, Boeing personnel had repaired the leak in the cooling tower so that discharge into the roof drains (and storm drain system) had ceased. This was confirmed during an inspection of the cooling tower on June 30, 1997 (Boeing 1997b).

October 1999**.** A spill of less than 70 gallons of hydraulic oil from a forklift in Building 14-01 was reported in October 1999 (Boeing 2001). None of the material was discharged to the LDW.

4.2.4 Historical Stormwater Discharges

Boeing submitted an application for an NPDES permit on March 18, 1981 (Boeing 1981a, 1981b, Ecology 1981c). According to the application, all industrial effluent discharged to the LDW from the Thompson site previously originated in the Building 14-02 boiler house. The effluent included two separate flows: air compressor blowdown and non-contact cooling water. The cooling water was discharged with no treatment, and the compressor blowdown was discharged to a small oil/water separator (Boeing 1981b). Boeing proposed to replace the existing separator with a more sophisticated system to accommodate fatigue testing of Boeing 757 aircraft frames on the west side of Building 14-01. The proposed system would treat the air compressor blowdown and the runoff water from the Fatigue Test pads due to the potential presence of oil. The proposed system incorporated a flow control collection basin, a three-cell oil/water separator, an emergency shut-off valve, and an overflow tank (Boeing 1981b). Under normal operating conditions, the runoff water would be treated by the separator and discharged to the storm drain system. In the case of an upset condition, the emergency valve would be closed and the oil and any contaminated water would be hauled away by a licensed disposal contractor (Boeing 1981b).

The following industrial waste streams were listed in the permit application (Boeing 1981b):

Waste Description	Source	Treatment	Disposal Method
Existing Discharges:			
Plaster rinse water	Engine mock-up, Bldg. 14-01	None	Metro sewer system
Leak detection water	Tube pressure test tank, Bldg. 14-01	None	Metro sewer system
Cooling water with low concentrations of nitrates	Cooling tower, Bldg. 14-01 roof	None	Metro sewer system
Cooling water	Booster pumps, Bldg. 14-01	None	Metro sewer system
Non-contact cooling water	Air compressors, Bldg. 14-02	None	Discharge to surface waters
Blowdown water	Boiler, Bldg. 14-02	None	Metro sewer system
Air compressor blowdown, possible oil	Bldg. 14-02	Oil/water separator	Water discharged to storm sewer; oil hauled away by disposal contractor
Proposed Discharges:			
Cooling water with low concentrations of nitrates	Cooling towers adjacent to Bldg. 14-03	None	Metro sewer system

Waste Description	Source	Treatment	Disposal Method
Washdown water	Test pad, Bldg. 14-03	Oil/water separator	Water discharged to storm sewer, oil hauled away by disposal contractor

A site inspection conducted by Ecology on May 20, 1981 confirmed the information cited in the permit application. An existing stormwater discharge to the LDW of air compressor blowdown (via an oil/water separator) and non-contact air compressor cooling water was identified (Ecology 1981b). The temperature of the cooling water was maintained at about 70°F. The proposed Fatigue Test Pad would add a new discharge; wash water from the test pad would be discharged via a new oil/water separator. The new oil/water separator would also be connected to an overflow tank to contain any emergency spills of hydraulic oil from the test pads (Ecology 1981b, 1981d).

Although issuance of the permit was delayed due to an administrative backlog at Ecology, discharge of 22,000 gpd of air compressor blowdown and washdown water via an oil/water separator, and 16,000 gpd of non-contact cooling water (a total discharge of 38,000 gpd) was approved beginning September 18, 1981 (Ecology 1981c; Boeing 1982). The NPDES Waste Discharge Permit (WA-003065-1[I]) was issued on September 14, 1982 (Ecology 1982f).

The expanded facility replaced the existing oil/water separator with a large three-cell oil/water separator with an emergency shut-off valve and a holding tank. The new separator treated air compressor blowdown, runoff and washdown water from the fatigue test pads, and condensed moisture from the heating system (Ecology 1982e, 1984b). The wastewater from the oil/water separator emptied into a storm drain tributary to the LDW. A September 14, 1982 site inspection indicated that the operation “looks clean” (Ecology 1984b).

No fueling or de-fueling operations took place on the site; only hydraulic oil filling operations were conducted on the test pads (Ecology 1982e). In case of an oil spill, the emergency valve was closed to prevent any oil from entering the storm sewer. The oil/water separator and holding tank were used to contain the spilled oil, which was then properly disposed of (Ecology 1982e).

In April 1985, Boeing requested a revision to the NPDES permit to modify the range of acceptable pH values from “6.5 to 8.5” to “6.0 to 9.0” because rain and other natural waters often approach the lower limit (6.5) or even fall outside of the lower limit (Boeing 1985a).

Also in April 1985, Boeing applied for a stormwater discharge permit for the Boeing Thompson facility (Boeing 1985b). The discharge was described as a Group I stormwater point source that drains primarily paved parking and industrial areas and rooftops. Most industrial activities were conducted inside buildings. The area drained was listed as 14 acres, of which about 30 percent was rooftop and the remainder paved. Monthly monitoring between 1982 and 1985 for oil and grease indicated that the long-term average concentration was less than 10 mg/kg. Oil & grease and total organic carbon were attributed to the vehicular traffic in the area (Boeing 1985b).

The NPDES waste discharge permit expired on September 14, 1987, and Boeing did not submit a new application. In November 1987, Ecology conducted an NPDES Compliance Inspection at the Boeing Thompson site (Ecology 1987). The inspection report indicated that the two main

discharges listed in the NPDES permit had ceased. The non-contact cooling water was being cooled and recirculated, rather than discharged. The floor drains and air compressor blowdown were being discharged to the Metro sewer system. The oil/water separator, which under the original operation was used to remove oil from the Fatigue Test Pad and air compressor blowdown discharges, was no longer essential. The separator was still active and was being used intermittently as an emergency unit to remove oil from uncontrollable oil spills.

The inspector noted that no record of Discharge Monitoring Reports (DMRs) was found (Ecology 1987). Monitoring of the effluent had been discontinued without informing Ecology. In addition, drums containing hazardous substances were being stored without containment. The facility was deemed to be in a noncompliance status. The inspection report also noted that there had been pH violations in the previous 12 months.

Boeing reapplied for the NPDES Permit (No. WA-003065-1(I)) on March 4, 1988. Although discharges and operations referenced in the permit had ceased, Boeing wanted to maintain the permit in an active status. Discharge of cooling water from the air compressors had been eliminated; the only remaining discharges were rainwater runoff (Boeing 1988b). Oil/water separators had been installed in the two main storm water discharges from the Boeing Thompson site; these were designed to the capacity required to handle 1100 gpm, equivalent to a 25-year storm (Boeing 1988a, 1988b). In August 1988, Boeing requested cancellation of this permit because the facility has no discharges other than storm water runoff (Boeing 1988c). The permit was cancelled by Ecology on February 24, 1989, with the stipulation that Boeing apply for a NPDES industrial stormwater general permit for this facility (Ecology 1989a). The facility is currently covered under industrial stormwater general permit No. SO3000148D.

4.2.5 Environmental Investigations and Cleanups

Investigation of Potential Release from Oil Collection Tanks (1992)

An overflow tank associated with an oil/water separator was found to have been overfilled in August 1992, and could have released hydraulic oil and/or surface oils from automobile traffic to surrounding soils and groundwater (Boeing 1992b). An investigation was conducted, which included drilling two soil borings adjacent to the overflow tank and installation of a groundwater monitoring well in one of the borings (Boeing 1992b). Two samples were to be collected and analyzed for total petroleum hydrocarbons.

Supplemental Investigation (1996)

GeoEngineers evaluated soil and groundwater quality near well I-206s in April 1996. Six strataprobe borings were advanced in close proximity to well I-206s as shown in Appendix C-8, Figure 11. Each probe was pushed to a depth of 20 feet bgs. Soil samples were collected from the probes on 1 or 3 foot sampling depth intervals. Sixty-three soil samples and six groundwater samples were analyzed for arsenic (GeoEngineers 1996, as cited in ERM 2000a).

The probes generally intercepted fill below the asphalt to depths of 5 or 6 feet bgs, consisting of 1 foot of sandy gravel immediately beneath the asphalt underlain by reddish brown sand with gravel. Underlying the fill was dark-gray to black, fine to medium sand with discontinuous

lenses of silt and silty sand. Groundwater was encountered in the probes at depths of 14 to 14.5 feet bgs. Based on water level measurements presented in the GeoEngineers report, groundwater in the area of I-206s was inferred to flow west to southwest, toward the water tank and potentially the Kenworth Motor Corporation property to the south.

Arsenic was detected in soil samples at concentrations ranging from 0.7 to 43 mg/kg. The dissolved concentrations of arsenic in groundwater ranged from 66 to 660 ug/L.

GeoEngineers was unable to determine the source of arsenic in groundwater at well I-206s based on analytical results and depth to groundwater. It was also GeoEngineers' opinion that potential sources for arsenic contamination detected in well I-206s may be attributable to other source material in the fill, and the presence of arsenic-treated pilings associated with the former Slip 5. In addition, GeoEngineers concluded that migration of arsenic-contaminated groundwater from the Boeing Isaacson soil remediation area toward well I-206s was not occurring.

Groundwater Sampling (2006/2007)

As part of the wet and dry season groundwater monitoring conducted by Paccar, Inc. at the former Kenworth Truck Tukwila site located immediately south of the Boeing Thompson property, two Thompson groundwater monitoring wells (I-205 and I-206) were sampled in March 2006 (wet season) and August 2006 (dry season). These wells had previously been sampled as part of groundwater monitoring at the Boeing Isaacson facility, described in Section 4.1.4 above.

Results indicated that most metals were below laboratory detection limits with the exception of arsenic. Wet season dissolved arsenic concentrations were 13.3 and 213. ug/L in wells I-205 and I-206, respectively. Dry season arsenic concentrations were similar at 9.8 and 235 ug/L (Ecology 2007d).

A groundwater sample collected at I-206 in September 2007 contained 720 ug/L dissolved arsenic (Landau 2008b, as cited in McCrone 2008).

4.2.6 Potential for Sediment Recontamination

Past activities at Boeing Thompson and adjacent properties have resulted in groundwater contamination.

Historical Contaminant Sources

The following potential contaminant sources associated with historical use have been identified at the Boeing Thompson property.

- **Soil Contamination at Boeing Isaacson**
  Soil and groundwater at Boeing Isaacson are contaminated with arsenic (see Section 3.2). Although extensive soil remediation has been conducted, arsenic-contaminated soils remain at the site. Groundwater flow toward the former Slip 5 and toward the Boeing Thompson property has been documented (ERM 2000d).

- **Arsenic-Treated Pilings Associated with the Former Slip 5**

  The Bissell Lumber Company constructed various structures within what was then Slip 5, including pilings and a log chute. It has been suggested that the pilings may have been treated with arsenic, and could therefore be a source of arsenic contamination in the Slip 5 area.

- **Fill Material**

  The fill placed in Slip 5 reportedly consisted of slag waste and soil; land reclamation along the LDW was primarily comprised of imported soil from offsite sources but may have also included slag, fire brick (which typically contained asbestos), and material dredged from the LDW (Dames & Moore 1983). Soil sampling conducted in 1983 identified high concentrations of metals in the fill material in the southern and western margins of the Boeing Isaacson property to the north (Dames & Moore 1983).

Ongoing Contaminant Sources

Potential sources of contaminants associated with current operations include: storage of materials in aboveground and underground tanks; outside material stored in containers; and outside waste stored in containers. The facility employs a variety of BMPs to minimize the potential for releases to the environment, and has implemented a SPCC plan, a hazardous waste management plan, and a hazardous materials management plan.

Current operations do not appear to be a significant source of potential recontamination of EAA-6 sediments, however no stormwater solids sampling has been conducted at this facility.

Potential Pathways to EAA-6 Sediments

The potential for sediment recontamination associated with this property is summarized by transport pathway below.

<u>Stormwater Discharges</u>

The stormwater system at Boeing Thompson discharges at two location, along the northern and southern shoreline. Contaminants in stormwater or storm drain solids may be discharged to the LDW through these outfalls. The facility operates under an industrial stormwater general permit. No sampling of stormwater solids has been conducted. The most recent stormwater compliance inspection conducted in April 2007 indicated that the benchmark level for zinc had been exceeded for three quarters, and that a Level 1 response was required. Therefore stormwater discharge is considered a potential sediment recontamination pathway at Boeing Thompson.

<u>Groundwater Discharges</u>

Arsenic is present at elevated concentrations in two groundwater monitoring wells (I-205 and I-206) at this property. This represents a potential source of contaminants to EAA-6 sediments.

Two drainage pipes extend from Boeing Thompson to the Kenworth Truck/Insurance Auto Auctions (IAA) property located immediately to the south. One of these drainage pipes is a 12-

inch perforated culvert pipe that drains groundwater and releases pressure from behind the concrete wall. This culvert pipe has no tie-ins with the Boeing Thompson stormwater system. The second pipe is identified as a foundation drain. Boeing is currently preparing a memorandum to document information about these two pipes. The two drainage pipes have a potential to discharge at the surface onto the Kenworth Truck/IAA property. Contaminants in groundwater at the Boeing Thompson site may therefore be transported to the adjacent property and ultimately to the LDW.

A storm drain line located on the northern edge of the former Kenworth Truck/IAA property, just south of the Thompson property line, drains to the LDW via a pumped oil/water separator located in the northwest corner of the former Kenworth Truck/IAA property. Due to the presence of a hole in this storm drain line and the continued operation of the pump, it is possible that arsenic-contaminated groundwater from the Thompson property may have moved offsite to the south.[19] Groundwater contours reportedly indicate a depression in this area. The pipe was slip-lined in 2006. This situation represents a potential source of LDW sediment recontamination.

Bank Erosion/Leaching

A wooden bulkhead is located along the boundary between the Boeing Isaacson property and the LDW. Rock and rubble fill material have been placed behind the bulkhead. Very little erodable soil material is present in this area. Bank erosion is believed to represent a less significant pathway for contaminants to the LDW than groundwater discharge. Given the lack of information on soil contamination at this property, however, bank erosion can not be ruled out as a potential source of sediment recontamination.

Surface Runoff/Spills

Surface drainage at the Boeing Thompson property is captured by the stormwater system, and the facility operates under a SWPPP and Best Management Practices (BMPs) to minimize the potential for environmental releases from spills. Therefore, there is a low potential for sediment recontamination associated with surface runoff and spills.

4.2.7 Data Gaps

Information needed to assess the potential for sediment recontamination associated with current or historical operations at the Boeing Thompson property are listed below. Data gaps were identified for the stormwater, groundwater, and bank erosion pathways to EAA-6 sediments.

General

- As of December 31, 2007, industrial/manufacturing activities have reportedly been relocated from the Boeing Thompson property to other facilities. No information was available regarding current activities at this site. An inspection is needed to evaluate the potential that current operations may contribute to recontamination of EAA-6 sediments.

[19] Personal communication with Rick Thomas, Washington Department of Ecology, February 11, 2008.

Stormwater Discharges

- Although stormwater from this facility discharges to the LDW at two locations, no sampling of stormwater solids has been conducted and therefore it is not possible to determine whether stormwater from current operations at Boeing Thompson is a source of contaminants to EAA-6 sediments.
- A stormwater compliance inspection was conducted by Ecology on April 6, 2007, which indicated that the benchmark level for total zinc had been exceeded for the preceding three quarters, and that a Level 1 response was required (Ecology 2007e). Follow-up should be conducted to ensure that this issue has been corrected.

