# Lower Duwamish Waterway River Mile 0.0-0.1 East (Spokane St. to Ash Grove Cement)

## Summary of Existing Information and Identification of Data Gaps

## Final Report

**December 2008**

**Waterbody No. WA-09-1010**

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Final Report

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**December 2008**

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# Acronyms/Abbreviations

| | |
|---|---|
| AET | Puget Sound Apparent Effects Threshold |
| AOP | air operating permit |
| BACT | best available control technology |
| BEHP | bis(2-ethylhexyl)phthalate |
| bgs | below ground surface |
| BMP | best management practices |
| BTEX | benzene, toluene, ethylbenzene, and xylenes |
| CAP | Cleanup Action Plan |
| CESQG | Conditionally Exempt Small Quantity Generator |
| COC | contaminant of concern |
| CSCSL | Confirmed and Suspected Contaminated Sites List |
| CSL | Cleanup Screening Level |
| CSO | combined sewer overflow |
| Data Gaps Report | Summary of Existing Information and Identification of Data Gaps Report |
| E & E | Ecology and Environment, Inc. |
| Ecology | Washington State Department of Ecology |
| ECOSS | Environmental Coalition of South Seattle |
| EF | exceedance factor |
| EMW | East Marginal Way |
| EOF | Emergency Overflow |
| EPA | U.S. Environmental Protection Agency |
| ESN | ESN Northwest |
| GIS | Geographic Information System |
| GPD | gallons per day |
| GSP | Grade Separation Project |
| ISIS | Integrated Site Information System |
| LAET | lowest apparent effects threshold |
| 2LAET | second lowest apparent effects threshold |
| LDW | Lower Duwamish Waterway |
| LDWG | Lower Duwamish Waterway Group |

## Acronyms/Abbreviations (Cont.)

| | |
|---|---|
| LUST | leaking underground storage tank |
| MDL | method detection limit |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| mgy | million gallons per year |
| MOU | Memorandum of Understanding |
| MTCA | Model Toxics Control Act |
| NFA | No Further Action |
| NOV | Notice of Violation |
| NPDES | National Pollutant Discharge Elimination System |
| NSPS | New Source Performance Standard |
| OC | organic carbon |
| PAHs | polycyclic aromatic hydrocarbons |
| PCBs | polychlorinated biphenyl |
| ppm | parts per million |
| PSCAA | Puget Sound Clean Air Agency |
| QA/QC | quality assurance/quality control |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| RM | river mile |
| SCAP | Source Control Action Plan |
| SD | storm drain |
| SMS | Washington State Sediment Management Standards |
| SPU | Seattle Public Utilities |
| SQS | Sediment Quality Standards |
| SVOC | semivolatile organic compound |
| T | Terminal |
| TAL | Target Analyte List |
| TCE | trichloroethene |
| TOC | total organic carbon |
| TPH | total petroleum hydrocarbons |

## Acronyms/Abbreviations (Cont.)

| | |
|---|---|
| TPH-D | diesel-range petroleum hydrocarbon |
| TRI | Toxics Release Inventory |
| UST | underground storage tank |
| VBLS | vanillin black liquor solids |
| VCP | Voluntary Cleanup Program |
| WSDOH | Washington State Department of Health |

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# 1.0 Introduction

## 1.1 Background and Purpose

This Summary of Existing Information and Identification of Data Gaps Report (Data Gaps Report) pertains to a section of the Lower Duwamish Waterway (LDW) referred to as River Mile (RM) 0.0-0.1 East (Spokane St. to Ash Grove Cement). This area is one of several source control areas identified as part of the overall cleanup process for the LDW Superfund Site. Figure 1 illustrates the LDW sediment areas that correspond to each source control area. The RM 0.0-0.1 East sediment area extends north-south between RMs 0.0 and 0.1, and east-west from the eastern shoreline to the eastern limit of the LDW navigational channel. The RM 0.0-0.1 East Source Control Area (RM 0.0-0.1 East) is defined by the portion of the overall LDW drainage basin1 that corresponds to this sediment area (Figure 2). RM 0.0-0.1 East consists of the adjacent properties within the RM 0.0-0.1 East drainage basin, and it includes embankment areas fronting the properties at the shoreline. Source control for most of Harbor Island and Terminal (T) 104 are being covered under the East Waterway RI/FS. While Ecology has not taken an active role in source control efforts for the East Waterway, it is interested in facilities which could be sources of recontamination in both the LDW and East Waterway.

This report summarizes readily available information regarding properties in the RM 0.0-0.1 East drainage basin[2]. This information is necessary:

- to identify potential upland sources of sediment recontamination;
- to identify any potential contaminant migration pathways into the LDW;
- to identify any data gaps needing attention before effective source control can be accomplished; and
- to determine what, if any, effective source control is already in place.

The LDW consists approximately of the lower 5.5 miles of the Duwamish River as it flows into Elliott Bay in Seattle, Washington. In September 2001, the U.S. Environmental Protection Agency (EPA) added this site to the National Priorities List due to chemical contaminants in sediments. The Washington State Department of Ecology (Ecology) added the site to the Washington State Hazardous Sites List on February 26, 2002.

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 Ecology. The LDWG is conducting a Remedial Investigation/Feasibility Study (RI/FS) for the LDW Superfund site.

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1 The area referred to herein as the "RM 0.0-0.1 East drainage basin" is actually a sub-drainage basin of the LDW valley. The LDW valley drainage basin has been divided into sub-drainage basins, defined tentatively by stormwater collection systems and outfalls, as shown in Figure 1.

2 This Data Gaps Report incorporates data published through July 2008.

EPA is leading the effort to determine the most effective cleanup strategies for the LDW through a RI/FS process. Ecology is the lead agency[3] for Source Control and is investigating upland sources of contamination and developing plans to reduce contaminant migration to waterway sediments. The Lower Duwamish Waterway Source Control Strategy (Ecology 2004) describes the process for identifying source control issues and implementing effective controls. The plan is to identify and manage sources of potential recontamination in coordination with sediment cleanups.

The focus of the Source Control Strategy is to identify and control contamination that could affect LDW sediments. This will be achieved using existing administrative and legal authorities to perform inspections and require necessary source control actions (Ecology 2007). It 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 on the Washington State Sediment Management Standards (SMS) (WAC 173-340-3707(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, often defined by drainage basins, have been identified and prioritized for SCAP development as described in the LDW Source Control Status Report (Ecology 2007). Before developing each SCAP, Ecology often prepares a Data Gaps Report for the specific 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 in the SCAP will be effective, implementable, and enforceable.

Further information about the LDW can be found on the following Web sites:

- Ecology's LDW Web site: http://www.ecy.wa.gov/programs/tcp/sites/lower_duwamish/lower_duwamish_hp.html
- EPA's LDW Web site: http://yosemite.epa.gov/r10/cleanup.nsf/sites/lduwamish
- The LDWG Web site: http://www.ldwg.org.

## 1.2 Organization of Document

Section 2 of this report provides background information on the LDW Superfund Site. Section 3 provides a summary of background information on RM 0.0-0.1 East, including a description of the RM 0.0-0.1 East drainage basin, contaminants of concern for the LDW sediments, and potential migration pathways of contaminants to LDW sediments. Section 4 describes potential sources of contaminants to RM 0.0-0.1 East sediments, including adjacent facilities of concern, stormwater, groundwater, spills, bank erosion, and atmospheric deposition. Section 4 also

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[3] EPA and Ecology signed an interagency Memorandum of Understanding (MOU) in April 2002 and updated the MOU in April 2004. The MOU divides responsibilities for the site. EPA is the lead agency for the sediment RI/FS, while Ecology is the lead agency for source control issues (EPA and Ecology 2002, 2004).

summarizes data gaps that will be incorporated into the SCAP for RM 0.0-0.1 East. Section 5 provides a list of documents cited in the report.

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

- Ecology Northwest Regional Office Central Records;
- Washington State Archives;
- King County Waste Discharge Permits and Authorizations;
- Seattle Public Utilities (SPU) Business Inspection Reports;
- Ecology Facility/Site Database (Ecology 2008a);
- Ecology Industrial Stormwater General Permits (Ecology 2008b);
- Ecology National Pollutant Discharge Elimination System (NPDES) and State Water Discharge Permit Database (Ecology 2008c);
- Ecology Hazardous Waste Facility Search Database (Ecology 2008d);
- Ecology Integrated Site Information System (ISIS; Ecology 2008e);
    - Confirmed and Suspected Contaminated Sites List (CSCSL)
    - Underground Storage Tank (UST) List
    - Leaking Underground Storage Tank (LUST) List
    - No Further Action (NFA) Sites List
- Ecology Washington Coastal Atlas Database (Ecology 2008f);
- EPA Toxics Release Inventory (TRI) Explorer Database (EPA 2008a);
- EPA Envirofacts Date Warehouse Database (EPA 2008b);
- EPA Enforcement and Compliance History Online Database (EPA 2008c);
- King County Geographic Information System (GIS) Center Parcel Viewer and Property Tax Records (King County 2008);
- LDWG Draft Phase 2 Remedial Investigation (RI) Report Database (LDWG 2008); and
- Puget Sound Clean Air Agency (PSCAA) Approved Air Operating Permits Database (PSCAA 2008).
- Port of Seattle files for T-102, T-104, and the Grade Separation Project

## 1.3 Scope of Document

The scope of the document research conducted for this Data Gaps Report is limited geographically to the upland area within the RM 0.0-0.1 East drainage basin (Figure 2) and discharge points into the LDW along the waterfronts of the properties within this boundary.

There are other potential sources of recontamination upstream up of RM 0.0-0.1 East that might impact the sediments of RM 0.0-0.1 East. However, they have been, or will be, addressed in other studies.

This report covers reviews of three properties within the RM 0.0-0.1 East drainage basin: Harbor Marina Corporate Center (T-102), Port of Seattle T-104, and Ash Grove Cement. The potential for any existing contamination to migrate to the LDW was examined for each of these facilities. Both T-102 and T-104 are also considered potential upland source areas for the East Waterway Operable Unit and are therefore undergoing an extensive source control evaluation relative to that site in the *East Waterway Existing Information Summary Report* (Anchor and Windward 2008). Source control for most of Harbor Island and T- 104 are being covered under the East Waterway RI/FS. While Ecology has not taken an active role in source control efforts for the East Waterway, it is interested in facilities which could be sources of recontamination in both the LDW and East Waterway. While it is possible that contamination from other properties (i.e., outside the RM 0.0-0.1 East drainage basin) may be migrating via unknown groundwater pathways into RM 0.0-0.1 East sediments, this report does not identify or assess the possibility of migration from sources outside of the RM 0.0-0.1 East drainage basin.

Similarly, air pollution is a potential source of contamination to RM 0.0-0.1 East sediments, with origins outside of the RM 0.0-0.1 East drainage basin. Although some limited discussion of atmospheric deposition is provided in Section 3, the scope of work for this report did not include an assessment of data gaps pertaining to air pollution effects on RM 0.0-0.1 East sediments.

Data on existing sediment contamination in RM 0.0-0.1 East are available. However, this report focuses only on upland sources that could recontaminate RM 0.0-0.1 East sediments if sediment remediation is required. This focus does not preclude the potential for recontamination from capped sediments, if sediment-capping is the remedial option selected. Potential recontamination from any contaminated sediments left in place will be important to address as part of the remedial option selection process for RM 0.0-0.1 East.

Ecology and Environment, Inc., (E & E) did not conduct quality assurance/quality control (QA/QC) on reported data as part of the scope of this report. Data published in previous reports approved by Ecology and/or EPA are assumed to have been validated and to be accurate. Information from reports by others that have not been approved by Ecology or EPA is included only for summary purposes.

# 2.0 Lower Duwamish Waterway Superfund Site

The Duwamish River originates at the confluence of the Black and Green rivers, near Tukwila, Washington. From the confluence, the Duwamish River flows approximately 12 miles (19 kilometers) before splitting at the southern end of Harbor Island to form the East and West Waterways, which discharge into Elliot Bay. The LDW study area consists of the downstream portion of the Duwamish River, excluding the East and West Waterways (just south of Harbor Island).

The LDW is a receiving water body for different types of industrial and municipal stormwater and periodic overflow discharges from combined sewer systems during high rainfall events. Industrial and municipal stormwater discharges to the LDW are discussed in Sections 2.3 and 4.0. There are currently no permitted discharges of industrial wastewater directly into the LDW.

## 2.1 Site History

General background and site description of the LDW Superfund Site is provided in the *Lower Duwamish Waterway Phase I Remedial Investigation Report* (Windward 2003), 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.

In the late 1800s and early 1900s, extensive topographic modifications were made to the river, including filling the tide flats and floodplains to create a straightened river channel. Current slips are frequently remnants of old river bed meanders. The channel was dredged for navigational purposes and the excavated waterway material was used to fill the old channel areas and the lowlands above flood levels. Because the dredge fill materials were similar to the native deposits, they are typically difficult to distinguish from the native silts and sands. Subsequent filling for land development has resulted in a surficial layer of fill over most of the lower Duwamish Valley. This material is typically more granular because it was generally placed to allow for stable construction and/or building foundations (Windward 2003).

Most of the upland areas adjacent to the LDW have been heavily industrialized for many decades. Historical and current commercial and industrial operations include cargo handling and storage, marine construction, boat manufacturing, marina operations, concrete manufacturing, paper and metals fabrication, food processing, and airplane parts manufacturing. Two mixed commercial and residential communities, Georgetown and South Park, are also located near the LDW (Windward 2003).

## 2.2 Site Geology and Hydrogeology

Groundwater within the Duwamish Valley alluvium is typically encountered under unconfined conditions within approximately 10 feet (3 meters) of the ground surface. Groundwater in this unconfined aquifer is found within the fill material and native alluvial deposits. The direction of groundwater flow in the unconfined aquifer is generally toward the LDW. However, the direction may vary locally depending on the nature of subsurface material, proximity to the LDW, and tidal influence. Tidal fluctuations generally affect groundwater flow direction within

300 to 500 feet (100 to 150 meters) of the LDW, depending on location (Windward 2003). A confirmed groundwater zone is present beneath the unconfined aquifer. Flow in this confined zone is to the north towards Elliot Bay. The bottom of the unconfined aquifer is located on top of a layer of marine sediment at a depth of 45 to 50 feet (13 to 15 meters) (Cook 2001).

## 2.3 Storm Drain and Sanitary Sewer Systems

Separated storm drain and sanitary sewer systems and combined sewer systems serve properties within the LDW drainage basin. Storm drains convey stormwater runoff collected from streets, parking lots, roofs, and other impervious surfaces, as well as pervious surfaces such as landscaped areas and lawns, to the waterway. Many properties directly adjacent to the LDW are served by private storm drain systems that discharge directly to the LDW. A combination of private and city storm drain systems serve upland areas of the LDW drainage basin.

Some areas in the vicinity of the LDW 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 stormwater 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 combined sewer overflow (CSO) outfalls. The CSO outfalls prevent the combined sewer system from backing up and creating flooding.

Untreated municipal/industrial wastewater and stormwater can discharge during CSOs to the LDW during these storm events. The city owns and operates the local sanitary sewer collectors and main 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. The city's combined sewer network has its own NPDES permit for CSOs; CSOs from the county's interceptor lines are administered under the NPDES permit established for the West Point Wastewater Treatment Plant. 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.

An Emergency Overflow (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 such as 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 stormwater outfall 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 1. Of the King County CSO outfalls along the LDW, the Michigan CSO, South Brandon Street CSO, and Hanford No. 1

(discharging via the city's Diagonal Avenue South CSO/SD) outfalls had the highest average CSO volumes between 1999 and 2005. Annual stormwater discharge volumes are usually substantially higher than annual CSO discharge volumes because stormwater outfalls discharge whenever it rains, while CSOs only occur when storm events 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 (Schmoyer 2002; SPU 2007)[4].

To minimize the frequency and volume of CSO events, the county uses different CSO control strategies to maximize system capacity. An automated control system manages flows through the county interceptor system so that the maximum amount of flow is contained in pipelines and storage facilities until it can be conveyed to a regional wastewater treatment plant for secondary treatment. As a result, some areas of the CSO drainage basins may discharge to different outfalls at different times, depending on the route the combined stormwater/wastewater has taken through the county conveyance system. 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. King County CSOs discharge untreated wastewater only when flows exceed the capacity of these systems (King County 2007)[5].

No CSOs or EOFs have been identified in the Ash Grove source control area.

For preparation of 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 stormwater outfall) 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 in which contaminants may be transported to the current source control area via a transport pathway that was not applicable for the earlier evaluation.

4 Stormwater discharges are regulated under a separate NPDES permit.

5 City CSOs are generally smaller and flows are not treated prior to discharge.

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# 3.0 RM 0.0-0.1 East Source Control Area

Within the RM 0.0-0.1 East drainage basin, three facilities of concern are identified for inclusion in this report: Harbor Marina Corporate Center (Port of Seattle T-102), Port of Seattle T-104, and Ash Grove Cement. Source control for most of Harbor Island and T-104 are being covered under the East Waterway RI/FS. While Ecology has not taken an active role in source control efforts for the East Waterway, it is interested in facilities which could be sources of recontamination in both the LDW and East Waterway. These facilities have confirmed or suspected contamination of various upland media, or are the locations of historical and/or current activities that could contribute contaminants to LDW sediments. These facilities are discussed in detail in Section 4.

## 3.1 RM 0.0-0.1 East Drainage Basin

Unlike other source control areas on the LDW, RM 0.0-0.1 includes two different upland areas that are separated by a narrow stretch of the waterway itself. The Harbor Marina Corporate Center (T-102) is located on Harbor Island which lies in the center of the waterway (Figure 1). Source control for most of Harbor Island is being covered under the East Waterway RI/FS, however Ecology is interested in facilities which could be sources of recontamination in both the Lower Duwamish and East Waterways. Port of Seattle T-104 and the Ash Grove Cement facility are both located on the east bank of the LDW. The sequence of historical aerial photographs (Appendix A3) shows many topographical and land-use modifications. The addition of highways, the progression of infrastructure, and other developments can be viewed in these photos.

## 3.2 Contaminants of Concern

Although the scope of this report does not include a detailed review of existing sediment conditions in the RM 0.0-0.1 East portion of the LDW, results from LDW sediment studies provide guidance in assessing source control requirements for the upland areas. Several contaminants in LDW sediments within the vicinity of RM 0.0-0.1 East are documented at levels of concern based on results of sampling conducted between 1991 and 2007. The SMS (Chapter 173-204 WAC) establish Marine Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL) for some chemicals that may be found in sediments. When chemical concentrations in sediments are less than the SQS, it is assumed that there will be no adverse effects on biological resources and no significant health risk to humans. CSLs represent "minor adverse effects" levels that are used as an upper limit for making decisions about source control and cleanup.

For this report, "Contaminant of Concern" (COC) is defined as a contaminant that may potentially recontaminate LDW sediments of RM 0.0-0.1 East if sediment remediation is performed[6]. To be identified as a COC for RM 0.0-0.1 East sediments, a contaminant must have met either of the following criteria:

A. The detected concentration in one or more RM 0.0-0.1 East sediment samples as reported in the *Lower Duwamish Waterway Phase 2 Remedial Investigation Draft Report* (Windward 2007a) exceeded the SQS or CSL value. Section 3.2.1 summarizes the separate sediment investigations performed in the vicinity of RM 0.0-0.1 East and the COCs identified as a result of those investigations.

B. The contaminant was detected above an applicable screening level in one or more samples of upland media (including stormwater, groundwater, soil, seeps, and storm drain solids), even if not detected in RM 0.0-0.1 East sediment samples. Section 3.2.2 summarizes the COCs identified at the facilities of concern through a review of available information and a comparison of sampling data to applicable screening levels.

### 3.2.1 Contaminants of Concern Identified through Sediment Investigations

Several environmental investigations involving collection of sediment in the RM 0.0-0.1 East source control area were identified in the *Lower Duwamish Waterway Phase 2 Remedial Investigation Draft Report* (Windward 2007a). These investigations include the *Harbor Island RI* (Weston 1993a/b), the *Duwamish Waterway Characterization Study* (NOAA 1998), the *EPA Site Inspection* (Weston 1999), and the *Lower Duwamish Waterway Phase 2 Remedial Investigation Draft Report* (Windward 2005a, 2005b, 2005c, 2007a, 2007b, and 2007c). Analytical results from all of these investigations are presented in and were drawn from the *Lower Duwamish Waterway Phase 2 Remedial Investigation Draft Report Database* (LDWG 2008), which can be accessed at www.ldwg.org. Surface and subsurface sampling locations as well as exceedance factors for chemicals of concern are shown in Figures 3 and 4. Appendix A summarizes chemicals detected in surface and subsurface sediment samples collected through the sediment investigations described in the subsection below. Analytical results with chemical concentrations exceeding SQS and CSL are presented in Tables 1 and 2 (Section 6).

#### 3.2.1.1 Sediment Investigations

This section describes COCs in RM 0.0-0.1 East sediments that were identified through previous sediment investigations. These investigations are discussed in the following subsections.

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

This investigation was performed in August 1998. Surface sediment samples were collected from five locations (DR001, DR002, DR003, DR055, and DR056) within the RM 0.0-0.1 East

[6] Although not explicitly addressed in the SMS, VOCs in pore water may cause adverse effects on benthic invertebrates and other aquatic biota, and are therefore considered COCs for source control efforts in the LDW.

source control area. All samples were analyzed for Target Analyte List (TAL) metals,[7] polycyclic aromatic hydrocarbons (PAHs), phthalates, and polychlorinated biphenyls (PCBs).

***LDW Phase 2 Remedial Investigation, Benthic Invertebrate, Clam Tissue, and Co-located Sediment Sampling (Windward 2005a)***

This investigation occurred from August to September 2004. As part of it, benthic invertebrate tissue and co-located sediment samples were collected. Within RM 0.0-0.1 East, one sample (B1b) was collected and analyzed for TAL metals, PAHs, phthalates, other semivolatile organic compounds (SVOCs), organochlorine pesticides, PCBs, and butyltins.

***LDW Phase 2 Remedial Investigation, Rounds 1, 2, and 3 Sediment Sampling (Windward 2005b, 2005c, and 2007b)***

Three rounds of sediment sampling were performed from 2005 to 2006 as part of the Phase 2 RI. A total of 11 surface sediment samples were collected within the RM 0.0-0.1 East source control area. Two Round 1 samples were taken in January 2005 (LDW-SS1 and LDW-SS4). Four Round 2 samples were taken in March 2005 (LDW-SS2, LDW-SS6, LDW-SS7, and LDW-SS8). Five Round 3 samples were taken in October 2006 (LDW-SS0301, LDW-SS302, LDW-SS303, LDW-SS304, and LDW-SS305). All samples were analyzed for SMS metals, butyltins, SVOCs, PCBs, dioxins/furans, and conventional compounds.

***LDW Remedial Investigation, Subsurface Sediment Sampling (Windward 2007c)***

This investigation was done in February 2006. As part of it, subsurface sediment samples were collected from four locations (LDW-SC1, LDW-SC2, LDW-SC3, and LDW-SC4) within RM 0.0-0.1 East. Samples were analyzed for metals, SVOCs, pesticides, and PCBs.

#### 3.2.1.2 Contaminants of Concern in Sediments

The *Lower Duwamish Waterway Phase 2 Remedial Investigation Draft Report* (Windward 2007a), which summarizes all LDW sediment investigation results, was queried by sample location for surface and subsurface sediment samples in which chemicals were detected. Chemical concentrations in sediment samples within the RM 0.0-0.1 East source control area were compared to SQS and CSL values, as shown in Appendix A. Chemical concentrations exceeding SQS and CSL are presented in Tables 1 and 2.

To allow for comparison of applicable SMS compounds to SQS and CSL, organic compounds were organic carbon (OC) normalized. Detected concentrations (dry-weight basis) were normalized to the total organic carbon (TOC) concentrations in samples. However, SQS and CSL limits are applicable to TOC-normalized concentrations only when TOC content is between 0.5 and 4.0%. For samples with TOC concentrations outside the applicable range,

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[7] TAL metals include: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, iron, lead, magnesium, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

concentrations of organic compounds were compared with Puget Sound Apparent Effects Threshold (AET) values. AET values are the functional equivalent of the SQS and CSL, only they are expressed on a dry-weight basis. The lowest AET (LAET) was used as the equivalent of the SQS, and the second lowest AET (2LAET) was used in place of the CSL.

Contaminants that exceeded the SQS or CSL were identified as COCs and are listed in the table below. COCs were identified in surface sediments at several locations including DR001, DR002, DR003, DR055, LDW-SS1, LDW-SS2, LDW-SS6, LDW-SS7, LDW-SS8, LDW-SS301, LDW-SS304, and LDW-SS307 (Figure 3). COCs were identified in subsurface sediments at the following locations: LDW-SC1, LDW-SC2, and LDW-SC4 (Figure 4). Analytes marked in gray are those exceeding both the SQS and the CSL values.

Figures 3 and 4 also illustrate the relationship between exceedance factors (EFs) and sample location. It can be seen that the highest EFs were generally found in the subsurface sediment, and that concentrations of the same compound generally increased with depth. Additionally, it can be seen that the five highest EFs are attributed to total PCBs, indicating that these compounds may potentially be a concern in this source control area.

**Contaminants of Concern (COCs) in Sediment**

| Contaminant of Concern (COC) | Surface Sediment | | Subsurface Sediment | |
|---|---|---|---|---|
| | > SQS | > CSL | > SQS | > CSL |
| ***Metals*** | | | | |
| Arsenic | ● | ● | ● | ● |
| Lead | ● | ● | ● | ● |
| Mercury | ● | ● | ● | ● |
| Zinc | ● | | ● | ● |
| ***PAHs*** | | | | |
| 1,2,4-Trichlorobenzene | | | ● | |
| Benzo(a)pyrene | ● | | | |
| Benzo(g,h,i)perylene | ● | | | |
| Benzofluoranthenes (total) | ● | | | |
| Chrysene | ● | | | |
| Dibenzo(a,h)anthracene | ● | | | |
| Fluoranthene | ● | | | |
| Indeno(1,2,3-cd)pyrene | ● | | | |
| Total HPAH | ● | | | |
| ***Phthalates*** | | | | |
| Bis(2-ethylhexyl)phthalate | ● | ● | ● | ● |

| Contaminants of Concern (COCs) in Sediment | | | | |
|---|---|---|---|---|
| **Contaminant of Concern (COC)** | **Surface Sediment** | | **Subsurface Sediment** | |
| | **> SQS** | **> CSL** | **> SQS** | **> CSL** |
| Butyl benzyl phthalate | | | ● | |
| ***Other SVOCs*** | | | | |
| 2,4-Dimethylphenol | | | ● | ● |
| ***PCBs*** | | | | |
| PCBs (total) | ● | ● | ● | ● |

**Note**:
This table includes data published through March 12, 2007.
Source: Lower Duwamish Waterway Group Web site sediment database (www.ldwg.org).
Shaded cells indicate the COCs exceeded both SQS and CSL.

## 3.2.2 Contaminants of Concern Identified in Upland Media

Available information, including sample results from environmental investigations, was reviewed for the three facilities of concern within the RM 0.0-0.1 East source control area. Environmental investigations and sampling results are described in more detail for each facility of concern in Section 4.

In general, a COC was identified in upland media at a facility of concern when the chemical was detected above an applicable screening level in one or more samples of upland media (including stormwater, groundwater, soil, seeps, and storm drain solids). Screening level criteria used included Model Toxics Control Act (MTCA) Method A cleanup levels for soil and groundwater, Ecology stormwater compliance benchmark levels for facilities covered under the Industrial Stormwater General Permit for stormwater discharge, SMS criteria for both sediments sampled within the LDW and storm drain solids, and a recently developed screening tool to help determine when a detected chemical is not a concern to LDW sediments (SAIC 2006).

Chemicals that were no longer detected above applicable screening levels in upland media following completion of remedial actions at potential upland sources were not included. In some instances, it was not feasible to determine whether a chemical was a COC because either applicable screening levels have not been established for that chemical or media, or applicable screening levels could not be applied due to inadequate data. Whenever these situations occurred, a data gap was identified to indicate where additional study may be necessary.

### 3.2.2.1 Application of Sediment Management Standards to the Identification of COCs

Section 3.2.1 discusses COCs identified through sediment sampling, for which SMS can be directly applied. However, there are no existing standard methods to determine which contaminants detected in upland media are potential COCs for LDW sediments.

There are no established cleanup levels or management standards for storm drain solids. Technically, the SMS criteria do not apply to storm drain solids. However, SMS criteria and LAET values provide a conservative basis to evaluate contaminant concentrations in storm drain solids samples. Any chemicals found in storm drain solids above SMS or LAET/2LAET screening levels are considered to be COCs with regard to LDW sediments because if the solids migrated to the LDW, they would become sediments. Although it is conservative to ignore mixing and dilution effects, SMS and LAET/2LAET criteria are considered a reasonable measure of contamination for storm drain solids. When feasible, contaminant concentrations detected in samples of storm drain solids were also compared to SQS/CSL and/or LAET/2LAET values to provide an indication of contaminant exceedances.

Recently, Ecology developed a screening tool to help determine when a detected chemical is not a concern to LDW sediments (SAIC 2006). Using conservative assumptions, the screening tool translates marine sediment concentration limits defined by SMS into upland soil and groundwater concentrations or screening limits. These screening levels were calculated by applying partitioning coefficients and other factors to the SMS criteria. These screening tool levels are referred to as either "soil-to-sediment screening levels" or "groundwater-to-sediment screening levels." Concentrations less than the screening tool levels provide an indication that SMS compounds in upland groundwater and soil are not likely to pose a risk to LDW sediments. The screening tool incorporates a number of conservative assumptions, including the absence of contaminant dilution and ample time for contaminant concentrations in soil, sediment, and groundwater to achieve equilibrium. In addition, the screening tool does not address issues of contaminant mass flux from upland to sediments, nor does it address the area or volume of sediment that might be affected by upland contaminants. Because of these assumptions and uncertainties, the screening levels given by the tool are most appropriately used for ruling out, but not establishing, a concern. If contaminant concentrations in upland soil or groundwater are below these screening levels, it is unlikely that they will exceed marine sediment SQS. However, upland concentrations that exceed these screening levels may or may not pose a threat to marine sediments. Additional site-specific information must be considered to make such an assessment.

Where feasible, these screening tool levels are compared to the most recent upland groundwater and soil results for a given property or study area. Generally, if a chemical is not detected above the applicable screening tool level (given appropriate reporting limits), it is not considered a COC for the given location. However, in some instances site-specific criteria are more stringent than the screening tool levels. In this case if a detected chemical concentration is below a screening tool level, but above a site-specific criterion, it cannot be ruled out as a COC. In other cases the method detection limit (MDL) or reporting limit may be greater than a screening tool level. In these cases, it cannot be determined if the concentration is below the screening tool level, so the chemical cannot be ruled out as a COC unless other factors prevail.

## 3.3 Potential Pathways of Contamination

To assess whether contamination in upland media is a potential source of LDW sediment recontamination, potential pathways between the potential source and the LDW must be evaluated. Pathways can lead to either point or non-point discharges. Point discharges include direct stormwater discharges via outfalls, CSO outfalls, spills, and direct wastewater discharges. Non-point discharges include groundwater migration, erosion or leaching from bank soils, and atmospheric deposition. In some cases a pathway is not known to have, historically or currently, any contamination. However, this report considers all pathways that could provide a conduit for upland contaminants to reach LDW sediments. The potential contaminant migration pathways evaluated for RM 0.0-0.1 East are described below and are discussed in more detail in Section 4.

### 3.3.1 Stormwater

Stormwater can discharge directly to the LDW via outfalls from adjacent sites or from municipal stormwater systems. Some of these direct discharges are authorized by Ecology through various types of NPDES permits. Stormwater from businesses, roads, and residential areas upland of the river is typically regulated by the public utilities agencies of Seattle, Tukwila, or King County, depending on the exact location and type of land use. Stormwater from urban areas may contain a wide variety of substances including bacteria, metals, oil, detergents, pesticides, fertilizers, and other chemicals that are washed off the land surface during rain events, as well as materials that are illegally dumped into storm drains. These pollutants are transported in dissolved and particulate phases to the LDW by a combination of public and private stormwater drain systems. Storm drains can also convey materials from businesses, residences, vehicle washing, runoff from landscaped areas, erosion of contaminated soil, and groundwater infiltration.

Storm drains and combined sewer systems in the LDW drainage basin are discussed in Section 2.3 and more specifically for the RM 0.0-0.1 East stormwater drainage basin in Section 3.1. Outfalls that discharge directly to the LDW within RM 0.0-0.1 East are shown in Figure 5. They include four public stormwater outfalls, #2151, #2154, #2156, and HRE-1, which are owned by the Port of Seattle and discussed in detail in Section 4.

### 3.3.2 Groundwater

Contaminated groundwater may enter the LDW directly via groundwater discharge to surface water, tidal fluctuation, seeps, or infiltration into storm drains/pipes, ditches, or creeks that discharge to the LDW. Contaminants from spills and releases to soils on properties in the RM 0.0-0.1 East drainage basin may migrate to groundwater and subsequently be transported to RM 0.0-0.1 East sediments.

Shallow groundwater in the Duwamish Valley is typically encountered within about 10 feet (3 meters) of the ground surface and exists under unconfined conditions. The general direction of shallow groundwater flow in the Duwamish Valley is toward the LDW, although the direction may vary locally depending on the nature of the subsurface material, proximity to the LDW, and tidal influence. Tidal fluctuations generally affect groundwater flow direction within 300 to 500 feet (100 to 150 meters) of the LDW, depending on location (Windward 2003).

### 3.3.3 Spills

Spills of waste materials containing COCs may occur directly to the LDW through in-water activities or indirectly through spills onto the ground within the RM 0.0-0.1 East drainage basin. Current activities in the RM 0.0-0.1 East properties may result in spills if adequate containment handling procedures are not followed.

### 3.3.4 Bank Erosion/Leaching

Waterway bank soil, contaminated fill, waste piles, landfills, and surface impoundments may release contaminants directly into RM 0.0-0.1 East waters through soil erosion, soil erosion to stormwater, leaching to groundwater, or leaching from banks to the LDW.