Groundwater Discharges

- Arsenic is present at elevated concentrations in two groundwater monitoring wells at this property. Although these wells have been sampled several times since 1988, a comprehensive soil and groundwater investigation has not been conducted at this property. Information on groundwater concentrations of arsenic and other contaminants of concern from throughout the site is needed to determine the sources of arsenic and to evaluate potential contaminant transport pathways to LDW sediment.
- Boeing is currently preparing a memorandum to document their findings associated with the two drainage pipes that may be discharging to the Kenworth Motor/IAA property. A review of this memorandum may provide additional information needed to assess the potential for sediment recontamination.
- The tidal efficiency observed in well I-205 measured during a tidal study in 2000 appeared to be anomalous (ERM 2000d). Recorded groundwater elevation changes at this well exhibited patterns inconsistent with data from other wells and piezometers in the vicinity. The reason for these anomalous results is unknown.
- The source of arsenic in groundwater as measured at wells I-205 and I-206 is not known. GeoEngineers (1996, as cited in ERM 2000a) concluded that the Boeing Isaacson was not the source of arsenic in these wells. However, the GeoEngineers report was not available in the files reviewed during preparation of this Data Gaps report, and this conclusion could not be verified.
- Although monitoring wells I-205 and I-206 have been sampled numerous times, little information on arsenic concentrations in groundwater in other areas of the property is available; this makes identification of the arsenic source difficult.
- Soil samples were collected and analyzed for arsenic at the Boeing Thompson property in 1996. No information on other contaminants that may be present in soils is available. Since contaminants in fill material are considered a potential source, additional soil data for arsenic and other chemicals is needed to evaluate the potential for recontamination of EAA-6 sediments.

Bank Erosion/Leaching

- No information is available regarding contaminant concentrations in bank soils.

5.0 Potential for Sediment Recontamination from Upland Properties

Stormwater from the central portion of KCIA drains to the Slip 5 outfall at EAA-6. Much of central KCIA is leased to a variety of airport tenants; these are listed in Table 6 and their locations are shown on Figure 11.

5.1 King County International Airport

KCIA is a general aviation airport owned and operated by King County as a public utility. The site covers about 615 acres, of which 435 acres are impervious surface covered by buildings and paved areas. The remaining 180 acres consist of grass and landscape areas (King County 2003).

Stormwater from approximately 237 acres of the central portion of KCIA drains to the Slip 5 storm drain outfall. The following tax parcels are located wholly or partially within this drainage basin:

Parcel No.	Taxpayer	Address	Parcel Size
0001600019	King County / Property Services	None Listed	0.89 acres
0001600049	King County	8700 East Marginal Way S.	9.09 acres
3324049011	King County	None Listed	0.61 acres
0007400032	King County	None Listed	8.13 acres
5422600160	King County	None Listed	2.43 acres
2824049007	King County	6771 Perimeter Rd. S.	564.77 acres

Parcel No. 0001600019 was formerly owned by Boeing; it was sold to the Museum of Flight Authority on April 9, 2002, and was subsequently sold to King County on December 19, 2003. Boeing had purchased the parcel from the Isaacson Corporation on March 14, 1984.

5.1.1 Current Operations

KCIA is a general aviation airport, serving industrial, business, and recreational purposes. The airport currently averages more than 300,000 operations (takeoffs and landings) each year and serves small commercial passenger airlines, cargo carriers, private aircraft owners, helicopters, corporate jets, and military and other aircraft.

There are about 15 miles of pipe in the airport storm drainage system. All stormwater discharges into the LDW. There are two pumping stations, which lift the water and pump it out at two outfalls. The north pump station discharges to Slip 4. The southern pump station drains the central portion of KCIA through the 48-inch pipe that runs under the Boeing Isaacson property and discharges to EAA-6 at approximately RM 3.8.

Facility Summary: KCIA	
Address	6771 Perimeter Rd. S. 7299 Perimeter Rd. S. 8700 East Marginal Way S.
Property Owner	King County
Tax Parcel No.	2824949007; 5422600160; 0007400032; 3324049011; 0001600049; 0001600019
Parcel Size	586 acres
Facility/Site ID	2387398
SIC Code	4581: Airports, Flying Fields, & Services
EPA ID No.	WAH000031371 (Inactive)
NPDES Permit No.	SO3000343 (KCIA Maintenance Facility and runways)
UST/LUST ID No.	NA

Potential sources of pollutants include de-icing activities, which are performed on aircraft to minimize ice buildup on the wings and plane body during cold weather conditions. Several tenants perform limited aircraft de-icing. KCIA has constructed dedicated areas for aircraft de-icing; the runoff from these areas is diverted to the sanitary sewer system and is conveyed to the local municipal treatment facilities. All tenants are required to de-ice aircraft in the specified locations to prevent de-icing fluids from entering the airport's stormwater system.

Airport tenants are listed in Table 6. Activities of airport tenants include fuel storage and maintenance of aircraft, maintenance of vehicles and equipment, and repair/storage of vehicles and equipment. Most maintenance and repair work is performed inside hangars. Tenant operations are described in more detail in Sections 5.1.3 through 5.1.21.

According to KCIA policy, airport tenants who generate a spill are responsible for cleanup and management of waste resulting from that spill (KCIA 2001). If KCIA assists in the cleanup of a spill, airport tenants will be required to reimburse the Airport for the associated costs. In the event of a spill, airport tenants are required to immediately notify the KCIA Aircraft Rescue Fire Fighting (ARFF) unit, which will respond to all reported spills. Facility operators are expected to take immediate action, using the best means available, to absorb or divert the flow of the spill from any nearby storm drain opening (KCIA 2001). It is KCIA's responsibility to report the spill to all agencies as required by federal, state and local laws and regulations.

Since 2002, Boeing has removed concrete joint caulking material containing up to 79,000 mg/kg PCBs from areas of north KCIA (within the EAA-3/Slip 4 drainage basin). A joint caulk sample collected from KCIA within the EAA-4 drainage basin (location JC-3) contained elevated levels of PCBs (Ecology 2007c). No sampling of joint caulking material has been conducted in the central portion of KCIA that drains to EAA-6.

5.1.2 Historical Operations

In the early 1900s, the winding course of the Duwamish River, which ran through much of the airport property, was straightened and filled. Construction of the airport began in 1928. The airport served as the community's aviation center until December 6, 1941, when the U.S. Army took over the airport for strategic and production reasons. The airport remained under military jurisdiction through the end of World War II.

In the late 1940s, the airport was reopened for passenger and other commercial traffic. Usage evolved to general aviation, serving industrial, business, and recreational purposes with the opening of Sea-Tac International Airport in 1947.

5.1.3 United Parcel Service (UPS) Boeing Field

Facility Summary: UPS Boeing Field	
Address	7500 Perimeter Rd. S. (per KC lease) 7575 Perimeter Rd. S. (per inspection report and FSD)
Property Owner	King County
Facility/Site ID	15215836
SIC Code	4513: Air Courier Services
EPA ID No.	WAD988521563
NPDES Permit No.	SO3000434
UST/LUST ID No.	NA

UPS conducts air cargo transport operations at this location, known as Hangar 5; the other side of Hangar 5 is operated by Ameriflight. The facility operates under an industrial stormwater general permit (SO3000434). Main activities include loading and unloading of packages from aircraft and general office activities (SPU 2001b). There is a small airplane maintenance area in part of the hangar section, and de-icing operations are conducted approximately once per year on this property. SPU conducted an inspection at this property on September 26, 2001. All catch basins were clean and clear at the time of the inspection. In a letter dated September 28, 2001, SPU indicated that the facility was in compliance with stormwater pollutant source control requirements (SPU 2001c).

The facility was inspected again on August 4, 2004 (SPU 2004b). At that time, outdoor mobile fueling operations were conducted at the site by Galvin. Two outdoor aboveground storage tanks were identified: a 6,000-gallon propylene glycol tank and a 2,000-gallon double-wall tank, contents unspecified (SPU 2004b). Wastes generated onsite included antifreeze (propylene glycol) between December and March, fluorescent light tubes, and petroleum/oils. No environmental compliance problems were identified (SPU 2004q).

Ecology conducted a stormwater compliance inspection on January 11, 2006 (Ecology 2006a). The following concerns and recommendations were noted:

- zinc exceeded the benchmark permit limits during the first and second quarters of 2005 and exceeded the permit action level during the third quarter of 2005
- copper exceeded the permit action level during the third quarter of 2005.

An unannounced NPDES compliance inspection was conducted by Ecology on February 26, 2008. During this inspection, the 6,000-gallon propylene glycol tank was under cover and properly located within secondary containment; however several partially-full 2000-gallon propylene glycol totes were stored outdoors without containment. UPS agreed to correct this situation immediately. According to Ecology's inspector, UPS is working on a Level 2 response to the elevated metals concentrations in their stormwater discharge (Wright 2008). An inspection report has not yet been prepared.

5.1.4 Caliber Inspection, Inc.

Facility Summary: Caliber Inspection	
Address	7500 Perimeter Rd. S.
Property Owner	King County (Facility subleased from UPS)
Facility/Site ID	18182664
SIC Code	8734: Testing Laboratories (per Ecology FSD) 7389: Business Services (per SPU inspection report)
EPA ID No.	WAD000067686
NPDES Permit No.	NA
UST/LUST ID No.	NA

Caliber Inspection conducts four types of non-destructive testing: X-ray testing using radioactive isotopes (indium-192, cobalt-60), ultrasonic testing, magnetic particle testing, and dye penetrant testing (SPU 2004o). Approximately half of the testing work is conducted at the facility's lab, and the other half is conducted in the field at client sites. About half of the testing conducted by Caliber Inspection is related to the aerospace industry.

An inspection was conducted by SPU on August 18, 2004 (SPU 2004o). A 15-ft by 15-ft by 3-ft immersion tank located in the central portion of the building contained a corrosion inhibitor (Immunol 1228). During the inspection, facility personnel indicated that the tank is emptied twice per year to the storm drain system (SPU 2004o). SPU requested that this be discharged to the sanitary sewer, with concurrence from King County Industrial Waste. Hazardous materials handled at this facility included radioactive materials (Indium-192, Cobalt-60), silver and other chemicals used in photo developing, cutting oils, and shop rags. Wastewater was pretreated to recover silver. Washing of passenger vehicles was conducted at this facility; washwater drained to the storm drain system (SPU 2004o). Three catch basins are located at this facility; these are maintained by King County.

In a letter dated December 28, 2004 (SPU 2004bbb), Ecology required the following corrective actions:

- Cease discharge of immersion tank contents into the storm drain system;
- Seal the catch basin in the central portion of the building (near the immersion tank) to prevent leaks or spills from entering the storm drain;
- Install an outlet trap in the catch basin located in the parking lot on the south side of the building;
- Obtain additional spill containment and clean-up materials in the magnetic particle testing building; modify the spill prevention and cleanup plan to include calling AARF in the case of a spill;
- Dispose of cutting oils that have been accumulating at the facility, and properly dispose of fluorescent tubes.

A re-inspection was conducted by SPU on May 31, 2005 (SPU 2005f). The facility was in compliance at that time, and no further action was recommended.

5.1.5 GSM, Inc.

Facility Summary: GSM	
Address	7575 Perimeter Road S.
Property Owner	King County (Facility subleased from UPS)
Facility/Site ID	NA
SIC Code	4581: Airports, Flying Fields, and Airport Terminal Services
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

GSM, Inc. conducts aircraft ground support services and equipment maintenance (SPU 2004p). There are no catch basins associated with this facility. Following a site inspection conducted on August 19, 2004, SPU commended the facility on its excellent waste disposal/recycling documentation practices (SPU 2004r).

Because there is no pathway for contaminants to reach the LDW from this facility, it poses minimal potential for LDW sediment recontamination.

5.1.6 Ameriflight, Inc. (Hangar 5)

Facility Summary: Ameriflight, Inc.	
Address	7585 Perimeter Rd. S. (Hangar 5)
Property Owner	King County
Facility/Site ID	8137128
SIC Code	4513: Air Courier Services
EPA ID No.	WAD988521324
NPDES Permit No.	SO3002830
UST/LUST ID No.	NA

Ameriflight is an air cargo airline. It operates at Hangar 5 and operations include outdoor mobile fueling of airplanes. Airplanes and fuel trucks are washed periodically; washwater drains to the sanitary sewer. UPS conducts de-icing at this location (SPU 2005d). Wastes and other materials generated at the site include: batteries, fluorescent light tubes, sheet metal (airplane parts), gasoline, solvents, shop rags, and Jet Fuel A. Metal and painted parts as well as trucks and forklifts are stored outside (Ecology 2006d). Catch basins at this facility are maintained by King County. This facility operates under an industrial stormwater general permit (SO3002830).

SPU conducted a stormwater pollution prevention inspection at Ameriflight on August 4, 2004 (SPU 2004a, 2004aa). Several housekeeping items were identified that needed to be addressed, including preparation of a spill prevention and cleanup plan, maintenance of adequate spill containment and clean-up materials, employee education, leaking containers in the flammables storage cabinet, and regular inspection of chemical and storage waste locations.

The inspector noted that a catch basin located in the southwest corner of the building drained to the public storm drain system. SPU requested that this catch basin be sealed to prevent leaks or spills from entering the storm drain.

A sample of storm drain solids was collected by SPU from a catch basin located just west of the hangar building. The sample was analyzed for PCBs, metals, and petroleum hydrocarbons. Results indicated elevated concentrations of PCBs (6.6 mg/kg DW, 154 mg/kg OC), mercury (0.61 mg/kg DW), and BEHP (185 mg/kg OC) (SPU 2004aa). The concentration of Total Petroleum Hydrocarbon (TPH)-heavy oil exceeded the MTCA Method A cleanup level for soil.

The SPU inspector indicated that the PCB contamination is likely historical because she did not identify any current use or storage of materials containing PCBs. SPU requested that the catch basins be cleaned and the sediment disposed of according to state and local regulations.

A re-inspection of this property was conducted on March 14, 2005, and the facility was judged to be in compliance with stormwater pollution source control requirements (SPU 2005d, 2005e). The interior catch basin had been covered with a polyurethane mat. Although the exterior catch basin (CB 1232) had been cleaned, it still contained approximately 9 inches of material within 3 inches of the outlet pipe (SPU 2005d). The inspector suggested that the catch basin be cleaned again, and the gravel area/roof downspout area be paved or a catch basin insert installed (SPU 2005d). No information was available with regard to whether this was done.

Ecology inspected this property on October 25, 2006 (Ecology 2006d). No stormwater sampling had been conducted at this facility since December 31, 2004. Ameriflight believed that KCIA was responsible for stormwater sampling, however according to the Airport Engineer, King County maintains the stormwater system but tenants are responsible for their own stormwater discharges (Ecology 2006d). The Ecology inspector was not able to determine whether the interior storm drains discharge to the sanitary or stormwater system. The following concerns and recommendations were identified:

- begin stormwater sampling by the third quarter of 2007
- develop a SWPPP as required by their stormwater permit
- conduct quarterly visual monitoring and summarize in a report or checklist
- determine if the drains in the hangar discharge to the sanitary or stormwater system
- if the drains discharge to the stormwater system, then take necessary actions to stop contaminants from entering the drains.

Ecology notified the facility that it is not in compliance with the terms and conditions of its stormwater permit in a letter dated March 8, 2007 (Ecology 2007b). A follow-up inspection has not been conducted.

5.1.7 Federal Express Perimeter Rd

Facility Summary: Federal Express	
Address	7607 Perimeter Road S.
Property Owner	King County
Facility/Site ID	75575157
SIC Code	4215: Courier Services, Except by Air
EPA ID No.	WAD988474698
NPDES Permit No.	NA
UST/LUST ID No.	2392

Federal Express leases the property at 7607 Perimeter Road S. from KCIA. No inspection reports were identified for this facility. Ecology's LUST/UST databases list this facility as "BFI Federal Express Station," and report that one unleaded gasoline tank was located at this site. Soil and groundwater cleanup was conducted between January 1990 and June 1995. The cleanup is complete and the tank has been removed. The facility operated under EPA ID No. WAD988474698; this number is currently inactive. No other information about operations at this facility was available at the time this Data Gaps report was prepared.