### 3.3.5 Atmospheric Deposition

Atmospheric deposition occurs when air pollution deposits enter the LDW directly or through stormwater. Such deposits can become a possible source of contamination to sediments. Air pollution is generated from air emissions that can be either from a point source or widely dispersed. Examples of point source emissions include paint overspray, sand-blasting, industrial smokestacks, and fugitive dust and particulates from loading/unloading of raw materials such as sand, gravel, and concrete. Examples of widely dispersed emissions include vehicle emissions and aircraft exhaust.

Ash Grove Cement is the only facility of concern identified for RM 0.0-0.1 East that has current operations with known point source emissions of air pollution that may contribute contaminants to RM 0.0-0.1 East sediments. Concerns related to air emissions from this facility are discussed in Section 4.4. However, additional data and information are addressed in the 2008 King County Atmospheric Deposition report.

The Washington State Department of Health hired a consultant to model air emissions from multiple sources in south Seattle. The objective of the multiple-source air modeling project in the Duwamish Valley was to identify air pollutants, key air pollution sources affecting residential areas of south Seattle, and the geographic areas of south Seattle that are affected by air pollutants. This effort is an initial step to identify priorities for future work in the area. A report published by Washington State Department of Health (WSDOH) in 2008 on the modeling effort summarized key findings and recommended future actions (WSDOH 2008). A study on atmospheric deposition planned by the Puget Sound Partnership has not been funded yet and no schedule has been developed. Ecology will continue to monitor these efforts (Ecology 2008g).

Out of concern for phthalate recontamination at sediment cleanup sites in the larger Puget Sound region, the Sediment Phthalates Work Group was formed in 2006. One accomplishment of this work group was reviewing existing information to explore the potential for phthalate recontamination via atmospheric pathways. The group concluded that phthalates reach sediments via a complex pathway involving off-gassing to air followed by attachment to particulates, deposition to the ground, and transport to sediments through stormwater (Sediment Phthalates Work Group 2007).

King County conducted air monitoring in the LDW area to assess whether atmospheric deposition is a potential source of phthalates, particularly bis(2-ethylhexyl)phthalate (BEHP), in stormwater runoff (KCDNRP 2008). The most significant finding is that BEHP concentrations were up to three times greater in the Duwamish Valley stations than in the Beacon Hill station. Results were similar to those of additional studies conducted within the same airshed and within other regions.

Based on comparison to results from other atmospheric deposition networks that employed high-volume air sampling techniques to collect gaseous and particulate phase air samples, the total deposition results from this study are likely to be biased low for the lighter phthalates, low- to mid-range for the PAH compounds, and low- to mid-range for the PCB congeners. Since side-by-side comparison sampling of the passive atmospheric deposition samplers with high-volume air samplers was not conducted, it is not possible to assess the degree of bias (KCDNRP 2008).

The sampling stations were located at Beacon Hill, Duwamish Valley, Georgetown, KCIA, and South Park Community Center. The range of air deposition flux values observed is given in the following table (KCDNRP 2008).

| Analyte | Range of Air Deposition Flux ($ug/m^2/day$) | Location of Highest Values |
|---|---|---|
| Butyl benzyl phthalate | 0.163 to 7.007 | South Park |
| Bis(2-ethylhexyl)phthalate | 0.261 to 12.240 | Duwamish Valley |
| Benzo(a)pyrene | 0.008 to 2.225 | KCIA |
| Pyrene | 0.035 to 4.652 | KCIA |
| Aroclor 1254 | <0.011 to 0.044 | Georgetown |
| Aroclor 1260 | <0.011 to 0.034 | Georgetown |

Detailed results are provided in King County's *Monitoring Report – October 2005 to April 2007* (KCDNRP 2008).

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# 4.0 Potential Sources of Sediment Recontamination

## 4.1 Introduction

This section summarizes available information on potential contaminant sources and pathways. The summary was evaluated to identify any potential for contaminant migration and recontamination of LDW sediments. In some instances, data, or lack of data, indicates a source or pathway may be present. A data gap is identified when available data are insufficient to confirm or rule out the presence of contamination or any significant potential for contaminant migration to LDW sediments.

Within RM 0.0-0.1 East, potential sources of sediment recontamination include direct discharges via public and private storm drain systems and direct and/or indirect discharges from facilities adjacent to the LDW (Figure 5). Discussed in the following sub-sections, these facilities were evaluated for the following means of potential recontamination of LDW sediments:

- Existing upland contamination of soil, groundwater, stormwater, or storm drain solids;
- Migration pathways that may exist between the potential sources and the LDW; and
- Activities that could lead to an accidental release of a COC.

Current and historical land uses and environmental investigations and cleanup activities were summarized for each facility of concern where information was available. More detail is provided for facilities where more information was available for review. Property ownership information was obtained from King County tax records and from existing reports. Current land use information was obtained from existing reports and Ecology online databases. The Ecology online databases were searched for information on CSCSL, current NPDES permits, USTs, LUST releases, and hazardous waste facilities. Reports and miscellaneous information in Ecology's files were also reviewed for relevant information. Section 1.2 lists all sources reviewed for this report.

## 4.2 Harbor Marina Corporate Center

### 4.2.1 Current Operations

Harbor Marina Corporate Center (Port of Seattle T-102) is located at the southern end of Harbor Island (Figure 2) at 1001 SW Klickitat Ave. It is used as a marina and office park, and includes two office buildings, paved parking, and the adjacent Harbor Marina. It encompasses approximately 18.47 acres. Source control for most of Harbor Island and T-104 are being covered under the East Waterway RI/FS. While Ecology has not taken an active role in source control efforts for the East Waterway, it is interested in facilities which could be sources of recontamination in both the LDW and East Waterway. Although petroleum fuel has been stored here in the past, there are currently no fueling stations or other chemical containment areas at the Marina. The site is bounded to the north by SW Manning Street and West Seattle Freeway and to the south, east, and west by the LDW. The surrounding land use is industrial and commercial, with nearby facilities conducting manufacturing and shipping operations.

| **Facility Summary: Harbor Marina Corporate Center** | |
|---|---|
| *Address* | 1011 SW Klickitat Ave. Suite 101 |
| *Property Owner* | Port of Seattle |
| *Property Lessee* | N/A |
| *Tax Parcel No.* | 7666701220 |
| *Parcel Size* | 18.47 acres |
| *Facility/Site ID* | 34525399 |
| *EPA ID No.* | N/A |
| *NPDES Permit No.* | N/A |
| *UST/LUST ID No.* | 3023 |
| *Listed on CSCSL* | No |
| *TRI No.* | N/A |
| *KCIWP* | N/A |

***Physical Setting***

The site is on the southern tip of Harbor Island, an artificial island created in 1905 to improve the seaport and provide additional land for industrial and commercial use. Harbor Island was built on shallow tidelands of the LDW from sedimentary materials sluiced from adjacent uplands and from regrading projects. The East and West waterways were then dredged, and the resulting dredge material, a mixture of sand, silt, clay, and gravel, was used as additional fill at the site.

Given the low elevation of the site and the proximity of the LDW, groundwater occurs at shallow depths (7 to 9 feet/ 2 to 3 meters) with very low gradient (estimated at 0.001). Groundwater fluctuations depend primarily on tidal variations in the LDW, as the extensive pavement on the site prevents rainwater infiltration. There are no water wells on or near the site (RETEC 1997).

## 4.2.2 Historical Use

Records indicate that since 1912, Harbor Island has been used for commercial and industrial activities. These have included secondary lead smelting, shipbuilding and repair, bulk petroleum fuel storage, metal fabrication, and containerized cargo shipping (Windward 2007a). The former USTs at the site included one 10,000-gallon leaded gasoline tank, one 10,000-gallon diesel tank, and one 2,000-gallon waste oil tank. The two 10,000-gallon USTs were placed side-by-side, approximately 100 feet (30 meters) from the LDW. The USTs were used to supply diesel and leaded gasoline to boats via dispensers located at the end of the main Marina dock. The waste oil UST was approximately 70 feet (21 meters) to the west and also had a concrete pad at the surface. All three USTs were installed in May 1984 (RETEC 1997).

### 4.2.3 Environmental Investigations and Cleanup Activities

***Phase II Environmental Site Assessment (1996)***

In May and June of 1996, GeoEngineers, Inc., completed a Phase II Environmental Site Assessment of the site. This investigation consisted of 10 geoprobe borings to depths of 12 feet below ground surface (bgs), collection of soil samples from these boring at 1- to 2-foot intervals, and collection of groundwater samples from three of the borings.

Chemical analyses of the soil samples indicated that at some depths diesel-range petroleum hydrocarbon (TPH-D) concentrations were in excess of the MTCA Method A cleanup level of 200 milligrams per kilogram (mg/kg) at the time of the investigation[8]. Exceedances were noted in the 10-foot depth of boring B-1 (440 parts per million [ppm] diesel) and at the 5-foot depth of boring B-3 (602 ppm heavy oil). Petroleum hydrocarbons were either not detected or were below MTCA levels in all other soil samples (RETEC 1997).

Analysis of the groundwater samples obtained using geoprobes indicated the presence of petroleum hydrocarbons exceeding MTCA Method A cleanup levels in all three samples collected near the former USTs. Concentrations of diesel-range hydrocarbons were detected at 1.26, 1.90 and 132 milligrams per liter (mg/L) and motor oil-range hydrocarbons at <8.25, 1.27 and 5.54 mg/L. The investigators noted that the sample with the highest level of diesel (132 mg/L) was collected from a point very close to the location of a former UST, within the tank backfill material: "Groundwater sample B-1 was collected from within the original excavation outline and thus was not representative of the actual groundwater present in the surrounding confined aquifer." The investigators also concluded that samples collected from the Geoprobe borings which actually penetrated the semi-confined aquifer outside of the eventual tank excavation outline all indicated that petroleum hydrocarbons were not present in the groundwater (RETEC 1997).

***UST Removal (1996)***

The Harbor Marina Corporate Center is on Ecology's LUST/UST database with three removed USTs. The property is listed with a LUST Release ID #498401 and UST ID #3023. All three USTs were installed in May, 1984 and were removed on October 22, 1996.

Removal of the USTs began on October 17, 1996 and was completed on October, 22, 1996. During the removal, the tanks were noted as being of steel construction and in excellent

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[8] Subsequent to 1996 the MTCA Method A cleanup levels for diesel and heavy oil have been revised upward to 2,000 ppm.

condition with no corrosion or holes. Exposed piping on the marina dock was also removed and disposed of, while buried piping between the tanks and the marina dock was drained, rinsed, capped, and left in place. Approximately 200 tons of crushed rock was imported to the site and used to bring the excavated areas up to grade. The area was then completely paved over. All excavated soil was removed from the site by Olympus. No further information regarding the disposal or destination of this material is available (RETEC 1997).

Immediately following the excavation and removal of the USTs on October 22, 1996, discrete soil samples were collected from the sidewalls and floor of each of the tank excavation sites. Three additional composite samples were obtained from the removed and stockpiled soil. Soil samples were taken from the west and south sidewalls of the gasoline and diesel UST excavations, and from the north and west sidewalls of the waste oil UST excavation. Soil from the floors beneath the former tanks was sampled from all three excavation sites.

Samples from the stockpile and the diesel and gasoline UST excavations were analyzed for diesel and oil, while the samples from the waste oil UST excavation were analyzed for heavy oil. Additionally, the sample taken from the gasoline UST excavation floor was analyzed for gasoline and benzene, toluene, ethylbenzene, and xylenes (BTEX).

Chemical analyses of these samples showed that only one soil sample, taken from the diesel UST excavation floor, contained levels of petroleum hydrocarbons in excess of the MTCA Method A cleanup levels. According to the reference cited, supplemental investigations confirmed these findings. Observations made during initial tank excavation indicated that all three steel USTs were in good condition with no corrosion or holes and that the contamination was a result of leakage from a pump on the diesel tank. However, Washington State Department of Ecology online database reports list this site as having a LUST. This discrepancy needs to be resolved (RETEC 1997).

Supplemental soil and groundwater sampling in the UST excavation areas was performed on October 31, 1996. Samples from nine 14-foot bgs geoprobe borings were collected, including eight soil samples and six groundwater samples, to determine the extents of diesel contamination. All eight soil samples were analyzed for diesel and oil, while all six groundwater samples were analyzed for diesel. In addition, one soil sample was also analyzed for gasoline, benzene, toluene, ethylbenzene, and xylenes.

Only one boring yielded diesel at a detectable limit: GP-5 soil showed a diesel level of 206 ppm, exceeding the MTCA Method A cleanup level of 200 ppm in effect at the time of investigation[9]. Samples from this boring were collected in the same area in which previous diesel exceedances were discovered in prior investigations. Diesel was not detected in any other soil samples, or in

[9] Subsequent to 1996 the MTCA Method A cleanup levels for diesel and heavy oil have been revised upward to 2,000 ppm.

any of the groundwater samples. Oil-range hydrocarbons were detected at levels exceeding MTCA cleanup levels in soil samples GP-1 and GP-8 at 1,740 ppm and 1,080 ppm, respectively. These hydrocarbons were not detected in any other soil or groundwater samples. RETEC noted the presence of a confining clay layer underneath the LUST which had most likely prevented the contamination from migrating downward (RETEC 1997).

***Port of Seattle Stormwater Mapping Inspection Reports and Maps (2006)***

An inspection was conducted on November 10, 2006 by the Phoinix Corporation to locate or verify all the drainage structures on the site, including structures related to the separate stormwater system as well as the combined sewer system. The inspection is a required component for the Port of Seattle to fulfill their NPDES Phase I Municipal Permit (Phoinix 2006). Thirty-three stormwater structures were verified on the property. These include 10 manholes (Type II), 22 catch basins (Type I) and 1 trench drain located throughout the property. Three outfalls were identified as metal structures with backflow prevention gates located in the southwest, south and southeast portions of the property. The nearby surface water and receiving waters are the Duwamish River and Elliott Bay/ Puget Sound (Phoinix 2006).

## 4.2.4 Potential Pathways of Contamination

### 4.2.4.1 Stormwater

There are three known stormwater outfalls on the perimeter of the Harbor Marina Corporate Center (Figure 5). Two of these are known to have at least some discharge flow, but no further information about discharge or permitting has been found for any of these three outfalls. However, there are no industrial activities on site and the Corporate Center is composed almost entirely of commercial buildings and paved parking lots. There are no current chemical holding areas or fueling stations. There is currently no requirement to monitor these outfalls and no information regarding sampling or monitoring of the outfall discharge was found. As no high risk pollution generating activities have been identified, the potential for these outfalls to recontaminate waterway sediment is considered to be relatively low.

### 4.2.4.2 Groundwater

The highly impervious ground cover and the low concentrations of groundwater contaminants suggest that there is little potential for contamination via this pathway. Although groundwater samples taken from the excavation sites did show some diesel exceedances, the contaminants found in the groundwater near the location of the former USTs would likely attenuate before migrating an appreciable distance due to the very low flow gradient and confining clay layer. Geoprobe boring samples obtained outside of the excavation area indicate that petroleum hydrocarbons had not migrated to groundwater (RETEC 1997).

### 4.2.4.3 Spills

Because the USTs and the damaged LUST were removed in 1996, there is no longer any concern for spills from USTs. In addition, the current operations do not employ any hazardous materials or store any contaminants on site. However, there is a risk for spills in the paved parking lot area from vehicle use that could potentially drain to the LDW. This risk is similar to other commercial parking areas throughout the city and is considered minimal.

#### 4.2.4.4 Bank Erosion/Leaching

The crushed rock cap and pavement of the former UST areas eliminate the potential for leaching from the impacted soil to groundwater or surface water.

### 4.2.5 Data Gaps

RETEC suggests in its 1997 report that some sample results show petroleum hydrocarbons at unacceptable levels but the report states that the results do not correlate well with other data. RTEC assumes this indicates the levels are related to historical fill activities on Harbor Island, not to the former USTs at the site. However, documents found relating to the Harbor Marina Corporate Center Underground Storage Tank Decommissioning indicate that the Diesel UST (#3023) on this property was reclassified as a LUST after the discovery of the damaged pipeline. These papers suggest that the ID #498401 was assigned to this new LUST, but this could not be confirmed in the Department of Ecology LUST/UST online database. Even though the tanks have been removed, this is an important classification to clarify in order to confirm the source identity.

The lack of information about the disposal of excavated soil from the tank removal activities is a data gap. Proper disposal and/or destruction of contaminants needs to be confirmed before assuming that contaminated soil removed from this site no longer poses a threat to the LDW.

The lack of information about the three stormwater outfalls is a data gap. Although there are indications that the risk of contaminant release through these outfalls is low, further information is needed to better assess this risk.

## 4.3 Port of Seattle Terminal 104

### 4.3.1 Current Operations

Terminal (T) 104 (formerly Terminal (T) 106NW) is owned by the Port of Seattle and is located at 3629 (or 3627)[10] Duwamish Ave South. The terminal consists of two separate areas divided by a railroad right-of-way running parallel to and south of the Spokane Street corridor. The overall terminal area is approximately 16.5 acres and is bounded by Spokane Street to the north, Duwamish Avenue to the east, Ash Grove Cement to the south, and the LDW to the west (Figure 6). The larger (main) portion of T-104 is south of the railroad right-of-way and consists of approximately 13.79 acres. The northern part of T-104 consisting of 2.7 acres, is located north

[10] Online facility database reports indicate that the address of 3627 Duwamish Ave. South is sometimes inter-changed with 3629 Duwamish Ave. South. Both addresses are applicable to this facility.

of the railroad right-of-way and does not offer water access. The Poncho's Legacy Property borders T-104 to the southeast. While not part of T-104, the Poncho's Legacy property is included in this source control area and this facility section as it is part of the East Marginal Way Grade Separation Project which also encompasses portions of T-104 (Anchor and Windward 2008). Source control for most of Harbor Island and T-104 are being covered under the East Waterway RI/FS. While Ecology has not taken an active role in source control efforts for the East Waterway, it is interested in facilities which could be sources of recontamination in both the LDW and East Waterway.

According to the site tenant Web site, this property currently hosts Western Cartage, Seattle Transload, and Seattle Bulk Rail Station Incorporated as a transloader triad known as Washington Transportation, Inc. (Seattle Transload 2008).

| **Facility Summary: Terminal 104 (formerly Terminal 106NW)** | |
|---|---|
| *Address* | 3629 (or 3627) Duwamish Ave S |
| *Property Owner* | Port of Seattle |
| *Property Lessee* | N/A |
| *Tax Parcel Nos.* | 7666700315/ 7666700755/ 7666700325 |
| *Parcel Size* | 16.5 acres |
| *Facility/Site ID* | 72668645 (104) or 2313 (106NW) |
| *EPA ID No.* | WAD988506234 |
| *NPDES Permit No.* | N/A |
| *UST/LUST ID No.* | 3009 |
| *Listed on CSCSL* | Yes |
| *TRI No.* | N/A |
| *KCIWP* | N/A |

### *Physical Setting*

According to the current East Waterway Operable Unit report (Anchor and Windward 2008), the northern area of T-104 (adjacent to the Spokane Street corridor) is vacant and undeveloped consisting of mostly unpaved gravel surface. The southern area is occupied by three warehouses that are used by the Port for storage and truck storage and maintenance.

Groundwater is typically present 7 to 8 feet (2 to 2.5 meters) bgs based on a geoprobe investigation (Shannon & Wilson 2005). Soils at the site generally consist of medium to fine sands and silts with varying amounts of silt, sand, and gravel.

***Current Redevelopment Activities – East Marginal Way Grade Separation Project***

A portion of the ongoing grade separation project is located within the eastern and northern portions of T-104 and is being constructed in order to provide a north, east, and southbound grade separation on Duwamish Avenue South. This will remove at-grade conflicts with existing rail tracks and improve access among Port terminals, Union Pacific and Burlington Northern Santa Fe rail yards, local manufacturers, and distribution warehouses. The right-of-way areas for this project include the north parcel and east portion of T-104 and neighboring properties (Figure 6). Project work will include demolition of existing structures and excavation for structural foundations and roadway-related structures.

Comprehensive environmental investigations have been conducted on the north parcel and east portion of T-104 as well as the aforementioned neighboring Poncho's Legacy property (Figure 6). The portions of those studies pertaining to T-104 are discussed further in Section 4.3.3. A Cleanup Action Plan (Environmental Partners 2007b) is being implemented under Ecology's Voluntary Cleanup Program (VCP) to address historical contamination in the project area.

### 4.3.2 Historical Use

The T-104 property has historically been used by a paper bag manufacturer, a lumber storage yard, an auto repair shop, a restaurant, a foundry supply warehouse, and a cargo transfer and storage yard (Anchor and Windward 2008). In addition, the former T-106NW area has been occupied by a lumber storage yard, ironwork warehouse, general store, carpenter shop, and auto repair shop. A variety of potentially hazardous materials, including heavy metals, solvents, degreasers and petroleum hydrocarbons, are commonly associated with the businesses formerly located at these sites (Shannon & Wilson 2005). Records indicate that as recently as 2005, a pest control company called Paratex leased the northwest corner of the parcel (King County 2005b). Records also indicate that the Port itself used the plot as a central Customs examination center (EMCON 1992a).

The Poncho's Legacy property was historically occupied by an iron works, a manufacturing company, a welded wire mesh industry, a real estate business, and currently a belt and rubber supply company. Potentially hazardous materials from historical use of this site are similar to those at the T-104 site (Shannon & Wilson 2005).

### 4.3.3 Environmental Investigations and Cleanup Activities

***LUST Removal (1991)***

In October 1991, one UST was removed by O'Sullivan Construction, Inc., under contract with the Port of Seattle (EMCON 1992a). This tank held approximately 3,000 gallons of unleaded gasoline and was presumably leaking contents, as the tank is listed as LUST #3009 in Ecology files. The location of the tank can be seen in Figures 7 and 8. No more information was found on this tank removal.

### *Remedial Investigation (1991)*

A Port of Seattle document from April 9, 1992, states that the Port's consultant, Shannon & Wilson, conducted a remedial investigation of the T-106NW site on October 10, 1991. The document states that the investigation discovered lead-contaminated solids in the catch basins both to the north and south of the transload dock (Figure 7), and elevated levels of lead in the dust on and around the docks. Soil samples taken at further distances from the dock and all subsurface soil samples showed no elevated lead levels. In the reference cited, the Port responded that it intended to immediately clean up this contamination. No further information regarding the resolution of this cleanup has been found (Port of Seattle 1992).

### *Final Environmental Site Assessment (1992)*

EMCON Northwest, Inc. was contracted by the Port of Seattle in November and December 1991 to conduct a subsurface environmental assessment at the former UST location. Investigation activities included drilling and sampling seven soil borings, converting six of these borings to groundwater monitoring wells, collecting samples from these monitoring wells, and analyzing for contaminants in all soil and groundwater samples. Samples were analyzed for total petroleum hydrocarbons (TPH) and BTEX (EMCON 1992a).

Results of these analyses indicated that BTEX concentrations were below cleanup levels in all soil samples, and also in all groundwater samples except MW-1, which was taken at the location of the former UST, and showed benzene, toluene, ethylbenzene, and xylenes above MTCA Method A cleanup levels. Results of TPH testing showed that all soil samples were below MTCA Method A levels, but that groundwater samples from wells MW-1, MW-4, and MW-6 all contained concentrations of petroleum hydrocarbons above the cleanup levels (EMCON 1992a). However, no downgradient flow of contaminants was evident.

### *Recurrent Groundwater Well Monitoring (1992-1993)*

EMCON Northwest, Inc. conducted four groundwater monitoring events between April 22, 1992, and February 10, 1993, at the six monitoring wells installed in the 1991 environmental site assessment outlined above. Samples from all six wells as well as a blind duplicate from MW-1 were analyzed (Figure 8). Results from these investigations are as follows[11]:

- *April 22, 1992* – Ethylbenzene, total xylenes, and TPH exceeded MTCA Method A cleanup levels in MW-1 as well as in the blind duplicate. Cleanup levels were not exceeded in any other samples (EMCON 1992b).
- *June 12, 1992* – The entire BTEX suite and TPH exceeded MTCA Method A cleanup levels in MW-1 and in the blind duplicate. Ethylbenzene and total xylenes exceeded

[11] Exceedances in this section refer to MTCA Method A Cleanup levels at the time of investigation. Subsequent to 1996, these levels were updated.

Method A in wells MW-3 and MW-4, and TPH exceeded MTCA Method A in well MW-3 (EMCON 1992c).

- *October 27, 1992* – The entire BTEX suite and TPH exceeded MTCA Method A cleanup levels in MW-1 and in the blind duplicate. Cleanup levels were not exceeded in any other samples (EMCON 1992d).
- *February 10, 1993* – TPH exceeded MTCA Method A cleanup levels in MW-1 and in the blind duplicate, and benzene exceeded the cleanup levels in well MW-1 but not in the duplicate. Cleanup levels were not exceeded in any other samples (EMCON 1993).

***UST Compliance Monitoring (1996)***

The Port of Seattle monitored groundwater quality in 1994 and 1995 in the vicinity of the former LUST 3009 (removed in 1991) on the T-106NW property. This work consisted of collecting water level measurements and samples at three wells, analyzing the samples for contaminants of concern, and reporting the analytical results (Port of Seattle 1996).

Samples were collected from wells MW-1, MW-5, and MW-6 and analyzed by Washington method WTPH-G for gasoline-range hydrocarbons and BTEX. These results showed that releases of fuel had impacted soil in limited areas of the shallow subsurface (8-10 feet/ 2.5 to 3.5 meters bgs) around MW-1, the location of the former UST. TPH concentrations in the vicinity of this well ranged from 9.8 to 110 mg/kg. Groundwater samples in these areas showed gasoline range hydrocarbons and BTEX levels above the MTCA Method A cleanup level, indicating that the gasoline from the UST had contaminated MW-1 soil and groundwater (Port of Seattle 1996).

Following this report, the Port of Seattle issued a letter to Ecology with plans to cease remedial action at the site even though MW-1 continued to have TPH concentrations above MTCA Method A cleanup levels. The Port decided that since no downgradient contamination had been detected and they believed that the groundwater at MW-1 was naturally attenuating, the cost of continued remediation was unwarranted and further remedial actions ceased (Port of Seattle 1996).

***Notice of Required Cleanup (2003)***

In April 2003, Ecology issued a letter to the Port of Seattle regarding changes to the MTCA Code that would affect the T-104 site. New MTCA exceedance levels led Ecology to reevaluate conditions at the Terminal and to determine that the remaining contamination posed a threat to human health and the environment. Ecology notified the Port of its requirement to clean up the remaining pollutants. No information has been found on whether this action occurred (Ecology 2003a).

***Environmental Investigations and Cleanup Actions Related to the East Marginal Way (EMW) Grade Separation Project***

A Stage 1 environmental investigation for T-104 and Poncho's Legacy property was conducted in 2005 to focus on the portions of the port terminal areas that would be affected by the East

Marginal Way Grade Separation Project (Shannon & Wilson 2005). Shannon & Wilson, Inc., in collaboration with ESN Northwest (ESN), conducted a geoprobe investigation at the grade separation project area that included T-104 and T-106 NW (now considered part of T-104). Nineteen probe locations were sampled continuously to 12 feet (3.5 meters) bgs and selected to screen areas for potential off-to-on-site migration of contamination and potential on-site contamination associated with past site uses. Results from the geoprobe sampling indicated that oil-range petroleum hydrocarbons, metals, and PAHs were present in the soil, while VOCs, metals, and PAHs were present in the groundwater at the site. However, none of the detected levels exceeded Ecology's MTCA Method A cleanup criteria (Shannon & Wilson 2005).

The areas on the site that would most likely be affected by the excavation during construction of the grade separation project include the parking areas on the east and south of Warehouse No.2 and to the north of Warehouse No.4. Most of the contamination in those areas was below MTCA Method A and B levels based on the analytical results. However, the cadmium concentration level in one soil sample at P18 and the arsenic and chromium levels in one groundwater sample at P17 exceeded the MTCA Method A levels. P17 and P18 (Figure 6) are located along the eastern edge of the site. Arsenic and lead were detected in groundwater samples in the area of proposed construction at P28. The source of the contamination is unknown. The cadmium contamination in the soil is likely due to imported fill. In addition, the arsenic, lead and chromium groundwater contamination may be related to fill material used at the site, or for the roadway upgradient and east of the site, or it could be associated with treated timber piles or former metal working shops in the area upgradient from the site (Shannon & Wilson 2005).

Groundwater collected from the south end of the site, near the inactive Port of Seattle rail spur had metal concentrations that exceeded the MTCA Method A levels, specifically for arsenic at P23, P25-P26; chromium at P25, and lead at P25-P26. As stated in the 2005 Shannon & Wilson report, the arsenic contamination is likely the result of historic treated wood pile storage, and the lead and chromium contamination is likely from the former metal working and plating operations on site (Shannon & Wilson 2005).

***Environmental Investigation- Stage 1 East Marginal Way Grade Separation Project Poncho's Legacy (2005)***

The Poncho's Legacy site is located at 3685 Duwamish Avenue South adjacent to T-104 (Figure 6). It is currently occupied by International Belt and Rubber Supply. A masonry warehouse and office building are the only two structures on the property. It is bordered by an inactive Port of Seattle railroad line on the south side. The site has been occupied by an iron works, an iron mesh manufacturing company, and a real estate business. Currently it is occupied by a rubber belt supply and retrofitting company. It is currently undergoing cleanup under Ecology's VCP (Anchor and Windward 2008).

While the Poncho's Legacy property is not part of T-104, it was included in the environmental investigation and sampling activities for the grade separation project. The site investigation for this project included the installation of monitoring wells and soil sampling on the T-104 property. Six probe locations, P5 – P7, P19, P25 and P26 (Figure 9) from the investigation were selected to screen areas for potential off-to-on-site migration of contamination associated with the surrounding businesses. Three other probe locations (P23, P24 and P28) were selected to screen areas for on-to-off site migration of potential contaminants from the property to Port of Seattle properties (Shannon & Wilson 2005).

Arsenic was detected in soil collected from the south rail spur area in probe P26 at a concentration which exceeded the Method A level. In addition, groundwater samples were collected from the same area that exceeded the Method A values for arsenic at P25 and P26; chromium at P25; and lead at P25 and P26. The T-106 area had similar groundwater findings that exceeded the Method A values for arsenic at P23 and P28; and lead at P28 (Shannon & Wilson 2005).

The source of the contamination is unknown. However, the distribution in groundwater suggests that it could be associated with the iron works formerly located on the property or with the Ash Grove Cement plant to the south (Shannon & Wilson 2005).

***Supplemental Investigation for the East Marginal Way (EMW) Grade Separation Project (2006-2007)***

A supplemental investigation was completed for the Port of Seattle's EMW Grade Separation Project (GSP) and included additional assessment of the nature and extent of trichloroethene (TCE) in soil and groundwater around the Poncho's Legacy property (Environmental Partners 2007a). TCE is a hazardous contaminant commonly used in auto making and repair, which are previous activities on this site. The project also evaluated soil and groundwater at other locations within the Grade Separation Project right-of-way. Soil and groundwater samples were collected using direct push technology in December 2006 and in January 2007. Borings were advanced to 12 feet (3.5 meters) bgs and one boring was advanced to 16 feet (5 meters) bgs. TCE was detected in soil at concentrations ranging from 0.0015 to 0.08 mg/kg; however, only location ST-6 had concentrations that exceeded the MTCA Method A cleanup level. The source of the contamination is unknown. TCE was also detected in groundwater at the western portion of the property and six locations,MW-12, MW-13, ST-5, ST-6, ST-8, ST-9 and ST-12 (Figure 9) had concentrations that exceeded the MTCA Method A or Method C cleanup criteria (Environmental Partners 2007a). Dissolved and total arsenic detected concentrations in the groundwater collected in the southern portion of the property exceeded the MTCA Method A and Method C cleanup levels for three locations (MW-10, MW-14 and MW-15). Geochemical conditions or off-site sources may be the cause for the arsenic contamination (Environmental Partners 2007a).

Lube oil-range hydrocarbons were detected in shallow soil (2-2.5 ft) at the gravel lot located in the eastern portion of the northern T-104 area. However only one direct push probe location (SW-12) had a concentration that exceeded the MTCA Method A cleanup level. These detections are assumed to be associated with the tractor-trailer usage for parking in the gravel lot. Gasoline-range petroleum hydrocarbons were detected in groundwater at the same area; however, only one location (SW-12) exceeded the MTCA Method A cleanup level. According to this additional sampling the extent of the gasoline-range petroleum hydrocarbons appears to be limited to a small area concentrated around SW-12 and a source for it was not found in the soil. Subsequent sampling results from points down-gradient of the 2005 probe locations did not show detections of petroleum hydrocarbons, indicating that the extent of lube oil-range hydrocarbons in groundwater is limited. This area is being addressed as part of the project's cleanup action plan (Environmental Partners 2007a).

The Cleanup Action Plan (CAP) for impacted soil and groundwater encountered in the Right of Way areas was completed by on March 9, 2007. The MTCA cleanup standards served as the basis for developing and selecting remedial actions. Based on the results of previous investigations, petroleum hydrocarbons were identified as the COCs for the property. In addition, RCRA metals, petroleum hydrocarbons and PAHS were the chemicals selected for analysis if contaminated materials were encountered during construction (Environmental Partners 2007b).

***Groundwater Remedial Action for ROW area (June 2007)***

Environmental Partners, Inc. conducted the baseline groundwater sampling in the portion of the ROW area located at the east end of the northern portion of T-104 in May 2007. New monitoring wells MW-21 and MW-22 (Figure 10) were installed, developed and sampled. A shallow soil sample and one sample just above the water table were collected from each location. Groundwater samples were collected from each well after the wells were developed. All the samples were analyzed for gasoline and diesel-range petroleum hydrocarbons and benzene, toluene, ethylbenzene, and xylenes. Petroleum hydrocarbons and BTEX were not detected at soil concentrations that exceeded the MTCA cleanup levels in any of the samples taken. However, results showed that gasoline-range hydrocarbons, ethylbenzene, and toluene were detected at MW-22. According to the Environmental Partners 2007 report, the estimated area of contaminated groundwater is approximately 5,000 square feet (465 square meters) over an estimated vertical thickness of 4 feet (1.5 meters) (Environmental Partners 2007c). This contamination is being addressed under the project's current cleanup action plan.