5.1.8 Hangar Holdings, Inc. (Vulcan, TAG Aviation, Former Shell Oil)

Facility Summary: Hangar Holdings, Inc.	
Address	7675 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	72811433
SIC Code	3721: Aircraft
EPA ID No.	WA8690590007 (inactive)
NPDES Permit No.	NA
UST/LUST ID No.	484990
Listed on CSCSL	YES

Hangar Holdings currently leases the property located at 7675 Perimeter Road S. from KCIA. Eight USTs at this location have been removed; these contained aviation fuel, and ranged in size from 5,000-9,999 gallons to 30,000-49,999 gallons.[20] Ecology's LUST database indicates that this was also the former location of a Shell Oil gas station. Two underground aviation fuel tanks, installed in September 1998, are currently operational.

In 1996, Hangar Holdings began excavation of two underground storage vaults for fire suppression water. During construction, a strong petroleum-like odor and visible staining were observed. Approximately 930 cubic yards of petroleum hydrocarbon-affected soil were excavated from this area and segregated from soils that showed no evidence of contamination (Hart Crowser 1997a, 1997b). This soil was stockpiled in the northeastern corner of the site. A series of five soil samples were collected from the side walls of the excavation, which indicated detectable concentrations of petroleum hydrocarbons in the southeastern corner and part of the east wall, and nondetectable concentrations in the other corners and side walls (Hart Crowser 1997b).

In July 1997, eight test pits were excavated in the area east of the excavation to identify the extent of the contaminated soils. At that time, the excavation for the first storage vault (the water storage tank) was complete, while excavation had not begun for the second vault (the water detention tank). Results indicated that the plume of hydrocarbon-affected soils appears to extend eastward from the water storage tank excavation, through the area of the water detention tank, and more than 50 feet beyond. The eastern and southern extents of the plume were not delineated (Hart Crowser 1997b). Petroleum concentrations ranged from <5 to 10,000 mg/kg as gasoline, <20 to 10,000 mg/kg as diesel, and <50 to 270 mg/kg as oil. Ethylbenzene (to 15 mg/kg) and xylenes (to 20 mg/kg) were also detected (Hart Crowser 1997b). Low concentrations of petroleum hydrocarbons (<1 mg/L) were also detected (Hart Crowser 1997a).

Hart Crowser (1997b) estimated that approximately 2,000 cubic yards of contaminated soil would be generated, assuming the excavation was made to the design depth of the vault of 12 to 13 feet. Test pits indicated that contaminated soils extended below this depth, possibly to 16 feet. Excavating this material would result in an additional 930 cubic yards of contaminated soils, for

[20] Washington State Department of Ecology Regulated Underground Storage Tanks Site List, February 19, 2008 (https://fortress.wa.gov/ecy/tcpwebreporting/reports.aspx)

a total volume of contaminated soil of approximately 4,000 cubic yards. Removal of all contaminated soil from the site (including soil outside the tank excavation) was estimated to result in 9,000 to 10,000 cubic yards of material.

At least some of this contaminated soil was taken to King County's land-farming facility at the north end of North Boeing Field (in an area also known as the Fire Training Area). According to an Ecology Environmental Report Tracking System (ERTS) Referral in April 2000, petroleum hydrocarbon contamination remains in the southern and eastern portions of the property, and the areal extent of contamination has not been determined (Ecology 2000a).

The site was added to Ecology's CSCSL, which cites confirmed contamination with petroleum products (soil and groundwater) and non-halogenated solvents (soil). In addition, PAHs (soil and groundwater) and non-halogenated solvents (groundwater) were present at concentrations below MTCA cleanup levels.[21] Site discovery took place on October 3, 2003, and the remedial action is listed as "currently in progress."

SPU conducted an inspection at this address in November 2001 (SPU 2001l). The facility occupying the parcel at this time was TAG Aviation USA, Inc., a company owned by Paul Allen. The company provided transportation for clients and small packages. Fueling of aircraft was conducted outdoors; maintenance was conducted inside the hangar. The building had a detention system in the parking lot, however it was blocked by a parked car at the time of the inspection. The parking lot had eight inlets to the detention system. On the hangar side, several inlets appeared to be connected to the storm drain system. An on/off valve was also located in this area; employees were reportedly trained to turn the valve to the off position in the event of a spill during fueling operations (SPU 2001l).

Based on this inspection, SPU identified one required corrective action: to post a written spill plan in the work area (SPU 2001n). The facility was re-inspected on February 2, 2002, and no further action was required (SPU 2002b).

An October 2004 SPU inspection at this address identified the operator as Vulcan, and indicated that it was a hangar for aircraft and maintenance activities (SPU 2004oo). The inspection report identified mobile fueling of aircraft as the only activity conducted outside of the hangar; all other activities were conducted inside the hangar. Approximately 12 catch basins are located at this property; all appeared clean. Wastes generated include petroleum/oils, solvents from a parts washer, and shop towels. A paint booth is located inside the hangar. No corrective actions were identified.

Both of the 20,000-gallon USTs currently located at this facility, which contain Jet-A fuel, passed a February 2007 underground tank inspection (Ecology 2007a).

[21] Department of Ecology – Toxics Cleanup Program, Integrated Site Information System, Confirmed and Suspected Contaminated Sites List. November 8, 2007. http://www.ecy.wa.gov/programs/tcp/cscs/cscspage.htm

5.1.9 Western Metal Products, Inc.

Facility Summary: Western Metal Products	
Address	7696 Perimeter Rd. S. 7800-7802 Perimeter Rd S.
Property Owner	King County
Facility/Site ID	NA
SIC Code	3499: Fabricated Metal Products
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

Western Metal Products is a small metal parts fabrication shop. There are three small buildings: the main building (7696 Perimeter Rd.), which houses office and fabrication space; the welding area (7800 Perimeter Rd.); and a storage building (7801 or 7802 Perimeter Rd.).

Wastes generated include aluminum scrap, used oils/cutting oils, mineral spirits (parts washer solvent), and other lubricants. Containerized products are stored outside.

There are three catch basins onsite; sediment had filled these catch basins to over 60 percent of their capacity at the time of an October 2004 inspection (SPU 2004nn). Corrective actions identified during the inspection included: improve or create spill response procedures; clean storm drain facilities; replace/repair missing or damaged storm drain components; and properly store non-containerized materials.

A March 2006 inspection indicated that the catch basins again (or possibly still) contained sediments to over 60 percent of their capacity (SPU 2006a). Open 5-gallon buckets of used oil were observed, and unlabeled and corroding bottles of chemicals were observed in a cabinet. Outside, several unlabeled 55-gallon drums of used oil were observed. A container used for disposal of metal shavings was not covered and was located near a full catch basin. The following corrective actions were required by SPU (SPU 2006b):

- dispose of fluorescent tubes properly
- prepare and maintain waste manifests
- label waste containers as required
- cover the metal shaving container
- implement additional sweeping practices around the outside of this container to prevent metal shavings from being discharged into the catch basin
- dispose of unwanted or unused chemicals or used oil.

A second and final corrective action notice was sent to Western Metal Products on August 22, 2006 (SPU 2006c). The facility was re-inspected on October 25, 2006 (SPU 2006d). At that time, very little work was being done at the facility. Although unknown chemicals had been disposed of and the scrap metal container was covered with a tarp, the used oil and other drums

had not been removed and there were still no labels on containers and no manifests on file. A December 22, 2006 letter from SPU indicated that the facility was in compliance with stormwater regulations (SPU 2006e). It is not clear whether the catch basins were cleaned out.

5.1.10 Galvin Flying Services

Facility Summary: Galvin Flying Services	
Address	7777 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	NA
SIC Code	4581: Airports, Flying Fields, & Services
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

Galvin Flying Services operates several buildings along the airport strip on Perimeter Road S. One of these, located at 7777 Perimeter Road, is within the EAA-6 stormwater drainage basin. This building is attached to 7827 Perimeter Road S., to the east, which is leased by Galvin Flying Services to Clay Lacy Aviation (see Section 5.1.11 below).

SPU conducted an inspection at the 7777 Perimeter Road side of the property on September 18, 2001 (SPU 2001a). At the time of the inspection, this building was being used for storage, and was scheduled for demolition (SPU 2001a). The facility was in compliance with stormwater pollutant source control requirements (SPU 2001d).

Another inspection of the 7777 Perimeter Road S. property was conducted on August 11, 2004 (SPU 2004l). At that time, the property was subleased to at least two tenants (Costco and Paul Allen), and was being used as a storage hangar and light maintenance area. Activities at the property included service and repair of aircraft, mobile fueling operations, and indoor aircraft washing. Two parts washers were located onsite within a fenced maintenance area (SPU 2004l). Washwater was being discharged to the sanitary sewer. A large trench at the entrance of the hangar doors drained to an oil/water separator and then to the sanitary sewer. Four catch basins were identified on the property; these were being inspected and cleaned on an annual basis. The following corrective actions were identified:

- update written spill prevention and cleanup plan
- obtain spill containment and cleanup materials
- educate employees about the spill plan and containment/cleanup materials (SPU 2004w).

A re-inspection was conducted on December 7, 2004 (SPU 2004ww). The facility was in compliance with source control requirements and no further action was required (SPU 2004aaa).

5.1.11 Galvin Flying Services / Clay Lacy Aviation

Facility Summary: Galvin Flying Services/Clay Lacy	
Address	7827 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	NA
SIC Code	4522: Air Transportation, Nonscheduled 4581: Airports, Flying Fields, and Airport Terminal Services
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

The 7827 Perimeter Road S. property is leased by Clay Lacy Aviation from Galvin Flying Services, which leases the property from King County. At the time of an October 2001 inspection, Clay Lacy was doing business as Flight Center (SPU 2001e). No storm drain inlets were located in this area, and no corrective actions were required as a result of the inspection (SPU 2001f).

Clay Lacy subleases portions of this building to several other businesses: Civil Air Patrol, MJL Partners, and IV Management. SPU inspections have been conducted at Civil Air Patrol and MJL Partners. No information was available about IV Management.

Civil Air Patrol rents office and parking space from Clay Lacy Aviation. They park two airplanes at the Clay Lacy field and have meeting space at this property. A September 20, 2004 inspection of this business indicated that no repairs are done at this property and no chemicals are used (SPU 2004bb).

MJL Partners rents space from Clay Lacy Aviation for service and repair of two aircraft. Four catch basins are located in this area. The following corrective actions were required as a result of the September 20, 2004 inspection (SPU 2004cc):

- complete a written spill prevention and cleanup plan
- install a spill kit
- educate employees about the spill plan and spill kit (SPU 2004pp).

SPU also requested that a container of insecticide left by a previous tenant be disposed of (SPU 2004qq). A follow-up inspection was conducted on December 7, 2004; a written spill plan had not been prepared (SPU 2004xx). On December 27, 2004, SPU indicated that the facility was in compliance and no further action was required (SPU 2004aaa).

5.1.12 Nordstrom, Inc.

Facility Summary: Nordstrom, Inc.	
Address	7979 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	36699669
SIC Code	4522: Air Transportation, Non-scheduled
EPA ID No.	WAD981773583
NPDES Permit No.	NA
UST/LUST ID No.	8045

Nordstrom flies material and clients into this property. Two aviation fuel USTs and a small (111 to 1,100 gallon) used oil/waste oil tank are located at this property. An aircraft washing area is connected to the sanitary sewer. The parking lot area has two storm drain inlets; these were clean and clear at the time of a November 5, 2001 inspection (SPU 2001o). No action was required (SPU 2001p).

The facility was inspected again in October 2004 (SPU 2004ccc). Wastes generated included batteries, fluorescent tubes, petroleum oils, and rags. According to the inspection report, there are seven catch basins at the property: one near the fueling area and six at the parking lot east of the runway. KCIA is responsible for maintenance of the parking lot catch basins; these drain to a KCIA oil/water separator and then to the storm drain system. Planes and helicopters are washed outdoors; a nearby catch basin is connected to an oil/water separator that drains to the sanitary sewer system (SPU 2004ccc). The only corrective action identified was to begin recycling of fluorescent light tubes (SPU 2004ddd).

5.1.13 DHL Express (ABX Air, Airborne Express)

Facility Summary: DHL	
Address	8013 to 8075 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	7723743
SIC Code	4513: Air Courier Services
EPA ID No.	NA
NPDES Permit No.	SO3004602
UST/LUST ID No.	NA

DHL Express (also known as ABX Air, Inc. and Airborne Express) operates a courier service at this location. They transport packages, perform some aircraft maintenance, and occasionally de-ice aircraft (SPU 2004g).

Wastes generated include fluorescent tubes, petroleum/oils, and de-icing wash (SPU 2004g). Aircraft de-icing is performed on this property; fueling of aircraft is done by Galvin Flying Services. Mobile fueling of fleet vehicles is done by a contractor. There is a wash rack for

vehicles and aircraft. Five catch basins are located on this property; several of the catch basins have no outlet trap because they are too shallow. An August 2004 site inspection resulted in one recommended action: to post a copy of the written spill prevention plan on the spill kit (SPU 2004g, 2004k). The facility operates under an industrial stormwater general permit (SO3004602).

Ecology conducted a stormwater compliance inspection in May 2006 (Ecology 2006c). During the inspection, petroleum sheens were observed entering the catch basin located in the northeast corner of the property. Aircraft de-icing wash water could enter the facility's storm drains. In addition, DMRs had not been submitted for the last three quarters of 2005 and the first quarter of 2006. The following concerns and recommendations were identified:

- retain a copy of the SWPPP onsite or within reasonable access to the site
- monitor stormwater discharges and submit DMRs as required
- implement operational and/or source control BMPs to stop petroleum sheens from entering storm drains
- do not allow wash water to enter the facility's stormwater drains (Ecology 2006c).

No follow-up inspection has been conducted.

5.1.14 Airwest Repair Services (Airwest Sales & Services, Bicknell)

Facility Summary: Airwest Repair Services	
Address	8167 Perimeter Rd S. 8187 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	NA
SIC Code	4581: Airports, Flying Fields, and Airport Terminal Services (Airwest)
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

The property located at 8167 and 8187 Perimeter Road S. is currently leased by Airwest Repair Services. The business has also been identified as Airwest Sales & Services; it is owned by Charles Bicknell (aka "Shorty"). The business is engaged in aircraft maintenance and storage.

Fueling operations on-site are rare; this is usually done by pilots from Galvin or Clay Lacy. Wastes generated at the facility include batteries, petroleum/oils, and sludge from the parts washer. There is one catch basin located at this facility, in the parking lot. There are no floor drains in the building and no washing is conducted at the facility.

SPU conducted an inspection of this property and its subtenants on August 5, 2004 (SPU 2004c). No environmental compliance problems were identified (SPU 2004h). At that time, Airwest

subleased portions of this property to Puget Sound Aviators, CJ Systems Aviation Group, and Sparrow Hawk Gyroplanes (SPU 2004c).

Puget Sound Aviators (PSA) operates a flight school at 8167 Perimeter Road S. (SIC Code 8299: Schools and Educational Services). Their airplanes are stored and maintained at Aeroflight (8555 Perimeter Road S.); this facility houses mainly office and classroom space. During the August 5, 2004 inspection, no environmental compliance issues were observed (SPU 2004d, 2004i).

CJ Systems Aviation Group (Corporate Jets, Inc.) maintains and stores helicopters at 8167 Perimeter Road S. (SIC Code 4581: Airports, Flying Fields, and Airport Terminal Services). Mobile fueling is performed by Galvin Flying Services; very little washing is done on site. The facility operates a parts washer. Wastes generated at this facility include motor oil, turbine engine oil, sludge from parts washer, mineral spirits, batteries, and rags. Helicopter parts are stored in two sheds. There is no floor drain in the building. The August 5, 2004 inspection identified the following corrective action: complete a written spill prevention and cleanup plan and post at appropriate locations (SPU 2004e, 2004t). A re-inspection was conducted on December 8, 2004, and no further actions were identified (SPU 2004yy).

GBA (Gyroplanes of Seattle, LLC) builds gyroplanes at 8167 Perimeter Road S. (no SIC code identified), and then transfers them to a facility in Auburn. They use up all chemicals and do not dispose of any wastes. No environmental compliance issues were observed during the August 5, 2004 SPU inspection (SPU 2004f, 2004j). It is not clear whether GBA is the same company as Sparrow Hawk Gyroplanes.