***Port of Seattle Stormwater Mapping Inspection Reports and Maps (2007)***

An inspection was conducted at T-104 on April 3, 2007 by the Phoinix Corporation to locate or verify all the drainage structures on the site, including structures related to the separate stormwater system as well as the combined sewer system, as well as mapping the catch basins and SWPP best management practices (BMP) structures. The inspection is a required component for the Port of Seattle to fulfill their NPDES Phase I Municipal Permit (Phoinix 2007). Two outfalls and seventy-six stormwater-related structures were verified on the property. These included 14 manholes (Type II), 42 catch basins (Type I), and 20 roof drains located throughout the property (Figure 11). Manhole 7005, located on the western side of the property, was identified as the manhole that most of the structures on the site appear to drain to; however, no outfall was found in the vicinity of this manhole. There is also no information indicating that this manhole vault drains to the sanitary sewer. This structure had a significant amount of sludge-like buildup with a petroleum odor and is also possibly plugged (Phoinix 2007). No further information is available regarding whether or not this problem was resolved.

## 4.3.4 Potential Pathways of Contamination

### 4.3.4.1 Stormwater

Two outfalls serving the T-104 area are located at the shoreline of the site (Figure 5). Recent surveys of the drainage systems at T-104 indicate that storm drains could serve as a pathway for upland contaminants, including petroleum, to reach the waterway. Surface runoff from paved areas at this site does not currently undergo treatment or separation before discharge, and according to recent surveys, the major drainage structure for the site which is located near the waterway is not adequately handling discharge and appears to contain petroleum contamination (Phoinix 2007). This pathway is potentially a significant source of contamination to the LDW.

### 4.3.4.2 Groundwater

Groundwater monitoring before and after the removal of LUST 3009 indicates that contamination was localized to the former UST area as no constituents were found in down-gradient samples. Although this area was a small part of the total plot, very little information has been found regarding facility operations on other areas of the site. Furthermore, a King County Industrial Waste Inspection report suggests that a pest control company had operated on site while not in compliance with some aspects of its pollution management (SPU 2005). Other historical activities at this site involved the use of hazardous compounds that could remain. Contaminants from past or current activities within T-104 could be potential sources for groundwater contamination. Therefore, groundwater contamination cannot be ruled out as a viable concern.

### 4.3.4.3 Spills

There is a potential for spills in the tenant operation areas to discharge to the LDW through the storm drain system. Documentation of tenant actions to control stormwater contaminants and comply with stormwater pollution prevention requirements is needed to verify that this potential pathway is being controlled.

## 4.3.5 Data Gaps

For this source control area, it is uncertain what roles, if any, the neighboring properties play in the contamination on site. It is possible that off-site contamination migrating via groundwater from the north and east may be contributing to the on-site contamination. More information is needed about historic and current operations in the adjacent off-site areas. Additional groundwater information, including concentrations and hydraulic contouring, is needed to better understand the potential for contaminant migration into this source control area from the north and east.

More information is needed about the nature and extent of groundwater contamination in the T-104 facility, including the adjacent former Poncho's Legacy site. For instance, the TCE contamination in the southeast portion of T-104, including the former Poncho's Legacy site, could be a result of historical auto degreaser and other auto industry compounds used in these areas. However, the extent of the TCE plume is unknown.

More information is needed about stormwater controls and storm drain cleaning by T-104 tenants. The information found regarding these components is insufficient to fully assess the potential for upland sources of contamination to migrate to the LDW via stormwater pathways. The conditions and potential sources of contaminants in the nearshore catch basins are not sufficiently understood. Though the recent mapping of these features (Phoinix 2007) helps to understand the stormwater drainage on these properties, it also illuminated some problems in the current system. More information about both the intended and actual functioning of the storm drain system is needed to ensure that contamination from the site is not reaching the waterway. Although the current tenant is developing spill prevention plans with the assistance of the Environmental Coalition of South Seattle (ECOSS), the resulting documentation has not been produced.

The history of lead contamination, together with historical documented site use (Shannon & Wilson 2002) indicate the potential for low level concentrations of lead and arsenic to be present in soil and groundwater. However, the site is paved and the shoreline is not eroding, so the risk of contaminants migrating to the LDW is relatively low and leaching of soil contaminants to groundwater is likely to be limited. Nevertheless, the nature and extent of historical site contamination from predominately metals is presently unknown.

## 4.4 Ash Grove Cement

The 24-acre Ash Grove Cement property consists of Parcel 1, more than 23.5 acres, and Parcel 2, less than half an acre. Parcel 1 has been part of the plant since 1920. Records indicate that Parcel 2 was also part of the cement facility since 1920, but was owned by the railroad companies prior to 1989. The Ash Grove property is bordered to the west by the LDW, to the north by Port of Seattle T-104 (also referred to by the Port of Seattle as T-106NW), to the east by East Marginal Way S., and to the south by Port of Seattle T-106 (this is a different property than the T-106NW noted in Section 4.3).

There are currently no documented USTs or LUSTs on the property, and all stormwater discharges to the King County (formerly METRO) sewer system under current permit 4009-02.

| Facility Summary: Ash Grove Cement | |
|---|---|
| *Address* | 3801 East Marginal Way S. |
| *Property Owner* | Ash Grove Cement West, Inc. |
| *Property Lessee* | Stoneway Concrete (2.2 acres) |
| *Tax Parcel Nos.* | 7666700350 / 7666700395 |
| *Parcel Sizes* | 23.35 acres / 0.32 acres |
| *Facility/Site ID* | 2142 |
| *EPA ID No.* | WAD009249616 |
| *NPDES Permit No.* | N/A |
| *UST/LUST ID No.* | N/A |
| *Listed on CSCSL* | No |
| *TRI No.* | 98134SHGRV3801E |
| *KCIWP* | 4009-01 (renewed as 4009-02) |

## 4.4.1 Current Operations

This property is owned by Ash Grove Cement Company, headquartered in Overland Park, Kansas. Ash Grove Cement is the fifth-largest cement manufacturer in the United States. The facility contains several large silos, storage domes, truck loading equipment, and storage sheds. Also located on the property is Stoneway Concrete, a ready-mix concrete plant owned by Gary Merlino Construction Co., Inc. This plant leases 2.2 acres from Ash Grove Cement (AGCC 2008).

According to Ecology's files, the Ash Grove Cement facility currently produces Type I, Type II, and Type III portland cement. It has the capacity to process 92 tons of clinker per hour. Processing clinker requires extreme heat which can be derived from burning petroleum coke, coal, natural gas, whole tires, and/or a small amount of internally generated waste fuels.

***Physical Setting***

Groundwater is at 5-10 feet (1.5 to 3 meters) bgs in composite fill material and is tidally influenced. Neither groundwater nor surface water within three miles of the site is used for drinking, irrigation, or industrial purposes. The entire site is fenced and has 24-hour security (EPA 1987).

Considerable information was reviewed on the history of the Ash Grove Cement property. This information is summarized in the following three sections: Historic Use, Regulatory History and Violations, and Environmental Investigations, Site Inspections, and Cleanups. Timelines for each of these sections can be seen in Figures 12, 13, and 14. Some information is repeated to be consistent with the timelines.

## 4.4.2 Historic Use

The Ash Grove Cement property has been used for cement manufacturing since 1920. From 1928 to 1984, the plant produced clinker using limestone, clay, sand, and small amounts of iron ore. Other additives including vanillin, calcium derivatives, and molasses were also used to maintain the quality of the resulting cement. The plant was owned and operated by the Pacific Coast Cement Company until 1934, when the name changed to Superior Portland Cement Company through the 1940s. In 1956, Lone Star Industries purchased the property and cement facility and began importing crushed limestone via barge from British Columbia. In 1973, an unlined settling pond was constructed on the southwest corner of the property less than 50 yards from the Duwamish River. Water contaminated with hazardous materials from the manufacturing process of the clinker and final cement product was pumped to this pond. The effluent was either discharged into the waterway or used for grass watering, dust suppression, or cement processing (Ecology 2007).

According to Ecology's files, a 1980 agreement between Lone Star Industries and Monsanto Chemical stated that Lone Star would purchase Vanillin Black Liquor Solids (VBLS) from Monsanto Chemical to use as a calcium source for cement production. Monsanto Chemical manufactured artificial vanilla at a former facility in the Slip 6 source control area (E & E 2008). The facility was later purchased by Rhône-Poulenc but is no longer in existence. This liquid was 1-2% copper and 31% calcium, with a pH of 12.5. Monsanto Chemical Company agreed to install and lease handling and storage facilities on the property to store the VBLS, but included a clause stating that the VBLS was provided to Lone Star on an "as is" basis "with all faults." In January 1983, a letter, referenced in Ecology's files, from Lone Star to PSCAA indicated that they would begin using VBLS as a dust suppressant on roads within the facility. An activity report referenced in Ecology's files and dated August 22, 1983, suggested the company was considering taking measures to sell its inventory. In November 1983, a Lone Star internal memo, referenced in Ecology's files, was circulated that discussed kiln dust as a hazardous waste under Ecology's new regulations. Lone Star decided to recycle kiln dust back into the cement production process to avoid being classified as a waste generator and agreed to purchase the remaining VBLS from Monsanto Chemical.

In January 1984 an agreement was reached to sell Lone Star to Ash Grove Cement Company. An Ecology Inspection Report dated October 24, 1985, stated that Ash Grove ceased manufacturing clinker on March 23, 1984. As the termination of site operations concluded two hours after company notification, large piles of raw materials such as VBLS, fly ash, coal slag, slurry, molasses, and Lignosite (sodium lignosulfate powder) remained on the site for an uncertain amount of time. At the time of the inspection, there were no plans to resume clinker manufacture and all equipment was offered for sale (Ecology 1985). In May of 1984, waste kiln dust and clinker were removed and used as soil stabilizer, but no mention of final destination was given in the resulting activity report. During July, the University of Washington, the original supplier of fly ash for Lone Star, removed and disposed of the remaining fly ash contained in the facility. In August, one kiln was reinstated to consume the remainder of the slurry inventory, and in October, Monsanto returned to remove the remaining 1,000 tons of VBLS. The stockpiled coal was not removed until January 1986, when it was sold to unnamed companies and removed. All of the remaining slag on the site property was removed and the settling pond was drained in August 1986 (Ecology 2007).

In March 1987, Gary Merlino Construction Co. began discussion with Ash Grove Cement Company to lease and construct a ready-mix cement facility on the site property. Construction on this project began in October 1987. During this same year, Rhône-Poulenc, Inc., bought back the VBLS storage tank. From 1987 to 1991, the facility continued to be used as a cement terminal and packing operation, as well as a sales front for silica and other bulk materials. Ash Grove Cement began moving forward with plans to modernize its facility in January 1989. Mills, slurry tanks, and pneumatic transfer lines were demolished and deconstructed, the wharf was enlarged, and the former settling pond was treated. No further information was found regarding the extent of these modifications into the sub-surface infrastructure. All gas, water, stormwater, and sanitary sewer lines in the demolition areas were removed to 6 inches below grade, but there is no indication why this work was done or if older plumbing below this level still exists. Chromium and asbestos-containing industrial materials including kiln break and insulation were identified, removed, and properly disposed of. However, there is record of a large transformer near the slurry tanks that contained 981 gallons of PCB oil, but there is no record of its disposal. The unlined settling pond was neutralized with sulfuric acid. By the end of September 1989, demolition and settling pond treatment were complete (Ecology 2007).

According to Ecology files, in 1990 the existing stormwater runoff and sewer plans were evaluated and a new plan was proposed. Under the new plan, the stormwater runoff directed to the unlined settling pond would be rerouted instead to the main sewer system on E. Marginal Way. In 1991, the old kiln foundations were demolished, and the former settling pond was filled. Ash Grove Cement Company began construction of a waste water connector between its facility and the King County interceptor line along East Marginal Way in February 1992. Existing stormwater lines were cleaned out. Early in 1993, Ash Grove began to burn waste oil in its kiln. The oil was contained in two holding tanks of 750 gallons each. PSCAA advised the company that the waste oil should be tested for metals, chlorides, PCBs, and its flash point. No documentation of this analysis, if it occurred, was found.

In 1995, Ash Grove Cement began receiving mill slag from Tek Cominco's plant in Trail, BC. The estimated amount of slag shipped to the company was approximately 36,000 tons. In 1999, approximately 750 cubic yards of gravel was spilled into the LDW at the south end of the facility's waterfront, and subsequently removed. In 2002, modifications began to help prevent additional spillage into the waterway. A large hopper and dockside conveyer system were installed on the barge unloading dock. Yearly monitoring of nearby bathymetry helped ensure that maintenance dredging was only removing intended material from the sediment. In 2005, Ash Grove began to use iron grit in place of the Tek Cominco mill slag (Ecology 2007). In May 2008 a barge docked at the facility broke in half, spilling part of its reportedly clean gravel load into the LDW. It is expected that Ash Grove will dredge out the spilled material according to their current dredging schedule (EPA 2008d).

### 4.4.3 Regulatory History and Violations

Lone Star Cement Corporation received its initial Waste Discharge Permit from the Pollution Control Commission on January 5, 1965. Permit #2119 allowed for up to 3.5 million gallons of cooling and contaminated process water to be discharged daily into the LDW. Lone Star was required to allow the wastewater to settle prior to discharge. This permit expired January 5, 1970 (PCC 1965). On January 15, 1970, Lone Star applied for and was granted Waste Discharge Permit #3279, which reduced the amount of waste water discharged into the waterway to 135,000 gallons per day (GPD). The same requirement for pre-settling applied, but the new permit stated that all uncontaminated stormwater could be discharged directly into the Duwamish. However, no information is available regarding the criteria to deem stormwater as "uncontaminated". This permit expired January 15, 1975 (PCC 1970).

Lone Star Cement received a letter on October 14, 1977 from Ron Devitt (District Environmental Quality Inspector) recommending that Lone Star apply for a waste discharge permit (Ecology 1977). Lone Star did so and on January 17, 1978, Ecology issued Lone Star Industries Waste Discharge Permit #5162. The permit allowed 214,100 gallons of process and stormwater to be discharged daily to the LDW. The permit required Lone Star to allow contaminated wastewater to percolate into the subsurface of the unlined settling pond before discharging the excess into the river. Under this permit, Lone Star was required to closely monitor pH and turbidity, and could not discharge any oil or materials spilled on the pier. This permit expired January 17, 1983 (Ecology 1978).

On March 23, 1984, Lone Star Cement Corporation was purchased by Ash Grove Cement Company. Permit #5162 was officially transferred to the new name and renewed on October 26, 1984. All permit parameters remained the same. This permit expired on October 26, 1989, and was renewed by Ash Grove on November 30, 1989 (OPCC 1984).

In July 1980, the company received a $250 penalty and Notice of Violation for "Tower 12." No other information was provided by the company regarding the cause for the violation. The EPA filed a lawsuit in the U.S. District Court in August 1984 against Ash Grove Cement Company for violation of the Clean Water Act. This citation was in response to an undetermined amount of cement dust being spilled into an unknown area of the Duwamish River. In November 1984, Ash Grove renewed Permit #5162 with no changes in effluent discharge allowances (Ecology 2007).

In 1985, Ash Grove and Seattle METRO discussed the problem of disposing of all stockpiled coal and slag. METRO granted the company an extension until the end of July 1985 to remove all stockpiles. In October, Ash Grove Cement pled guilty to one criminal count of violation of the River and Harbors Act for not removing these waste piles and paid a fine of $5,000. PSCAA also fined the company $1,000 for fugitive dust releases (Ecology 2007).

On October 26, 1989, renewal of the Ash Grove wastewater permit was required under new rules. The new regulations required runoff water, truck wash water, and pond discharge to fall under the permitting guidance. In November 1989, Ash Grove applied for and was granted an updated Industrial/Commercial Waste Discharge permit, but it is not clear if this permitted discharging to the waterway, the sanitary sewer, or both (Ecology 2007).

In February 1990, Ash Grove submitted forms for the new NPDES requirements under EPA ID# WAD009249616. The company determined in March 1990 that it should revise the drainage plan and close the settling pond. Ecology approval was given to modify the Waste Discharge Permit to allow Lone Star to fill the pond with rocks and soil cover, and divert all process wastewater to the METRO sanitary sewer system (Ecology 2007).

On July 3, 1991, Ash Grove was issued a Wastewater Discharge Authorization (#296) by the King County Industrial Waste Program. The authorization granted permission to discharge up to 1,000 GPD of industrial wastewater into the King County sewer system, allowed for self-monitoring, and imposed general discharge limitations. Permit #5162 was therefore replaced and subsequently cancelled. In October 1991, the City of Seattle agreed that the Ash Grove Cement Company was not required to possess a NPDES permit for the stormwater hook up, and that industrial process and cooling water would be rerouted to the METRO sewer system. On December 20, this modification was approved and Lone Star could then discharge up to 20,000 GPD of wastewater to the sewer system (Ecology 2007).

According to Ecology's files, PSCAA was notified of an overfilled silo in February 1992; no further information is available about this incident. Later in February 1992, an investigation found that a Merlino employee pumped water from an excavation directly into the river and a complaint was filed with the U.S. Coast Guard (Ecology 2007). In April 1992, Ash Grove notified Ecology that 3-4 cubic yards of crushed limestone had been accidentally dropped into the Duwamish River due to improperly functioning mechanisms on the unloading barge. Ash Grove later installed an automated system to shut down conveyer belts in emergencies (AGCC 1992).

In 1996, PSCAA developed a new system of addressing violations. A civil penalty policy was implemented that elevated chronic repeat violations to Notices of Violation (NOVs) and directed civil penalties for these assessments. NOVs were issued to Ash Grove for violations including fugitive dust release, illegal emissions, operating and maintenance plan deviations, and other items. Many penalties contained more than one type of violation. Many NOVs have been issued to Ash Grove in its history, and since development of the new violation system, 33 have been elevated to civil penalties. The following table outlines these civil penalties, the cause of the violations, and the penalties assessed if applicable (Ecology 2007).

| Civil Penalty No. | NOV No. | Date Issued | Types of CPs | Civil Penalty Explanation |
|---|---|---|---|---|
| 9862 | 3-001117 | 3/25/2005 | Other | Failure to conduct a New Source Performance Standard (NSPS) performance test on the coal mill stacks within 180 days of permit issuance. Failure to conduct particulate and opacity testing on the coal mill stacks. |

| Civil Penalty No. | NOV No. | Date Issued | Types of CPs | Civil Penalty Explanation |
|---|---|---|---|---|
| 9352 | 36739<br>36740<br>36879 | 8/10/2001 | Illegal Emission | Emission of an air contaminant in sufficient quantities and of such characteristics as was or was likely to be injurious to human health, plant, or animal life or property, or interfered with the enjoyment of life and property. |
| 9120 | 37085 | 2/16/2001 | Fugitive Dust | Emission of fugitive dust without reasonable precautions to control emissions. |
| 9109 | 36372 | 12/8/2000 | Illegal Emission | Smoke emissions and kiln exhaust resulting from failure to operate and maintain equipment in good working order. |
| 9095 | 36734 | 10/20/2000 | Illegal Emission | $NO_x$ emissions from the main baghouse exceeding 501 ppm at 10% $O_2$ for a 24-hour average. |
| 9079 | 36735 | 8/18/2000 | Illegal Emission | $NO_x$ emissions from the main baghouse that exceeded 501 ppm at 10% $O_2$ for a 24-hour average. |
| 9071 | 36690 | 7/7/2000 | Illegal Emission | $NO_x$ emissions from the main baghouse that exceeded 501 ppm at 10% $O_2$ for a 24-hour average. |
| 9053 | 36687 | 7/30/2001 | Illegal Emission | $NO_x$ emissions in excess of 700 ppm for a one-hour average and 501 ppm for a 24-hour average. |
| 8998 | 36726 | 9/29/1999 | Illegal Emission | $NO_x$ emissions in excess of 501 ppm at 10% $O_2$ for a 24-hour average. |
| 8985 | 36725 | 9/29/1999 | Illegal Emission | $NO_x$ emissions in excess of 501 ppm at 10% $O_2$ for a 24-hour average. |
| 8972 | 36721 | 3/3/1999 | Illegal Emission | $NO_x$ emissions in excess of 501 ppm at 10% $O_2$ for a 24-hour average. |
| 8937 | 36867<br>36868<br>36869<br>36870 | 1/27/1999 | Illegal Emission | $NO_x$ emissions in excess of 501 ppm at 10% $O_2$ for a 24-hour average and in excess of 700 ppm one-hour average. |
| 8936 | 36866 | 11/12/1998 | Illegal Emission | $NO_x$ emissions in excess of 501 ppm at 10% $O_2$ for a 24-hour average. |
| 8929 | 37075 | 10/21/1998 | Fugitive Dust<br>Illegal Emission | Dust emission from finish mill #2 baghouse and fugitive dust emissions in the yard between clay shed and truck dump area during loader activity. |
| 8908 | 36225 | 8/12/1998 | Illegal Emission | $SO_2$ emissions during the startup of the kiln in excess of 200 ppm at 10% $O_2$ for one-hour average. |
| 8899 | 36561 | 7/29/1998 | O & M Plan | Failure to comply with a corrective action order. |

| Civil Penalty No. | NOV No. | Date Issued | Types of CPs | Civil Penalty Explanation |
|---|---|---|---|---|
| 8897 | 36559 | 7/29/1998 | O & M Plan | Operating the cement kiln without a written quality control program. |
| 8886 | 36583<br>36584<br>36585 | 7/7/1998 | Illegal Emission | Emissions of an air contaminant that was greater than 5% opacity for a one-hour average and greater than 20% opacity for more than 3 minutes in an hour. |
| 8801 | 36863<br>36864 | 2/10/1998 | Fugitive Dust | Emission of portland cement clinker that interfered with the enjoyment of life or property. |
| 8761 | 37062<br>37063 | 12/9/1997 | Illegal Emission<br>Fugitive Dust | Causing or allowing large holes in the shrink wrap temporary conveyor enclosure and continuous emissions of dust from the white fly ash silo. |
| 8760 | 36861 | 12/11/1997 | Illegal Emission<br>Fugitive Dust | Emissions of fugitive dust without using best available control technology (BACT). Operation of equipment that was not in good working order. |
| 8743 | 36229<br>36230<br>36232 | 10/28/1997 | Illegal Emission | $SO_2$ emissions in excess of 180 ppm at 10% $O_2$ and NOx emissions in excess of 700 ppm at to 10% $O_2$ for one-hour average. |
| 8658 | 36217 | 5/27/1997 | Illegal Emission | Nitrogen Oxide emissions in excess of 700 ppm at 10% $O_2$ for one-hour average. |
| 8420 | 36903 | 9/20/1996 | Illegal Emission | Visible emissions at 5% opacity from the exhaust stack of the mill sweep #2 baghouse. |
| 8355 | 33673<br>33680<br>33924<br>33925 | 5/23/1996 | Fugitive Dust | Not Available |
| 8352 | 4-2346 | 5/20/1996 | Other | Removal of asbestos-containing materials, and violation of Article 4 of Regulation III. |
| 8350 | 34406 | 5/16/1996 | Fugitive Dust | Emission of fugitive dust in violation of Regulation I. |
| 8331 | 34405 | 3/21/1996 | Illegal Emission | Caused or allowed operation with $NO_x$ levels greater than 700 ppm at 10% $O_2$ for a one-hour average. |

| Civil Penalty No. | NOV No. | Date Issued | Types of CPs | Civil Penalty Explanation |
|---|---|---|---|---|
| 8330 | 34404 | 3/21/1996 | Illegal Emission | Caused or allowed operation with emission levels of $SO_2$ from the main stack greater than 200 ppm corrected to 10% for a one-hour average during startup. |
| 8311 | 33673<br>33680<br>33764<br>33765<br>33924<br>33925<br>34406 | 2/22/1996 | Fugitive Dust | Emission of fugitive dust from the clinker storage shed building without using BACT. |
| 8291 | 33673<br>33680<br>33764<br>33765<br>33924<br>33925<br>34406 | 1/24/1996 | Fugitive Dust | Emission of fugitive dust from the clinker conveyor going from clinker silos to finish mill. |
| 8290 | 33907 | 1/24/1996 | Fugitive dust | Emission of fugitive dust from the preheat end of the kiln. |
| 8289 | 33290<br>33757<br>33756 | 1/24/1996 | Illegal Emission | Emission of an air contaminant of 30-85% opacity for 6 minutes in an hour without using BACT. |

On August 16, 2001, the King County Industrial Waste Program issued Wastewater Discharge Authorization No. 4009-01 to Ash Grove. This permit allows for up to 7,500 GPD of industrial wastewater and stormwater to be discharged into the King County Sewer System (formerly METRO). Included in the permit requirements were self-monitoring protocols, settling as a pre-treatment process, and general discharge limitations. This permit was renewed as No. 4009-02 on August 17, 2006, with the same requirements and limitations (King County 2006).

On September 12, 2003, the Department of Ecology granted Inactive Facility Status to Ash Grove Cement and therefore listed them as exempt from having to submit further Pollution Prevention Planning documents or Annual Progress Reports. Ash Grove was granted this status as it generates less than 2,640 lbs. of dangerous wastes annually, and there are no opportunities to reduce hazardous substance use any further (AGCC 2003). This status was conditional upon Ash Grove staying within Conditionally Exempt Small Quantity Generator (CESQG) thresholds as it would still be operational (Ecology 2003b).

PSCAA issued a Title V Air Operating Permit (AOP) (No. 11339) to Ash Grove Cement on May 15, 2004. This AOP is required of any company listed as a major source of any pollutant. A "major source" is defined as an air pollutant source that potentially emits more than 100 tons per year of any criteria pollutant, 10 tons per year of any single hazardous air pollutant, or 25 tons per year of any combination of hazardous air pollutants. This permit regulated the entire facility as well as specific components of the processing equipment (Ecology 2007).

### 4.4.4 Environmental Investigations, Site Inspections, and Cleanups

Ecology conducted a site inspection of Lone Star Cement on May 15, 1974, and rated the operations as "fair." The inspector verified that the site setup did not require a NPDES permit as all water was collected and incorporated into makeup water. The emergency overflow and settling pond was in place and received water from tanks and heavy rainfall. This overflow pond was tested to determine the cause of its yellowish-green color. Results of those tests showed that the pH was as high as 10.7. Heavy metals testing showed copper levels less than 0.01 mg/L and nickel concentrations less than 0.1 mg/L. No further action was taken (Ecology 1974).

Ecology performed a second inspection on October 13, 1977, after which the operations were deemed "satisfactory." However, the inspector noted several concerns about the plant. The settling pond was in proper condition, but storm drainage south of the shop area drained toward and into the Duwamish waterway instead of to the pond. Seepage and stormwater from the site and the pier also directly entered the groundwater and river system. The inspector agreed to discuss these things with Lone Star as well as remind them that the discharge permit had expired in 1975 (Ecology 1977).

A second "satisfactory" inspection was conducted by Ecology on July 1, 1982. The inspector again noted, however, that some of the stormwater drainage was not intercepted by the settling pond. A separate runoff pond had accumulated due to runoff from the paved and unpaved areas. No berm or other containment was found for this second pond. No further action was taken (Ecology 1982).

Ecology tested the waters of both the settling pond and the truck wash station on December 14, 1983. The pH levels of the settling pond and truck wash were 10.8 and 11.2, respectively. These high pH values were attributed to use of limestone in cement. Copper concentrations exceeded acute criteria, while lead and zinc were slightly below exceedance levels (REL 1983). No currently available documentation indicates that any further action or investigation was performed at that time. A letter dated January 29, 1985, from METRO authorities requested that Ecology closely monitor the pond to address concerns about heavy metal loading from the settling pond to the LDW (METRO 1985). Ash Grove responded with a statement that its discharge was permitted adequately and no new monitoring was necessary. Records indicate that no further monitoring was done at that time.

According to Ecology files, on a site tour in October 1984 METRO noted problems with storage and containment at the facility. In January 1985, Ash Grove responded by agreeing to store oil indoors and remove all coal, fly ash, and slag from the property by May 1985 (AGCC 1985). Ash Grove failed to remove these items by the deadline and was cited and fined for violating the River and Harbors Act (Ecology 2007).

In October 1985 two USTs were removed, and another two were removed in April of 1986. No further information about these activities is available (Ecology 2007).

On October 24, 1985, a METRO representative inspected the facility to follow up on findings from a 1984 site tour. The inspector noted that fly ash that had remained onsite after cessation of clinker manufacture had been reclaimed and removed by the supplier, the University of Washington. Approximately 2,000 tons of the estimated 4,000 tons of coal remaining on site had been sold, and the remainder was expected to be sold as well. METRO understood that the intention was to sell and remove all stockpiled coal by January 1986. Additionally, all slag was expected to be removed by August 1986 (Ecology 1986). During the October 1985 site visit, METRO raised concerns about the stockpiled materials. The company was required to perform an elutriation test on all the coal, fly ash, and slag and to test the dredged settling pond. These tests were performed in August 1986. The analyses showed no contaminants exceeding MCL limits. The coal, ash, and slag were removed throughout 1986. The dredged material had a pH of 11.0 and therefore was not suitable for general disposal, but was approved for disposal into an acceptable landfill in January 1987 (Ecology 1987).

A June 13, 1986, memo stated plans to clean up some leaking and damaged transformers on the property. On June 26, 1986, six transformers were removed from the site. Crowley Environmental Services submitted hazardous waste manifests for the transformers, the PCB liquids drained from them, and the approximately 13,500 pounds of PCB-contaminated soils removed from the kiln and slurry areas of the facility. No further information is available on the contamination levels at the site or in the removed soil, or on final disposal of the contaminated items (Ecology 2007).

Later that same year, Ash Grove Cement began meeting with an EPA subcontractor (E & E) to discuss a site investigation to determine the possibility of Superfund status at the plant site. This inspection was performed on July 30, 1987. E & E and EPA agreed that no further action was needed at this site. The rationale given was that since the samples taken from the settling pond dredge material showed no contaminant exceedances, the potential for detecting hazardous levels of contamination in the soil and/or groundwater was low. No further investigation or action was performed at that time (E & E 1987).

On February 1, 1991, Ash Grove submitted an Annual Dangerous Waste Report stating that large numbers of out-of-service transformers, switches, and other PCB-contaminated materials were stored on the property. One neutral driving transformer was checked and found to have 890 mg/kg PCBs; the PCB threshold level established by Ecology at that time was 1 mg/kg. The transformer was immediately removed and disposed of, although no further information regarding the disposal or destination of this item is available (Ecology 2007).

Ecology performed a site inspection of Ash Grove Cement on October 21, 1991, to address concerns of the company over the requirement to obtain a permit to begin releasing wastewater into the City of Seattle sewer system. The inspector noted two sources of stormwater contamination: a truck wash station that discharged directly to the settling pond, and a 7,500-gallon ethylene glycol tank with no cover or containment. Ash Grove responded that the truck wash water would soon be rerouted to the sanitary sewer and agreed to provide containment for the ethylene glycol tank. No further cleanup was initiated at that time (Ecology 1991).

A follow-up inspection by Ecology was conducted on June 27, 1994, to confirm that the connection to the METRO sewer system had been accomplished appropriately and that the sedimentation pond had been covered. The inspection report noted that the area where the pond had been was filled in and covered with concrete. Ash Grove also appeared to have successfully connected to the METRO sanitary collection system and all waters including surface waters were appropriately directed to the sanitary system. The inspector recommended the cancellation of Ash Grove's discharge permit #5162 and no further action was taken at that time (Ecology 1994).

On April 17, 2000, Ecology conducted a Dangerous Waste Compliance Inspection of the Ash Grove Cement site. The inspector noted issues of non-compliance, including many instances of poor containment of solvents and other chemicals. There were many unlabeled and unmarked barrels, drums, and buckets containing unknown liquid waste or solvents. These containers were often dented, damaged, or uncovered and had no secondary containment measures in place to prevent environmental release. Ash Grove was required to become compliant and resolve these violations by May 2000 (Ecology 2000).

On April 27, 2005, the City of Seattle and King County performed a joint initial inspection of the Ash Grove Cement facility and notified the company of some areas of concern. Many of the concerns were related to a lack of proper secondary containment to ensure that oils, lubricants, automotive liquid products, and other liquids were appropriately contained in case of a spill. Ash Grove was requested to resolve these issues and informed that a second, unannounced inspection would follow in subsequent months. This inspection occurred on December 20, 2005, and Ash Grove was declared in complete compliance (King County 2005a, b).

## 4.4.5 Potential Pathways of Contamination

### 4.4.5.1 Stormwater

There is no indication that stormwater outfalls exist on the Ash Grove site. All stormwater discharge has been routed to the King County (formerly METRO) sanitary sewer since 1991. However, if there are unidentified outfalls, or if large volumes of rain overwhelm the system, the nature of operations on the site introduces the possibility of contamination from cement-producing materials reaching the LDW either by surface runoff or through a CSO discharge. However, these are fairly low risks.

### 4.4.5.2 Groundwater

Records of historical operations on the Ash Grove site indicate that many contaminants were released or stored on the property. Cement-making materials, chemicals, and PCBs, among other materials, were contained in high quantities on the site at various times. Due to the lack of groundwater sampling on the site it is unclear whether these materials are held onsite at present, but past events suggest that persistent contamination may exist. The potential for these constituents to have impacted the groundwater onsite is high, and therefore a potential pathway to the Duwamish Waterway exists.

#### 4.4.5.3 Spills

Numerous spill events have occurred at Ash Grove and are outlined in the above violations section. Although preventative measures have been taken, the potential still exists for future spills of cement-producing materials into the Duwamish Waterway.

### 4.4.6 Data Gaps

Information provided for review about current operations on the Ash Grove Cement site was insufficient. No information post-2005 has been found regarding operations, inspections, or compliance. More details are needed on current tenants, operations, facilities, and lessees.

More information is needed on current stormwater management on the Ash Grove site. More information is needed about the BMPs of the facility, particularly the site's ability to handle high precipitation events, which prevent stormwater overflow from carrying contaminants to the LDW through direct surface runoff.

There have been a number of historical spills and contaminant releases on the Ash Grove Cement site, but it is not always clear if any contamination remains that could affect groundwater. Currently, there are no documented USTs or LUSTs on the property, but in 1985 and 1986 four previously undocumented tanks were removed, and no further information is available about potential residual contamination. In 1993, it was indicated that waste oil held in two large holding tanks was being used in the kiln process.

The condition of the waste oil that was burned beginning in 1993 is unknown. Although airborne contaminates resulting from such burning are not a significant concern at this point in time, any past spills may have left contaminants in the groundwater or soil at the facility.

PCBs appear to have been a significant component of the contaminant releases on the site. Along with other analytes, PCBs could still persist in the soil and groundwater on the property. More information is needed on whether any recent sampling or analytical testing for these contaminants.