5.1.15 BAX Global, Inc.

Facility Summary: BAX Global	
Address	8201 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	NA
SIC Code	None Listed
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

This business transports packages and containers. Loading/unloading occurs on the north side of the building; there are two catch basins in this area. Maintenance of trucks and aircraft is also conducted at this facility. Waste materials are stored on the south side of the building and include used petroleum products (oil, antifreeze); waste materials are stored on a pallet within spill containment barriers. At the time of a November 5, 2001 SPU inspection, no spill plan was in place and a spill kit was not available (SPU 2001k). The facility was requested to implement a spill plan (SPU 2001m). This corrective action had not been implemented during a February 13, 2002 re-inspection (SPU 2002c). The facility was deemed in compliance with the stormwater pollutant source control requirements after a March 6, 2002 re-inspection (SPU 2002d). No other inspections have been conducted at this facility.

5.1.16 Clay Lacy Aviation (Gateway USA, Flight Center, Flightcraft Inc. Seattle)

Facility Summary: Clay Lacy Aviation	
Address	8285 Perimeter Rd. S. 8403 Perimeter Road S.
Property Owner	King County
Facility/Site ID	6436627
SIC Code	4581: Airports, Flying Fields, and Airport Terminal Services
EPA ID No.	WAD063351332
NPDES Permit No.	NA
UST/LUST ID No.	8044

Clay Lacy Aviation provides airport services at two buildings in this general location: 8285 Perimeter Road S. and 8403 Perimeter Road S. They are mainly engaged in services to private jets and fixed base operations (FBO). Activities include aircraft fueling, de-icing, and hangar space.

This facility underwent a voluntary cleanup in 1996 under the name Flightcraft, Inc. A No Further Action (NFA) determination was made on July 23, 1996. Ecology's UST database lists 11 underground tanks at this location; seven tanks have been removed and four (installed in 1996) remain operational. Three aviation fuel tanks are within the 20,000 to 29,999-gallon size range, while one unleaded gasoline tank contains 10,000 to 10,999 gallons.[22] The tanks that were removed contained kerosene, aviation fuel, used oil/waste oil, and unleaded gasoline.

At the time of an August 2003 site inspection, Clay Lacy was not doing aircraft maintenance at this location, but was planning to do so in the future. They sublease hangar space to approximately 20 tenants (SPU 2003). Waste materials generated by this facility include: batteries; fluorescent tubes; hydraulic oil; and other petroleum products. There are five catch basins located in this area.

Clay Lacy operates six fueling trucks. The fueling pad is equipped with an oil/water separator that is connected to the storm drain system. There is a shut-off valve and a drain cover to minimize the risk of contaminant transport to the storm drain system. Jet-A fuel and aviation gasoline are stored in four underground storage tanks. The fueling area is uncovered.

The Clay Lacy de-icing/wash area is reportedly used for the entire airport. When the de-icing/wash area is in use, drainage is switched from the storm drain system to an oil/water separator connected to the sanitary system (SPU 2003).

The following corrective actions were identified during the August 2004 SPU inspection:

[22] Washington State Department of Ecology Regulated Underground Storage Tanks Site List, February 19, 2008 (https://fortress.wa.gov/ecy/tcpwebreporting/reports.aspx)

- complete a written spill prevention and cleanup plan and post at appropriate locations
- post signage near the dual valve shut off system in the de-icing area to alert operators how to properly use the system to avoid stormwater contamination
- place a spill kit in the de-icing area (SPU 2004v).

A re-inspection in December 2004 indicated that the facility is in compliance with stormwater pollutant source control requirements (SPU 2004zz).

5.1.17 Wings Aloft / Southeast "T" Hangars

Facility Summary: Wings Aloft / Southeast "T" Hangars	
Address	8453-8525 Perimeter Rd. S. (per KC lease) 8467 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	NA
SIC Code	8299: Schools and Educational Services
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

Wings Aloft leases several buildings from KCIA. The company operates a flight school; activities at the property include maintenance and fueling of aircraft. All washing and de-icing is done at the Clay Lacy facility to the north. The company operates one fueling truck and a parts washer. Hazardous waste liquids are stored inside the hangar and are disposed of by Emerald Services. A stormwater inspection conducted by SPU in October 2001 found the business to be in compliance with stormwater pollutant source control requirements (SPU 2001g, 2001i). Another inspection was conducted in September 2004 (SPU 2004x). Seven catch basins were identified on this property; these were too shallow to be equipped with outlet traps. Waste oil is stored in a 650-gallon aboveground storage tank located inside the maintenance building. The following corrective action was identified as a result of this inspection: complete a written spill prevention and cleanup plan and post at appropriate locations. Secondary containment for the waste oil storage tank was recommended (SPU 2004ii). A letter dated February 8, 2005 indicated that the facility was in compliance with requirements, but recommended that secondary containment be implemented for the facility's hazardous waste storage areas (SPU 2005b).

Wings Aloft subleases portions of the hangar buildings to the following businesses: Reed Aviation, Airtech Instrument Company, Puget Sound Aviators, Cascade Air Frame, Helicopters NW, and Washington Avionics.

Reed Aviation conducts airframe maintenance inside a hangar at 8490 Perimeter Road S. All work is performed indoors. The facility includes a parts washer and generates small quantities of used oil. After an October 2004 SPU site inspection, Reed was notified that a written spill prevention and cleanup plan would be required (SPU 2004ll, 2004rr). Subsequently, SPU decided that this was not required because this is a one-man all indoor operation, however a spill plan was recommended (SPU 2005a).

Airtech Instrument Company repairs aviation-related instruments including pressure gauges and electrical volt meters (SIC 5065: Electronic Parts and Equipment) at 8490 Perimeter Road S. All activities are conducted indoors (SPU 2004dd). The facility uses various solvents and generates small quantities of waste oil, which are disposed of by Wings Aloft. No environmental compliance issues were identified during a September 2004 site inspection (SPU 2004dd, 2004hh).

Cascade Air Frame conducts routine maintenance for helicopters at 8500 Perimeter Road S. (SIC 4581: Airports, Flying Fields, and Airport Terminal Services). Activities at the site include washing of helicopters (using a King County wash rack that drains to the sanitary sewer) and parts washing. Virtually all activities are conducted indoors, and there is no floor drain (SPU 2004ss). During a November 2004 site inspection, the SPU inspector was impressed with the waste oil storage area, especially the secondary containment and spill control measures that were in place (SPU 2004tt). No compliance issues were noted.

Helicopters Northwest provides helicopter flight training (SIC 4522: Air Transportation, Nonscheduled) at 8500 Perimeter Road S. No maintenance is performed at this location; washing and maintenance are performed at Emerald City Leasing. Aircraft are stored inside the hangars. No environmental compliance issues were observed during a September 2004 SPU inspection (SPU 2004ff, 2004kk).

Washington Avionics, Inc. sells and repairs aviation equipment at 8525 Perimeter Road S. All activities are conducted indoors. The only hazardous materials used are aerosol cans. No environmental compliance issues were observed during a September 2004 SPU inspection (SPU 2004y, 2004z).

5.1.18 Aeroflight National Charter Network (Seattle Air Corp., BFI Holdings)

Facility Summary: Aeroflight	
Address	8535 Perimeter Rd. S. 8555 Perimeter Rd. S.
Property Owner	King County
Facility/Site ID	7318944
SIC Code	4581: Airports, Flying Fields, and Airport Terminal Services
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	447641

Aeroflight National Charter Network is located at 8535 and 8555 Perimeter Road S. The business transports passengers and packages; activities at the property include maintenance, fueling, and storage of aircraft and cargo. Maintenance of aircraft is performed inside the hangars. Washing is done outside. According to an October 2001 SPU site inspection, only water is used for washing (SPU 2001h). Five fuel trucks are located near the runway. A covered hazardous waste storage area is located on the north side of the property.

During the 2001 inspection, two tanks for waste fluids were located inside a bermed area on the north side of the hangar building; these tanks are no longer in use (SPU 2001h). Several 55-gallon drums and miscellaneous containers of hazardous materials were accumulating outside of the bermed, covered area; these were not labeled. A catch basin connected to the storm drain system was located approximately 40 to 50 feet away. Because the containers were exposed to rainwater, overflows to the pavement or physical damage to the drums/containers could result in transport of contaminants to the storm drain system (SPU 2001j). As a result, SPU required that the containers be removed and place inside the covered area. The facility was re-inspected in January 2002 and no further action was required (SPU 2002a).

The facility was inspected again in August 2004 (SPU 2004n). Five catch basins are located at this property. Waste materials generated at the site include batteries, paints, motor oil, solvent sludge, and occasionally Jet-A fuel and piston fuel. A sand blaster is used to clean metal parts. Mobile fueling operations are conducted at this location and aircraft are parked outdoors. Maintenance and repair activities are conducted in the two maintenance hangars. A shed next to the building was filled with drums. SPU required the facility to complete a written spill prevention and cleanup plan and post it at appropriate locations at the facility (SPU 2004u).

During another inspection in February 2005, a dye test was conducted at the catch basin near the wash rack; results indicated that the catch basin is connected to the storm drain system. As a result, the following corrective actions were required by SPU:

- coordinate re-routing of the washpad to the sanitary system or find a suitable location for washing where washwater drains to the sanitary sewer
- minimize washing and limit use of soap and other chemicals until the washpad is moved or rerouted
- upgrade the hazardous material storage area (SPU 2005c).

In a May 2005 letter to Aeroflight, King County requested information about the floor drain in the hazardous waste storage room and where it drains to (King County 2005). Subsequent inspections were conducted in June and July 2005 (SPU 2005h, Stewart 2005). The facility discontinued washing aircraft at this location in early 2005. A drain in the hazardous waste area was sealed in August 2005. An August 2005 letter from SPU to Aeroflight indicated that no further action was required, but reminded the facility that no outdoor washing is allowed (SPU 2005i).

5.1.19 Federal Drug Enforcement Administration

Facility Summary: FDEA	
Address	8700 East Marginal Way S., Hangar B
Property Owner	King County
Facility/Site ID	NA
SIC Code	4522: Air Transportation, Non-scheduled
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

The Drug Enforcement Administration maintains a small office and a hangar with one helicopter at 8700 East Marginal Way S. (Hangar B). No maintenance is conducted at the site, and no chemicals are used. A catch basin located near Hangar B was clean at the time of a July 29, 2007 SPU inspection (SPU 2007). Used oil was stored south of the hangar; it was covered and within secondary containment.

5.1.20 South Seattle Community College (SSCC) Aviation Department

Facility Summary: SSCC/	
Address	8900 East Marginal Way S.
Property Owner	King County
Facility/Site ID	NA
SIC Code	8299: Schools and Educational Services
EPA ID No.	NA
NPDES Permit No.	NA
UST/LUST ID No.	NA

SSCC operates an aircraft repair school at this location. During a 2004 inspection, SSCC shared the hangar space with the Startube Company, which conducted research on fuel injectors. This business moved out as of November 2004 (SPU 2004eee).

Five catch basins are located at this property. Seven airplanes and two helicopters are stored at the site for use in training of mechanics; the aircraft do not fly – they are used for training purposes only. Chemicals used onsite include hydraulic fluid, oil, and solvents (in parts washer). Most chemicals are reused for training purposes. No fueling is conducted at this location. There is a floor drain in the hangar building. The following corrective actions were required as a result of an August 2004 SPU site inspection (SPU 2004m): develop and implement a written spill prevention plan, including preparation of a spill kit and education of employees about the spill plan and spill containment and cleanup materials (SPU 2004s). A November 2004 re-inspection indicated that no further action was required (SPU 2004uu, 2004vv).

5.1.21 Other Facilities at KCIA

Former Boeing Electronics Manufacturing Facility (EMF)

The former Boeing EMF (Building 3-962) was located at 7355 Airport Way S., near the northeast corner of the Slip 5 drainage basin. The facility was demolished in April 1996, however the property is still leased by Boeing and is currently subleased to UPS.

The EMF (FSD No. 63879778) was leased by Boeing in the 1940s and was initially used for prototype aircraft testing. It was reconfigured in the 1960s to manufacture electronic circuit boards using, among other things, solvent cleaning equipment including a vapor degreaser, underground solvent storage tank, and associated supply piping. Electronic circuit board manufacturing was discontinued in 1982, and the associated vapor degreasing equipment was removed during that time. During the removal of this equipment, trichloroethylene (TCE) contamination of groundwater underlying the EMF was discovered. The EMF buildings were demolished in 1996. Boeing initially worked to deal with the groundwater plume under Ecology's Voluntary Cleanup Program (VCP ID No. NW0080). Groundwater cleanup actions conducted under the VCP included in-well vapor stripping and groundwater recirculation, chemical oxidation utilizing potassium permanganate and sodium persulfate, and implementation of an enhanced reductive dechlorination bioremediation remedy utilizing sodium lactate, sugar products and emulsified vegetable oil.

Groundwater treatment at the site has been ongoing since 1997. The plume extends west and travels beneath the Boeing Plant 2 site and toward the LDW within the EAA-4 Source Control Area. The EMF plume may be commingling with other VOC groundwater plumes originating from solid waste management units located at Boeing Plant 2. Boeing Plant 2 is the subject of an ongoing RCRA Corrective Action, under an Administrative Order on Consent issued to Boeing by EPA in 1994.

In a Removal Action Settlement Agreement and Order on Consent negotiated between Boeing and EPA, Boeing agreed to characterize the EMF and EMF plume and develop an Engineering Evaluation/Cost Analysis (EE/CA) of removal action alternatives, including a recommended alternative. Boeing is currently working to prepare the EE/CA.

Because the VOC groundwater plume flows toward Boeing Plant 2 (EAA-4), and because the facility has been demolished, the potential for contaminants in stormwater to reach EAA-6 from this property is very low. However, cleanup activities should be monitored to ensure that contaminated soil does not enter the KCIA stormwater system.

ARFF – King County Sheriff's Office

A September 24, 2004 inspection report indicates that the Aircraft Rescue Fire Fighting (ARFF) facility is located at 8190 East Marginal Way S., on the west side of KCIA, northwest of the airport control tower and just east of Boeing Plant 2 (SPU 2004ee). At that time, the ARFF facility stored fire-fighting trucks and fire suppression foam. The following corrective actions were recommended in a letter dated October 4, 2004:

- install secondary containment for fire suppression foam product stored at the facility, or seal the floor drain in the storage room;
- inspect the sump inside the building annually and clean up as necessary
- eliminate storage of garbage or other materials over catch basins (SPU 2004mm).

A no further action letter was reportedly sent on November 19, 2004. Although this area is identified as draining to Slip 5 in the inspection report, KCIA storm drain maps indicate that this area drains to EAA-4.

The mailing address for this facility is 7300 Perimeter Road S., which is located at the northern tip of the Slip 5 drainage basin. King County lease information indicates that several agency/business offices are located in this building in addition to the King County Sheriff's Office Special Operations Division. These are: MicroDATA, Inc.; Boeing (Markov Site); King County E-911; King County Public Health; and King County Safety & Claims.

Midfield Airpark T-Hangars and Southwest T-Hangars

No inspection reports or other information was available for businesses located within these hangars. According to SPU, all are in compliance with stormwater pollution source control requirements.

FAA Air Traffic Control Tower

A source control inspection for the Federal Aviation Administration (FAA) Air Traffic Control Tower (located at 8200 East Marginal Way S.) indicates that this property drains to the Slip 5 drainage sub-basin, however a King County storm drainage system map indicates that it drains to an outfall within EAA-4. An inspection conducted in September 2004 indicated no environmental compliance issues (SPU 2004gg, 2004jj).

Pajaro, LLC

The property located at 8075 Perimeter Road S. is currently leased to Pajaro, LLC. Pajaro plans to use this property for air cargo/fixed base operations at some time in the future. No additional information was available about current or past uses at this location.

5.2 Potential for Sediment Recontamination

Activities at KCIA may result in the transport of contaminants to EAA-6 sediments via stormwater. No contaminant sources associated with historical site use have been identified.

Ongoing Contaminant Sources

The following potential ongoing contaminant sources at KCIA have been identified:

- **Airport Operations**

  Airport activities including de-icing of aircraft, fueling operations, and maintenance of aircraft and vehicles could represent a source of contaminants to EAA-6 sediments via the stormwater pathway.

- **Operations at KCIA Tenant Properties**

  KCIA tenants engage in a variety of activities, including aircraft maintenance, metal fabrication, fueling, and equipment/vehicle washing. These activities, if not properly managed, could result in the release of pollutants to the stormwater system and subsequently to the LDW.

- **PCBs in Concrete Joint Caulking Material**

  Since 2002, Boeing has removed concrete joint caulking material containing up to 79,000 mg/kg PCBs from areas of north KCIA (within the EAA-3/Slip 4 drainage basin). A joint caulk sample collected from KCIA within the EAA-4 drainage basin (location JC-3) contained elevated levels of PCBs (Ecology 2007c). If exposed concrete is present in this area, PCBs in joint caulking material within the EAA-6 drainage basin could be a source of sediment recontamination.

Potential Pathways to EAA-6 Sediments

The potential for sediment recontamination associated with this property is summarized by transport pathway below. Because KCIA is not adjacent to the LDW, bank erosion/leaching and spills to the waterway are not relevant pathways to EAA-6 sediments.

Stormwater

Very little sampling of storm drain solids has been conducted in this area of KCIA. However, storm drain solids collected from catch basins at the Ameriflight facility in 2004 contained PCBs at 6.6 mg/kg and mercury at 0.61 mg/kg. The source of these contaminants was not determined. Other properties have documented soil and groundwater contamination, such as the former Boeing EMF, which is currently undergoing investigation and cleanup, and Hangar Holdings, where petroleum-contaminated soil was left in place after construction activities in 1996/1997. Contaminants in soil and groundwater could enter the KCIA stormwater system through cracks or gaps in the stormwater piping. In addition, cleanup activities at the Boeing EMF could result in transport of contaminants in soil to the stormwater system if site activities are improperly managed. Most of the KCIA tenant facilities have not been inspected since 2004.

Groundwater

Due to the distance of KCIA from the LDW, and the lack of documented sources of COCs in groundwater that discharges to EAA-6, groundwater discharge is not believed to be a significant pathway for sediment recontamination.

5.3 Data Gaps

Information needed to assess the potential for sediment recontamination associated with operations at central KCIA is listed below. Data gaps were identified for the stormwater discharge pathway only.

Stormwater Discharge

- Sampling of storm drain solids is needed to determine whether these upland properties are a source of contaminants to EAA-6 sediments. In addition, KCIA has been asked to clean out all catch basins; the status of this effort is not known.
- The presence or absence of PCB-containing joint caulking material in central KCIA needs to be determined in order to assess the potential for EAA-6 sediment recontamination via this pathway.
- UPS Boeing Field was out of compliance with its stormwater permit during the most recent Ecology inspection. UPS is working to correct issues associated with elevated copper and zinc in their stormwater. Follow-up is needed to ensure that these issues are corrected.
- Ameriflight was out of compliance with its stormwater permit during the most recent Ecology inspection. Follow-up is needed to identify which drains discharge to stormwater and to ensure that contaminants are not entering storm drains.
- Completion of the cleanup of contamination associated with petroleum LUSTs at Hangar Holdings needs to be confirmed.
- An October 2006 inspection at Western Metal Products specified that catch basins needed to be cleaned out; it is not known whether these catch basins were cleaned. Contaminants in catch basin could potentially be transported to EAA-6 sediments.
- DHL Express was out of compliance with is stormwater permit during the most recent Ecology inspection. Follow-up inspection needed to ensure that contaminants are not entering KCIA storm drains.
- The most recent inspections at Galvin Flying Services/Clay Lacy Aviation and BAX Global were conducted over 5 years ago, and Federal Express Perimeter Rd. has never been inspected, based on the documents available during preparation of this Data Gaps report. The potential for sediment recontamination associated with these facilities cannot be determined.
- Remedial activities at the former Boeing EMF need to be monitored to ensure that contaminated soil does not enter the storm drain system.
- Based on stormwater system maps from KCIA, the ARFF facility and the Air Traffic Control Tower drain to EAA-4, not EAA-6. Confirmation is needed.
- Several KCIA tenant inspections were conducted in 2004 or 2005. Some of the facilities inspected may no longer be conducting business at this location, and new ones may have taken their place. Additional site inspections are needed to verify that the activities at the KCIA tenant facilities are in compliance with source control best management practices.

6.0 Summary of Data Gaps

Data gaps have been identified for outfalls, adjacent properties, and upland properties in Sections 3 through 5, respectively. These data gaps are summarized below, listed by potential sediment recontamination pathway.

6.1 Stormwater Discharge

6.1.1 King County Slip 5 SD/City of Seattle EOF

- No data is available about concentrations of COCs in storm drain solids and stormwater near the outfall.
- If contaminants are present at concentrations of potential concern near the outfall, then source tracing samples are needed to identify potential source(s) of the contaminants. Storm drain solids data are needed from the 48-inch storm drain line near the lift station at KCIA Outfall #2, through the Boeing Isaacson property, and from CB-39 on the Boeing Thompson property.
- Results of storm drain sampling by the Elliott Bay Action Program should be reviewed to identify additional contaminants that may be of concern in stormwater.

6.1.2 Boeing Isaacson

- No information is available about the condition of the 48-inch county storm drain line that passes through the Boeing Isaacson property. Arsenic in soil and groundwater around this pipe could be entering the storm drain line through gaps or holes in the piping, if any exist, and could subsequently be transported to the LDW and EAA-6 sediments.
- The purpose, function, and configuration of the edge drains along the Boeing Isaacson shoreline are unclear.
- No information is available regarding contaminant concentrations in catch basins that drain to the Boeing Thompson stormwater system (CB-10, CB-11, CB-12, CB-15, CB-16, CB-34, and CB-35).
- No information is available on the source or status of the “outfall of unresolved origin” reportedly located near the Boeing Isaacson/Jorgensen Forge property boundary.

6.1.3 Boeing Thompson

- Although stormwater from this facility discharges to the LDW at two locations, no sampling of stormwater solids has been conducted and therefore it is not possible to determine whether stormwater from current operations at Boeing Thompson is a source of contaminants to EAA-6 sediments.
- A stormwater compliance inspection was conducted by Ecology on April 6, 2007, which indicated that the benchmark level for total zinc had been exceeded for the preceding three quarters, and that a Level 1 response was required (Ecology 2007e). Follow-up should be conducted to ensure that this issue has been corrected.

- As of December 31, 2007, industrial/manufacturing activities have reportedly been relocated from the Boeing Thompson property to other facilities. No information was available regarding current activities at this site. An inspection is needed to evaluate the potential that current operations may contribute to recontamination of EAA-6 sediments.

6.1.4 KCIA

- Sampling of storm drain solids is needed to determine whether these upland properties are a source of contaminants to EAA-6 sediments. In addition, KCIA has been asked to clean out all catch basins; the status of this effort is not known.
- The presence or absence of PCB-containing joint caulking material in central KCIA needs to be determined in order to assess the potential for EAA-6 sediment recontamination via this pathway.
- UPS Boeing Field was out of compliance with its stormwater permit during the most recent Ecology inspection. UPS is working to correct issues associated with elevated copper and zinc in their stormwater. Follow-up is needed to ensure that these issues are corrected.
- Ameriflight was out of compliance with its stormwater permit during the most recent Ecology inspection. Follow-up is needed to identify which drains discharge to stormwater and to ensure that contaminants are not entering storm drains.
- Completion of the cleanup of contamination associated with petroleum LUSTs at Hangar Holdings needs to be confirmed.
- An October 2006 inspection at Western Metal Products specified that catch basins needed to be cleaned out; it is not known whether these catch basins were cleaned. Contaminants in catch basin could potentially be transported to EAA-6 sediments.
- DHL Express was out of compliance with is stormwater permit during the most recent Ecology inspection. Follow-up inspection needed to ensure that contaminants are not entering KCIA storm drains.
- The most recent inspections at Galvin Flying Services/Clay Lacy Aviation and BAX Global were conducted over 5 years ago, and Federal Express Perimeter Rd. has never been inspected, based on the documents available during preparation of this Data Gaps report. The potential for sediment recontamination associated with these facilities cannot be determined.
- Remedial activities at the former Boeing EMF need to be monitored to ensure that contaminated soil does not enter the storm drain system.
- Based on stormwater system maps from KCIA, the ARFF facility and the Air Traffic Control Tower drain to EAA-4, not EAA-6. Confirmation is needed.
- Several KCIA tenant inspections were conducted in 2004 or 2005. Some of the facilities inspected may no longer be conducting business at this location, and new ones may have taken their place. Additional site inspections are needed to verify that the activities at the KCIA tenant facilities are in compliance with source control best management practices.

6.2 Groundwater Discharge

6.2.1 Boeing Isaacson

- Data on contaminant concentrations in subsurface soil near the former location of the Slip 5 outfall is not available. These data are needed to evaluate the potential for historical releases of contaminants from the central KCIA storm drain system; if present, these may be transported to the LDW and EAA-6 sediments via groundwater.
- The extent of contaminated soil to the north of the 48-inch storm drain line is unknown. Contaminants in soil could enter the storm drain line through gaps or holes in the piping, and subsequently could be transported to the LDW.
- Arsenic has been detected in groundwater at the Isaacson property at concentrations up to 1,600 ug/L. Additional groundwater data are needed to determine whether residual historical contamination poses a risk of sediment recontamination via groundwater transport.
- In 1997, GeoEngineers conducted a statistical analysis of groundwater data at the Boeing Isaacson (and Thompson) properties; they calculated a 95 percent upper confidence limit and concluded that downgradient monitoring wells at the Boeing Isaacson site were in compliance with ambient water quality criteria. This analysis was not available for review at the time this Data Gaps report was prepared, and the groundwater data available for review were incomplete. Additional groundwater samples at the Boeing Isaacson property were collected in 2000 and 2007. Therefore, the validity of this conclusion needs to be evaluated.
- Soil and groundwater sampling at this property has focused on arsenic. However, investigations conducted in 1983 and 1988 identified lead (to 95 ug/L), silver (to 8.1 ug/L), and zinc (to 14,000 ug/L) at concentrations above groundwater-to-sediment screening levels[23]. Other metals may be associated with fill material used at the site. Arsenic remediation activities may have resulted in reduction or elimination of the sources of these contaminants, however no sampling has been conducted to determine whether this is the case.

6.2.2 Boeing Thompson

- Arsenic is present at elevated concentrations in two groundwater monitoring wells at this property. Although these wells have been sampled several times since 1988, a comprehensive soil and groundwater investigation has not been conducted at this property. Information on groundwater concentrations of arsenic and other contaminants of concern from throughout the site is needed to determine the sources of arsenic and to evaluate potential contaminant transport pathways to LDW sediment.
- Boeing is currently preparing a memorandum to document their findings associated with the two drainage pipes that may be discharging to the Kenworth Motor/IAA property. A review of this memorandum may provide additional information needed to assess the potential for sediment recontamination.

[23] Groundwater-to-sediment screening levels based on CSLs are 13 ug/L for lead, 1.5 ug/L for silver, and 76 ug/L for zinc, as described in SAIC 2006.

- The tidal efficiency observed in well I-205 measured during a tidal study in 2000 appeared to be anomalous (ERM 2000d). Recorded groundwater elevation changes at this well exhibited patterns inconsistent with data from other wells and piezometers in the vicinity. The reason for these anomalous results is unknown.
- The source of arsenic in groundwater as measured at wells I-205 and I-206 is not known. GeoEngineers (1996, as cited in ERM 2000a) concluded that the Boeing Isaacson was not the source of arsenic in these wells. However, the GeoEngineers report was not available in the files reviewed during preparation of this Data Gaps report, and this conclusion could not be verified.
- Although monitoring wells I-205 and I-206 have been sampled numerous times, little information on arsenic concentrations in groundwater in other areas of the property is available; this makes identification of the arsenic source difficult.
- Soil samples were collected and analyzed for arsenic at the Boeing Thompson property in 1996. No information on other contaminants that may be present in soils is available. Since contaminants in fill material are considered a potential source, additional soil data for arsenic and other chemicals is needed to evaluate the potential for recontamination of EAA-6 sediments.

6.3 Bank Erosion/Leaching

6.3.1 Boeing Isaacson

- No information is available regarding contaminant concentrations in bank soils.

6.3.2 Boeing Thompson

- No information is available regarding contaminant concentrations in bank soils.

7.0 References

Boeing. 1981a. Letter from T.J. Burke, Senior Manager, Facilities Engineering, Boeing Commercial Airplane Company, to R. Sylvester, District Inspector, Environmental Quality, Department of Ecology, Re: Application for NPDES Permit for Boeing's Thompson Site. March 18, 1981. [800]

Boeing. 1981b. Letter from T.J. Burke, Senior Manager, Facilities Engineering, Boeing Commercial Airplane Company, to R. Sylvester, District Inspector, Environmental Quality, Department of Ecology, Re: Signed Application for NPDES Permit for Boeing's Thompson Site. March 26, 1981. [801]

Boeing. 1982. Letter from T.J. Burke, Senior Manager, Facilities Engineering, Boeing Commercial Airplane Company, to Robert McCormick, Regional Manager, Washington State Department of Ecology, Re: Boeing-Thompson Site NPDES Permit No. WA-003065-1 (I), Proposed Permit & Publication Notice. May 18, 1982. [807]

Boeing. 1985a. Letter from W.R. Diefenderfer, Supervisor, Facilities Plant Engineering, Boeing Commercial Airplane Company, to Joan K. Thomas, Regional Manager, Washington State Department of Ecology, Re: Request for Revision to Permits WA-000086-8 and WA-003065-1. April 22, 1985. [823]

Boeing. 1985b. Letter from W.R. Diefenderfer, Supervisor, Facilities Plant Engineering, Boeing Commercial Airplane Company, Renton Division, to Joan K. Thomas, Regional Manager, Washington State Department of Ecology, Re: Application for NPDES stormwater discharge permits: Boeing-Thompson Site, Boeing-Isaacson Site, Boeing Kent Benaroya Site, North Boeing Field Site, Boeing – Valley Office Park Site. April 23, 1985. [824]

Boeing. 1987. Letter from J.T. Johnstone, Boeing Military Airplane Company, to Dan Cargill, District Inspector, Washington Department of Ecology, Re: Heat Transfer Oil Spill. May 5, 1987. [899]

Boeing. 1988a. Letter from L.F. Boulanger, Plant Engineering Manager, Boeing Advanced Systems Company, to Mary A. Kautz, Enforcement Officer, Washington Department of Ecology, Re: NPDES Permit Renewals. March 4, 1988. [843]

Boeing. 1988b. Letter from J.T. Johnstone, Manager, Environmental Affairs, Boeing Advanced Systems, to Mr. Alejandro Gonzalez, Department of Ecology, Re: Additional information for renewal of NPDES permits. July 19, 1988. [850]

Boeing. 1988c. Letter from J.T. Johnstone, Manager, BAS Environmental Affairs, Boeing Advanced Systems, to Mary Kautz, Enforcement Officer, Washington Department of Ecology, Re: Cancellation of NPDES Permit No. WA-003065-1(I). August 30, 1988. [852]

Boeing. 1988d. Letter from J.T. Johnstone, Manager, Environmental Affairs, Boeing Advanced Systems, to David Misko, Washington Department of Ecology, Re: Revised Notification of Dangerous Waste Activities. September 16, 1988. [1051]

Boeing. 1988e. Letter from Paul Johansen, Environmental Projects, Boeing Support Services, to Mr. John Conroy, Washington Department of Ecology, Re: Isaacson Building 14-05, Extraction of Arsenic from Soil. November 11, 1988. [896]