Historical operations resulted in a number of spills and other incidents. As recently as 2005, inspections showed Ash Grove to be lacking proper containment equipment for its chemical holding areas and proper handling procedures of solvents and dangerous materials. More information is needed on storage tanks, current operations, and procedures for chemical holding and transfer in order to assess potential scenarios for contaminant spills.

It is uncertain if any pipe lines were left in place after facility modifications were made in 1989. If not properly decommissioned, abandoned pipes may provide a conduit for contaminate migration to the LDW.

Further information is needed about past disposal actions for soil, equipment, and any other potentially hazardous materials used or stored historically on this site. It is important to know the fate of transported contaminants in order to confirm they no longer pose a threat to the LDW.

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# 6.0 Tables

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**Table 1. Chemicals Above Screening Levels in Surface Sediment: Ash Grove**

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 77.2 | | mg/kg dw | 3.01 | | 57 | 93 | mg/kg dw | 1.4 | 0.83 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 82.9 | | mg/kg dw | 1.05 | | 57 | 93 | mg/kg dw | 1.5 | 0.89 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 123 | | mg/kg dw | 3.01 | | 57 | 93 | mg/kg dw | 2.2 | 1.3 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 573 | | mg/kg dw | 1.05 | | 450 | 530 | mg/kg dw | 1.3 | 1.1 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.59 | | mg/kg dw | 2.32 | | 0.41 | 0.59 | mg/kg dw | 1.4 | 1 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.91 | | mg/kg dw | 1.55 | | 0.41 | 0.59 | mg/kg dw | 2.2 | 1.5 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 553 | | mg/kg dw | 1.05 | | 410 | 960 | mg/kg dw | 1.3 | 0.58 |
| **PAHs** | | | | | | | | | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 2.6 | | mg/kg dw | 1.95 | 130 | 99 | 210 | mg/kg OC | 1.3 | 0.62 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 1 | | mg/kg dw | 1.95 | 51 | 31 | 78 | mg/kg OC | 1.6 | 0.65 |
| EPA SI | DR055 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 6.8 | | mg/kg dw | 1.95 | 350 | 230 | 450 | mg/kg OC | 1.5 | 0.78 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 3.6 | | mg/kg dw | 1.95 | 180 | 110 | 460 | mg/kg OC | 1.6 | 0.39 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.34 | | mg/kg dw | 1.95 | 17 | 12 | 33 | mg/kg OC | 1.4 | 0.52 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 4.5 | | mg/kg dw | 1.98 | 230 | 160 | 1200 | mg/kg OC | 1.4 | 0.19 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 1.1 | | mg/kg dw | 1.95 | 56 | 34 | 88 | mg/kg OC | 1.6 | 0.64 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 21.4 | | mg/kg dw | 1.95 | 1100 | 960 | 5300 | mg/kg OC | 1.1 | 0.21 |
| **Phthalates** | | | | | | | | | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.85 | | mg/kg dw | 1.05 | 81 | 47 | 78 | mg/kg OC | 1.7 | 1 |
| **PCBs** | | | | | | | | | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.267 | J | mg/kg dw | 2.12 | 12.6 | 12 | 65 | mg/kg OC | 1.1 | 0.19 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.32 | | mg/kg dw | 2.32 | 14 | 12 | 65 | mg/kg OC | 1.2 | 0.22 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 210 | | ug/kg dw | 5.88 | | 130 | 1000 | ug/kg dw | 1.6 | 0.21 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.59 | J | mg/kg dw | 3.01 | 20 | 12 | 65 | mg/kg OC | 1.7 | 0.31 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 1.92 | | mg/kg dw | 1.05 | 183 | 12 | 65 | mg/kg OC | 15 | 2.8 |

Key:

DW- Dry Weight
CSL- Cleanup Screening Level
PAH- Polynuclear Aromatic Hydrocarbon
PCB- Polychlorinated Biphenol
OC- Organic Carbon
TOC- Total Organic Carbon
SQS- Sediment Quality Standard
SVOC- Semivolatile Organic Compound

Notes:

1. SQS and CSL values are substituted with AET values for dry weight comparison where organic compounds are not OC-normalized (when TOC% DW is outside of the 0.5-4.0% range).
2. Exceedance factors are the ratio of the detected concentration to the CSL or the SQS (or to AET values where applicable); exceedance factors are shown only if they are greater than 1.

Source:

Lower Duwamish Waterway Group, 2007. Online Lower Duwamish Waterway Group Draft Remedial Investigation Report (November 2007) Database. http://www.ldwg.org.

**Table 2. Chemicals Above Screening Levels in Subsurface Sediment: Ash Grove**

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Arsenic | 63 | | | mg/kg dw | 1.97 | | 57 | 93 | mg/kg dw | 1.1 | 0.68 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Arsenic | 190 | | | mg/kg dw | 0.897 | | 57 | 93 | mg/kg dw | 3.3 | 2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Arsenic | 210 | | | mg/kg dw | 6.29 | | 57 | 93 | mg/kg dw | 3.7 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Arsenic | 270 | | | mg/kg dw | 0.31 | | 57 | 93 | mg/kg dw | 4.7 | 2.9 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Lead | 569 | | | mg/kg dw | 0.897 | | 450 | 530 | mg/kg dw | 1.3 | 1.1 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Lead | 1050 | | | mg/kg dw | 6.29 | | 450 | 530 | mg/kg dw | 2.3 | 2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Lead | 1210 | | | mg/kg dw | 0.31 | | 450 | 530 | mg/kg dw | 2.7 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Mercury | 0.43 | J | | mg/kg dw | 1.97 | | 0.41 | 0.59 | mg/kg dw | 1.05 | 0.73 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Mercury | 0.53 | J | | mg/kg dw | 1.54 | | 0.41 | 0.59 | mg/kg dw | 1.3 | 0.9 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Mercury | 0.61 | | | mg/kg dw | 2.1 | | 0.41 | 0.59 | mg/kg dw | 1.5 | 1 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Mercury | 1.22 | | | mg/kg dw | 2.36 | | 0.41 | 0.59 | mg/kg dw | 3 | 2.1 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Mercury | 1.27 | | | mg/kg dw | 1.95 | | 0.41 | 0.59 | mg/kg dw | 3.1 | 2.2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Zinc | 604 | | | mg/kg dw | 6.29 | | 410 | 960 | mg/kg dw | 1.5 | 0.63 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Zinc | 748 | | | mg/kg dw | 0.897 | | 410 | 960 | mg/kg dw | 1.8 | 0.78 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Zinc | 1430 | | | mg/kg dw | 0.31 | | 410 | 960 | mg/kg dw | 3.5 | 1.5 |
| **SVOCs** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,2,4-Trichlorobenzene | 0.02 | | 0.00002 | ug/kg dw | 1.95 | 1 | 0.81 | 1.8 | mg/kg OC | 1.2 | 0.56 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | 2,4-Dimethylphenol | 46 | | 46 | ug/kg dw | 1.73 | | 29 | 29 | ug/kg dw | 1.6 | 1.6 |
| **Phthalates** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Bis(2-ethylhexyl)phthalate | 1800 | | 1800 | ug/kg dw | 6.29 | | 1300 | 1900 | ug/kg dw | 1.4 | 0.95 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 1.8 | | 0.0018 | ug/kg dw | 2.1 | 86 | 47 | 78 | mg/kg OC | 1.8 | 1.1 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 0.9 | | 0.0009 | ug/kg dw | 0.897 | 100 | 47 | 78 | mg/kg OC | 2.1 | 1.3 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 2.4 | | 0.0024 | ug/kg dw | 1.95 | 120 | 47 | 78 | mg/kg OC | 2.6 | 1.5 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Butyl benzyl phthalate | 0.098 | J | 0.000098 | ug/kg dw | 1.95 | 5 | 4.9 | 64 | mg/kg OC | 1.02 | 0.078 |
| **PCBs** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | PCBs (total calc'd) | 0.35 | | 0.00035 | ug/kg dw | 1.97 | 18 | 12 | 65 | mg/kg OC | 1.5 | 0.28 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | PCBs (total calc'd) | 209 | | 209 | ug/kg dw | 0.31 | | 130 | 1000 | ug/kg dw | 1.6 | 0.21 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | PCBs (total calc'd) | 0.49 | | 0.00049 | ug/kg dw | 1.97 | 25 | 12 | 65 | mg/kg OC | 2.1 | 0.38 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | PCBs (total calc'd) | 0.44 | | 0.00044 | ug/kg dw | 1.6 | 28 | 12 | 65 | mg/kg OC | 2.3 | 0.43 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | PCBs (total calc'd) | 0.6 | | 0.0006 | ug/kg dw | 1.73 | 35 | 12 | 65 | mg/kg OC | 2.9 | 0.54 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | PCBs (total calc'd) | 3.4 | | 0.0034 | ug/kg dw | 2.1 | 160 | 12 | 65 | mg/kg OC | 13 | 2.5 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | PCBs (total calc'd) | 1.38 | | 0.00138 | ug/kg dw | 0.897 | 150 | 12 | 65 | mg/kg OC | 13 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | PCBs (total calc'd) | 4.3 | | 0.0043 | ug/kg dw | 2.36 | 180 | 12 | 65 | mg/kg OC | 15 | 2.8 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | PCBs (total calc'd) | 2900 | | 2900 | ug/kg dw | 6.29 | | 130 | 1000 | ug/kg dw | 22 | 2.9 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | PCBs (total calc'd) | 6.7 | | 0.0067 | ug/kg dw | 1.95 | 340 | 12 | 65 | mg/kg OC | 28 | 5.2 |

Key:

DW- Dry Weight
CSL- Cleanup Screening Level
PAH- Polynuclear Aromatic Hydrocarbon
PCB- Polychlorinated Biphenol
OC- Organic Carbon
TOC- Total Organic Carbon
SQS- Sediment Quality Standard
SVOC- Semivolatile Organic Compound

Notes:

1. SQS and CSL values are substituted with AET values for dry weight comparison where organic compounds are not OC-normalized (when TOC% DW is outside of the 0.5-4.0% range).
2. Exceedance factors are the ratio of the detected concentration to the CSL or the SQS (or to AET values where applicable); exceedance factors are shown only if they are greater than 1.

Source:

Lower Duwamish Waterway Group, 2007. Online Lower Duwamish Waterway Group Draft Remedial Investigation Report (November 2007) Database. http://www.ldwg.org.

# 6.0 Tables

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Table 1. Chemicals Above Screening Levels in Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 77.2 | | mg/kg dw | 3.01 | | 57 | 93 | mg/kg dw | 1.4 | 0.83 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 82.9 | | mg/kg dw | 1.05 | | 57 | 93 | mg/kg dw | 1.5 | 0.89 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 123 | | mg/kg dw | 3.01 | | 57 | 93 | mg/kg dw | 2.2 | 1.3 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 573 | | mg/kg dw | 1.05 | | 450 | 530 | mg/kg dw | 1.3 | 1.1 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.59 | | mg/kg dw | 2.32 | | 0.41 | 0.59 | mg/kg dw | 1.4 | 1 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.91 | | mg/kg dw | 1.55 | | 0.41 | 0.59 | mg/kg dw | 2.2 | 1.5 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 553 | | mg/kg dw | 1.05 | | 410 | 960 | mg/kg dw | 1.3 | 0.58 |
| **PAHs** | | | | | | | | | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 2.6 | | mg/kg dw | 1.95 | 130 | 99 | 210 | mg/kg OC | 1.3 | 0.62 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 1 | | mg/kg dw | 1.95 | 51 | 31 | 78 | mg/kg OC | 1.6 | 0.65 |
| EPA SI | DR055 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 6.8 | | mg/kg dw | 1.95 | 350 | 230 | 450 | mg/kg OC | 1.5 | 0.78 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 3.6 | | mg/kg dw | 1.95 | 180 | 110 | 460 | mg/kg OC | 1.6 | 0.39 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.34 | | mg/kg dw | 1.95 | 17 | 12 | 33 | mg/kg OC | 1.4 | 0.52 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 4.5 | | mg/kg dw | 1.98 | 230 | 160 | 1200 | mg/kg OC | 1.4 | 0.19 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 1.1 | | mg/kg dw | 1.95 | 56 | 34 | 88 | mg/kg OC | 1.6 | 0.64 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 21.4 | | mg/kg dw | 1.95 | 1100 | 960 | 5300 | mg/kg OC | 1.1 | 0.21 |
| **Phthalates** | | | | | | | | | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.85 | | mg/kg dw | 1.05 | 81 | 47 | 78 | mg/kg OC | 1.7 | 1 |
| **PCBs** | | | | | | | | | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.267 | J | mg/kg dw | 2.12 | 12.6 | 12 | 65 | mg/kg OC | 1.1 | 0.19 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.32 | | mg/kg dw | 2.32 | 14 | 12 | 65 | mg/kg OC | 1.2 | 0.22 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 210 | | ug/kg dw | 5.88 | | 130 | 1000 | ug/kg dw | 1.6 | 0.21 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.59 | J | mg/kg dw | 3.01 | 20 | 12 | 65 | mg/kg OC | 1.7 | 0.31 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 1.92 | | mg/kg dw | 1.05 | 183 | 12 | 65 | mg/kg OC | 15 | 2.8 |

Key:

DW- Dry Weight
CSL- Cleanup Screening Level
PAH- Polynuclear Aromatic Hydrocarbon
PCB- Polychlorinated Biphenol
OC- Organic Carbon
TOC- Total Organic Carbon
SQS- Sediment Quality Standard
SVOC- Semivolatile Organic Compound

Notes:

1. SQS and CSL values are substituted with AET values for dry weight comparison where organic compounds are not OC-normalized (when TOC% DW is outside of the 0.5-4.0% range).
2. Exceedance factors are the ratio of the detected concentration to the CSL or the SQS (or to AET values where applicable); exceedance factors are shown only if they are greater than 1.

Source:

Lower Duwamish Waterway Group, 2007. Online Lower Duwamish Waterway Group Draft Remedial Investigation Report (November 2007) Database. http://www.ldwg.org.

**Table 2. Chemicals Above Screening Levels in Subsurface Sediment: Ash Grove**

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Metals** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Arsenic | 63 | | | mg/kg dw | 1.97 | | 57 | 93 | mg/kg dw | 1.1 | 0.68 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Arsenic | 190 | | | mg/kg dw | 0.897 | | 57 | 93 | mg/kg dw | 3.3 | 2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Arsenic | 210 | | | mg/kg dw | 6.29 | | 57 | 93 | mg/kg dw | 3.7 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Arsenic | 270 | | | mg/kg dw | 0.31 | | 57 | 93 | mg/kg dw | 4.7 | 2.9 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Lead | 569 | | | mg/kg dw | 0.897 | | 450 | 530 | mg/kg dw | 1.3 | 1.1 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Lead | 1050 | | | mg/kg dw | 6.29 | | 450 | 530 | mg/kg dw | 2.3 | 2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Lead | 1210 | | | mg/kg dw | 0.31 | | 450 | 530 | mg/kg dw | 2.7 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Mercury | 0.43 | J | | mg/kg dw | 1.97 | | 0.41 | 0.59 | mg/kg dw | 1.05 | 0.73 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Mercury | 0.53 | J | | mg/kg dw | 1.54 | | 0.41 | 0.59 | mg/kg dw | 1.3 | 0.9 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Mercury | 0.61 | | | mg/kg dw | 2.1 | | 0.41 | 0.59 | mg/kg dw | 1.5 | 1 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Mercury | 1.22 | | | mg/kg dw | 2.36 | | 0.41 | 0.59 | mg/kg dw | 3 | 2.1 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Mercury | 1.27 | | | mg/kg dw | 1.95 | | 0.41 | 0.59 | mg/kg dw | 3.1 | 2.2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Zinc | 604 | | | mg/kg dw | 6.29 | | 410 | 960 | mg/kg dw | 1.5 | 0.63 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Zinc | 748 | | | mg/kg dw | 0.897 | | 410 | 960 | mg/kg dw | 1.8 | 0.78 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Zinc | 1430 | | | mg/kg dw | 0.31 | | 410 | 960 | mg/kg dw | 3.5 | 1.5 |
| **SVOCs** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,2,4-Trichlorobenzene | 0.02 | | 0.00002 | ug/kg dw | 1.95 | 1 | 0.81 | 1.8 | mg/kg OC | 1.2 | 0.56 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | 2,4-Dimethylphenol | 46 | | 46 | ug/kg dw | 1.73 | | 29 | 29 | ug/kg dw | 1.6 | 1.6 |
| **Phthalates** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Bis(2-ethylhexyl)phthalate | 1800 | | 1800 | ug/kg dw | 6.29 | | 1300 | 1900 | ug/kg dw | 1.4 | 0.95 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 1.8 | | 0.0018 | ug/kg dw | 2.1 | 86 | 47 | 78 | mg/kg OC | 1.8 | 1.1 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 0.9 | | 0.0009 | ug/kg dw | 0.897 | 100 | 47 | 78 | mg/kg OC | 2.1 | 1.3 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 2.4 | | 0.0024 | ug/kg dw | 1.95 | 120 | 47 | 78 | mg/kg OC | 2.6 | 1.5 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Butyl benzyl phthalate | 0.098 | J | 0.000098 | ug/kg dw | 1.95 | 5 | 4.9 | 64 | mg/kg OC | 1.02 | 0.078 |
| **PCBs** | | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | PCBs (total calc'd) | 0.35 | | 0.00035 | ug/kg dw | 1.97 | 18 | 12 | 65 | mg/kg OC | 1.5 | 0.28 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | PCBs (total calc'd) | 209 | | 209 | ug/kg dw | 0.31 | | 130 | 1000 | ug/kg dw | 1.6 | 0.21 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | PCBs (total calc'd) | 0.49 | | 0.00049 | ug/kg dw | 1.97 | 25 | 12 | 65 | mg/kg OC | 2.1 | 0.38 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | PCBs (total calc'd) | 0.44 | | 0.00044 | ug/kg dw | 1.6 | 28 | 12 | 65 | mg/kg OC | 2.3 | 0.43 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | PCBs (total calc'd) | 0.6 | | 0.0006 | ug/kg dw | 1.73 | 35 | 12 | 65 | mg/kg OC | 2.9 | 0.54 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | PCBs (total calc'd) | 3.4 | | 0.0034 | ug/kg dw | 2.1 | 160 | 12 | 65 | mg/kg OC | 13 | 2.5 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | PCBs (total calc'd) | 1.38 | | 0.00138 | ug/kg dw | 0.897 | 150 | 12 | 65 | mg/kg OC | 13 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | PCBs (total calc'd) | 4.3 | | 0.0043 | ug/kg dw | 2.36 | 180 | 12 | 65 | mg/kg OC | 15 | 2.8 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | PCBs (total calc'd) | 2900 | | 2900 | ug/kg dw | 6.29 | | 130 | 1000 | ug/kg dw | 22 | 2.9 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | PCBs (total calc'd) | 6.7 | | 0.0067 | ug/kg dw | 1.95 | 340 | 12 | 65 | mg/kg OC | 28 | 5.2 |

Key:
DW- Dry Weight
CSL- Cleanup Screening Level
PAH- Polynuclear Aromatic Hydrocarbon
PCB- Polychlorinated Biphenol
OC- Organic Carbon
TOC- Total Organic Carbon
SQS- Sediment Quality Standard
SVOC- Semivolatile Organic Compound

Notes:
1. SQS and CSL values are substituted with AET values for dry weight comparison where organic compounds are not OC-normalized (when TOC% DW is outside of the 0.5-4.0% range).
2. Exceedance factors are the ratio of the detected concentration to the CSL or the SQS (or to AET values where applicable); exceedance factors are shown only if they are greater than 1.

Source:
Lower Duwamish Waterway Group, 2007. Online Lower Duwamish Waterway Group Draft Remedial Investigation Report (November 2007) Database. http://www.ldwg.org.

# 7.0 Figures

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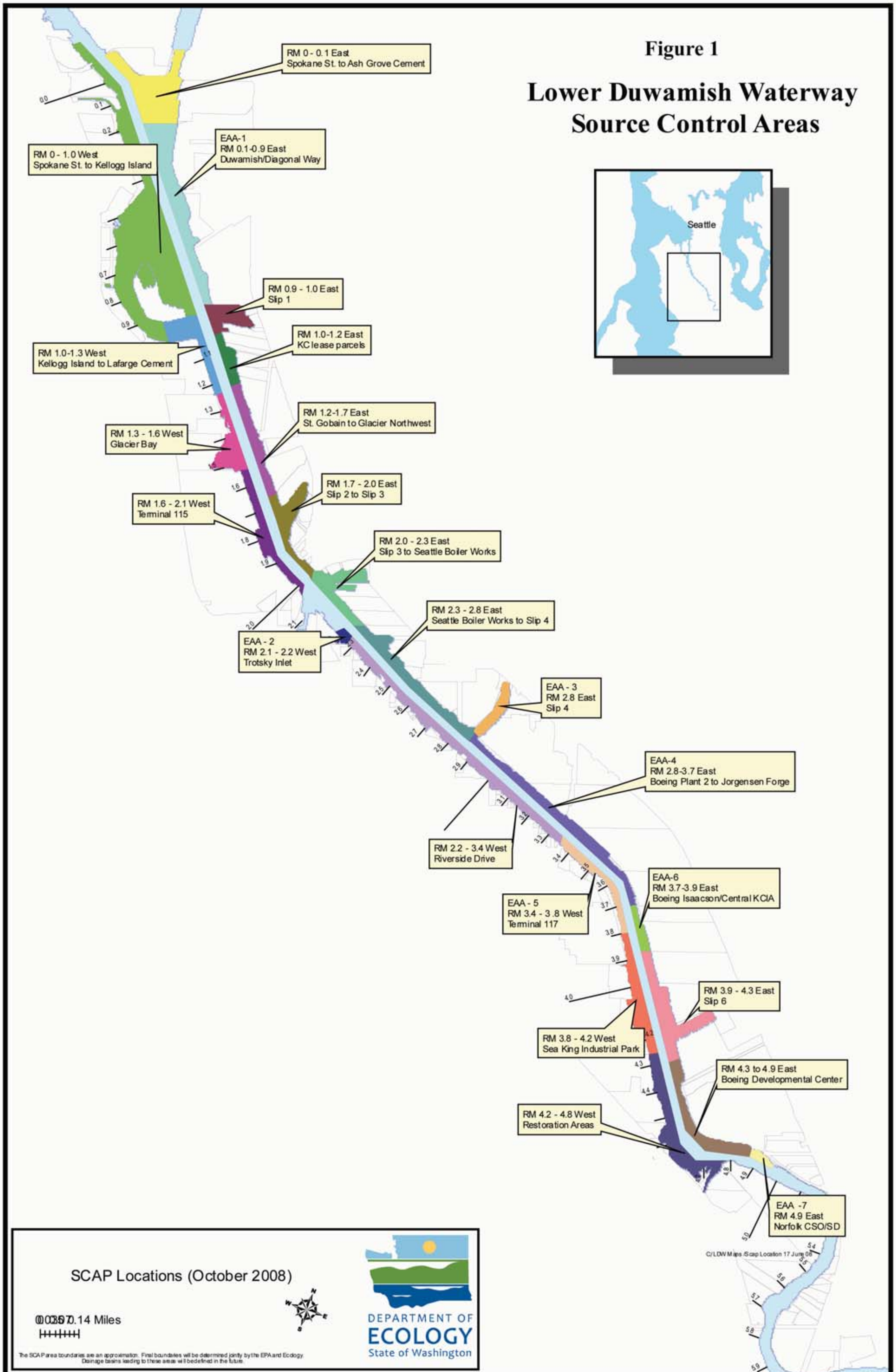
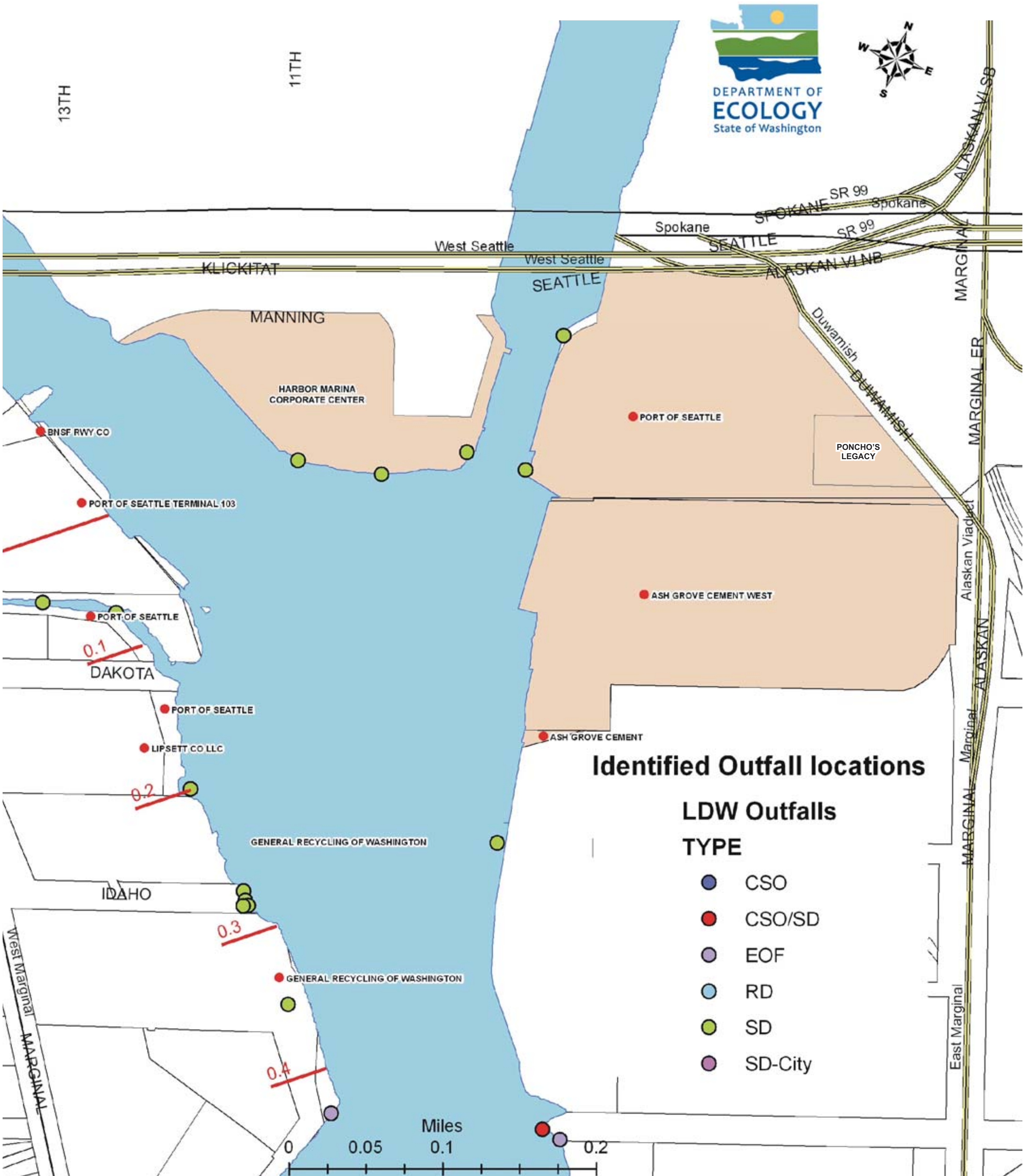



**Figure 1**

**Lower Duwamish Waterway Source Control Areas**

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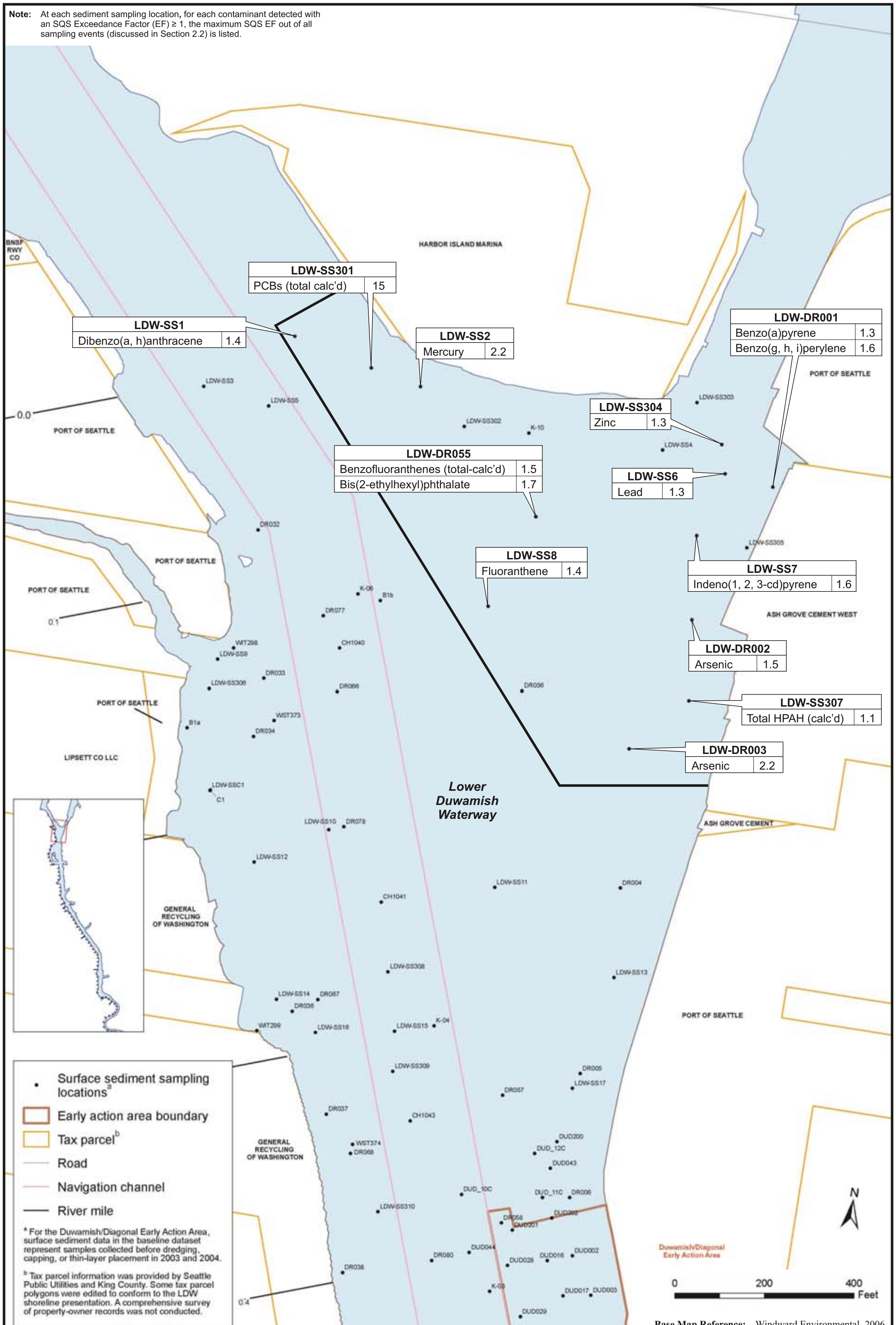
LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

Figure 2
RM 0.0-0.1 EAST
ASHGROVE DRAINAGE BASIN

**Base Map Reference:**
Department of Ecology, 2008.

Date: 11-26-08 | Drawn by: AES | 10:002330WD1405\fig 2

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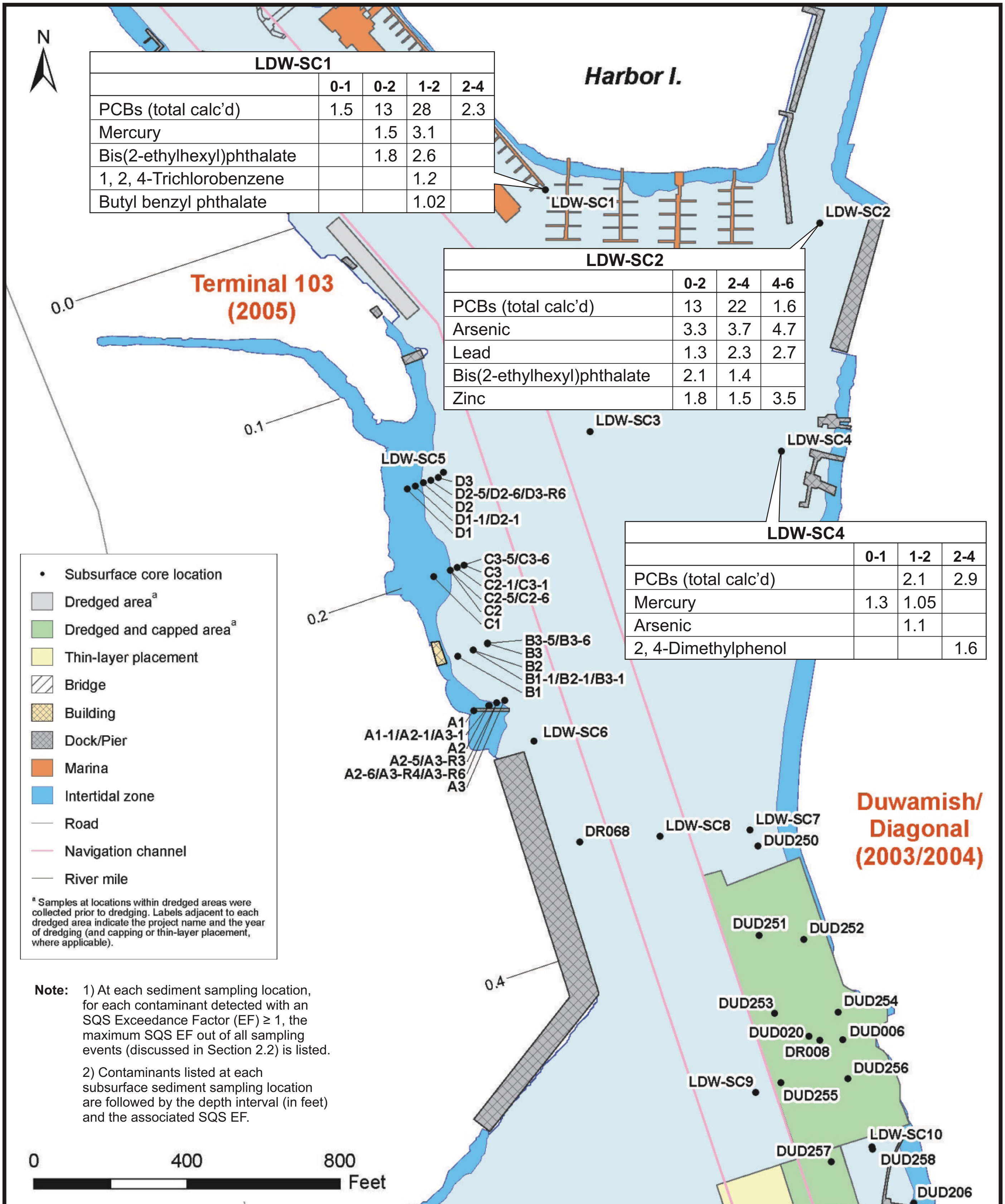
LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