Boeing. 1989. Letter from Kirk Thomson, Manager, Environmental Affairs, Boeing Support Services, to Mr. Michael Rundlett, Washington Department of Ecology, Re: Excavation at Boeing Thompson-Isaacson Site. March 27, 1989. [888]

Boeing. 1990a. Letter from Paul J. Johansen, Manager, Environmental Projects, The Boeing Company, to Julie Sellick, Supervisor, Solid and Hazardous Waste Section, Washington Department of Ecology, Re: Soil Stabilization at Boeing Thompson-Isaacson Site. August 17, 1990. [1043]

Boeing. 1990b. Letter from Paul J. Johansen, Manager, Environmental Projects, The Boeing Company, to Julie Sellick, Supervisor, Solid and Hazardous Waste Section, Washington Department of Ecology, Re: Soil Stabilization at Boeing Thompson-Isaacson Site: Follow-On Questions from Ecology. September 11, 1990. [1041]

Boeing. 1990c. Letter from Paul J. Johansen, Manager, Environmental Projects, The Boeing Company, to Julie Sellick, Supervisor, Solid and Hazardous Waste Section, Washington Department of Ecology, Re: Soil Stabilization at Boeing Thompson-Isaacson Site. December 17, 1990. [909]

Boeing. 1991a. Letter from J. Scott Wilbur, Project Hydrogeologist, The Boeing Company, to Julie Sellick, Supervisor, Solid and Hazardous Waste Section, Washington Department of Ecology, Re: Soil Stabilization at Boeing Thompson-Isaacson Site: Pilot Test Report. July 10, 1991. [923]

Boeing. 1991b. Data: Summary of Soil Stabilization Pilot Test Results. July 9, 1991. [1042]

Boeing. 1992a. Letter from Paul J. Johansen, Manager, Environmental Projects, The Boeing Company, to Julie Sellick, District Manager, Hazardous Waste, Washington Department of Ecology, Re: Submittal of the “Final Report Thompson-Isaacson Site, Full Scale Soil Stabilization Program Summary Report” (prepared by GeoEngineers and Landau Associates for Boeing). April 28, 1992. [908]

Boeing. 1992b. Letter from J.T. Johnstone, Environmental Affairs Manager, Boeing Defense & Space Group, to Mr. Joe Hickey, Washington Department of Ecology, Re: Investigation of Potential Release from Oil Collection Tank. August 18, 1992. [906]

Boeing. 1992c. Executive Summary, Pollution Prevention Plan, Thompson Site. Prepared by The Boeing Company. September 1, 1992. [885]

Boeing. 1993. Thompson Site, Pollution Prevention Progress Report. Boeing Defense & Space Group. September 1, 1993. [884]

Boeing. 1994a. Letter from L.M. Babich, III, Environmental Affairs Manager, Boeing Commercial Airplane Group, to Ms. Jeannie Summerhays, Hazardous Waste Inspector, Washington State Department of Ecology, Re: Change in Environmental Management at The Boeing Company's Thompson Facility (WAD 980982912, 8701 East Marginal Way South, Tukwila, Washington). May 31, 1994. [1047]

Boeing. 1994b. Letter from L.M. Babich, III, Environmental Affairs Manager, Boeing Commercial Airplane Group, to Ms. Pam Elardo, Water Quality Engineer, Washington Department of Ecology, Re: Thompson Site Facility Discharging of Fire System and Associated Sprinkler System Non-Process Water to the Duwamish River. September 13, 1994. [1057]

Boeing. 1994c. The Boeing Company, Renton Division, Thompson Site Pollution Prevention Plan Progress Report, 1994. [883]

Boeing. 1997a. Letter from L.M. Babich III, 737/757 Programs Environmental Affairs Manager, Boeing Commercial Airplane Group, to Mr. Ron DeVitt, Washington State Department of Ecology, Re: Leakage from cooling tower. June 18, 1997. [1062]

Boeing. 1997b. Letter from L.M. Babich III, 737/757 Programs Environmental Affairs Manager, Boeing Commercial Airplane Group, to Mr. Ron DeVitt, Washington State Department of Ecology, Re: Elimination of Discharge, Cooling Tower Leak at Building 14-14. June 30, 1997. [1063]

Boeing. 2001. Stormwater Pollution Prevention Plan, The Boeing Company, Thompson Site, Existing Permit SO3000148. April 2001. [1061]

Boeing. 2007. Letter from Paul J. Johansen, Project Manager, The Boeing Company, to Mr. Dale Myers, Washington State Department of Ecology, Re: Independent Remedial Action, Sump Removal and Soil Excavation, Boeing Isaacson Property, Seattle, Washington. [858]

Burlington Environmental. 1991. Letter from Ron Atwood, Division Manager, Puget Sound Plant Operations, Burlington Environmental, Inc., to Ms. Linda Devange, Hazardous Waste Reduction & Management, The Boeing Company, Re: Disposal of Dioxin-Containing Waste (Dearborn 711). May 21, 1991. [1045]

City of Tukwila. 2001. Boundary Line Adjustment No. L 2000-080. City of Tukwila, Washington. Recorded by King County Department of Assessments on November 8, 2001. [1109]

Dames & Moore. 1983. Report of Evaluation of Site Contamination, Isaacson Steel Property, for the Boeing Aerospace Company. October 4, 1983. [815]

Ecology. 1981a. Letter from Robert J. Sylvester, District Supervisor, Environmental Quality, Department of Ecology, to T.J. Burke, Senior Manager, Facilities Engineering, Boeing Commercial Airplane Company, Re: NPDES Waste Discharge Permit, 757 Fatigue Testing Program. April 3, 1981. [802]

Ecology. 1981b. Inspection Report, Boeing-Thompson Site. Prepared by M. Dawda, Department of Ecology. May 20, 1981. [808]

Ecology. 1981c. Letter from John F. Spencer, Deputy Director, Department of Ecology, to T.J. Burke, Senior Manager, Facilities Engineering, Boeing Commercial Airplane Company, Re: National Pollutant Discharge Elimination System (NPDES) Permit No. WA-003065-1 (I) Boeing-Thompson Site. [803]

Ecology. 1981d. Letter from Robert K. McCormick, Regional Manager, Department of Ecology, to Elliott Burkeheiser, The Boeing Company, Re: NPDES Permit No. WA-003065-1(I), Oil/Water Separator, Thompson Site. July 23, 1981. [812]

Ecology. 1981e. Letter from M.M. Dawda, District Engineer, Environmental Quality, Department of Ecology, to T.J. Burke, Senior Manager, Facilities Engineering, Boeing Commercial Airplane Company, Re: Draft NPDES Permit No. WA-003065-1 (I), Boeing-Thompson Site. October 7, 1981. [804]

Ecology. 1982a. Letter from M.M. Dawda, District Engineer, Environmental Quality, Department of Ecology, to T.J. Burke, Senior Manager, Facilities Engineering, Boeing Commercial Airplane Company, Re: Proposed Permit & Publication Notice, Boeing-Thompson Site, NPDES Permit No. WA-003065-1 (I). April 27, 1982. [805]

Ecology. 1982b. Telephone Record prepared by Tom Moore, Ecology. Conversation with Elliot Burkeheiser, Boeing Aircraft Company, Re: NPDES WA-003065-1 (I) Thompson Site. May 11, 1982. [806]

Ecology. 1982c. Memorandum to File from Julie Sellick, Ecology, Re: Chromic-Sulfuric Acid Spill/Leak at the Boeing EMF Facility in Seattle, Washington. May 28, 1982. [809]

Ecology. 1982d. Letter from Julie Sellick, NWRO, Department of Ecology, to Gail Keyes, Department of Ecology, Re: Notice of Violation Recommendation, Chromic-Sulfuric Acid Spill/Leak at the Boeing EMF Facility in Seattle, Washington. June 28, 1982. [810]

Ecology. 1982e. Letter from M.M. Dawda, District Engineer, Environmental Quality, Department of Ecology, to T.J. Burke, Senior Manager, Facilities Engineering, The Boeing Company, Re: The Boeing Company – Thompson Site, NPDES Permit #WA-003065-1 (I). [811]

Ecology. 1982f. National Pollutant Discharge Elimination System Waste Discharge Permit No. WA-003065-1 (I), Expiration 9/14/87, The Boeing Company – Thompson Site, P.O. Box 3707, Seattle, Washington 98124. September 14, 1982. [813]

Ecology. 1982g. Letter from Gail Keyes, Enforcement Officer, Ecology, to V.E. Norton, Manager, Facilities Engineering, The Boeing Company, Re: Order, Docket No. DE 82-469. October 7, 1982. [814]

Ecology. 1984a. Letter from Robert K. McCormick, Regional Manager, Ecology, to Mr. Donald L. Hegland, Executive Vice President, Isaacson Corporation, Re: Excavation of Hot Spots. February 9, 1984. [818]

Ecology. 1984b. Inspection Report, Boeing-Thompson Site. Prepared by M. Dawda, Department of Ecology. October 25, 1984. [840]

Ecology. 1984c. Letter from Robert K. McCormick, Regional Manager, Department of Ecology, to Mr. Donald L. Hegland, Executive Vice President, Isaacson Corporation, Re: Isaacson Property. June 29, 1984. [1032]

Ecology. 1987. NPDES Compliance Inspection Report, Boeing Company-Thompson Site. Prepared by Alejandro Gonzalez, Washington Department of Ecology. November 16, 1987. [841]

Ecology. 1988a. Letter from Richard Koch, Acting Metro District Supervisor, Northwest Regional Office, Washington Department of Ecology, to J.T. Johnstone, Facilities Manager Environmental Affairs, Boeing Advanced Systems, Re: Isaacson Bldg. 1405. May 10, 1988. [849]

Ecology. 1988b. Memorandum to File from Lynn Coleman, Ecology Northwest Regional Office, Re: Boeing Isaacson Steel Property Site Visit. December 19, 1988. [895]

Ecology. 1989a. Letter from David Nunnallee, Acting Section Supervisor, Northwest Regional Office, Washington Department of Ecology, to James T. Johnstone, The Boeing Aerospace Company, Re: Cancellation of NPDES Permit No. WA-003065-1. February 24, 1989. [1058]

Ecology. 1989b. Memorandum from Monica Farris, Hazardous Waste Development and Support Section, Washington Department of Ecology, to Lynn Coleman, Northwest Regional Office, Re: Boeing's Isaacson property clean-up. March 1, 1989. [890]

Ecology. 1989c. Potential Hazardous Waste Site, Site Identification, Isaacson/Thompson Property – Boeing. Prepared by Lynn Coleman, Washington Department of Ecology. March 6, 1989. [889]

Ecology. 1989d. Memorandum to File from Lynn Coleman, Ecology Northwest Regional Office, Re: Boeing Isaacson/Thompson Site Cleanup Progress. April 28, 1989. [887]

Ecology. 1989e. Memorandum to File from Lynn Coleman, Ecology Northwest Regional Office, Re: Boeing Isaacson Site Visit. May 24, 1989. [886]

Ecology. 1990. Letter from Jeannie Summerhays, Hazardous Waste Inspector, Washington Department of Ecology, to Mr. Paul Johansen, Boeing Support Services, Re: Soils Treatment Proposal for the Thompson-Isaacson Site. November 19, 1990. [1040]

Ecology. 1991a. Letter from Julie Sellick, Supervisor, Solid and Hazardous Waste Section, Washington Department of Ecology, to Mr. Paul Johansen, The Boeing Company, Re: Pilot Project Approval for Thompson-Isaacson Site and Response to Materials Provided 3/12/91. March 22, 1991. [1037]

Ecology. 1991b. Letter from M. Vernice Santee, Environmental Review Section, Washington Department of Ecology, to Mr. Darren Wilson, City of Tukwila, Re: Comment on Prethreshold Consultation for the Boeing Thompson/Isaacson Site Soil Stabilization Project. May 1, 1991. [1036]

Ecology. 1991c. Letter from Julie Sellick, Solid and Hazardous Waste Supervisor, Washington Department of Ecology, to Mr. Paul Johansen, Boeing Support Services, Re: Approval for Full-Scale Soil Stabilization Project at the Thompson-Isaacson Site. July 31, 1991. [1035]

Ecology. 1992. Letter from Barbara Smith, Supervisor, Hazardous Waste Compliance Unit 1, Washington Department of Ecology, to Ms. Linda J. DeVange, Environmental Administrator, The Boeing Company, Re: Unused Product – Dearborn 711. March 9, 1992. [1044]

Ecology. 1997. Dangerous Waste Compliance Inspection Checklist, Boeing Thompson Site. Prepared by J. David Hohmann, Washington Department of Ecology. August 5, 1997. [1046]

Ecology. 2000a. Environmental Report Tracking System Referral, King County Airport/Hangar Holdings. April 3, 2000. [216]

Ecology. 2000b. Letter from Nnamdi Madakor, Toxics Cleanup Program, Northwest Regional Office, to Mr. Tim McCormick, ERM, Re: Request for Review and Opinion Letter, Boeing Isaacson Property, 8625 East Marginal Way, Seattle, WA 98108. VCP ID#NW0453. May 16, 2000. [847]

Ecology. 2001. Letter from Nnamdi Madakor, Toxics Cleanup Program, Northwest Regional Office, to Mr. Paul Frankel, Energy and Environmental Affairs, The Boeing Company, Re: Request for Review and Opinion Letter, Boeing Isaacson Property, 8625 East Marginal Way, Seattle, WA 98108. VCP ID# NW0453. January 12, 2001. [877]

Ecology. 2004. Lower Duwamish Waterway Source Control Strategy. Publication No. 04-09-043. Prepared by Washington State Department of Ecology, Northwest Regional Office, Toxics Cleanup Program. January 2004.

Ecology. 2006a. Stormwater Compliance Inspection Report, United Parcel Service, Inc., SO3000434D, 7575 Perimeter Road S., Seattle, WA 98108. Prepared by Greg Stegman,

Washington Department of Ecology, Northwest Regional Office. January 11, 2006. [1113]

Ecology. 2006b. Lower Duwamish Waterway Source Control Action Plan for the Slip 4 Early Action Area. Washington State Department of Ecology, Publication No. 06-09-046. July 2006.

Ecology. 2006c. Stormwater Compliance Inspection Report, ABX Air, Inc./DHL Express, SO3004602B, 8075 Perimeter Road S., Seattle, WA 98108. Prepared by Greg Stegman, Washington Department of Ecology, Northwest Regional Office. May 24, 2006. [1110]

Ecology. 2006d. Stormwater Compliance Inspection Report, Ameriflight Inc., SO3002830C, 7585 Perimeter Road S., Seattle, WA 98108. Prepared by Greg Stegman, Washington Department of Ecology, Northwest Regional Office. October 25, 2006. [1111]

Ecology. 2006e. Letter from Barbara Smith, Hazardous Waste and Toxics Reduction Program, Washington Department of Ecology, to Mr. Michael Verhaar, Boeing Thompson, Re: Dangerous Waste Compliance Inspection at Boeing Thompson. March 27, 2006. [1055]

Ecology. 2007a. Underground Storage Tank Inspection Form, Vulcan Flight Mgt/Hangar Holdings, 7675 Perimeter Road S. Prepared by Baron, Washington Department of Ecology. February 28, 2007. [1114]

Ecology. 2007b. Letter from Gregory P. Stegman, Water Quality Program, Northwest Regional Office, Department of Ecology, to Mr. Rod Fichter, Ameriflight, Inc., Re: Non-Compliance with Industrial Stormwater General Permit No. SO3002830 terms and conditions. March 8, 2007. [1112]

Ecology. 2007c. Lower Duwamish Waterway Source Control Status Report. 2003 to June 2007. Washington State Department of Ecology. Publication No. 07-04-064. July 2007.

Ecology. 2007d. Letter from Maura S. O'Brien, Site Manager, Toxics Cleanup Program, Northwest Regional Office, Washington Department of Ecology, to Mr. Paul Frankel, Energy and Environmental Affairs, The Boeing Company, Re: Groundwater Sampling Results for Wet and Dry Season at I-205 and -206 at Boeing Isaacson Property, 8625 East Marginal Way, Tukwila, WA 98018. November 8, 2007. [1107]

Ecology. No Date. Boeing Plant 2 and Areas South, Historical Review, Sanborn Fire Insurance Maps (1904 to 1946). [892]

EPA. No Date. Administrative Settlement Agreement and Order on Consent for Removal Action. U.S. EPA Region X, CERCLA Docket No. 10-2007-0091. In the Matter of: Boeing Electronics Manufacturing Facility, Seattle, Washington. [1038]

ERM. 2000a. Conceptual Proposal for No Further Action Determination at the Boeing Isaacson Property. Prepared by Environmental Resources Management for The Boeing Company. April 2000. [919]

ERM. 2000b. Memorandum from Tom Cammarata, ERM, and Lisa Yost, Exponent, to Mr. Paul Frankel, The Boeing Company, Re: Boeing-Former Thompson-Isaacson Steel Site, Overview of ERM Site Characterization Strategy. July 13, 2000. [917]

ERM. 2000c. Request for Soil NFA Determination, Supporting Information, Boeing Isaacson Site, VCP ID#NW0453. Prepared by Environmental Resources Management for The Boeing Company. November 2000. [918]

ERM. 2000d. Request for Groundwater NFA Determination, Hydrogeologic Investigation and Site-Specific Action Level for Arsenic in Groundwater, Boeing Isaacson Site, VCP ID#NW0453. Prepared by Environmental Resources Management for The Boeing Company. November 2000. [1033]

ERM. 2001. Letter from Paul Frankel, Boeing, Lisa Yost, Exponent, and Mike Arnold, ERM, to Nnamdi Madakor, Washington State Department of Ecology, Re: 6 February 2001 Meeting Summary. February 21, 2001. [921]

Exponent. 1998. Duwamish Waterway Phase I Site Characterization Report. Prepared by Exponent for The Boeing Company. March 1998. As cited in Windward 2003a.

Foster. 1945. Sources of Pollution in the Duwamish-Green River Drainage Area. Prepared by Richard F. Foster, Washington Pollution Control Commission. December 6, 1945. [784]

GeoEngineers. 1997. Thompson-Isaacson Site Evaluation Groundwater Compliance Monitoring Program. Prepared by GeoEngineers for The Boeing Company. As cited in ERM 2000a.

Graham & Dunn. 1986. Letter from Frederick Frederickson, Graham & Dunn, Attorneys at Law, to Mr. Jeff Goltz, Attorney at Law, Department of Ecology, Re: Isaacson vs. Holland-America, et al. December 18, 1986. [831]

Hart Crowser. 1997a. Technical Memorandum from Garry Horvitz and Mike Ehlebracht, Hart Crowser, to Jeff Graves, Vulcan Northwest, Re: Groundwater Quality Testing Results for HHI Hangar Site. May 1, 1997. [219]

Hart Crowser. 1997b. Memorandum from Garry Horvitz and Mike Ehlebracht, Hart Crowser, to Jeff Graves, Vulcan Northwest, Re: Estimated Extents and Volumes of Contaminated Soils, Hangar Holdings, Inc. Corporate Hangar Project. August 8, 1997. [217]

Hartley. 2008. Email from Kathryn Hartley, Landau, to Kathryn Lewis, Re: Isaacson Cumulative Groundwater Data. January 18, 2008.

Isaacson. 1983. Letter from Henry C. Isaacson, Jr., Isaacson Corporation, to Mr. Robert McCormick, Manager, Northwest Regional Office, Washington Department of Ecology, Re: Closure of Steel Fabrication Operation at 8620 E. Marginal Way South. December 20, 1983. [1050]

Isaacson. 1984a. Letter from Donald L. Hegland, Executive Vice President, Isaacson Corporation, to Mr. Robert McCormick, Manager, Northwest Regional Office,

Washington Department of Ecology, Re: Soil Contamination Problems. January 31, 1984. [817]

Isaacson. 1984b. DRAFT Letter from Donald L. Hegland, Executive Vice President, Isaacson Corporation, to Mr. Robert McCormick, Regional Manager, Department of Ecology, Re: Response to November 20, 1984 letter concerning cleanup of arsenic contaminated soils. December 1984. [821]

King County. 2003. Storm Water Pollution Prevention Plan, King County International Airport, Seattle, WA. April 2003. As cited in Ecology 2006b.

King County. 2005. Letter from Sue Hamilton, Hazardous Waste Investigator, King County, to Mr. Levan, Aeroflight, Re: Meeting on April 22, 2005 at 8555 Perimeter Road South. May 11, 2005. [922]

King County. 2007. Combined Sewer Overflow Program. 2006-2007 Annual Report. Wastewater Treatment Division, King County Department of Natural Resources and Parks. October 2007.

King County & SPU. 2005. King County and Seattle Public Utilities Source Control Program for the Lower Duwamish Waterway, June 2005 Progress Report. Prepared by Seattle Public Utilities and King County Industrial Waste. [10]

KCIA. 1997. Letter from Cynthia Stewart, Manager, King County International Airport, to Jeff Graves, Vulcan Northwest, Inc., Re: Hangar Holdings Geotechnical Groundwater Reports. July 15, 1997. [218]

KCIA. 2001. King County International Airport, Proposed Policy and Procedure, Response to Spills. December 15, 2001. [825]

Landau. 1986. First Annual Report, Ground Water Monitoring Program, Boeing Isaacson Property, 8541 East Marginal Way South, Seattle, Washington. Prepared by Landau Associates, Inc. for The Boeing Company. June 1986. [829]

Landau. 1987. Second Annual Report, Ground Water Monitoring Program, Boeing Isaacson Property, 8541 East Marginal Way South, Seattle, Washington. Prepared by Landau Associates, Inc. for The Boeing Company. May 29, 1987. [838]

Landau. 1988a. Data Report: Building 14-09, Thompson-Isaacson Site Investigation. Prepared for The Boeing Company by Landau Associates, Inc. May 4, 1988. [848]

Landau. 1988b. Data Report No. 2: Building 14-09, Thompson-Isaacson Site Investigation. Prepared for The Boeing Company by Landau Associates, Inc. July 8, 1988. [1031]

Landau. 1989. Final Report, Thompson-Isaacson Site Soil Excavation Work Plan. Prepared by Landau Associates, Inc. for The Boeing Company. March 21, 1989. [900]

Landau. 1990. Thompson-Isaacson Site Soil Remedial Action Plan. Prepared by Landau Associates, Inc. for The Boeing Company. December 17, 1990. [937]

Landau. 1991. Thompson-Isaacson Site Ground Water Monitoring Program. Prepared by Landau Associates, Inc. for The Boeing Company. March 1, 1991. [912]

Landau & GeoEngineers. 1992. Final Report, Thompson-Isaacson Site, Full-Scale Soil Stabilization Program, Summary Report. Prepared by Landau Associates, Inc. and GeoEngineers for The Boeing Company. Volumes I, II, and III. April 27, 1992. [907]

Landau. 2007. Sump Removal and Soil Excavation, Boeing Isaacson Property, Seattle, Washington. Prepared by Landau Associates for The Boeing Company. February 5, 2007. [859]

Landau. 2008. Cumulative Data Table. Summary of Compounds Detected in Groundwater, Boeing Isaacson-Thompson Site, Seattle, Washington. Draft.

McCrone. 2008. Email from Lawrence McCrone, Exponent, to Sarah Good, Ecology, Re: Boeing Comments on draft Summary of Existing Information and Identification of Data Gaps Report for Early Action Area 6. March 19, 2008.

METRO. 1990. Letter from Louise Kulzer, Industrial Waste Investigator, Municipality of Metropolitan Seattle (METRO), to Doug Knutson, Department of Ecology, Re: Boeing Airplane Co. (formerly Boeing Advanced System), Waste Discharge Permit Applications. March 21, 1990. [1054]

NOAA (National Oceanic and Atmospheric Administration). 1998. Duwamish Waterway sediment characterization study report. Damage Assessment Center, National Oceanic and Atmospheric Administration, Seattle, WA. As cited in Windward 2003a.

O'Brien. 2007. Email from Maura O'Brien, Washington Department of Ecology, to Iris Winstanley, SAIC, Re: Current Status of Boeing Thompson/Isaacson Property. December 13, 2007. [1108]

Office of the Attorney General. 1987. Letter from T.C. Richmond, Washington State Office of the Attorney General, to Jeff Goltz and Nancy Ellison, Ecology, Re: Isaacson v. Holland-America, et al. January 8, 1987. [833]

SAIC. 2006. Soil and Groundwater Screening Criteria, Source Control Action Plan, Slip 4, Lower Duwamish Waterway. Prepared for Washington State Department of Ecology. Prepared by Science Applications International Corporation (SAIC), Bothell, WA. August 2006.

SPU. 2001a. Stormwater Pollution Prevention Inspection Report, Galvin Flying Inc., 7777 Perimeter Rd. S. Seattle Public Utilities Business Inspection Checklist. September 18, 2001. [976]

SPU. 2001b. Stormwater Pollution Prevention Inspection Report, UPS, 7575 Perimeter Rd. S. Seattle Public Utilities Business Inspection Checklist. September 26, 2001. [1011]

SPU. 2001c. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Jay Cheney, c/o Galvin Flying Service, Re: Results from the September 18th 2001 stormwater pollution prevention inspection: No action required. September 28, 2001. [1012]

SPU. 2001d. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Marvin Lock, c/o United Parcel Service, Re: Results from the September 26th 2001 stormwater pollution prevention inspection: No action required. September 25, 2001. [979]

SPU. 2001e. Stormwater Pollution Prevention Inspection Report, Seattle Public Utilities. Flight Center, 7827 Perimeter Rd. S. Business Inspection Checklist. October 9, 2001. [988]

SPU. 2001f. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Flight Center, C/o Larry McGauran, Re: Results from the October 9th 2001 stormwater pollution prevention inspection: No action required. October 16, 2001. [992]

SPU. 2001g. Stormwater Pollution Prevention Inspection Report, Seattle Public Utilities. Wings Aloft, 8467 Perimeter Rd. S. Business Inspection Checklist. October 18, 2001. [1028]

SPU. 2001h. Stormwater Pollution Prevention Inspection Report, Seattle Public Utilities. Aeroflight, 8555 Perimeter Rd. S. Business Inspection Checklist. October 18, 2001. [939]

SPU. 2001i. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Tom Noble, C/o Wings Aloft, Re: Results from the October 18th 2001 stormwater pollution prevention inspection: No action required. October 25, 2001. [1029]

SPU. 2001j. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Justin Knapp, C/o Aeroflight, Re: Results from October 18th 2001 stormwater pollution prevention inspection: Corrective action required. October 25, 2001. [941]

SPU. 2001k. Stormwater Pollution Prevention Inspection Report, Seattle Public Utilities. BAX Global, 8201 Perimeter Rd. S. Business Inspection Checklist. November 5, 2001. [952]

SPU. 2001l. Stormwater Pollution Prevention Inspection Report, Seattle Public Utilities. Tag Aviation, 7675 Perimeter Rd. S. Business Inspection Checklist. November 7, 2001. [1016]

SPU. 2001m. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Rollie Grams, C/o BaxGlobal, Re: Results from November 5th 2001 stormwater pollution prevention inspection: Corrective action required. November 13, 2001. [955]

SPU. 2001n. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Aaron Zimmerman, C/o Tag Aviation, Re: Results from November 7th 2001

stormwater pollution prevention inspection: Corrective action required. November 20, 2001. [1015]

SPU. 2001o. Stormwater Pollution Prevention Inspection Report, Seattle Public Utilities. All Star Nordstrom, 7979 Perimeter Rd. S. Business Inspection Checklist. November 5, 2001. [994]

SPU. 2001p. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Gary Smith, C/o Nordstrom, Re: Results from November 5th 2001 stormwater pollution prevention inspection: No action required. November 13, 2001. [996]

SPU. 2002a. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Aeroflight, C/o Justin Knapp, Re: Results from the January 17th 2002 stormwater pollution prevention inspection: No action required. January 29, 2002. [940]

SPU. 2002b. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Aaron Zimmerman, C/o Tag Aviation, Re: Results from the February 6th 2002 stormwater pollution prevention inspection: No action required. February 14, 2002. [1014]

SPU. 2002c. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Rollie Grams, C/o BaxGlobal, Re: Results from the February 13th 2002 stormwater pollution prevention inspection: Corrective action required. February 14, 2002. [954]

SPU. 2002d. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Rollie Grams, C/o BaxGlobal, Re: Results from the March 6th 2002 stormwater pollution prevention re-inspection: No action required. March 7, 2002. [953]

SPU. 2003. Stormwater Pollution Prevention Inspection Report, Clay Lacy Aviation, 8285 Perimeter Rd. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 4, 2003. [963]

SPU. 2004a. Stormwater Pollution Prevention Inspection Report, Ameriflight, 7585 Perimeter Rd. S. Hangar #5. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 4, 2004. [947]

SPU. 2004b. Stormwater Pollution Prevention Inspection Report, UPS, 7575 S. Perimeter Rd. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 4, 2004. [1009]

SPU. 2004c. Stormwater Pollution Prevention Inspection Report, Airwest Repair Services, 8167 Perimeter Rd. S.. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 5, 2004. [944]

SPU. 2004d. Stormwater Pollution Prevention Inspection Report, Puget Sound Aviators, 8167 Perimeter Rd. S.. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 5, 2004. [997]

SPU. 2004e. Stormwater Pollution Prevention Inspection Report, CJ Systems Aviation Group, 8167 Perimeter Rd. S.. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 5, 2004. [966]

SPU. 2004f. Stormwater Pollution Prevention Inspection Report, Gyroplanes of Seattle, LLC, 8167 Perimeter Rd. S.. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 5, 2004. [980]

SPU. 2004g. Stormwater Pollution Prevention Inspection Report, DHL, 8075 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 6, 2004. [969]

SPU. 2004h. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Airwest Repair Services, Attn: Charles Bicknell, Re: Results from the August 5, 2004 pollution prevention inspection: No action required. August 9, 2004. [945]

SPU. 2004i. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Puget Sound Aviators, Attn: Lauren Roux, Re: Results from the August 5, 2004 pollution prevention inspection: No action required. August 11, 2004. [998]

SPU. 2004j. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to GBA Gyroplanes of Seattle, LLC, Attn: Randy Copeland, Re: Results from the August 5, 2004 pollution prevention inspection: No action required. August 11, 2004. [981]

SPU. 2004k. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to ABX Air/DHL, Attn: Lee Neal, Re: Results from August 6, 2004 pollution prevention inspection: Action Recommended. August 11, 2004. [970]

SPU. 2004l. Stormwater Pollution Prevention Inspection Report, Galvin Flying Service, 7777 Perimeter Rd. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 11, 2004. [975]

SPU. 2004m. Stormwater Pollution Prevention Inspection Report, SSCC-Aviation, 8900 East Marginal Way S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 11, 2004. [1002]

SPU. 2004n. Stormwater Pollution Prevention Inspection Report, Aeroflight, 8555 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 12, 2004. [898]

SPU. 2004o. Stormwater Pollution Prevention Inspection Report, Caliber Inspection, Inc., 7500 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 18, 2004. [957]

SPU. 2004p. Stormwater Pollution Prevention Inspection Report, GSM Inc., 7575 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 19, 2004. [982]

SPU. 2004q. Letter from Tanya Treat, Surface Water Quality Inspector, Seattle Public Utilities, to UPS, Attn: Michael Copenspire, Re: Results from August 4, 2004 stormwater pollution prevention inspection: No action required. August 23, 2004. [1010]

SPU. 2004r. Letter from Tanya Treat, Surface Water Quality Inspector, Seattle Public Utilities, to GSM, Attn: Peter Strauss, Re: Results from August 19, 2004 stormwater pollution prevention inspection: No action required. August 23, 2004. [983]

SPU. 2004s. Letter from Savina Uzunow, Surface Water Quality Inspector, Seattle Public Utilities, to South Seattle Community College Aviation Department, Attn: Laura Hopkins, Re: Results from August 11, 2004 stormwater pollution prevention inspection: Corrective action required. August 23, 2004. [1004]

SPU. 2004t. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to CJ Systems Aviation Group, Attn: Steve Vandergreen, Re: Results from August 5, 2004 pollution prevention inspection: Corrective action required. August 25, 2004. [968]

SPU. 2004u. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Aeroflight, Attn: Steve LeVan, Re: Results from August 12, 2004 pollution prevention inspection: Corrective action required. August 25, 2004. [938]

SPU. 2004v. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Clay Lacy Aviation, Attn: Larry McGavern, Re: Results from August 4, 2004 pollution prevention inspection: Corrective action required. August 25, 2004. [964]

SPU. 2004w. Letter from Tanya Treat, Surface Water Quality Inspector, Seattle Public Utilities, to Galvin Flying Services, Inc., Attn: Jay Cheney, Re: Results from August 11, 2004 stormwater pollution prevention inspection: Corrective action required. September 8, 2004. [978]

SPU. 2004x. Stormwater Pollution Prevention Inspection Report, Wings Aloft, 8467 Perimeter Road S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 13, 2004. [1025]

SPU. 2004y. Stormwater Pollution Prevention Inspection Report, Washington Avionics Inc., 8525 Perimeter Road S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 15, 2004. [1017]

SPU. 2004z. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Washington Avionics, Attn: Lloyd Loundsbury, Re: Results from the September 15, 2004 pollution prevention inspection: No action required. September 16, 2004. [1018]

SPU. 2004aa. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Ameriflight, Attn: Rod Fichter, Re: Results from August 8, 2004 stormwater pollution prevention inspection: Corrective action required. September 16, 2004. [949]

SPU. 2004bb. Stormwater Pollution Prevention Inspection Report, Civil Air Patrol, 7827 Perimeter Road S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 20, 2004. [962]

SPU. 2004cc. Stormwater Pollution Prevention Inspection Report, MJL Partners, 7827 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 20, 2004. [987]

SPU. 2004dd. Stormwater Pollution Prevention Inspection Report, Airtech Instrument Company, 8490 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 22, 2004. [942]

SPU. 2004ee. Stormwater Pollution Prevention Inspection Report, ARFF – KC Airport, 8190 East Marginal Way S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 24, 2004. [950]

SPU. 2004ff. Stormwater Pollution Prevention Inspection Report, Helicopters NW, 8500 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 29, 2004. [984]

SPU. 2004gg. Stormwater Pollution Prevention Inspection Report, FAA Air Traffic Control Tower, 8200 East Marginal Way S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. September 29, 2004. [971]

SPU. 2004hh. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Airtech Instrument Co., Inc., Attn: Mark Schwartz, Re: Results from the September 22, 2004 pollution prevention inspection: No action required. September 30, 2004. [943]

SPU. 2004ii. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Wings Aloft, Attn: Steve Lee, Re: Results from September 13, 2004 pollution prevention inspection: Corrective action required. October 1, 2004. [1027]

SPU. 2004jj. Letter from Savina Uzunow, Surface Water Quality Inspector, Seattle Public Utilities, to FAA ATCT, Attn: John Miller, Re: Results from September 29, 2004 stormwater pollution prevention inspection: No corrective action required. October 1, 2004. [972]

SPU. 2004kk. Letter from Tanya Treat, Surface Water Quality Inspector, Seattle Public Utilities, to Helicopters Northwest, Inc., Attn: Doug Skeem, Re: Results from the September 29, 2004 stormwater pollution prevention inspection: No action required. October 1, 2004. [985]

SPU. 2004ll. Stormwater Pollution Prevention Inspection Report, Reed Aviation, 8490 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. October 4, 2004. [999]

SPU. 2004mm. Letter from Savina Uzunow, Surface Water Quality Inspector, Seattle Public Utilities, to King County Sheriff's Office, Attn: Deputy T.K. Legg, Re: Results from September 24, 2004 stormwater pollution prevention inspection: Corrective action recommended. October 4, 2004. [951]

SPU. 2004nn. Stormwater Pollution Prevention Inspection Report, Western Metal Products, 7696 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. October 7, 2004. [1021]

SPU. 2004oo. Stormwater Pollution Prevention Inspection Report, Vulcan, 7675 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. October 8, 2004. [1013]

SPU. 2004pp. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Galvin Flying, Attn: Jay Cheney, Re: Results from September 20, 2004 stormwater pollution prevention inspection: Corrective action required. October 14, 2004. [991]

SPU. 2004qq. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Larry McGaven, Clay Lacy Aviation. October 18, 2004. [990]

SPU. 2004rr. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Reed Aviation, Attn: John Reed, Re: Results from October 4, 2004 pollution prevention inspection: Corrective action required. October 21, 2004. [1001]

SPU. 2004ss. Stormwater Pollution Prevention Inspection Report, Cascade Air Frame, 8500 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. November 2, 2004. [960]

SPU. 2004tt. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Cascade Airframe Repair, Inc., Attn: Robert Starr, Re: Results from the November 2, 2004 stormwater pollution prevention inspection: No action required. November 2, 2004. [961]

SPU. 2004uu. Stormwater Pollution Prevention Inspection Report, South Seattle Community College – Aviation Dept., 8900 E. Marginal Way S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. November 19, 2004. [1003]

SPU. 2004vv. Letter from Savina Uzunow, Surface Water Quality Inspector, Seattle Public Utilities, to South Seattle Community College Aviation Department, Attn: Laura Hopkins, Re: Results from the November 19, 2004 pollution prevention inspection: No further action required. November 22, 2004. [1005]

SPU. 2004ww. Stormwater Pollution Prevention Inspection Report, Galvin Flying Service, 7777 Perimeter Rd. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. December 7, 2004. [974]

SPU. 2004xx. Stormwater Pollution Prevention Inspection Report, MJL Partners, 7827 Perimeter Rd. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. December 7, 2004. [986]

SPU. 2004yy. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Corporate Jets, Inc., Attn: Steve Vandergriend, Re: Results from the December 8, 2004 stormwater pollution prevention re-inspection: No further action required. December 14, 2004. [967]

SPU. 2004zz. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Clay Lacy Aviation, Attn: Larry McGavern, Re: Results from the December 16, 2004 stormwater pollution prevention re-inspection: No further action required. December 20, 2004. [965]

SPU. 2004aaa. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Galvin Flying Services, Inc., Attn: Jay Cheney, Re: Results from the December 16, 2004 stormwater pollution prevention re-inspection: No action required. December 27, 2004. [977]

SPU. 2004bbb. Letter from Tanya Treat, Surface Water Quality Inspector, Seattle Public Utilities, to Mr. Todd Meadows, Caliber Inspection, Re: Results from August 18, 2004 stormwater pollution prevention inspection: Corrective action required. December 28, 2004. [958]

SPU. 2004ccc. Stormwater Pollution Prevention Inspection Report, Nordstrom, 7979 Perimeter Rd. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. October 29, 2004. [993]

SPU. 2004ddd. Letter from Savina Uzunow, Surface Water Quality Inspector, Seattle Public Utilities, to Nordstrom, C/o Ken Koch, Re: Results from the October 29, 2004 pollution prevention inspection: No corrective action required. November 8, 2004. [995]

SPU. 2004eee. Stormwater Pollution Prevention Inspection Report, Startube, 8900 East Marginal Way S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. August 11, 2004. [1007]

SPU. 2005a. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Reed Aviation, Attn: John Reed. January 20, 2005. [1000]

SPU. 2005b. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Wings Aloft, Attn: Tom Noble and Steve Lee, Re: Results from the stormwater pollution prevention inspection process: No further action required. February 8, 2005. [1026]

SPU. 2005c. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Steve LeVan, Aeroflight, Re: Results from Feb 14, 2005 stormwater pollution prevention inspection: Corrective action required. February 22, 2005. [936]

SPU. 2005d. Stormwater Pollution Prevention Inspection Report, Ameriflight, 7585 Perimeter Rd.. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. March 14, 2005. [946]

SPU. 2005e. Letter from Tanya Treat, Surface Water Quality Inspector, Seattle Public Utilities, to Ameriflight, Attn: Rod Fichter, Re: Results from the March 4, 2005 stormwater pollution prevention re-inspection: No further action required. March 14, 2005. [948]

SPU. 2005f. Stormwater Pollution Prevention Inspection Report, Caliber Inspection, 7500 Perimeter Rd. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. May 31, 2005. [956]

SPU. 2005g. Letter from Tanya Treat, Surface Water Quality Inspector, Seattle Public Utilities, to Caliber Inspection, Attn: Mr. Todd Meadows, Re: Results from the May 31 stormwater pollution prevention re-inspection: No further action required. May 31, 2005. [959]

SPU. 2005h. Stormwater Pollution Prevention Inspection Report, Aeroflight, 8555 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. June 10, 2005. [897]

SPU. 2005i. Letter from Ellen Stewart, Surface Water Quality Inspector, Seattle Public Utilities, to Aeroflight, Attn: Steve LeVan, Re: Results from the stormwater pollution prevention inspection: No further action required. August 9, 2005. [902]

SPU. 2006a. Stormwater Pollution Prevention Inspection Report, Western Metal Products, 7696 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. March 29, 2006. [1020]

SPU. 2006b. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Western Metal Products, Inc., Attn: Ethel Woods and Bill Wolfe, Re: Results from March 29, 2006 stormwater pollution prevention inspection: Corrective action required. April 11, 2006. [1024]

SPU. 2006c. Letter from Tasha Bassett, Surface Water Quality Inspector, Seattle Public Utilities, to Western Metal Products, Inc., Attn: Ethel Woods and Bill Wolfe, Re: Results from March 29, 2006 stormwater pollution prevention inspection: Second and Final Corrective action required. August 22, 2006. [1023]

SPU. 2006d. Stormwater Pollution Prevention Inspection Report, Western Metal Products, 7696 Perimeter Rd. S. Joint Inspection Program, Lower Duwamish Waterway, King County Industrial Waste and Seattle Public Utilities. October 25, 2006. [1019]

SPU. 2006e. Letter from Tasha Bassett, Environmental Compliance Inspector, Seattle Public Utilities, to Western Metal Products, Inc., Attn: Ethel Woods, Re: Results from the pollution prevention re-inspection: In Compliance. December 22, 2006. [1022]

SPU. 2007. Stormwater Pollution Prevention Inspection Report, Federal Drug Enforcement, 8700 East Marginal Way S., Hangar B. Joint Inspection Program, Lower Duwamish

Waterway, King County Industrial Waste and Seattle Public Utilities. July 29, 2007. [973]

SSCC. 2004. Letter from Laura Hopkins, Associate Dean of Aviation, South Seattle Community College, to Savina Uzunow, Seattle Public Utilities, Re: Corrective actions. October 28, 2004. [1006]

Stewart. 2005. Email from Ellen Stewart, Seattle Public Utilities, to Rick Renaud, King County International Airport, Re: Washing at Aeroflight. July 21, 2005. [904]

Technical Dryer. 1991. Thompson-Isaacson Site Storm Drain Line and Soil Core Sampling. Summary Report. Prepared by Technical Dryer, Inc. for Boeing Environmental Affairs. March 6, 1991. [913]

Vulcan Northwest. 1997. Letter from Jeff Graves, Project Manager, Hangar Holdings, to Mr. Jeff Winter, Airport Engineer, King County International Airport, Department of Construction and Facilities Management, Re: Soil Excavation. July 23, 1997. [222]

Weston. 1999. Weston (Roy F. Weston, Inc.). 1999. Site inspection report: Lower Duwamish River. RM 2.5-11.5. Volume 1 – Report and appendices. Prepared by Roy F. Weston, Inc. for U.S. Environmental Protection Agency Region 10, Seattle, WA. As cited in Windward 2003a.

Wicks, P.H. 1983. Evaluation of Potential Soil and Ground Water Contamination at the Isaacson Corporation Property, Seattle, Washington. Prepared by Patrick H. Wicks, P.E., in association with Sweet, Edwards & Associates, Inc. Submitted to Isaacson Corporation and Graham & Dunn, Attorneys-at-Law. December 21, 1983. [816]

Windward. 2003a. Phase 1 Remedial Investigation Report. Final. Prepared by Windward Environmental LLC for the Lower Duwamish Waterway Group. July 3, 2003.

Windward. 2003b. Task 5: Identification of candidate sites for early action; Technical memorandum: Data analysis and candidate site identification. Final. Prepared by Windward Environmental LLC for the Lower Duwamish Waterway Group. June 12, 2003.

Windward. 2005a. Data Report: Round 1 Surface Sediment Sampling for Chemical Analyses and Toxicity Testing. Final. Prepared by Windward Environmental LLC for the Lower Duwamish Waterway Group. October 21, 2005.

Windward. 2005b. Data Report: Round 2 Surface Sediment Sampling for Chemical Analyses and Toxicity Testing. Final. Prepared by Windward Environmental LLC for the Lower Duwamish Waterway Group. December 9, 2005.

Windward. 2007a. Data Report: Subsurface Sediment Sampling for Chemical Analyses. Final. Prepared by Windward Environmental LLC and RETEC for the Lower Duwamish Waterway Group. January 29, 2007.

Windward. 2007b. Data Report: Round 3 Surface Sediment Sampling for Chemical Analyses and Toxicity Testing. Final. Prepared by Windward Environmental LLC for the Lower Duwamish Waterway Group. March 12, 2007.

Windward. 2007c. Lower Duwamish Waterway Remedial Investigation Report, Draft. Prepared by Windward Environmental for Lower Duwamish Waterway Group. November 5, 2007.

Wright. 2008. Email from Robert Wright (Ecology) to Sarah Good (Ecology) and Kris Flint (EPA) Re: Question from EAA-6 Data Gaps report. March 28, 2008.

Figures

Tables

Appendix A
Sediment Sampling Data

Table A-1 **Surface Sediment Sampling Results, Early Action Area 6**

Table A-2 **Subsurface Sediment Sampling Results, Early Action Area 6**

Appendix B
Aerial Photographs

Early Action Area 6 - 1936 Aerial Photo

Early Action Area 6 - 1946 Aerial Photo

Early Action Area 6 - 1956 Aerial Photo

Early Action Area 6 - 1960 Aerial Photo

Early Action Area 6 - 1969 Aerial Photo

Early Action Area 6 - 1974 Aerial Photo

Early Action Area 6 - 1980 Aerial Photo

Early Action Area 6 - 1990 Aerial Photo

Early Action Area 6 - 1995 Aerial Photo

Early Action Area 6 - 2004 Aerial Photo

Appendix C
Selected Historical Data
Boeing Isaacson and Boeing Thompson Properties

C-1. Dames & Moore 1983: Report of Evaluation of Site Contamination, Isaacson Steel Property

C-2. Wicks 1983: Evaluation of Potential Soil and Ground Water Contamination at the Isaacson Corporation Property, Seattle, Washington

C-3. Landau 1986: First Annual Report, Ground Water Monitoring Program, Boeing Isaacson Property

Landau 1987: Second Annual Report, Ground Water Monitoring Program, Boeing Isaacson Property

C-4. Landau 1988a: Data Report, Building 14-09, Thompson-Isaacson Site Investigation

Landau 1988b: Data Report 2,Building 14-09, Thompson-Isaacson Site Investigation

C-5. Landau 1990: Thompson-Isaacson Site, Soil Remedial Action Plan

C-6. Technical Dryer 1991: Thompson-Isaacson Site, Storm Drain Line and Soil Core Sampling, Summary Report

C-7. Landau 1992: Thompson-Isaacson Site, Full-Scale Soil Stabilization Program, Summary Report

C-8. ERM 2000a: Conceptual Proposal for No Further Action Determination at the Boeing Isaacson Property

C-9. ERM 2000d: Request for Groundwater NFA Determination, Hydrogeologic Investigation and Site-Specific Action Level for Arsenic in Groundwater, Boeing Isaacson Site, VCP ID# NW0453

C-10. Landau 2007: Sump Removal and Soil Excavation, Boeing Isaacson Property, Seattle, Washington