Figure 3
RM 0.0-0.1 EAST SURFACE
SEDIMENT SAMPLING LOCATIONS

Date: 12/4/08 | Drawn by: AES | 10:002330WD1405\fig 3




| LDW-SC1 | 0-1 | 0-2 | 1-2 | 2-4 |
|---|---|---|---|---|
| PCBs (total calc'd) | 1.5 | 13 | 28 | 2.3 |
| Mercury | | 1.5 | 3.1 | |
| Bis(2-ethylhexyl)phthalate | | 1.8 | 2.6 | |
| 1, 2, 4-Trichlorobenzene | | | 1.2 | |
| Butyl benzyl phthalate | | | 1.02 | |

| LDW-SC2 | 0-2 | 2-4 | 4-6 |
|---|---|---|---|
| PCBs (total calc'd) | 13 | 22 | 1.6 |
| Arsenic | 3.3 | 3.7 | 4.7 |
| Lead | 1.3 | 2.3 | 2.7 |
| Bis(2-ethylhexyl)phthalate | 2.1 | 1.4 | |
| Zinc | 1.8 | 1.5 | 3.5 |

| LDW-SC4 | 0-1 | 1-2 | 2-4 |
|---|---|---|---|
| PCBs (total calc'd) | | 2.1 | 2.9 |
| Mercury | 1.3 | 1.05 | |
| Arsenic | | 1.1 | |
| 2, 4-Dimethylphenol | | | 1.6 |

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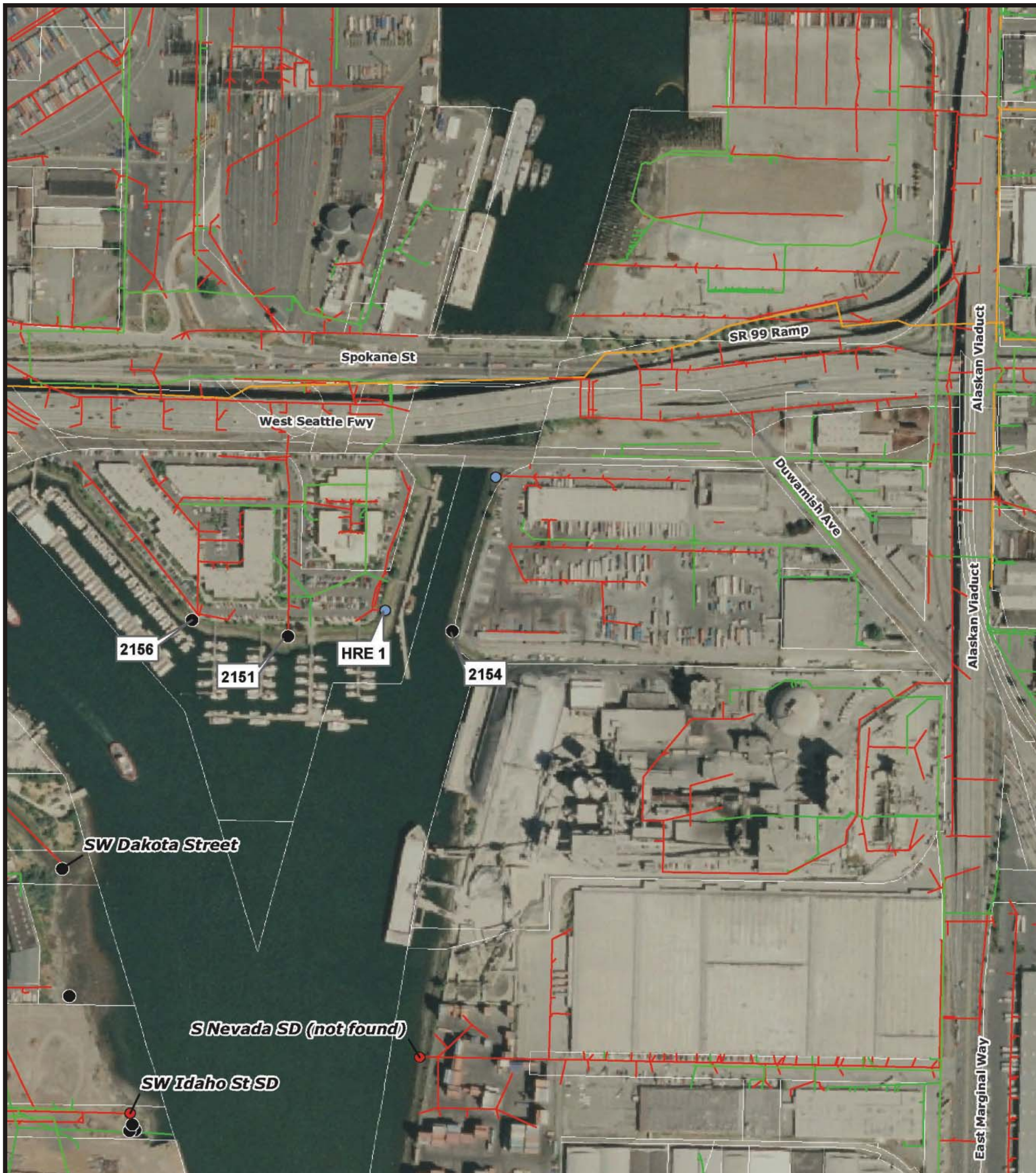
LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

Figure 4
RM 0.0-0.1 EAST SUBSURFACE SEDIMENT SAMPLING LOCATIONS

**Base Map Reference:**
Windward Environmental, 2006.

Date: 12-4-08
Drawn by: AES
10:002330WD1405\fig 4




**Outfall Type**

- All Other Types
- CSO-KC
- CSO/SD-City
- Private SD
- SD-City
- SD-WSDOT/City
- Catch Basins
- Culverts, Ditches and NDS
- Combined Sewer/Storm Drainage
- Storm Drain
- Sanitary Sewer
- Parcel Boundary

N W E S

0 100 200 400 600 800 Feet

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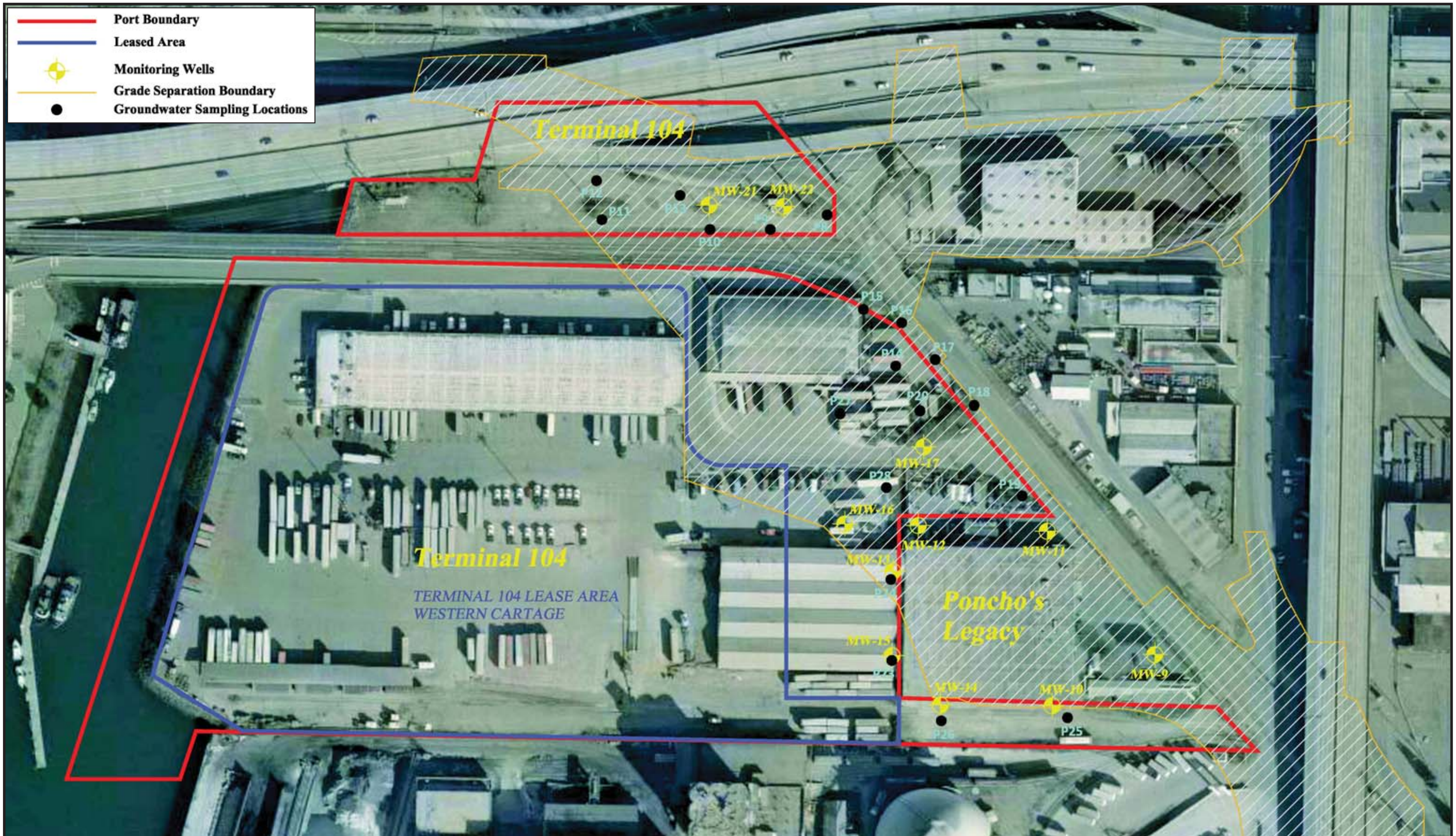
| LOWER DUWAMISH WATERWAY RM 0.0-0.1 EAST Tukwila, Washington | Figure 5 STORM DRAIN SYSTEM WITHIN RM 0.0-0.1 EAST | | |
|---|---|---|---|
| **Base Map Reference:** Ecology and Environment, Inc. GIS Dept., 2008. | Date: 12-8-08 | Drawn by: AES | 10:002330WD1405\fig 5 |

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N W E S

0 60 120
Approximate Scale in Feet

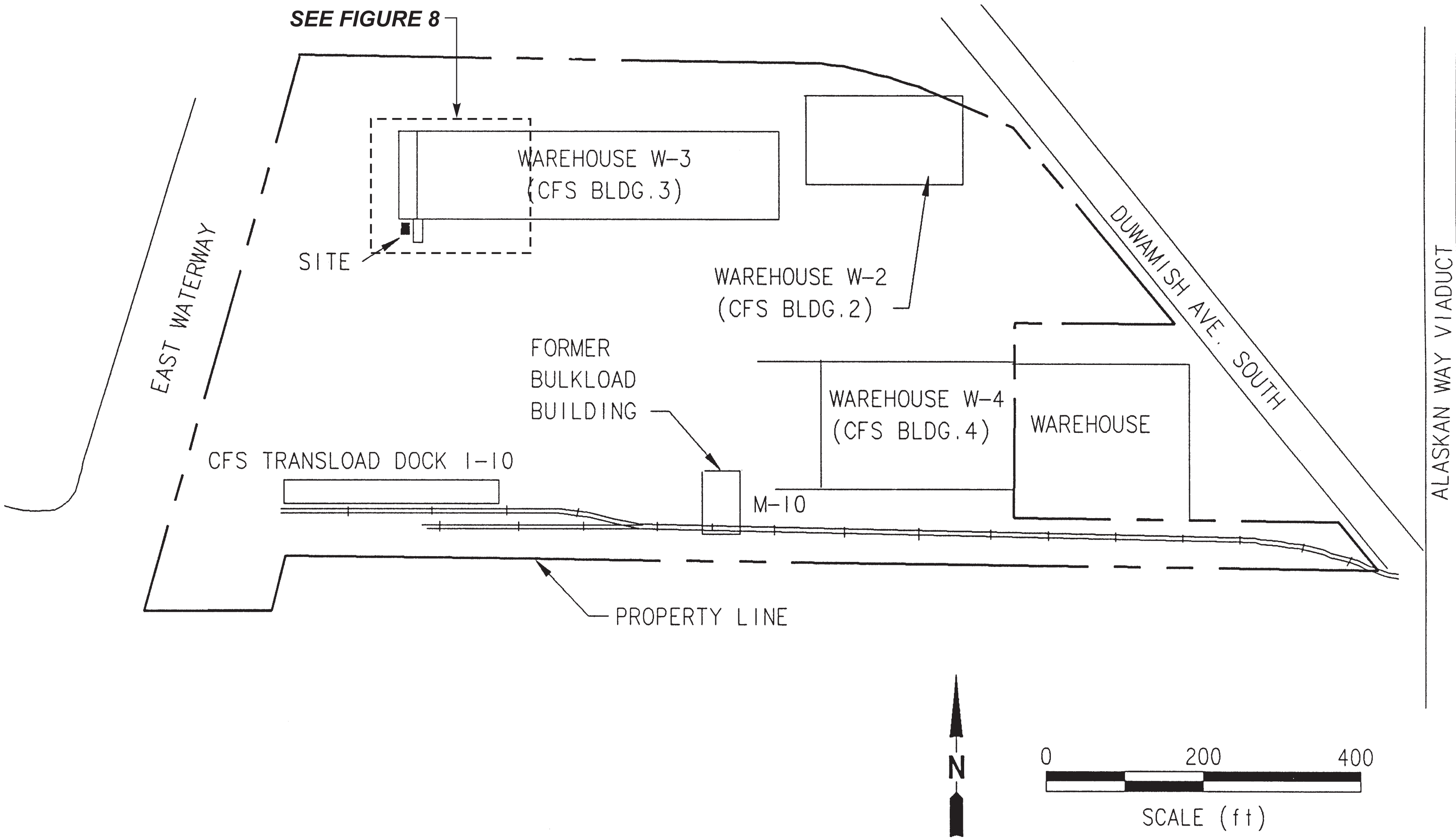
LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

**Source:** Port of Seattle, 2007.

Figure 6

TERMINAL 104/TERMINAL 106 NW CURRENT LEASE LINES

| Date: | Drawn by: | |
|---|---|---|
| 11/26/08 | AES | 10:002330WD1405\fig 6 |

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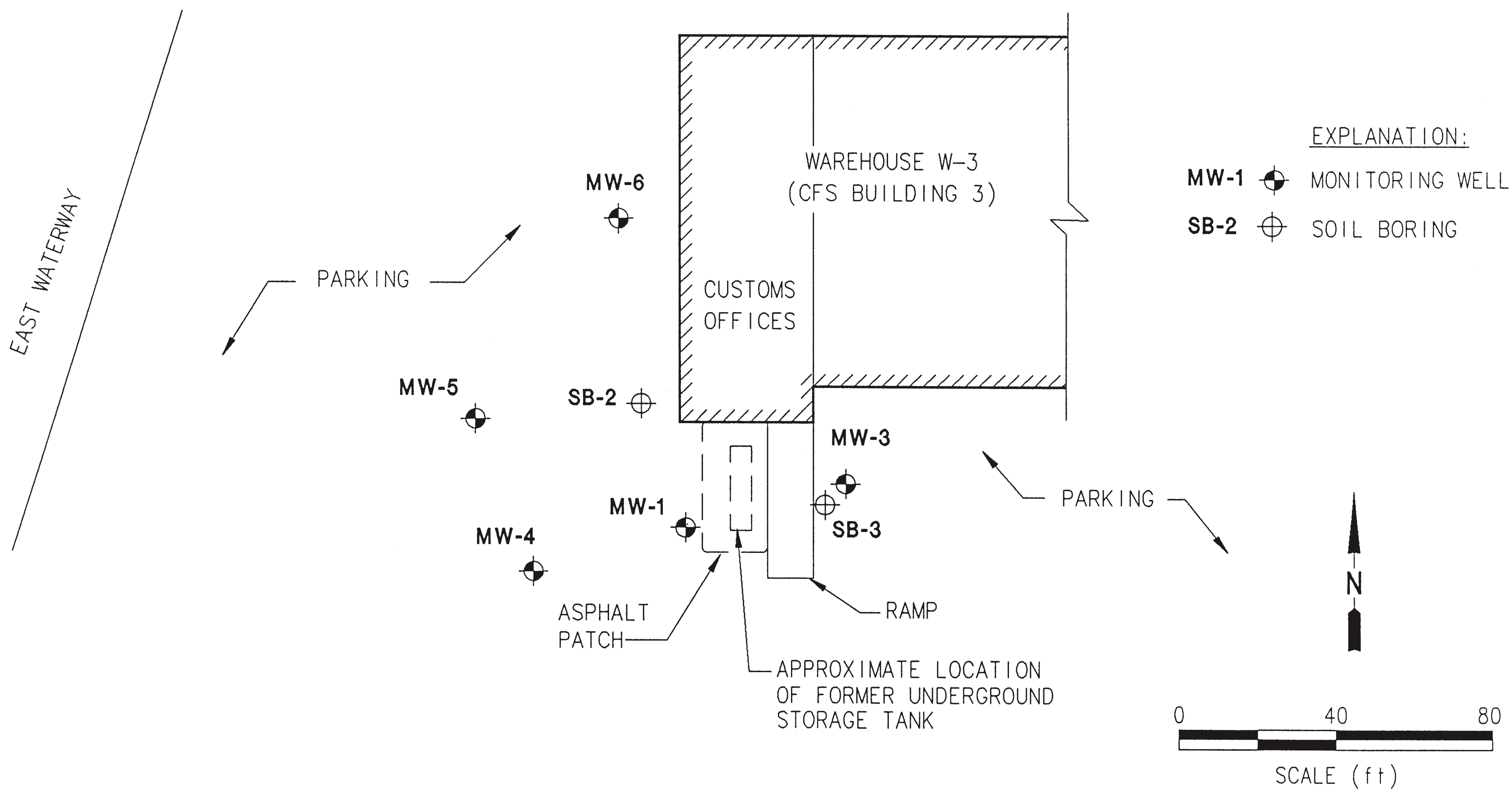
LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

Figure 7
HISTORIC SITE LOCATION MAP (1991)

**Source:** Sweet-Edwards EMCON, December 1991.

| Date: | Drawn by: | |
|---|---|---|
| 11/26/08 | AES | 10:002330WD1405\fig 7 |

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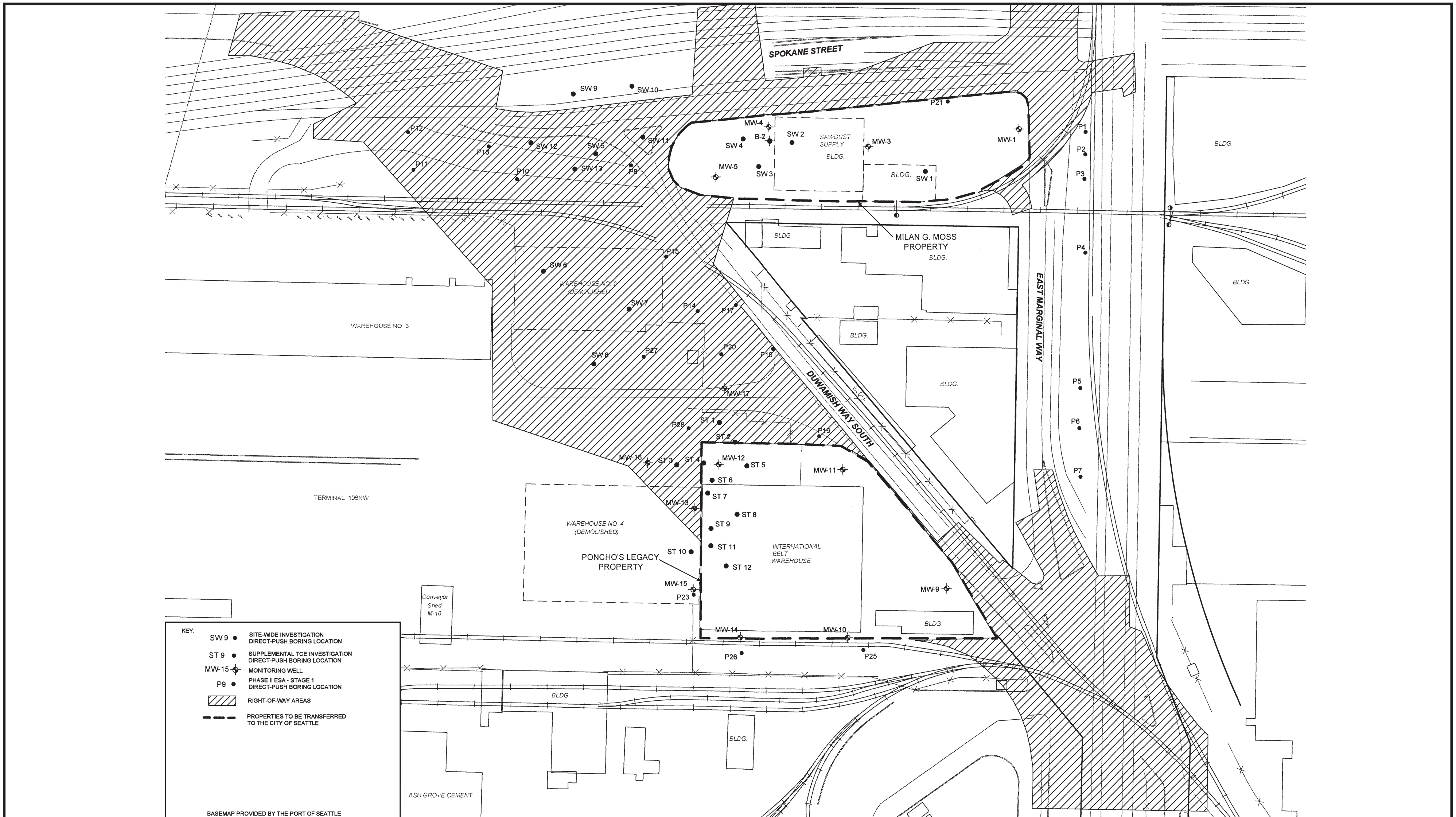
LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

**Source:** Sweet-Edwards EMCON, January 1992.

Figure 8
TERMINAL 104/TERMINAL 106 NW GROUNDWATER MONITORING WELL LOCATIONS (1992)

Date: 11/26/08 | Drawn by: AES | 10:002330WD1405\fig 8

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N W E S

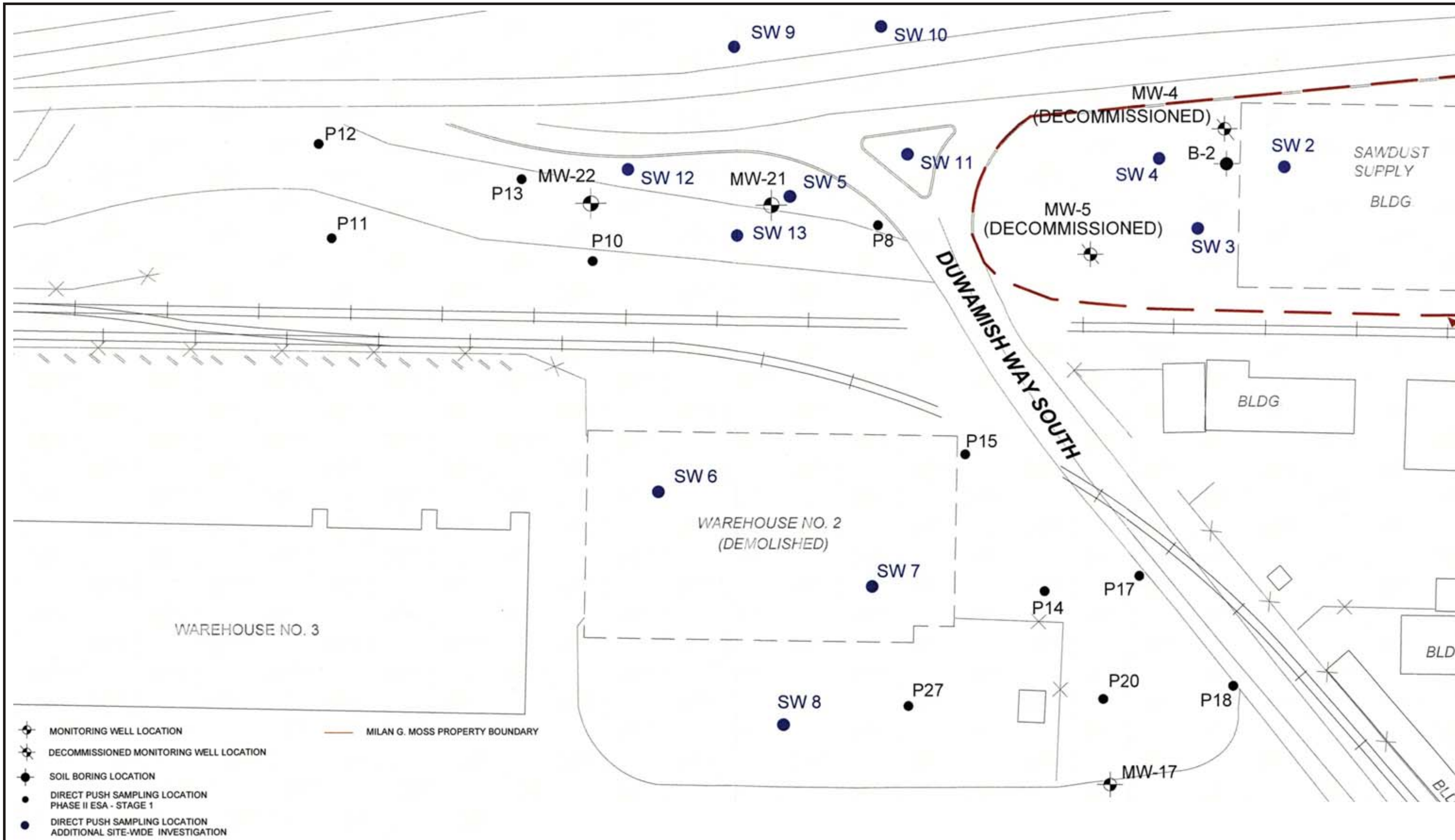
0 50 100
Approximate Scale in Feet

LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

**Source:** Environmental Partners, Inc., April 2007.

Figure 9
SITE-WIDE SAMPLING AND MONITORING LOCATIONS

| Date: | Drawn by: | |
|---|---|---|
| 12/4/08 | AES | 10:002330WD1405\fig 9 |

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N
W E
S

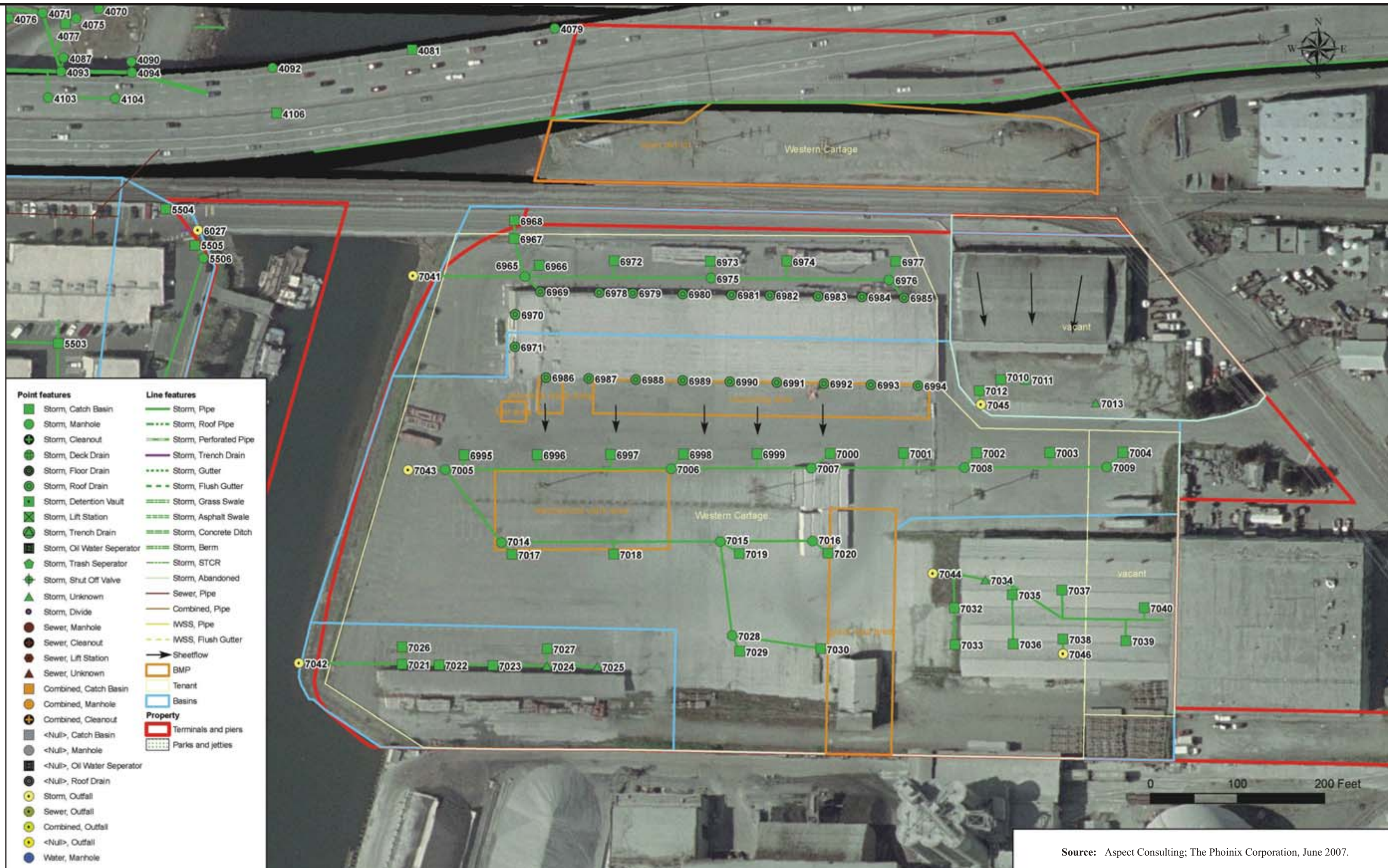
0 25 50
SCALE: 1" = 50'

LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

**Source:** Environmental Partners, Inc., June 2007.

Figure 10
TERMINAL 104/TERMINAL 106 NW GROUNDWATER
MONITORING WELL LOCATIONS (2007)

| Date: | Drawn by: | |
|---|---|---|
| 12/4/08 | AES | 10:002330WD1405\fig 10 |

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Seattle, Washington

LOWER DUWAMISH WATERWAY
RM 0.0-0.1 EAST
Tukwila, Washington

Figure 11
TERMINAL 104/TERMINAL 106 NW STORMWATER STRUCTURES

| Date: | Drawn by: | |
|---|---|---|
| 12/4/08 | AES | 10:002330WD1405\fig 11 |

# 8.0 Appendices

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Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1,2,3,4,6,7,8-HpCDD | 220 | J | ng/kg dw | 2.31 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1,2,3,4,6,7,8-HpCDF | 30 | | ng/kg dw | 2.31 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1,2,3,4,7,8,9-HpCDF | 3.9 | J | ng/kg dw | 2.31 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1,2,3,4,7,8-HxCDF | 4.2 | J | ng/kg dw | 2.31 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1,2,3,6,7,8-HxCDD | 9.6 | | ng/kg dw | 2.31 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1,2,3,7,8,9-HxCDD | 6.1 | | ng/kg dw | 2.31 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2,3,7,8-TCDF | 1.8 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | OCDD | 2600 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | OCDF | 130 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HpCDD | 700 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HpCDF | 150 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HxCDD | 90 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HxCDF | 52 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PeCDF | 20 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total TCDD | 5.8 | | ng/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total TCDF | 27 | | ng/kg dw | 2.31 | | | | | | |
| **Metals** | | | | | | | | | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | Aluminum | 38800 | | mg/kg dw | 1.37 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | Aluminum | 43200 | | mg/kg dw | 2.86 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | Aluminum | 26000 | | mg/kg dw | 3.01 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | Aluminum | 22600 | | mg/kg dw | 2.31 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | Aluminum | 22000 | | mg/kg dw | 2.12 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | Aluminum | 22700 | | mg/kg dw | 5.88 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | Aluminum | 33500 | | mg/kg dw | 1.89 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Antimony | 13 | J | mg/kg dw | 3.01 | | | | mg/kg dw | | |
| EPA SI | DR002 | 0.2 | 1998 | Antimony | 6 | J | mg/kg dw | 2.31 | | | | mg/kg dw | | |
| EPA SI | DR003 | 0.2 | 1998 | Antimony | 6 | J | mg/kg dw | 5.88 | | | | mg/kg dw | | |
| EPA SI | DR002 | 0.2 | 1998 | Antimony | 0.38 | J | mg/kg dw | 0.5 | | | | mg/kg dw | | |
| EPA SI | DR003 | 0.2 | 1998 | Antimony | 3.6 | J | mg/kg dw | 1.05 | | | | mg/kg dw | | |
| EPA SI | DR002 | 0.2 | 1998 | Antimony | 1.1 | J | mg/kg dw | 3.01 | | | | mg/kg dw | | |
| EPA SI | DR003 | 0.2 | 1998 | Antimony | 3.1 | J | mg/kg dw | 1.37 | | | | mg/kg dw | | |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 5.34 | J | mg/kg dw | 0.5 | | 57 | 93 | mg/kg dw | 0.094 | 0.057 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 6.2 | | mg/kg dw | 1.58 | | 57 | 93 | mg/kg dw | 0.11 | 0.067 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 7.6 | | mg/kg dw | 1.95 | | 57 | 93 | mg/kg dw | 0.13 | 0.082 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 7.8 | | mg/kg dw | 1.55 | | 57 | 93 | mg/kg dw | 0.14 | 0.084 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 8.9 | | mg/kg dw | 2.86 | | 57 | 93 | mg/kg dw | 0.16 | 0.096 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 9.9 | | mg/kg dw | 1.89 | | 57 | 93 | mg/kg dw | 0.17 | 0.11 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 11.1 | | mg/kg dw | 1.37 | | 57 | 93 | mg/kg dw | 0.19 | 0.12 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 11.6 | | mg/kg dw | 1.98 | | 57 | 93 | mg/kg dw | 0.2 | 0.12 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 12.2 | | mg/kg dw | 2.12 | | 57 | 93 | mg/kg dw | 0.21 | 0.13 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 12 | | mg/kg dw | 2.25 | | 57 | 93 | mg/kg dw | 0.21 | 0.13 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 11.7 | | mg/kg dw | 1.31 | | 57 | 93 | mg/kg dw | 0.21 | 0.13 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 13.4 | | mg/kg dw | 2.31 | | 57 | 93 | mg/kg dw | 0.24 | 0.14 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 13.9 | | mg/kg dw | 1.77 | | 57 | 93 | mg/kg dw | 0.24 | 0.15 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 13.7 | | mg/kg dw | 2.11 | | 57 | 93 | mg/kg dw | 0.24 | 0.15 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 14.6 | | mg/kg dw | 5.88 | | 57 | 93 | mg/kg dw | 0.26 | 0.16 |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 15.2 | mg/kg dw | 2.32 | | 57 | 93 | mg/kg dw | 0.27 | 0.16 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 16.7 | mg/kg dw | 2.72 | | 57 | 93 | mg/kg dw | 0.29 | 0.18 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 21.2 | mg/kg dw | 2.44 | | 57 | 93 | mg/kg dw | 0.37 | 0.23 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 77.2 | mg/kg dw | 3.01 | | 57 | 93 | mg/kg dw | 1.4 | 0.83 |
| EPA SI | DR002 | 0.2 | 1998 | Arsenic | 82.9 | mg/kg dw | 1.05 | | 57 | 93 | mg/kg dw | 1.5 | 0.89 |
| EPA SI | DR003 | 0.2 | 1998 | Arsenic | 123 | mg/kg dw | 3.01 | | 57 | 93 | mg/kg dw | 2.2 | 1.3 |
| EPA SI | DR002 | 0.2 | 1998 | Barium | 89.3 | mg/kg dw | 1.37 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Barium | 134 | mg/kg dw | 2.86 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Barium | 110 | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Barium | 91 | mg/kg dw | 2.31 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Barium | 104 | mg/kg dw | 2.12 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Barium | 99 | mg/kg dw | 5.88 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Barium | 106 | mg/kg dw | 1.89 | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Beryllium | 0.54 J | mg/kg dw | 2.86 | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Beryllium | 0.47 | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Beryllium | 0.46 | mg/kg dw | 2.31 | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Beryllium | 0.42 | mg/kg dw | 2.12 | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Beryllium | 0.51 | mg/kg dw | 5.88 | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Beryllium | 0.52 | mg/kg dw | 1.89 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.071 | mg/kg dw | 0.5 | | 5.1 | 6.7 | mg/kg dw | 0.014 | 0.011 |
| EPA SI | DR055 | 0.1 | 1998 | Cadmium | 0.4 | mg/kg dw | 1.89 | | 5.1 | 6.7 | mg/kg dw | 0.078 | 0.06 |
| EPA SI | DR055 | 0.1 | 1998 | Cadmium | 0.43 | mg/kg dw | 2.31 | | 5.1 | 6.7 | mg/kg dw | 0.084 | 0.064 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.5 | mg/kg dw | 1.98 | | 5.1 | 6.7 | mg/kg dw | 0.098 | 0.075 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.5 | mg/kg dw | 2.32 | | 5.1 | 6.7 | mg/kg dw | 0.098 | 0.075 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.5 | mg/kg dw | 1.77 | | 5.1 | 6.7 | mg/kg dw | 0.098 | 0.075 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.5 | mg/kg dw | 2.11 | | 5.1 | 6.7 | mg/kg dw | 0.098 | 0.075 |
| EPA SI | DR055 | 0.1 | 1998 | Cadmium | 0.59 | mg/kg dw | 2.12 | | 5.1 | 6.7 | mg/kg dw | 0.12 | 0.088 |
| EPA SI | DR055 | 0.1 | 1998 | Cadmium | 0.63 | mg/kg dw | 5.88 | | 5.1 | 6.7 | mg/kg dw | 0.12 | 0.094 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.8 | mg/kg dw | 2.44 | | 5.1 | 6.7 | mg/kg dw | 0.16 | 0.12 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.8 | mg/kg dw | 2.25 | | 5.1 | 6.7 | mg/kg dw | 0.16 | 0.12 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 0.9 | mg/kg dw | 2.72 | | 5.1 | 6.7 | mg/kg dw | 0.18 | 0.13 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 1.1 | mg/kg dw | 3.01 | | 5.1 | 6.7 | mg/kg dw | 0.22 | 0.16 |
| EPA SI | DR055 | 0.1 | 1998 | Cadmium | 1.5 | mg/kg dw | 3.01 | | 5.1 | 6.7 | mg/kg dw | 0.29 | 0.22 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cadmium | 3.8 | mg/kg dw | 1.05 | | 5.1 | 6.7 | mg/kg dw | 0.75 | 0.57 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 10.5 | mg/kg dw | 0.5 | | 260 | 270 | mg/kg dw | 0.04 | 0.039 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 15.8 | mg/kg dw | 1.55 | | 260 | 270 | mg/kg dw | 0.061 | 0.059 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 17.8 | mg/kg dw | 1.95 | | 260 | 270 | mg/kg dw | 0.068 | 0.066 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 18.9 | mg/kg dw | 1.58 | | 260 | 270 | mg/kg dw | 0.073 | 0.07 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 21.3 | mg/kg dw | 1.31 | | 260 | 270 | mg/kg dw | 0.082 | 0.079 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 24.1 | mg/kg dw | 1.77 | | 260 | 270 | mg/kg dw | 0.093 | 0.089 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 28.8 | mg/kg dw | 2.11 | | 260 | 270 | mg/kg dw | 0.11 | 0.11 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 30.1 | mg/kg dw | 1.98 | | 260 | 270 | mg/kg dw | 0.12 | 0.11 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 30 | mg/kg dw | 3.01 | | 260 | 270 | mg/kg dw | 0.12 | 0.11 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 33 | mg/kg dw | 2.31 | | 260 | 270 | mg/kg dw | 0.13 | 0.12 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 33 | mg/kg dw | 2.12 | | 260 | 270 | mg/kg dw | 0.13 | 0.12 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 33 | mg/kg dw | 2.32 | | 260 | 270 | mg/kg dw | 0.13 | 0.12 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 36 | mg/kg dw | 5.88 | | 260 | 270 | mg/kg dw | 0.14 | 0.13 |

**Appendix 1. Sampling Results for Surface Sediment: Ash Grove**

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 38 | | mg/kg dw | 1.05 | | 260 | 270 | mg/kg dw | 0.15 | 0.14 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 40.6 | | mg/kg dw | 1.37 | | 260 | 270 | mg/kg dw | 0.16 | 0.15 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 42 | | mg/kg dw | 3.01 | | 260 | 270 | mg/kg dw | 0.16 | 0.16 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 42 | | mg/kg dw | 2.44 | | 260 | 270 | mg/kg dw | 0.16 | 0.16 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 41 | | mg/kg dw | 2.25 | | 260 | 270 | mg/kg dw | 0.16 | 0.15 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 44.4 | | mg/kg dw | 2.86 | | 260 | 270 | mg/kg dw | 0.17 | 0.16 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 43 | | mg/kg dw | 1.89 | | 260 | 270 | mg/kg dw | 0.17 | 0.16 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium | 43 | | mg/kg dw | 2.72 | | 260 | 270 | mg/kg dw | 0.17 | 0.16 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chromium VI | 13.5 | J | mg/kg dw | 2.86 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cobalt | 10.9 | J | mg/kg dw | 1.37 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Cobalt | 14.9 | | mg/kg dw | 2.86 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 14 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 10 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 10 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 11 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 14 | | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 4.7 | | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 4.9 | | mg/kg dw | 1.58 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 10.8 | | mg/kg dw | 2.44 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 8 | | mg/kg dw | 1.98 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 7 | | mg/kg dw | 1.05 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 11.6 | | mg/kg dw | 2.72 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 10.8 | | mg/kg dw | 2.25 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 4.9 | | mg/kg dw | 1.55 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 8.6 | | mg/kg dw | 2.32 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 6.4 | | mg/kg dw | 1.31 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 8 | | mg/kg dw | 1.77 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 10.1 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Cobalt | 6.9 | | mg/kg dw | 2.11 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Cobalt | 5 | | mg/kg dw | 1.95 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 15.1 | | mg/kg dw | 0.5 | | 390 | 390 | mg/kg dw | 0.039 | 0.039 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 32.3 | | mg/kg dw | 1.58 | | 390 | 390 | mg/kg dw | 0.083 | 0.083 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 34.5 | | mg/kg dw | 1.55 | | 390 | 390 | mg/kg dw | 0.088 | 0.088 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 35.9 | | mg/kg dw | 1.95 | | 390 | 390 | mg/kg dw | 0.092 | 0.092 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 45.8 | | mg/kg dw | 1.31 | | 390 | 390 | mg/kg dw | 0.12 | 0.12 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 66.4 | | mg/kg dw | 1.77 | | 390 | 390 | mg/kg dw | 0.17 | 0.17 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 66.7 | | mg/kg dw | 2.11 | | 390 | 390 | mg/kg dw | 0.17 | 0.17 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 68.6 | | mg/kg dw | 1.37 | | 390 | 390 | mg/kg dw | 0.18 | 0.18 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 68.8 | J | mg/kg dw | 1.98 | | 390 | 390 | mg/kg dw | 0.18 | 0.18 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 86 | | mg/kg dw | 2.31 | | 390 | 390 | mg/kg dw | 0.22 | 0.22 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 87 | | mg/kg dw | 1.89 | | 390 | 390 | mg/kg dw | 0.22 | 0.22 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 84 | | mg/kg dw | 2.32 | | 390 | 390 | mg/kg dw | 0.22 | 0.22 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 91 | | mg/kg dw | 2.12 | | 390 | 390 | mg/kg dw | 0.23 | 0.23 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 90 | | mg/kg dw | 5.88 | | 390 | 390 | mg/kg dw | 0.23 | 0.23 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 103 | | mg/kg dw | 1.05 | | 390 | 390 | mg/kg dw | 0.26 | 0.26 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 116 | | mg/kg dw | 2.25 | | 390 | 390 | mg/kg dw | 0.3 | 0.3 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 124 | | mg/kg dw | 2.44 | | 390 | 390 | mg/kg dw | 0.32 | 0.32 |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 123 | | mg/kg dw | 2.72 | | 390 | 390 | mg/kg dw | 0.32 | 0.32 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Copper | 132 | | mg/kg dw | 2.86 | | 390 | 390 | mg/kg dw | 0.34 | 0.34 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 137 | | mg/kg dw | 3.01 | | 390 | 390 | mg/kg dw | 0.35 | 0.35 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Copper | 153 | | mg/kg dw | 3.01 | | 390 | 390 | mg/kg dw | 0.39 | 0.39 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Iron | 39900 | | mg/kg dw | 1.37 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Iron | 44300 | | mg/kg dw | 2.86 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Iron | 37500 | J | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Iron | 31800 | J | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Iron | 29600 | J | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Iron | 34700 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Iron | 39900 | J | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 17.5 | | mg/kg dw | 0.5 | | 450 | 530 | mg/kg dw | 0.039 | 0.033 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 25 | | mg/kg dw | 1.95 | | 450 | 530 | mg/kg dw | 0.056 | 0.047 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 27 | | mg/kg dw | 1.58 | | 450 | 530 | mg/kg dw | 0.06 | 0.051 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 27 | | mg/kg dw | 1.55 | | 450 | 530 | mg/kg dw | 0.06 | 0.051 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 34.8 | J | mg/kg dw | 1.37 | | 450 | 530 | mg/kg dw | 0.077 | 0.066 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 35.1 | J | mg/kg dw | 2.86 | | 450 | 530 | mg/kg dw | 0.078 | 0.066 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 37 | | mg/kg dw | 1.31 | | 450 | 530 | mg/kg dw | 0.082 | 0.07 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 44 | | mg/kg dw | 1.98 | | 450 | 530 | mg/kg dw | 0.098 | 0.083 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 48.4 | | mg/kg dw | 1.89 | | 450 | 530 | mg/kg dw | 0.11 | 0.091 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 56 | | mg/kg dw | 2.11 | | 450 | 530 | mg/kg dw | 0.12 | 0.11 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 60.9 | | mg/kg dw | 2.31 | | 450 | 530 | mg/kg dw | 0.14 | 0.11 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 63 | | mg/kg dw | 2.32 | | 450 | 530 | mg/kg dw | 0.14 | 0.12 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 70.1 | | mg/kg dw | 5.88 | | 450 | 530 | mg/kg dw | 0.16 | 0.13 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 76 | | mg/kg dw | 1.77 | | 450 | 530 | mg/kg dw | 0.17 | 0.14 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 79 | | mg/kg dw | 2.25 | | 450 | 530 | mg/kg dw | 0.18 | 0.15 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 86 | | mg/kg dw | 2.44 | | 450 | 530 | mg/kg dw | 0.19 | 0.16 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 91.7 | | mg/kg dw | 2.12 | | 450 | 530 | mg/kg dw | 0.2 | 0.17 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 94 | | mg/kg dw | 2.72 | | 450 | 530 | mg/kg dw | 0.21 | 0.18 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 292 | | mg/kg dw | 3.01 | | 450 | 530 | mg/kg dw | 0.65 | 0.55 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 339 | | mg/kg dw | 3.01 | | 450 | 530 | mg/kg dw | 0.75 | 0.64 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Lead | 573 | | mg/kg dw | 1.05 | | 450 | 530 | mg/kg dw | 1.3 | 1.1 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Manganese | 376 | J | mg/kg dw | 1.37 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Manganese | 411 | | mg/kg dw | 2.86 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Manganese | 402 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Manganese | 366 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Manganese | 318 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Manganese | 372 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Manganese | 412 | | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.049 | | mg/kg dw | 0.5 | | 0.41 | 0.59 | mg/kg dw | 0.12 | 0.083 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.09 | | mg/kg dw | 1.58 | | 0.41 | 0.59 | mg/kg dw | 0.22 | 0.15 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.13 | | mg/kg dw | 1.31 | | 0.41 | 0.59 | mg/kg dw | 0.32 | 0.22 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.16 | J | mg/kg dw | 1.98 | | 0.41 | 0.59 | mg/kg dw | 0.39 | 0.27 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.16 | | mg/kg dw | 1.95 | | 0.41 | 0.59 | mg/kg dw | 0.39 | 0.27 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Mercury | 0.18 | J | mg/kg dw | 1.37 | | 0.41 | 0.59 | mg/kg dw | 0.44 | 0.31 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.18 | | mg/kg dw | 1.77 | | 0.41 | 0.59 | mg/kg dw | 0.44 | 0.31 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Mercury | 0.2 | J | mg/kg dw | 2.86 | | 0.41 | 0.59 | mg/kg dw | 0.49 | 0.34 |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Mercury | 0.22 | | mg/kg dw | 3.01 | | 0.41 | 0.59 | mg/kg dw | 0.54 | 0.37 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS6 | 0.1 | 2005 | Mercury | 0.22 | | mg/kg dw | 2.31 | | 0.41 | 0.59 | mg/kg dw | 0.54 | 0.37 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.23 | | mg/kg dw | 1.89 | | 0.41 | 0.59 | mg/kg dw | 0.56 | 0.39 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.25 | | mg/kg dw | 1.05 | | 0.41 | 0.59 | mg/kg dw | 0.61 | 0.42 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.27 | | mg/kg dw | 5.88 | | 0.41 | 0.59 | mg/kg dw | 0.66 | 0.46 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.27 | | mg/kg dw | 3.01 | | 0.41 | 0.59 | mg/kg dw | 0.66 | 0.46 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.27 | | mg/kg dw | 2.11 | | 0.41 | 0.59 | mg/kg dw | 0.66 | 0.46 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.3 | | mg/kg dw | 2.12 | | 0.41 | 0.59 | mg/kg dw | 0.73 | 0.51 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.34 | | mg/kg dw | 2.72 | | 0.41 | 0.59 | mg/kg dw | 0.83 | 0.58 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.38 | | mg/kg dw | 2.44 | | 0.41 | 0.59 | mg/kg dw | 0.93 | 0.64 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.4 | | mg/kg dw | 2.25 | | 0.41 | 0.59 | mg/kg dw | 0.98 | 0.68 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.59 | | mg/kg dw | 2.32 | | 0.41 | 0.59 | mg/kg dw | 1.4 | 1 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Mercury | 0.91 | | mg/kg dw | 1.55 | | 0.41 | 0.59 | mg/kg dw | 2.2 | 1.5 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 0.543 | J | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 1.1 | | mg/kg dw | 1.58 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 3 | | mg/kg dw | 2.44 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 1.6 | | mg/kg dw | 1.98 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 6 | | mg/kg dw | 1.05 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 3 | | mg/kg dw | 2.72 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 2 | | mg/kg dw | 2.25 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 0.5 | | mg/kg dw | 1.55 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 1 | | mg/kg dw | 2.32 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 0.6 | | mg/kg dw | 1.31 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 1.5 | | mg/kg dw | 1.77 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 8.5 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 0.9 | | mg/kg dw | 2.11 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Molybdenum | 0.5 | | mg/kg dw | 1.95 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 23.1 | | mg/kg dw | 1.37 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 24.9 | | mg/kg dw | 2.86 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 27.6 | | mg/kg dw | 3.01 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 24.9 | | mg/kg dw | 2.31 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 21.2 | | mg/kg dw | 2.12 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 25.1 | | mg/kg dw | 5.88 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 27.5 | | mg/kg dw | 1.89 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 7 | | mg/kg dw | 0.5 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 10 | | mg/kg dw | 1.58 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 26 | | mg/kg dw | 2.44 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 22 | | mg/kg dw | 1.98 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 15 | | mg/kg dw | 1.05 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 28 | | mg/kg dw | 2.72 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 26 | | mg/kg dw | 2.25 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 10.9 | | mg/kg dw | 1.55 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 23 | | mg/kg dw | 2.32 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 20.4 | | mg/kg dw | 1.31 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 22.5 | | mg/kg dw | 1.77 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 20 | | mg/kg dw | 3.01 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 18.8 | | mg/kg dw | 2.11 | | | | mg/kg dw | | |

**Appendix 1. Sampling Results for Surface Sediment: Ash Grove**

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Nickel | 11.9 | | mg/kg dw | 1.95 | | | | mg/kg dw | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Selenium | 20 | J | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Selenium | 0.7 | J | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Selenium | 0.6 | J | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Selenium | 5 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Selenium | 23 | J | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Selenium | 0.4 | J | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.054 | J | mg/kg dw | 0.5 | | 6.1 | 6.1 | mg/kg dw | 0.0089 | 0.0089 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.39 | | mg/kg dw | 1.89 | | 6.1 | 6.1 | mg/kg dw | 0.064 | 0.064 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.4 | J | mg/kg dw | 1.77 | | 6.1 | 6.1 | mg/kg dw | 0.066 | 0.066 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Silver | 0.41 | | mg/kg dw | 2.31 | | 6.1 | 6.1 | mg/kg dw | 0.067 | 0.067 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.5 | | mg/kg dw | 2.32 | | 6.1 | 6.1 | mg/kg dw | 0.082 | 0.082 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Silver | 0.51 | | mg/kg dw | 2.12 | | 6.1 | 6.1 | mg/kg dw | 0.084 | 0.084 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.52 | J | mg/kg dw | 5.88 | | 6.1 | 6.1 | mg/kg dw | 0.085 | 0.085 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.7 | | mg/kg dw | 2.72 | | 6.1 | 6.1 | mg/kg dw | 0.11 | 0.11 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.7 | | mg/kg dw | 2.25 | | 6.1 | 6.1 | mg/kg dw | 0.11 | 0.11 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.7 | | mg/kg dw | 3.01 | | 6.1 | 6.1 | mg/kg dw | 0.11 | 0.11 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 0.8 | | mg/kg dw | 2.44 | | 6.1 | 6.1 | mg/kg dw | 0.13 | 0.13 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Silver | 1.14 | | mg/kg dw | 3.01 | | 6.1 | 6.1 | mg/kg dw | 0.19 | 0.19 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Silver | 3 | | mg/kg dw | 1.05 | | 6.1 | 6.1 | mg/kg dw | 0.49 | 0.49 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Sodium | 11700 | J | mg/kg dw | 1.37 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Sodium | 12700 | | mg/kg dw | 2.86 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Sodium | 14600 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Sodium | 12600 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Sodium | 12100 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Sodium | 13400 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Sodium | 14700 | | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.32 | J | mg/kg dw | 1.37 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.04 | J | mg/kg dw | 2.86 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.22 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.12 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.13 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.15 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.15 | | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.06 | | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Thallium | 0.6 | | mg/kg dw | 1.05 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Tin | 14 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Tin | 5 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Tin | 6 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Tin | 6 | | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 72.2 | | mg/kg dw | 1.37 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 97.1 | | mg/kg dw | 2.86 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 78 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 63 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 62 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 74 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 92 | | mg/kg dw | 1.89 | | | | | | |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Vanadium | 27.7 | | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 42.3 | | mg/kg dw | 1.58 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 81.7 | | mg/kg dw | 2.44 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 61.5 | | mg/kg dw | 1.98 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 37 | | mg/kg dw | 1.05 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 80.2 | | mg/kg dw | 2.72 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 81.7 | | mg/kg dw | 2.25 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 37.4 | | mg/kg dw | 1.55 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 64 | | mg/kg dw | 2.32 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 40.3 | | mg/kg dw | 1.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 49.3 | | mg/kg dw | 1.77 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 52 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 45.3 | | mg/kg dw | 2.11 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Vanadium | 40.6 | | mg/kg dw | 1.95 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 36.6 | | mg/kg dw | 0.5 | | 410 | 960 | mg/kg dw | 0.089 | 0.038 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 60.3 | | mg/kg dw | 1.58 | | 410 | 960 | mg/kg dw | 0.15 | 0.063 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 74 | | mg/kg dw | 1.95 | | 410 | 960 | mg/kg dw | 0.18 | 0.077 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 97 | | mg/kg dw | 1.31 | | 410 | 960 | mg/kg dw | 0.24 | 0.1 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 106 | | mg/kg dw | 1.55 | | 410 | 960 | mg/kg dw | 0.26 | 0.11 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 119 | | mg/kg dw | 1.98 | | 410 | 960 | mg/kg dw | 0.29 | 0.12 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 123 | | mg/kg dw | 1.37 | | 410 | 960 | mg/kg dw | 0.3 | 0.13 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 139 | | mg/kg dw | 2.11 | | 410 | 960 | mg/kg dw | 0.34 | 0.14 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 144 | | mg/kg dw | 1.89 | | 410 | 960 | mg/kg dw | 0.35 | 0.15 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 142 | | mg/kg dw | 1.77 | | 410 | 960 | mg/kg dw | 0.35 | 0.15 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 146 | | mg/kg dw | 2.86 | | 410 | 960 | mg/kg dw | 0.36 | 0.15 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 151 | | mg/kg dw | 2.32 | | 410 | 960 | mg/kg dw | 0.37 | 0.16 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 155 | | mg/kg dw | 2.31 | | 410 | 960 | mg/kg dw | 0.38 | 0.16 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 156 | | mg/kg dw | 5.88 | | 410 | 960 | mg/kg dw | 0.38 | 0.16 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 164 | | mg/kg dw | 2.12 | | 410 | 960 | mg/kg dw | 0.4 | 0.17 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 178 | | mg/kg dw | 2.25 | | 410 | 960 | mg/kg dw | 0.43 | 0.19 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 198 | | mg/kg dw | 2.44 | | 410 | 960 | mg/kg dw | 0.48 | 0.21 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 197 | | mg/kg dw | 2.72 | | 410 | 960 | mg/kg dw | 0.48 | 0.21 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 346 | | mg/kg dw | 3.01 | | 410 | 960 | mg/kg dw | 0.84 | 0.36 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 372 | | mg/kg dw | 3.01 | | 410 | 960 | mg/kg dw | 0.91 | 0.39 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS304 | 0.1 | 2006 | Zinc | 553 | | mg/kg dw | 1.05 | | 410 | 960 | mg/kg dw | 1.3 | 0.58 |
| **Organometals** | | | | | | | | | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibutyltin as ion | 0.045 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibutyltin as ion | 0.052 | J | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibutyltin as ion | 0.032 | J | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibutyltin as ion | 0.13 | | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibutyltin as ion | 0.0054 | J | mg/kg dw | 2.25 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibutyltin as ion | 0.0069 | | mg/kg dw | 1.55 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibutyltin as ion | 18 | | mg/kg dw | 2.32 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Monobutyltin as ion | 0.037 | J | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Monobutyltin as ion | 0.029 | J | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Monobutyltin as ion | 0.022 | J | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Monobutyltin as ion | 0.0046 | J | mg/kg dw | 0.5 | | | | | | |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Monobutyltin as ion | 0.0054 | | mg/kg dw | 2.32 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Tetrabutyltin as ion | 0.005 | J | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Tetrabutyltin as ion | 0.058 | | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.17 | J | mg/kg dw | | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.32 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.23 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.14 | J | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 2.3 | J | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.019 | | mg/kg dw | 2.44 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.01 | | mg/kg dw | 1.98 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.02 | | mg/kg dw | 1.05 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.0075 | | mg/kg dw | 2.72 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.02 | | mg/kg dw | 2.25 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.017 | | mg/kg dw | 1.55 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.055 | | mg/kg dw | 2.32 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Tributyltin as ion | 0.014 | | mg/kg dw | 1.95 | | | | | | |
| **SVOCs** | | | | | | | | | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2,4-Dimethylphenol | 6.1 | | ug/kg dw | 3.01 | | 29 | 29 | ug/kg dw | 0.21 | 0.21 |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2,4-Dimethylphenol | 6.7 | | ug/kg dw | 2.11 | | 29 | 29 | ug/kg dw | 0.23 | 0.23 |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2-Methylphenol | 9.1 | | ug/kg dw | 2.11 | | 63 | 63 | ug/kg dw | 0.14 | 0.14 |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2-Methylphenol | 10 | | ug/kg dw | 3.01 | | 63 | 63 | ug/kg dw | 0.16 | 0.16 |
| Harbor Island RI | K-10 | 0.1 | 1991 | 4-Methylphenol | 4.8 | J | ug/kg dw | 0.5 | | 670 | 670 | ug/kg dw | 0.0072 | 0.0072 |
| EPA SI | DR055 | 0.1 | 1998 | Benzoic acid | 54 | J | ug/kg dw | 1.58 | | 650 | 650 | ug/kg dw | 0.083 | 0.083 |
| EPA SI | DR055 | 0.1 | 1998 | Benzoic acid | 72 | | ug/kg dw | 0.5 | | 650 | 650 | ug/kg dw | 0.11 | 0.11 |
| EPA SI | DR055 | 0.1 | 1998 | Biphenyl | 0.0022 | J | mg/kg dw | 0.5 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbazole | 0.04 | | mg/kg dw | 3.01 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbazole | 0.05 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbazole | 0.03 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbazole | 0.04 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbazole | 0.012 | | mg/kg dw | 0.5 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbazole | 0.14 | | mg/kg dw | 1.98 | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbazole | 0.051 | J | mg/kg dw | 2.72 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dibenzothiophene | 0.0023 | J | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | N-Nitrosodiphenylamine | 0.024 | | mg/kg dw | 1.05 | 2.3 | 11 | 11 | mg/kg OC | 0.21 | 0.21 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenol | 19 | J | ug/kg dw | 0.5 | | 420 | 1200 | ug/kg dw | 0.045 | 0.016 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenol | 20 | | ug/kg dw | 2.31 | | 420 | 1200 | ug/kg dw | 0.048 | 0.017 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenol | 30 | | ug/kg dw | 3.01 | | 420 | 1200 | ug/kg dw | 0.071 | 0.025 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenol | 30 | | ug/kg dw | 1.89 | | 420 | 1200 | ug/kg dw | 0.071 | 0.025 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenol | 110 | | ug/kg dw | 1.31 | | 420 | 1200 | ug/kg dw | 0.26 | 0.092 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenol | 420 | J | ug/kg dw | | | 420 | 1200 | ug/kg dw | 1 | 0.35 |
| **PAHs** | | | | | | | | | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1-Methylnaphthalene | 0.0031 | J | mg/kg dw | 0.5 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1-Methylnaphthalene | 0.062 | | mg/kg dw | 3.01 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 1-Methylnaphthalene | 0.081 | | mg/kg dw | 2.11 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2-Methylnaphthalene | 0.0031 | J | mg/kg dw | 0.5 | 0.62 | 38 | 64 | mg/kg OC | 0.016 | 0.0097 |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2-Methylnaphthalene | 0.085 | | mg/kg dw | 3.01 | 2.8 | 38 | 64 | mg/kg OC | 0.074 | 0.044 |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2-Methylnaphthalene | 0.11 | | mg/kg dw | 2.11 | 5.2 | 38 | 64 | mg/kg OC | 0.14 | 0.081 |

Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthene | 0.02 | | mg/kg dw | 2.12 | 0.94 | 16 | 57 | mg/kg OC | 0.059 | 0.016 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthene | 0.03 | | mg/kg dw | 3.01 | 1 | 16 | 57 | mg/kg OC | 0.063 | 0.018 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthene | 0.0065 | J | mg/kg dw | 0.5 | 1.3 | 16 | 57 | mg/kg OC | 0.081 | 0.023 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthene | 0.099 | | mg/kg dw | 2.11 | 4.7 | 16 | 57 | mg/kg OC | 0.29 | 0.082 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthene | 0.095 | | mg/kg dw | 1.98 | 4.8 | 16 | 57 | mg/kg OC | 0.3 | 0.084 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthene | 0.19 | | mg/kg dw | 3.01 | 6.3 | 16 | 57 | mg/kg OC | 0.39 | 0.11 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthylene | 0.0046 | J | mg/kg dw | 0.5 | 0.92 | 66 | 66 | mg/kg OC | 0.014 | 0.014 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthylene | 0.037 | J | mg/kg dw | 2.72 | 1.4 | 66 | 66 | mg/kg OC | 0.021 | 0.021 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthylene | 0.037 | J | mg/kg dw | 2.32 | 1.6 | 66 | 66 | mg/kg OC | 0.024 | 0.024 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthylene | 0.036 | J | mg/kg dw | 2.11 | 1.7 | 66 | 66 | mg/kg OC | 0.026 | 0.026 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthylene | 0.053 | J | mg/kg dw | 3.01 | 1.8 | 66 | 66 | mg/kg OC | 0.027 | 0.027 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthylene | 0.068 | | mg/kg dw | 1.98 | 3.4 | 66 | 66 | mg/kg OC | 0.052 | 0.052 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Acenaphthylene | 0.081 | | mg/kg dw | 1.95 | 4.2 | 66 | 66 | mg/kg OC | 0.064 | 0.064 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.021 | | mg/kg dw | 2.44 | 0.86 | 220 | 1200 | mg/kg OC | 0.0039 | 0.00072 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.021 | | mg/kg dw | 1.58 | 1.3 | 220 | 1200 | mg/kg OC | 0.0059 | 0.0011 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.05 | | mg/kg dw | 1.89 | 2.6 | 220 | 1200 | mg/kg OC | 0.012 | 0.0022 |
| EPA SI | DR002 | 0.2 | 1998 | Anthracene | 0.047 | J | mg/kg dw | 1.77 | 2.7 | 220 | 1200 | mg/kg OC | 0.012 | 0.0023 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.029 | | mg/kg dw | 1.05 | 2.8 | 220 | 1200 | mg/kg OC | 0.013 | 0.0023 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.018 | J | mg/kg dw | 0.5 | 3.6 | 220 | 1200 | mg/kg OC | 0.016 | 0.003 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.12 | | mg/kg dw | 3.01 | 4 | 220 | 1200 | mg/kg OC | 0.018 | 0.0033 |
| NOAA SiteChar | EST229 | 0.2 | 1997 | Anthracene | 0.11 | | mg/kg dw | 2.72 | 4 | 220 | 1200 | mg/kg OC | 0.018 | 0.0033 |
| NOAA SiteChar | EST227 | 0 | 1997 | Anthracene | 0.1 | | mg/kg dw | 2.32 | 4.3 | 220 | 1200 | mg/kg OC | 0.02 | 0.0036 |
| NOAA SiteChar | EST228 | 0.1 | 1997 | Anthracene | 0.073 | | mg/kg dw | 1.55 | 4.7 | 220 | 1200 | mg/kg OC | 0.021 | 0.0039 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.13 | | mg/kg dw | 2.31 | 5.6 | 220 | 1200 | mg/kg OC | 0.025 | 0.0047 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.12 | | mg/kg dw | 2.12 | 5.7 | 220 | 1200 | mg/kg OC | 0.026 | 0.0048 |
| NOAA SiteChar | EST230 | 0.2 | 1997 | Anthracene | 0.19 | | mg/kg dw | 2.25 | 8.4 | 220 | 1200 | mg/kg OC | 0.038 | 0.007 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 0.19 | | mg/kg dw | 1.98 | 9.6 | 220 | 1200 | mg/kg OC | 0.044 | 0.008 |
| EPA SI | DR002 | 0.2 | 1998 | Anthracene | 0.13 | | mg/kg dw | 1.31 | 9.9 | 220 | 1200 | mg/kg OC | 0.045 | 0.0083 |
| EPA SI | DR002 | 0.2 | 1998 | Anthracene | 0.28 | | mg/kg dw | 2.11 | 13 | 220 | 1200 | mg/kg OC | 0.059 | 0.011 |
| EPA SI | DR002 | 0.2 | 1998 | Anthracene | 0.42 | | mg/kg dw | 3.01 | 14 | 220 | 1200 | mg/kg OC | 0.064 | 0.012 |
| EPA SI | DR002 | 0.2 | 1998 | Anthracene | 0.29 | | mg/kg dw | 1.95 | 15 | 220 | 1200 | mg/kg OC | 0.068 | 0.013 |
| Harbor Island RI | K-10 | 0.1 | 1991 | Anthracene | 110 | | ug/kg dw | 5.88 | | 960 | 4400 | ug/kg dw | 0.11 | 0.025 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.061 | | mg/kg dw | 1.58 | 3.9 | 110 | 270 | mg/kg OC | 0.035 | 0.014 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.031 | | mg/kg dw | 0.5 | 6.2 | 110 | 270 | mg/kg OC | 0.056 | 0.023 |
| EPA SI | DR003 | 0.2 | 1998 | Benzo(a)anthracene | 0.071 | | mg/kg dw | 1.05 | 6.8 | 110 | 270 | mg/kg OC | 0.062 | 0.025 |
| EPA SI | DR003 | 0.2 | 1998 | Benzo(a)anthracene | 0.12 | | mg/kg dw | 1.77 | 6.8 | 110 | 270 | mg/kg OC | 0.062 | 0.025 |
| EPA SI | DR003 | 0.2 | 1998 | Benzo(a)anthracene | 0.2 | | mg/kg dw | 2.44 | 8.2 | 110 | 270 | mg/kg OC | 0.075 | 0.03 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.19 | | mg/kg dw | 1.89 | 10 | 110 | 270 | mg/kg OC | 0.091 | 0.037 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.31 | | mg/kg dw | 2.72 | 11 | 110 | 270 | mg/kg OC | 0.1 | 0.041 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.32 | | mg/kg dw | 2.32 | 14 | 110 | 270 | mg/kg OC | 0.13 | 0.052 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.33 | | mg/kg dw | 2.25 | 15 | 110 | 270 | mg/kg OC | 0.14 | 0.056 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.47 | | mg/kg dw | 3.01 | 16 | 110 | 270 | mg/kg OC | 0.15 | 0.059 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.37 | | mg/kg dw | 2.12 | 17 | 110 | 270 | mg/kg OC | 0.15 | 0.063 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.31 | | mg/kg dw | 1.55 | 20 | 110 | 270 | mg/kg OC | 0.18 | 0.074 |
| EPA SI | DR003 | 0.2 | 1998 | Benzo(a)anthracene | 0.49 | | mg/kg dw | 2.31 | 21 | 110 | 270 | mg/kg OC | 0.19 | 0.078 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.68 | | mg/kg dw | 3.01 | 23 | 110 | 270 | mg/kg OC | 0.21 | 0.085 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.34 | | mg/kg dw | 1.31 | 26 | 110 | 270 | mg/kg OC | 0.24 | 0.096 |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 0.54 | | mg/kg dw | 1.98 | 27 | 110 | 270 | mg/kg OC | 0.25 | 0.1 |
| EPA SI | DR002 | 0.2 | 1998 | Benzo(a)anthracene | 410 | | ug/kg dw | 5.88 | | 1300 | 1600 | ug/kg dw | 0.32 | 0.26 |
| EPA SI | DR003 | 0.2 | 1998 | Benzo(a)anthracene | 430 | J | ug/kg dw | | | 1300 | 1600 | ug/kg dw | 0.33 | 0.27 |
| EPA SI | DR003 | 0.2 | 1998 | Benzo(a)anthracene | 0.87 | | mg/kg dw | 2.11 | 41 | 110 | 270 | mg/kg OC | 0.37 | 0.15 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)anthracene | 2.2 | | mg/kg dw | 1.95 | 110 | 110 | 270 | mg/kg OC | 1 | 0.41 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.091 | | mg/kg dw | 1.58 | 5.8 | 99 | 210 | mg/kg OC | 0.059 | 0.028 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.038 | | mg/kg dw | 0.5 | 7.6 | 99 | 210 | mg/kg OC | 0.077 | 0.036 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.19 | | mg/kg dw | 2.44 | 7.8 | 99 | 210 | mg/kg OC | 0.079 | 0.037 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.096 | | mg/kg dw | 1.05 | 9.1 | 99 | 210 | mg/kg OC | 0.092 | 0.043 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.19 | | mg/kg dw | 1.89 | 10 | 99 | 210 | mg/kg OC | 0.1 | 0.048 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.19 | | mg/kg dw | 1.77 | 11 | 99 | 210 | mg/kg OC | 0.11 | 0.052 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.41 | | mg/kg dw | 3.01 | 14 | 99 | 210 | mg/kg OC | 0.14 | 0.067 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.38 | | mg/kg dw | 2.72 | 14 | 99 | 210 | mg/kg OC | 0.14 | 0.067 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.38 | | mg/kg dw | 2.32 | 16 | 99 | 210 | mg/kg OC | 0.16 | 0.076 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.38 | | mg/kg dw | 2.25 | 17 | 99 | 210 | mg/kg OC | 0.17 | 0.081 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 290 | J | ug/kg dw | | | 1600 | 3000 | ug/kg dw | 0.18 | 0.097 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.42 | | mg/kg dw | 2.31 | 18 | 99 | 210 | mg/kg OC | 0.18 | 0.086 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.41 | | mg/kg dw | 2.12 | 19 | 99 | 210 | mg/kg OC | 0.19 | 0.09 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.57 | | mg/kg dw | 3.01 | 19 | 99 | 210 | mg/kg OC | 0.19 | 0.09 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.32 | | mg/kg dw | 1.55 | 21 | 99 | 210 | mg/kg OC | 0.21 | 0.1 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 370 | | ug/kg dw | 5.88 | | 1600 | 3000 | ug/kg dw | 0.23 | 0.12 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.45 | | mg/kg dw | 1.98 | 23 | 99 | 210 | mg/kg OC | 0.23 | 0.11 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(a)pyrene | 0.6 | | mg/kg dw | 2.11 | 28 | 99 | 210 | mg/kg OC | 0.28 | 0.13 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 0.39 | | mg/kg dw | 1.31 | 30 | 99 | 210 | mg/kg OC | 0.3 | 0.14 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(a)pyrene | 2.6 | | mg/kg dw | 1.95 | 130 | 99 | 210 | mg/kg OC | 1.3 | 0.62 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 0.58 | | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.49 | | mg/kg dw | 2.31 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 0.54 | | mg/kg dw | 2.12 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.51 | | mg/kg dw | 5.88 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 0.23 | | mg/kg dw | 1.89 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.041 | | mg/kg dw | 0.5 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 0.11 | | mg/kg dw | 1.58 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.32 | | mg/kg dw | 2.44 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 1.3 | | mg/kg dw | 1.98 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.12 | | mg/kg dw | 1.05 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 0.38 | | mg/kg dw | 2.72 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.7 | | mg/kg dw | 2.25 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 0.52 | | mg/kg dw | 1.55 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.82 | | mg/kg dw | 2.32 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.78 | | mg/kg dw | 1.31 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 0.34 | | mg/kg dw | 1.77 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 0.84 | | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(b)fluoranthene | 1.4 | | mg/kg dw | 2.11 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(b)fluoranthene | 4.6 | | mg/kg dw | 1.95 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(e)pyrene | 0.039 | J | mg/kg dw | 0.5 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 0.032 | | mg/kg dw | 2.44 | 1.3 | 31 | 78 | mg/kg OC | 0.042 | 0.017 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.05 | | mg/kg dw | 1.58 | 3.2 | 31 | 78 | mg/kg OC | 0.1 | 0.041 |

Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 0.072 | | mg/kg dw | 1.77 | 4.1 | 31 | 78 | mg/kg OC | 0.13 | 0.053 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 0.098 | | mg/kg dw | 2.25 | 4.4 | 31 | 78 | mg/kg OC | 0.14 | 0.056 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.11 | | mg/kg dw | 1.98 | 5.6 | 31 | 78 | mg/kg OC | 0.18 | 0.072 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.19 | | mg/kg dw | 3.01 | 6.3 | 31 | 78 | mg/kg OC | 0.2 | 0.081 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.2 | | mg/kg dw | 3.01 | 6.6 | 31 | 78 | mg/kg OC | 0.21 | 0.085 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 0.032 | J | mg/kg dw | 0.5 | 6.4 | 31 | 78 | mg/kg OC | 0.21 | 0.082 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.11 | | mg/kg dw | 1.55 | 7.1 | 31 | 78 | mg/kg OC | 0.23 | 0.091 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.2 | | mg/kg dw | 2.72 | 7.4 | 31 | 78 | mg/kg OC | 0.24 | 0.095 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.15 | | mg/kg dw | 1.89 | 7.9 | 31 | 78 | mg/kg OC | 0.25 | 0.1 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 0.18 | | mg/kg dw | 2.32 | 7.8 | 31 | 78 | mg/kg OC | 0.25 | 0.1 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 0.18 | | mg/kg dw | 2.11 | 8.5 | 31 | 78 | mg/kg OC | 0.27 | 0.11 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.24 | | mg/kg dw | 2.12 | 11 | 31 | 78 | mg/kg OC | 0.35 | 0.14 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 0.14 | | mg/kg dw | 1.31 | 11 | 31 | 78 | mg/kg OC | 0.35 | 0.14 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 240 | | ug/kg dw | 5.88 | | 670 | 720 | ug/kg dw | 0.36 | 0.33 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(g,h,i)perylene | 0.27 | | mg/kg dw | 2.31 | 12 | 31 | 78 | mg/kg OC | 0.39 | 0.15 |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(g,h,i)perylene | 1 | | mg/kg dw | 1.95 | 51 | 31 | 78 | mg/kg OC | 1.6 | 0.65 |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.45 | | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.49 | | mg/kg dw | 2.31 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.41 | | mg/kg dw | 2.12 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.37 | | mg/kg dw | 5.88 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.21 | | mg/kg dw | 1.89 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.036 | J | mg/kg dw | 0.5 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.074 | | mg/kg dw | 1.58 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.057 | | mg/kg dw | 2.44 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.76 | | mg/kg dw | 1.98 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.089 | | mg/kg dw | 1.05 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.52 | | mg/kg dw | 2.72 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.38 | | mg/kg dw | 2.25 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.28 | | mg/kg dw | 1.55 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.44 | | mg/kg dw | 2.32 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.53 | | mg/kg dw | 1.31 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.17 | | mg/kg dw | 1.77 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 0.61 | | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzo(k)fluoranthene | 0.6 | | mg/kg dw | 2.11 | | | | | | |
| EPA SI | DR056 | 0.2 | 1998 | Benzo(k)fluoranthene | 2.2 | | mg/kg dw | 1.95 | | | | | | |
| EPA SI | DR001 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 0.18 | | mg/kg dw | 1.58 | 11 | 230 | 450 | mg/kg OC | 0.048 | 0.024 |
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 0.077 | J | mg/kg dw | 0.5 | 15 | 230 | 450 | mg/kg OC | 0.065 | 0.033 |
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 0.38 | | mg/kg dw | 2.44 | 16 | 230 | 450 | mg/kg OC | 0.07 | 0.036 |
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 0.21 | | mg/kg dw | 1.05 | 20 | 230 | 450 | mg/kg OC | 0.087 | 0.044 |
| EPA SI | DR001 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 0.44 | | mg/kg dw | 1.89 | 23 | 230 | 450 | mg/kg OC | 0.1 | 0.051 |
| EPA SI | DR055 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 0.51 | | mg/kg dw | 1.77 | 29 | 230 | 450 | mg/kg OC | 0.13 | 0.064 |
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 0.9 | | mg/kg dw | 2.72 | 33 | 230 | 450 | mg/kg OC | 0.14 | 0.073 |
| EPA SI | DR001 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 1.03 | | mg/kg dw | 3.01 | 34.2 | 230 | 450 | mg/kg OC | 0.15 | 0.076 |
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 0.98 | | mg/kg dw | 2.31 | 42 | 230 | 450 | mg/kg OC | 0.18 | 0.093 |
| EPA SI | DR001 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 0.95 | | mg/kg dw | 2.12 | 45 | 230 | 450 | mg/kg OC | 0.2 | 0.1 |
| EPA SI | DR001 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 1.08 | | mg/kg dw | 2.25 | 48 | 230 | 450 | mg/kg OC | 0.21 | 0.11 |
| EPA SI | DR055 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 1.45 | | mg/kg dw | 3.01 | 48.2 | 230 | 450 | mg/kg OC | 0.21 | 0.11 |

Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 0.8 | | mg/kg dw | 1.55 | 52 | 230 | 450 | mg/kg OC | 0.23 | 0.12 |
| EPA SI | DR001 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 1.26 | | mg/kg dw | 2.32 | 54.3 | 230 | 450 | mg/kg OC | 0.24 | 0.12 |
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 880 | | ug/kg dw | 5.88 | | 3200 | 3600 | ug/kg dw | 0.28 | 0.24 |
| EPA SI | DR055 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 2 | | mg/kg dw | 2.11 | 95 | 230 | 450 | mg/kg OC | 0.41 | 0.21 |
| EPA SI | DR056 | 0.2 | 1998 | Benzofluoranthenes (total-calc'd) | 1.31 | | mg/kg dw | 1.31 | 100 | 230 | 450 | mg/kg OC | 0.43 | 0.22 |
| EPA SI | DR001 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 2.1 | | mg/kg dw | 1.98 | 110 | 230 | 450 | mg/kg OC | 0.48 | 0.24 |
| EPA SI | DR055 | 0.1 | 1998 | Benzofluoranthenes (total-calc'd) | 6.8 | | mg/kg dw | 1.95 | 350 | 230 | 450 | mg/kg OC | 1.5 | 0.78 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.18 | | mg/kg dw | 2.44 | 7.4 | 110 | 460 | mg/kg OC | 0.067 | 0.016 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.13 | | mg/kg dw | 1.58 | 8.2 | 110 | 460 | mg/kg OC | 0.075 | 0.018 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.09 | | mg/kg dw | 1.05 | 8.6 | 110 | 460 | mg/kg OC | 0.078 | 0.019 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.21 | | mg/kg dw | 1.77 | 12 | 110 | 460 | mg/kg OC | 0.11 | 0.026 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.064 | J | mg/kg dw | 0.5 | 13 | 110 | 460 | mg/kg OC | 0.12 | 0.028 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.28 | | mg/kg dw | 1.89 | 15 | 110 | 460 | mg/kg OC | 0.14 | 0.033 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.55 | | mg/kg dw | 2.72 | 20 | 110 | 460 | mg/kg OC | 0.18 | 0.043 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.73 | | mg/kg dw | 3.01 | 24 | 110 | 460 | mg/kg OC | 0.22 | 0.052 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.56 | | mg/kg dw | 2.12 | 26 | 110 | 460 | mg/kg OC | 0.24 | 0.057 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.62 | | mg/kg dw | 2.25 | 28 | 110 | 460 | mg/kg OC | 0.25 | 0.061 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.66 | | mg/kg dw | 2.31 | 29 | 110 | 460 | mg/kg OC | 0.26 | 0.063 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.52 | | mg/kg dw | 1.55 | 34 | 110 | 460 | mg/kg OC | 0.31 | 0.074 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 1.1 | | mg/kg dw | 3.01 | 37 | 110 | 460 | mg/kg OC | 0.34 | 0.08 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.89 | | mg/kg dw | 2.32 | 38 | 110 | 460 | mg/kg OC | 0.35 | 0.083 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 590 | | ug/kg dw | 5.88 | | 1400 | 2800 | ug/kg dw | 0.42 | 0.21 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 730 | J | ug/kg dw | | | 1400 | 2800 | ug/kg dw | 0.52 | 0.26 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 0.86 | | mg/kg dw | 1.31 | 66 | 110 | 460 | mg/kg OC | 0.6 | 0.14 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 1.6 | | mg/kg dw | 1.98 | 81 | 110 | 460 | mg/kg OC | 0.74 | 0.18 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 1.7 | | mg/kg dw | 2.11 | 81 | 110 | 460 | mg/kg OC | 0.74 | 0.18 |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Chrysene | 3.6 | | mg/kg dw | 1.95 | 180 | 110 | 460 | mg/kg OC | 1.6 | 0.39 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.0045 | J | mg/kg dw | 0.5 | 0.9 | 12 | 33 | mg/kg OC | 0.075 | 0.027 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.033 | | mg/kg dw | 1.77 | 1.9 | 12 | 33 | mg/kg OC | 0.16 | 0.058 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.06 | | mg/kg dw | 3.01 | 2 | 12 | 33 | mg/kg OC | 0.17 | 0.061 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.04 | | mg/kg dw | 1.89 | 2.1 | 12 | 33 | mg/kg OC | 0.18 | 0.064 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.045 | J | mg/kg dw | 1.98 | 2.3 | 12 | 33 | mg/kg OC | 0.19 | 0.07 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.06 | J | mg/kg dw | 2.32 | 2.6 | 12 | 33 | mg/kg OC | 0.22 | 0.079 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.077 | | mg/kg dw | 3.01 | 2.6 | 12 | 33 | mg/kg OC | 0.22 | 0.079 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.06 | | mg/kg dw | 2.12 | 2.8 | 12 | 33 | mg/kg OC | 0.23 | 0.085 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.073 | | mg/kg dw | 2.72 | 2.7 | 12 | 33 | mg/kg OC | 0.23 | 0.082 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.05 | | mg/kg dw | 1.55 | 3.2 | 12 | 33 | mg/kg OC | 0.27 | 0.097 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.08 | | mg/kg dw | 2.31 | 3.5 | 12 | 33 | mg/kg OC | 0.29 | 0.11 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 70 | | ug/kg dw | 5.88 | | 230 | 540 | ug/kg dw | 0.3 | 0.13 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzo(a,h)anthracene | 0.081 | J | mg/kg dw | 2.11 | 3.8 | 12 | 33 | mg/kg OC | 0.32 | 0.12 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.1 | | mg/kg dw | 1.31 | 7.6 | 12 | 33 | mg/kg OC | 0.63 | 0.23 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzo(a,h)anthracene | 0.34 | | mg/kg dw | 1.95 | 17 | 12 | 33 | mg/kg OC | 1.4 | 0.52 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzofuran | 0.02 | | mg/kg dw | 2.31 | 0.87 | 15 | 58 | mg/kg OC | 0.058 | 0.015 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzofuran | 0.03 | | mg/kg dw | 3.01 | 1 | 15 | 58 | mg/kg OC | 0.067 | 0.017 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzofuran | 0.007 | J | mg/kg dw | 0.5 | 1.4 | 15 | 58 | mg/kg OC | 0.093 | 0.024 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzofuran | 0.024 | | mg/kg dw | 1.05 | 2.3 | 15 | 58 | mg/kg OC | 0.15 | 0.04 |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | Dibenzofuran | 0.17 | | mg/kg dw | 3.01 | 5.6 | 15 | 58 | mg/kg OC | 0.37 | 0.097 |

Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound1 | LDW-SS4 | 0.1 | 2005 | Dibenzofuran | 0.12 | | mg/kg dw | 2.11 | 5.7 | 15 | 58 | mg/kg OC | 0.38 | 0.098 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.12 | | mg/kg dw | 1.58 | 7.6 | 160 | 1200 | mg/kg OC | 0.048 | 0.0063 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.13 | | mg/kg dw | 1.05 | 12 | 160 | 1200 | mg/kg OC | 0.075 | 0.01 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.32 | | mg/kg dw | 2.44 | 13 | 160 | 1200 | mg/kg OC | 0.081 | 0.011 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.24 | | mg/kg dw | 1.77 | 14 | 160 | 1200 | mg/kg OC | 0.088 | 0.012 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.36 | | mg/kg dw | 1.89 | 19 | 160 | 1200 | mg/kg OC | 0.12 | 0.016 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.46 | | mg/kg dw | 2.12 | 22 | 160 | 1200 | mg/kg OC | 0.14 | 0.018 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.6 | | mg/kg dw | 2.72 | 22 | 160 | 1200 | mg/kg OC | 0.14 | 0.018 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.35 | | mg/kg dw | 1.55 | 23 | 160 | 1200 | mg/kg OC | 0.14 | 0.019 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.62 | | mg/kg dw | 2.25 | 28 | 160 | 1200 | mg/kg OC | 0.18 | 0.023 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.15 | J | mg/kg dw | 0.5 | 30 | 160 | 1200 | mg/kg OC | 0.19 | 0.025 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluoranthene | 0.62 | | mg/kg dw | 1.95 | 32 | 160 | 1200 | mg/kg OC | 0.2 | 0.027 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 1.2 | | mg/kg dw | 3.01 | 40 | 160 | 1200 | mg/kg OC | 0.25 | 0.033 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 0.99 | | mg/kg dw | 2.31 | 43 | 160 | 1200 | mg/kg OC | 0.27 | 0.036 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 750 | | ug/kg dw | 5.88 | | 1700 | 2500 | ug/kg dw | 0.44 | 0.3 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluoranthene | 2.4 | | mg/kg dw | 3.01 | 80 | 160 | 1200 | mg/kg OC | 0.5 | 0.067 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 1.1 | | mg/kg dw | 1.31 | 84 | 160 | 1200 | mg/kg OC | 0.53 | 0.07 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 2.6 | | mg/kg dw | 2.32 | 110 | 160 | 1200 | mg/kg OC | 0.69 | 0.092 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluoranthene | 2.5 | | mg/kg dw | 2.11 | 120 | 160 | 1200 | mg/kg OC | 0.75 | 0.1 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 1500 | J | ug/kg dw | | | 1700 | 2500 | ug/kg dw | 0.88 | 0.6 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Fluoranthene | 4.5 | | mg/kg dw | 1.98 | 230 | 160 | 1200 | mg/kg OC | 1.4 | 0.19 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.03 | J | mg/kg dw | 2.72 | 1.1 | 23 | 79 | mg/kg OC | 0.048 | 0.014 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 30 | | ug/kg dw | 5.88 | | 540 | 1000 | ug/kg dw | 0.056 | 0.03 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.04 | | mg/kg dw | 3.01 | 1.3 | 23 | 79 | mg/kg OC | 0.057 | 0.016 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.03 | | mg/kg dw | 2.12 | 1.4 | 23 | 79 | mg/kg OC | 0.061 | 0.018 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.0072 | J | mg/kg dw | 0.5 | 1.4 | 23 | 79 | mg/kg OC | 0.061 | 0.018 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.04 | | mg/kg dw | 2.31 | 1.7 | 23 | 79 | mg/kg OC | 0.074 | 0.022 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.047 | J | mg/kg dw | 2.32 | 2 | 23 | 79 | mg/kg OC | 0.087 | 0.025 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.039 | J | mg/kg dw | 1.95 | 2 | 23 | 79 | mg/kg OC | 0.087 | 0.025 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.027 | | mg/kg dw | 1.05 | 2.6 | 23 | 79 | mg/kg OC | 0.11 | 0.033 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.14 | | mg/kg dw | 1.98 | 7.1 | 23 | 79 | mg/kg OC | 0.31 | 0.09 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.22 | | mg/kg dw | 3.01 | 7.3 | 23 | 79 | mg/kg OC | 0.32 | 0.092 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Fluorene | 0.21 | | mg/kg dw | 2.11 | 10 | 23 | 79 | mg/kg OC | 0.43 | 0.13 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.05 | | mg/kg dw | 1.58 | 3.2 | 34 | 88 | mg/kg OC | 0.094 | 0.036 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.074 | | mg/kg dw | 1.77 | 4.2 | 34 | 88 | mg/kg OC | 0.12 | 0.048 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.12 | | mg/kg dw | 2.44 | 4.9 | 34 | 88 | mg/kg OC | 0.14 | 0.056 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.027 | | mg/kg dw | 0.5 | 5.4 | 34 | 88 | mg/kg OC | 0.16 | 0.061 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.059 | | mg/kg dw | 1.05 | 5.6 | 34 | 88 | mg/kg OC | 0.16 | 0.064 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.12 | | mg/kg dw | 2.25 | 5.3 | 34 | 88 | mg/kg OC | 0.16 | 0.06 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.2 | | mg/kg dw | 3.01 | 6.6 | 34 | 88 | mg/kg OC | 0.19 | 0.075 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.22 | | mg/kg dw | 3.01 | 7.3 | 34 | 88 | mg/kg OC | 0.21 | 0.083 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.14 | | mg/kg dw | 1.89 | 7.4 | 34 | 88 | mg/kg OC | 0.22 | 0.084 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.12 | | mg/kg dw | 1.55 | 7.7 | 34 | 88 | mg/kg OC | 0.23 | 0.088 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.22 | | mg/kg dw | 2.72 | 8.1 | 34 | 88 | mg/kg OC | 0.24 | 0.092 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.19 | | mg/kg dw | 2.32 | 8.2 | 34 | 88 | mg/kg OC | 0.24 | 0.093 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.21 | | mg/kg dw | 2.11 | 10 | 34 | 88 | mg/kg OC | 0.29 | 0.11 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.24 | | mg/kg dw | 2.12 | 11 | 34 | 88 | mg/kg OC | 0.32 | 0.13 |

Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.22 | | mg/kg dw | 1.98 | 11 | 34 | 88 | mg/kg OC | 0.32 | 0.13 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.14 | | mg/kg dw | 1.31 | 11 | 34 | 88 | mg/kg OC | 0.32 | 0.13 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 200 | J | ug/kg dw | | | 600 | 690 | ug/kg dw | 0.33 | 0.29 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 0.27 | | mg/kg dw | 2.31 | 12 | 34 | 88 | mg/kg OC | 0.35 | 0.14 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 240 | | ug/kg dw | 5.88 | | 600 | 690 | ug/kg dw | 0.4 | 0.35 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Indeno(1,2,3-cd)pyrene | 1.1 | | mg/kg dw | 1.95 | 56 | 34 | 88 | mg/kg OC | 1.6 | 0.64 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Naphthalene | 0.03 | | mg/kg dw | 3.01 | 1 | 99 | 170 | mg/kg OC | 0.01 | 0.0059 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Naphthalene | 0.0075 | | mg/kg dw | 0.5 | 1.5 | 99 | 170 | mg/kg OC | 0.015 | 0.0088 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Naphthalene | 0.037 | | mg/kg dw | 1.05 | 3.5 | 99 | 170 | mg/kg OC | 0.035 | 0.021 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Naphthalene | 0.12 | | mg/kg dw | 3.01 | 4 | 99 | 170 | mg/kg OC | 0.04 | 0.024 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Naphthalene | 0.09 | | mg/kg dw | 2.11 | 4.3 | 99 | 170 | mg/kg OC | 0.043 | 0.025 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Perylene | 0.016 | J | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.05 | | mg/kg dw | 1.58 | 3.2 | 100 | 480 | mg/kg OC | 0.032 | 0.0067 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.077 | | mg/kg dw | 2.44 | 3.2 | 100 | 480 | mg/kg OC | 0.032 | 0.0067 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenanthrene | 0.11 | | mg/kg dw | 1.77 | 6.2 | 100 | 480 | mg/kg OC | 0.062 | 0.013 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.12 | | mg/kg dw | 1.89 | 6.3 | 100 | 480 | mg/kg OC | 0.063 | 0.013 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.039 | J | mg/kg dw | 0.5 | 7.8 | 100 | 480 | mg/kg OC | 0.078 | 0.016 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.087 | | mg/kg dw | 1.05 | 8.3 | 100 | 480 | mg/kg OC | 0.083 | 0.017 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.13 | | mg/kg dw | 1.55 | 8.4 | 100 | 480 | mg/kg OC | 0.084 | 0.018 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.25 | | mg/kg dw | 2.72 | 9.2 | 100 | 480 | mg/kg OC | 0.092 | 0.019 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.25 | | mg/kg dw | 2.25 | 11 | 100 | 480 | mg/kg OC | 0.11 | 0.023 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.37 | | mg/kg dw | 3.01 | 12 | 100 | 480 | mg/kg OC | 0.12 | 0.025 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.25 | | mg/kg dw | 2.12 | 12 | 100 | 480 | mg/kg OC | 0.12 | 0.025 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.29 | | mg/kg dw | 2.31 | 13 | 100 | 480 | mg/kg OC | 0.13 | 0.027 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenanthrene | 0.27 | | mg/kg dw | 1.95 | 14 | 100 | 480 | mg/kg OC | 0.14 | 0.029 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 230 | | ug/kg dw | 5.88 | | 1500 | 5400 | ug/kg dw | 0.15 | 0.043 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenanthrene | 0.19 | | mg/kg dw | 1.31 | 15 | 100 | 480 | mg/kg OC | 0.15 | 0.031 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 0.76 | | mg/kg dw | 2.32 | 33 | 100 | 480 | mg/kg OC | 0.33 | 0.069 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenanthrene | 1 | | mg/kg dw | 3.01 | 33 | 100 | 480 | mg/kg OC | 0.33 | 0.069 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 510 | J | ug/kg dw | | | 1500 | 5400 | ug/kg dw | 0.34 | 0.094 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Phenanthrene | 1.2 | | mg/kg dw | 2.11 | 57 | 100 | 480 | mg/kg OC | 0.57 | 0.12 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | Phenanthrene | 1.8 | | mg/kg dw | 1.98 | 91 | 100 | 480 | mg/kg OC | 0.91 | 0.19 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.14 | | mg/kg dw | 1.58 | 8.9 | 1000 | 1400 | mg/kg OC | 0.0089 | 0.0064 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.23 | | mg/kg dw | 2.44 | 9.4 | 1000 | 1400 | mg/kg OC | 0.0094 | 0.0067 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.32 | | mg/kg dw | 1.89 | 17 | 1000 | 1400 | mg/kg OC | 0.017 | 0.012 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.32 | | mg/kg dw | 1.77 | 18 | 1000 | 1400 | mg/kg OC | 0.018 | 0.013 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.53 | | mg/kg dw | 2.72 | 19 | 1000 | 1400 | mg/kg OC | 0.019 | 0.014 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.52 | | mg/kg dw | 2.25 | 23 | 1000 | 1400 | mg/kg OC | 0.023 | 0.016 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.15 | J | mg/kg dw | 0.5 | 30 | 1000 | 1400 | mg/kg OC | 0.03 | 0.021 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.76 | | mg/kg dw | 2.31 | 33 | 1000 | 1400 | mg/kg OC | 0.033 | 0.024 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.76 | | mg/kg dw | 2.12 | 36 | 1000 | 1400 | mg/kg OC | 0.036 | 0.026 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 1.1 | | mg/kg dw | 3.01 | 37 | 1000 | 1400 | mg/kg OC | 0.037 | 0.026 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.59 | | mg/kg dw | 1.55 | 38 | 1000 | 1400 | mg/kg OC | 0.038 | 0.027 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 1.2 | | mg/kg dw | 3.01 | 40 | 1000 | 1400 | mg/kg OC | 0.04 | 0.029 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.56 | | mg/kg dw | 1.05 | 53 | 1000 | 1400 | mg/kg OC | 0.053 | 0.038 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 0.69 | | mg/kg dw | 1.31 | 53 | 1000 | 1400 | mg/kg OC | 0.053 | 0.038 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 1.4 | | mg/kg dw | 2.32 | 60 | 1000 | 1400 | mg/kg OC | 0.06 | 0.043 |

Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 1.4 | | mg/kg dw | 2.11 | 66 | 1000 | 1400 | mg/kg OC | 0.066 | 0.047 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 2.8 | | mg/kg dw | 1.98 | 140 | 1000 | 1400 | mg/kg OC | 0.14 | 0.1 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 3.1 | | mg/kg dw | 1.95 | 160 | 1000 | 1400 | mg/kg OC | 0.16 | 0.11 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 730 | | ug/kg dw | 5.88 | | 2600 | 3300 | ug/kg dw | 0.28 | 0.22 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS302 | 0 | 2006 | Pyrene | 900 | J | ug/kg dw | | | 2600 | 3300 | ug/kg dw | 0.35 | 0.27 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 0.83 | | mg/kg dw | 1.58 | 53 | 960 | 5300 | mg/kg OC | 0.055 | 0.01 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 1.65 | | mg/kg dw | 2.44 | 67.6 | 960 | 5300 | mg/kg OC | 0.07 | 0.013 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 1.77 | | mg/kg dw | 1.77 | 100 | 960 | 5300 | mg/kg OC | 0.1 | 0.019 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 0.57 | J | mg/kg dw | 0.5 | 110 | 960 | 5300 | mg/kg OC | 0.11 | 0.021 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 2.11 | | mg/kg dw | 1.89 | 112 | 960 | 5300 | mg/kg OC | 0.12 | 0.021 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 1.22 | | mg/kg dw | 1.05 | 116 | 960 | 5300 | mg/kg OC | 0.12 | 0.022 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 3.76 | | mg/kg dw | 2.72 | 138 | 960 | 5300 | mg/kg OC | 0.14 | 0.026 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 3.77 | | mg/kg dw | 2.25 | 168 | 960 | 5300 | mg/kg OC | 0.18 | 0.032 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 5.4 | | mg/kg dw | 3.01 | 180 | 960 | 5300 | mg/kg OC | 0.19 | 0.034 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 4.05 | | mg/kg dw | 2.12 | 191 | 960 | 5300 | mg/kg OC | 0.2 | 0.036 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 3.17 | | mg/kg dw | 1.55 | 205 | 960 | 5300 | mg/kg OC | 0.21 | 0.039 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 4.92 | | mg/kg dw | 2.31 | 213 | 960 | 5300 | mg/kg OC | 0.22 | 0.04 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 7.9 | | mg/kg dw | 3.01 | 260 | 960 | 5300 | mg/kg OC | 0.27 | 0.049 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 7.3 | J | mg/kg dw | 2.32 | 310 | 960 | 5300 | mg/kg OC | 0.32 | 0.058 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 4100 | J | ug/kg dw | | | 12000 | 17000 | ug/kg dw | 0.34 | 0.24 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 4280 | | ug/kg dw | 5.88 | | 12000 | 17000 | ug/kg dw | 0.36 | 0.25 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 5.1 | | mg/kg dw | 1.31 | 390 | 960 | 5300 | mg/kg OC | 0.41 | 0.074 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 9.5 | J | mg/kg dw | 2.11 | 450 | 960 | 5300 | mg/kg OC | 0.47 | 0.085 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS305 | 0.1 | 2006 | Total HPAH (calc'd) | 12.3 | J | mg/kg dw | 1.98 | 621 | 960 | 5300 | mg/kg OC | 0.65 | 0.12 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total HPAH (calc'd) | 21.4 | | mg/kg dw | 1.95 | 1100 | 960 | 5300 | mg/kg OC | 1.1 | 0.21 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.098 | | mg/kg dw | 2.44 | 4 | 370 | 780 | mg/kg OC | 0.011 | 0.0051 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.071 | | mg/kg dw | 1.58 | 4.5 | 370 | 780 | mg/kg OC | 0.012 | 0.0058 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.17 | | mg/kg dw | 1.89 | 9 | 370 | 780 | mg/kg OC | 0.024 | 0.012 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.16 | J | mg/kg dw | 1.77 | 9 | 370 | 780 | mg/kg OC | 0.024 | 0.012 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.2 | | mg/kg dw | 1.55 | 13 | 370 | 780 | mg/kg OC | 0.035 | 0.017 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.43 | J | mg/kg dw | 2.72 | 16 | 370 | 780 | mg/kg OC | 0.043 | 0.021 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.083 | J | mg/kg dw | 0.5 | 17 | 370 | 780 | mg/kg OC | 0.046 | 0.022 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.18 | | mg/kg dw | 1.05 | 17.1 | 370 | 780 | mg/kg OC | 0.046 | 0.022 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.59 | | mg/kg dw | 3.01 | 20 | 370 | 780 | mg/kg OC | 0.054 | 0.026 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.46 | | mg/kg dw | 2.31 | 20 | 370 | 780 | mg/kg OC | 0.054 | 0.026 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.42 | | mg/kg dw | 2.12 | 20 | 370 | 780 | mg/kg OC | 0.054 | 0.026 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.44 | | mg/kg dw | 2.25 | 20 | 370 | 780 | mg/kg OC | 0.054 | 0.026 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.32 | | mg/kg dw | 1.31 | 24 | 370 | 780 | mg/kg OC | 0.065 | 0.031 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 370 | | ug/kg dw | 5.88 | | 5200 | 13000 | ug/kg dw | 0.071 | 0.028 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.68 | J | mg/kg dw | 1.95 | 35 | 370 | 780 | mg/kg OC | 0.095 | 0.045 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 510 | J | ug/kg dw | | | 5200 | 13000 | ug/kg dw | 0.098 | 0.039 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 0.94 | J | mg/kg dw | 2.32 | 41 | 370 | 780 | mg/kg OC | 0.11 | 0.053 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 2 | J | mg/kg dw | 3.01 | 66 | 370 | 780 | mg/kg OC | 0.18 | 0.085 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 1.9 | J | mg/kg dw | 2.11 | 90 | 370 | 780 | mg/kg OC | 0.24 | 0.12 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total LPAH (calc'd) | 2.3 | | mg/kg dw | 1.98 | 120 | 370 | 780 | mg/kg OC | 0.32 | 0.15 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 4.6 | J | mg/kg dw | | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 6 | | mg/kg dw | 3.01 | | | | | | |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 5.38 | | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 4.47 | | mg/kg dw | 2.12 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 4.65 | | mg/kg dw | 5.88 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 2.28 | | mg/kg dw | 1.89 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 0.66 | J | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 0.9 | | mg/kg dw | 1.58 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 1.75 | | mg/kg dw | 2.44 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS307 | 0.2 | 2006 | Total PAH (calc'd) | 14.6 | J | mg/kg dw | 1.98 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 1.4 | | mg/kg dw | 1.05 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 4.19 | J | mg/kg dw | 2.72 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 4.21 | | mg/kg dw | 2.25 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 3.37 | | mg/kg dw | 1.55 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 8.2 | J | mg/kg dw | 2.32 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 5.4 | | mg/kg dw | 1.31 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 1.93 | J | mg/kg dw | 1.77 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 9.9 | J | mg/kg dw | 3.01 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 11.5 | J | mg/kg dw | 2.11 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS303 | 0.1 | 2006 | Total PAH (calc'd) | 22 | J | mg/kg dw | 1.95 | | | | | | |
| **Pesticides** | | | | | | | | | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 2,4'-DDT | 0.0018 | JN | mg/kg dw | 0.5 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 4,4'-DDD | 0.00029 | JN | mg/kg dw | 0.5 | | | | | | |
| Harbor Island RI | K-10 | 0.1 | 1991 | 4,4'-DDT | 0.0016 | JN | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound1 | LDW-SS1 | 0 | 2005 | DDTs (total-calc'd) | 0.0037 | JN | ug/kg dw | 0.5 | | | | ug/kg dw | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Endrin ketone | 0.00083 | JN | mg/kg dw | 0.5 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Heptachlor | 0.0018 | JN | ug/kg dw | 1.37 | | | | ug/kg dw | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS7 | 0.1 | 2005 | Heptachlor epoxide | 0.00047 | JN | mg/kg dw | 0.5 | | | | | | |
| **Phthalates** | | | | | | | | | | | | | | |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.028 | J | mg/kg dw | 0.5 | 5.6 | 47 | 78 | mg/kg OC | 0.12 | 0.072 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.18 | | mg/kg dw | 1.95 | 9.2 | 47 | 78 | mg/kg OC | 0.2 | 0.12 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.19 | | mg/kg dw | 1.55 | 12 | 47 | 78 | mg/kg OC | 0.26 | 0.15 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.3 | | mg/kg dw | 1.98 | 15 | 47 | 78 | mg/kg OC | 0.32 | 0.19 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.44 | | mg/kg dw | 3.01 | 15 | 47 | 78 | mg/kg OC | 0.32 | 0.19 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.65 | | mg/kg dw | 3.01 | 22 | 47 | 78 | mg/kg OC | 0.47 | 0.28 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.41 | | mg/kg dw | 1.89 | 22 | 47 | 78 | mg/kg OC | 0.47 | 0.28 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.31 | | mg/kg dw | 1.31 | 24 | 47 | 78 | mg/kg OC | 0.51 | 0.31 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.59 | | mg/kg dw | 2.25 | 26 | 47 | 78 | mg/kg OC | 0.55 | 0.33 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.46 | | mg/kg dw | 1.77 | 26 | 47 | 78 | mg/kg OC | 0.55 | 0.33 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.59 | | mg/kg dw | 2.11 | 28 | 47 | 78 | mg/kg OC | 0.6 | 0.36 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 790 | | ug/kg dw | 5.88 | | 1300 | 1900 | ug/kg dw | 0.61 | 0.42 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 850 | J | ug/kg dw | | | 1300 | 1900 | ug/kg dw | 0.65 | 0.45 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.8 | | mg/kg dw | 2.32 | 34 | 47 | 78 | mg/kg OC | 0.72 | 0.44 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.88 | | mg/kg dw | 2.31 | 38 | 47 | 78 | mg/kg OC | 0.81 | 0.49 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.97 | | mg/kg dw | 2.12 | 46 | 47 | 78 | mg/kg OC | 0.98 | 0.59 |
| EPA SI | DR055 | 0.1 | 1998 | Bis(2-ethylhexyl)phthalate | 0.85 | | mg/kg dw | 1.05 | 81 | 47 | 78 | mg/kg OC | 1.7 | 1 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.011 | | mg/kg dw | 1.55 | 0.71 | 4.9 | 64 | mg/kg OC | 0.14 | 0.011 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.014 | | mg/kg dw | 1.95 | 0.72 | 4.9 | 64 | mg/kg OC | 0.15 | 0.011 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.032 | | mg/kg dw | 3.01 | 1.1 | 4.9 | 64 | mg/kg OC | 0.22 | 0.017 |

Appendix 1.  Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.03 | J | mg/kg dw | 2.11 | 1.4 | 4.9 | 64 | mg/kg OC | 0.29 | 0.022 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.035 | J | mg/kg dw | 2.32 | 1.5 | 4.9 | 64 | mg/kg OC | 0.31 | 0.023 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.02 | | mg/kg dw | 1.31 | 1.5 | 4.9 | 64 | mg/kg OC | 0.31 | 0.023 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.03 | | mg/kg dw | 1.89 | 1.6 | 4.9 | 64 | mg/kg OC | 0.33 | 0.025 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.05 | | mg/kg dw | 3.01 | 1.7 | 4.9 | 64 | mg/kg OC | 0.35 | 0.027 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.03 | | mg/kg dw | 1.77 | 1.7 | 4.9 | 64 | mg/kg OC | 0.35 | 0.027 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.06 | | mg/kg dw | 2.72 | 2.2 | 4.9 | 64 | mg/kg OC | 0.45 | 0.034 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.07 | | mg/kg dw | 2.31 | 3 | 4.9 | 64 | mg/kg OC | 0.61 | 0.047 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 0.08 | | mg/kg dw | 2.12 | 3.8 | 4.9 | 64 | mg/kg OC | 0.78 | 0.059 |
| EPA SI | DR055 | 0.1 | 1998 | Butyl benzyl phthalate | 50 | | ug/kg dw | 5.88 | | 63 | 900 | ug/kg dw | 0.79 | 0.056 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dimethyl phthalate | 0.0074 | J | mg/kg dw | 2.32 | 0.32 | 53 | 53 | mg/kg OC | 0.006 | 0.006 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dimethyl phthalate | 0.0061 | | mg/kg dw | 1.31 | 0.47 | 53 | 53 | mg/kg OC | 0.0089 | 0.0089 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Dimethyl phthalate | 0.0086 | | mg/kg dw | 1.77 | 0.49 | 53 | 53 | mg/kg OC | 0.0092 | 0.0092 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Di-n-butyl phthalate | 0.02 | | mg/kg dw | 2.31 | 0.87 | 220 | 1700 | mg/kg OC | 0.004 | 0.00051 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Di-n-butyl phthalate | 0.0048 | J | mg/kg dw | 0.5 | 0.96 | 220 | 1700 | mg/kg OC | 0.0044 | 0.00056 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Di-n-butyl phthalate | 0.032 | J | mg/kg dw | 1.95 | 1.6 | 220 | 1700 | mg/kg OC | 0.0073 | 0.00094 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Di-n-butyl phthalate | 0.021 | | mg/kg dw | 1.05 | 2 | 220 | 1700 | mg/kg OC | 0.0091 | 0.0012 |
| LDWRI-SurfaceSedimentRound2 | LDW-SS8 | 0.1 | 2005 | Di-n-butyl phthalate | 20 | | ug/kg dw | 5.88 | | 1400 | 5100 | ug/kg dw | 0.014 | 0.0039 |
| **PCBs** | | | | | | | | | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1242 | 0.0088 | J | mg/kg dw | 0.5 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1242 | 0.034 | | mg/kg dw | 1.98 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1248 | 0.032 | | mg/kg dw | 1.37 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1248 | 0.032 | J | mg/kg dw | 1.58 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1248 | 0.041 | J | mg/kg dw | 2.44 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1248 | 0.74 | | mg/kg dw | 1.05 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1248 | 0.062 | | mg/kg dw | 2.72 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1248 | 0.061 | | mg/kg dw | 2.25 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1248 | 0.032 | | mg/kg dw | 1.55 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1248 | 0.079 | | mg/kg dw | 2.32 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1248 | 0.028 | | mg/kg dw | 1.31 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1248 | 0.095 | J | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1248 | 0.043 | J | mg/kg dw | 2.11 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.037 | J | mg/kg dw | 1.37 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.046 | | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.085 | | mg/kg dw | 2.31 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.149 | | mg/kg dw | 2.12 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.094 | | mg/kg dw | 5.88 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.031 | | mg/kg dw | 1.89 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.026 | | mg/kg dw | 0.5 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.079 | | mg/kg dw | 1.58 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.062 | J | mg/kg dw | 2.44 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.084 | | mg/kg dw | 1.98 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.91 | | mg/kg dw | 1.05 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.092 | | mg/kg dw | 2.72 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.1 | | mg/kg dw | 2.25 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.038 | | mg/kg dw | 1.55 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.14 | | mg/kg dw | 2.32 | | | | | | |

Appendix 1. Sampling Results for Surface Sediment: Ash Grove

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.047 | | mg/kg dw | 1.31 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.055 | | mg/kg dw | 1.77 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1254 | 0.25 | J | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.089 | | mg/kg dw | 2.11 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1254 | 0.049 | | mg/kg dw | 1.95 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.018 | | mg/kg dw | 1.37 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.053 | | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.101 | J | mg/kg dw | 2.31 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.118 | J | mg/kg dw | 2.12 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.12 | | mg/kg dw | 5.88 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.029 | | mg/kg dw | 1.89 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.026 | J | mg/kg dw | 0.5 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.05 | | mg/kg dw | 1.58 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.05 | J | mg/kg dw | 2.44 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.12 | | mg/kg dw | 1.98 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.27 | | mg/kg dw | 1.05 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.086 | | mg/kg dw | 2.72 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.089 | | mg/kg dw | 2.25 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.038 | | mg/kg dw | 1.55 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.1 | | mg/kg dw | 2.32 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.062 | | mg/kg dw | 1.31 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.082 | | mg/kg dw | 1.77 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.24 | J | mg/kg dw | 3.01 | | | | | | |
| EPA SI | DR002 | 0.2 | 1998 | Aroclor-1260 | 0.099 | | mg/kg dw | 2.11 | | | | | | |
| EPA SI | DR003 | 0.2 | 1998 | Aroclor-1260 | 0.046 | | mg/kg dw | 1.95 | | | | | | |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 10 | J | ug/kg dw | 0.22 | | 130 | 1000 | ug/kg dw | 0.077 | 0.01 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.06 | | mg/kg dw | 1.89 | 3.2 | 12 | 65 | mg/kg OC | 0.27 | 0.049 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.099 | | mg/kg dw | 3.01 | 3.3 | 12 | 65 | mg/kg OC | 0.28 | 0.051 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.095 | | mg/kg dw | 1.95 | 4.9 | 12 | 65 | mg/kg OC | 0.41 | 0.075 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.11 | | mg/kg dw | 1.88 | 5.9 | 12 | 65 | mg/kg OC | 0.49 | 0.091 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.153 | J | mg/kg dw | 2.44 | 6.27 | 12 | 65 | mg/kg OC | 0.52 | 0.096 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.087 | J | mg/kg dw | 1.37 | 6.4 | 12 | 65 | mg/kg OC | 0.53 | 0.098 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.108 | | mg/kg dw | 1.55 | 6.97 | 12 | 65 | mg/kg OC | 0.58 | 0.11 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.13 | | mg/kg dw | 1.76 | 7.4 | 12 | 65 | mg/kg OC | 0.62 | 0.11 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.13 | | mg/kg dw | 1.73 | 7.5 | 12 | 65 | mg/kg OC | 0.63 | 0.12 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.137 | | mg/kg dw | 1.77 | 7.74 | 12 | 65 | mg/kg OC | 0.65 | 0.12 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.186 | J | mg/kg dw | 2.31 | 8.05 | 12 | 65 | mg/kg OC | 0.67 | 0.12 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.24 | | mg/kg dw | 2.72 | 8.82 | 12 | 65 | mg/kg OC | 0.74 | 0.14 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.161 | J | mg/kg dw | 1.58 | 10.2 | 12 | 65 | mg/kg OC | 0.85 | 0.16 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.137 | | mg/kg dw | 1.31 | 10.5 | 12 | 65 | mg/kg OC | 0.88 | 0.16 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.231 | J | mg/kg dw | 2.11 | 10.9 | 12 | 65 | mg/kg OC | 0.91 | 0.17 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.25 | | mg/kg dw | 2.25 | 11 | 12 | 65 | mg/kg OC | 0.92 | 0.17 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.061 | J | mg/kg dw | 0.5 | 12 | 12 | 65 | mg/kg OC | 1 | 0.18 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.24 | | mg/kg dw | 1.98 | 12 | 12 | 65 | mg/kg OC | 1 | 0.18 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.267 | J | mg/kg dw | 2.12 | 12.6 | 12 | 65 | mg/kg OC | 1.1 | 0.19 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.32 | | mg/kg dw | 2.32 | 14 | 12 | 65 | mg/kg OC | 1.2 | 0.22 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 210 | | ug/kg dw | 5.88 | | 130 | 1000 | ug/kg dw | 1.6 | 0.21 |

**Appendix 1. Sampling Results for Surface Sediment: Ash Grove**

| Sampling Event | Sample Location | River Mile | Year | Chemical | Concentration | | Concentration Units | TOC (%DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 0.59 | J | mg/kg dw | 3.01 | 20 | 12 | 65 | mg/kg OC | 1.7 | 0.31 |
| LDWRI-SurfaceSedimentRound3 | LDW-SS301 | 0 | 2006 | PCBs (total calc'd) | 1.92 | | mg/kg dw | 1.05 | 183 | 12 | 65 | mg/kg OC | 15 | 2.8 |
| **Volatiles** | | | | | | | | | | | | | | |
| LDWRI-Benthic | B1b | 0.1 | 2004 | Carbon disulfide | 0.0025 | J | mg/kg dw | 2.31 | | | | | | |
| LDWRI-SurfaceSedimentRound2 | LDW-SS2 | 0 | 2005 | Methyl ethyl ketone | 0.0167 | | mg/kg dw | 2.31 | | | | | | |

Key:
DW- Dry Weight
CSL- Cleanup Screening Level
PAH- Polynuclear Aromatic Hydrocarbon
PCB- Polychlorinated Biphenol
OC- Organic Carbon
TOC- Total Organic Carbon
SQS- Sediment Quality Standard
SVOC- Semivolatile Organic Compound

Notes:
1. SQS and CSL values are substituted with AET values for dry weight comparison where organic compounds are not OC-normalized (when TOC% DW is outside of the 0.5-4.0% range).
2. Exceedance factors are the ratio of the detected concentration to the CSL or the SQS (or to AET values where applicable); exceedance factors are shown only if they are greater than 1.

Source:
Lower Duwamish Waterway Group, 2007. Online Lower Duwamish Waterway Group Draft Remedial Investigation Report (November 2007) Database. http://www.ldwg.org.

**Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove**

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dioxins/Furans** | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Dibenzofuran | 0.02 | | mg/kg dw | 1.54 | 1.3 | 15 | 58 | mg/kg OC | 0.087 | 0.022 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Dibenzofuran | 0.026 | | mg/kg dw | 1.97 | 1.3 | 15 | 58 | mg/kg OC | 0.087 | 0.022 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Dibenzofuran | 0.034 | | mg/kg dw | 1.73 | 2 | 15 | 58 | mg/kg OC | 0.13 | 0.034 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Dibenzofuran | 0.067 | | mg/kg dw | 0.897 | 7.5 | 15 | 58 | mg/kg OC | 0.5 | 0.13 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Dibenzofuran | 58 | | ug/kg dw | 6.29 | | 540 | 700 | ug/kg dw | 0.11 | 0.083 |
| **Metals** | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Antimony | 40 | J | mg/kg dw | 0.897 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Antimony | 30 | J | mg/kg dw | 0.31 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Arsenic | 10 | | mg/kg dw | 1.6 | | 57 | 93 | mg/kg dw | 0.18 | 0.11 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Arsenic | 14 | | mg/kg dw | 1.73 | | 57 | 93 | mg/kg dw | 0.25 | 0.15 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Arsenic | 18 | | mg/kg dw | 1.54 | | 57 | 93 | mg/kg dw | 0.32 | 0.19 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Arsenic | 22 | | mg/kg dw | 2.1 | | 57 | 93 | mg/kg dw | 0.39 | 0.24 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Arsenic | 63 | | mg/kg dw | 1.97 | | 57 | 93 | mg/kg dw | 1.1 | 0.68 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Arsenic | 190 | | mg/kg dw | 0.897 | | 57 | 93 | mg/kg dw | 3.3 | 2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Arsenic | 210 | | mg/kg dw | 6.29 | | 57 | 93 | mg/kg dw | 3.7 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Arsenic | 270 | | mg/kg dw | 0.31 | | 57 | 93 | mg/kg dw | 4.7 | 2.9 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Cadmium | 0.4 | | mg/kg dw | 1.6 | | 5.1 | 6.7 | mg/kg dw | 0.078 | 0.06 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Cadmium | 0.7 | | mg/kg dw | 1.54 | | 5.1 | 6.7 | mg/kg dw | 0.14 | 0.1 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Cadmium | 1 | | mg/kg dw | 1.73 | | 5.1 | 6.7 | mg/kg dw | 0.2 | 0.15 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Cadmium | 2 | | mg/kg dw | 2.1 | | 5.1 | 6.7 | mg/kg dw | 0.39 | 0.3 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Cadmium | 2 | | mg/kg dw | 1.97 | | 5.1 | 6.7 | mg/kg dw | 0.39 | 0.3 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Cadmium | 3.4 | | mg/kg dw | 0.897 | | 5.1 | 6.7 | mg/kg dw | 0.67 | 0.51 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Cadmium | 3.9 | | mg/kg dw | 0.31 | | 5.1 | 6.7 | mg/kg dw | 0.76 | 0.58 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Cadmium | 5 | | mg/kg dw | 6.29 | | 5.1 | 6.7 | mg/kg dw | 0.98 | 0.75 |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 2 to 4 | 2006 | Chromium | 10.4 | | mg/kg dw | 0.669 | | 260 | 270 | mg/kg dw | 0.04 | 0.039 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 11 to 12 | 2006 | Chromium | 10.7 | | mg/kg dw | 0.749 | | 260 | 270 | mg/kg dw | 0.041 | 0.04 |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 0 to 2 | 2006 | Chromium | 12.4 | | mg/kg dw | 2.1 | | 260 | 270 | mg/kg dw | 0.048 | 0.046 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Chromium | 21.1 | | mg/kg dw | 1.6 | | 260 | 270 | mg/kg dw | 0.081 | 0.078 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Chromium | 22 | | mg/kg dw | 0.31 | | 260 | 270 | mg/kg dw | 0.085 | 0.081 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Chromium | 25.9 | | mg/kg dw | 1.73 | | 260 | 270 | mg/kg dw | 0.1 | 0.096 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Chromium | 27.8 | | mg/kg dw | 1.54 | | 260 | 270 | mg/kg dw | 0.11 | 0.1 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Chromium | 40.2 | | mg/kg dw | 1.97 | | 260 | 270 | mg/kg dw | 0.15 | 0.15 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Chromium | 43 | | mg/kg dw | 0.897 | | 260 | 270 | mg/kg dw | 0.17 | 0.16 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Chromium | 52 | | mg/kg dw | 6.29 | | 260 | 270 | mg/kg dw | 0.2 | 0.19 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Chromium | 74.3 | | mg/kg dw | 2.1 | | 260 | 270 | mg/kg dw | 0.29 | 0.28 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Cobalt | 10 | | mg/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Cobalt | 5.3 | | mg/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 11 to 12 | 2006 | Cobalt | 3.6 | | mg/kg dw | 0.749 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Cobalt | 9 | | mg/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 0 to 2 | 2006 | Cobalt | 4.4 | | mg/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 2 to 4 | 2006 | Cobalt | 3.8 | | mg/kg dw | 0.669 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Cobalt | 9 | | mg/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Cobalt | 9 | | mg/kg dw | 0.31 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Cobalt | 7.7 | | mg/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Cobalt | 10.2 | | mg/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Cobalt | 5.6 | | mg/kg dw | 1.73 | | | | | | |

**Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove**

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC2 | 11 to 12 | 2006 | Copper | 10.5 | | mg/kg dw | 0.749 | | 390 | 390 | mg/kg dw | 0.027 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 0 to 2 | 2006 | Copper | 15.1 | | mg/kg dw | 2.1 | | 390 | 390 | mg/kg dw | 0.039 | 0.039 |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 2 to 4 | 2006 | Copper | 15.2 | | mg/kg dw | 0.669 | | 390 | 390 | mg/kg dw | 0.039 | 0.039 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Copper | 25.9 | | mg/kg dw | 1.6 | | 390 | 390 | mg/kg dw | 0.066 | 0.066 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Copper | 37.1 | J | mg/kg dw | 1.73 | | 390 | 390 | mg/kg dw | 0.095 | 0.095 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Copper | 90.2 | J | mg/kg dw | 1.54 | | 390 | 390 | mg/kg dw | 0.23 | 0.23 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Copper | 111 | | mg/kg dw | 2.1 | | 390 | 390 | mg/kg dw | 0.28 | 0.28 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Copper | 126 | J | mg/kg dw | 0.897 | | 390 | 390 | mg/kg dw | 0.32 | 0.32 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Copper | 123 | | mg/kg dw | 0.31 | | 390 | 390 | mg/kg dw | 0.32 | 0.32 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Copper | 134 | J | mg/kg dw | 6.29 | | 390 | 390 | mg/kg dw | 0.34 | 0.34 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Copper | 146 | J | mg/kg dw | 1.97 | | 390 | 390 | mg/kg dw | 0.37 | 0.37 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Lead | 23 | J | mg/kg dw | 1.6 | | 450 | 530 | mg/kg dw | 0.051 | 0.043 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Lead | 92 | | mg/kg dw | 1.54 | | 450 | 530 | mg/kg dw | 0.2 | 0.17 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Lead | 123 | | mg/kg dw | 1.73 | | 450 | 530 | mg/kg dw | 0.27 | 0.23 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Lead | 149 | J | mg/kg dw | 2.1 | | 450 | 530 | mg/kg dw | 0.33 | 0.28 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Lead | 320 | | mg/kg dw | 1.97 | | 450 | 530 | mg/kg dw | 0.71 | 0.6 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Lead | 569 | | mg/kg dw | 0.897 | | 450 | 530 | mg/kg dw | 1.3 | 1.1 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Lead | 1050 | | mg/kg dw | 6.29 | | 450 | 530 | mg/kg dw | 2.3 | 2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Lead | 1210 | | mg/kg dw | 0.31 | | 450 | 530 | mg/kg dw | 2.7 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Mercury | 0.21 | | mg/kg dw | 1.6 | | 0.41 | 0.59 | mg/kg dw | 0.51 | 0.36 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Mercury | 0.21 | J | mg/kg dw | 0.897 | | 0.41 | 0.59 | mg/kg dw | 0.51 | 0.36 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Mercury | 0.22 | J | mg/kg dw | 1.73 | | 0.41 | 0.59 | mg/kg dw | 0.54 | 0.37 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Mercury | 0.27 | | mg/kg dw | 2.17 | | 0.41 | 0.59 | mg/kg dw | 0.66 | 0.46 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Mercury | 0.28 | J | mg/kg dw | 6.29 | | 0.41 | 0.59 | mg/kg dw | 0.68 | 0.47 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Mercury | 0.33 | | mg/kg dw | 1.97 | | 0.41 | 0.59 | mg/kg dw | 0.8 | 0.56 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Mercury | 0.43 | J | mg/kg dw | 1.97 | | 0.41 | 0.59 | mg/kg dw | 1.05 | 0.73 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Mercury | 0.53 | J | mg/kg dw | 1.54 | | 0.41 | 0.59 | mg/kg dw | 1.3 | 0.9 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Mercury | 0.61 | | mg/kg dw | 2.1 | | 0.41 | 0.59 | mg/kg dw | 1.5 | 1 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Mercury | 1.22 | | mg/kg dw | 2.36 | | 0.41 | 0.59 | mg/kg dw | 3 | 2.1 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Mercury | 1.27 | | mg/kg dw | 1.95 | | 0.41 | 0.59 | mg/kg dw | 3.1 | 2.2 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Molybdenum | 3.4 | | mg/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Molybdenum | 0.7 | | mg/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Molybdenum | 11 | | mg/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Molybdenum | 6 | | mg/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Molybdenum | 6 | | mg/kg dw | 0.31 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Molybdenum | 2.1 | | mg/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Molybdenum | 6.8 | | mg/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Molybdenum | 1.6 | | mg/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Nickel | 32 | | mg/kg dw | 2.1 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Nickel | 10 | | mg/kg dw | 1.6 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 11 to 12 | 2006 | Nickel | 7 | | mg/kg dw | 0.749 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Nickel | 17 | | mg/kg dw | 6.29 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 0 to 2 | 2006 | Nickel | 9 | | mg/kg dw | 2.1 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 2 to 4 | 2006 | Nickel | 7 | | mg/kg dw | 0.669 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Nickel | 23 | | mg/kg dw | 0.897 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Nickel | 13 | | mg/kg dw | 0.31 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Nickel | 20 | | mg/kg dw | 1.54 | | | | mg/kg dw | | |

**Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove**

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Nickel | 23 | | mg/kg dw | 1.97 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Nickel | 12 | | mg/kg dw | 1.73 | | | | mg/kg dw | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Silver | 0.7 | | mg/kg dw | 1.6 | | 6.1 | 6.1 | mg/kg dw | 0.11 | 0.11 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Silver | 0.9 | | mg/kg dw | 1.73 | | 6.1 | 6.1 | mg/kg dw | 0.15 | 0.15 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Silver | 1.6 | | mg/kg dw | 1.97 | | 6.1 | 6.1 | mg/kg dw | 0.26 | 0.26 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Silver | 2 | | mg/kg dw | 0.897 | | 6.1 | 6.1 | mg/kg dw | 0.33 | 0.33 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Silver | 3.3 | | mg/kg dw | 2.1 | | 6.1 | 6.1 | mg/kg dw | 0.54 | 0.54 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Silver | 4.1 | | mg/kg dw | 0.31 | | 6.1 | 6.1 | mg/kg dw | 0.67 | 0.67 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Silver | 5 | | mg/kg dw | 6.29 | | 6.1 | 6.1 | mg/kg dw | 0.82 | 0.82 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Vanadium | 74.1 | | mg/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Vanadium | 44.2 | | mg/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 11 to 12 | 2006 | Vanadium | 37.2 | | mg/kg dw | 0.749 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Vanadium | 26 | | mg/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 0 to 2 | 2006 | Vanadium | 46.2 | | mg/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 2 to 4 | 2006 | Vanadium | 35.7 | | mg/kg dw | 0.669 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Vanadium | 37 | | mg/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Vanadium | 39.8 | | mg/kg dw | 0.31 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Vanadium | 55.2 | | mg/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Vanadium | 65.2 | | mg/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Vanadium | 54.8 | | mg/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 2 to 4 | 2006 | Zinc | 20.9 | | mg/kg dw | 0.669 | | 410 | 960 | mg/kg dw | 0.051 | 0.022 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 11 to 12 | 2006 | Zinc | 21.5 | | mg/kg dw | 0.749 | | 410 | 960 | mg/kg dw | 0.052 | 0.022 |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 0 to 2 | 2006 | Zinc | 22.9 | | mg/kg dw | 2.1 | | 410 | 960 | mg/kg dw | 0.056 | 0.024 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Zinc | 56.4 | J | mg/kg dw | 1.6 | | 410 | 960 | mg/kg dw | 0.14 | 0.059 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Zinc | 89 | | mg/kg dw | 1.73 | | 410 | 960 | mg/kg dw | 0.22 | 0.093 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Zinc | 120 | | mg/kg dw | 1.54 | | 410 | 960 | mg/kg dw | 0.29 | 0.13 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Zinc | 212 | J | mg/kg dw | 2.1 | | 410 | 960 | mg/kg dw | 0.52 | 0.22 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Zinc | 288 | | mg/kg dw | 1.97 | | 410 | 960 | mg/kg dw | 0.7 | 0.3 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Zinc | 604 | | mg/kg dw | 6.29 | | 410 | 960 | mg/kg dw | 1.5 | 0.63 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Zinc | 748 | | mg/kg dw | 0.897 | | 410 | 960 | mg/kg dw | 1.8 | 0.78 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Zinc | 1430 | | mg/kg dw | 0.31 | | 410 | 960 | mg/kg dw | 3.5 | 1.5 |
| **Organometals** | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Dibutyltin as ion | 34 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Dibutyltin as ion | 18 | | ug/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Dibutyltin as ion | 31 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Monobutyltin as ion | 10 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Monobutyltin as ion | 6.1 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Tributyltin as ion | 64 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Tributyltin as ion | 190 | | ug/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Tributyltin as ion | 190 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Tributyltin as ion | 10 | | ug/kg dw | 1.73 | | | | | | |
| **SVOCs** | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | 2,4-Dimethylphenol | 6.3 | J | ug/kg dw | 6.29 | | 29 | 29 | ug/kg dw | 0.22 | 0.22 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | 2,4-Dimethylphenol | 9.2 | | ug/kg dw | 0.31 | | 29 | 29 | ug/kg dw | 0.32 | 0.32 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | 2,4-Dimethylphenol | 46 | | ug/kg dw | 1.73 | | 29 | 29 | ug/kg dw | 1.6 | 1.6 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | 2-Methylphenol | 4.2 | J | ug/kg dw | 6.29 | | 63 | 63 | ug/kg dw | 0.067 | 0.067 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 2-Methylphenol | 9.2 | | ug/kg dw | 1.95 | | 63 | 63 | ug/kg dw | 0.15 | 0.15 |

Appendix 2.  Sampling Results for Subsurface Sediment: Ash Grove

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 2-Methylphenol | 14 | | ug/kg dw | 2.36 | | 63 | 63 | ug/kg dw | 0.22 | 0.22 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | 4-Methylphenol | 13 | J | ug/kg dw | 0.897 | | 670 | 670 | ug/kg dw | 0.019 | 0.019 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | 4-Methylphenol | 41 | | ug/kg dw | 6.29 | | 670 | 670 | ug/kg dw | 0.061 | 0.061 |
| LDW Subsurface Sediment 2006 | LDW-SC3 | 0 to 2 | 2006 | Benzoic acid | 58 | J | ug/kg dw | 2.1 | | 650 | 650 | ug/kg dw | 0.089 | 0.089 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Benzoic acid | 72 | | ug/kg dw | 1.6 | | 650 | 650 | ug/kg dw | 0.11 | 0.11 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Benzoic acid | 100 | | ug/kg dw | 2.1 | | 650 | 650 | ug/kg dw | 0.15 | 0.15 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Benzoic acid | 400 | J | ug/kg dw | 1.54 | | 650 | 650 | ug/kg dw | 0.62 | 0.62 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Benzoic acid | 400 | J | ug/kg dw | 1.97 | | 650 | 650 | ug/kg dw | 0.62 | 0.62 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Benzoic acid | 420 | J | ug/kg dw | 6.29 | | 650 | 650 | ug/kg dw | 0.65 | 0.65 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Benzyl alcohol | 44 | | ug/kg dw | 0.897 | | 57 | 73 | ug/kg dw | 0.77 | 0.6 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | N-Nitroso-di-n-propylamine | 32 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Pentachlorophenol | 14 | J | ug/kg dw | 2.17 | | 360 | 690 | ug/kg dw | 0.039 | 0.02 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Pentachlorophenol | 21 | J | ug/kg dw | 1.97 | | 360 | 690 | ug/kg dw | 0.058 | 0.03 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Pentachlorophenol | 24 | J | ug/kg dw | 6.29 | | 360 | 690 | ug/kg dw | 0.067 | 0.035 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Pentachlorophenol | 46 | | ug/kg dw | 0.31 | | 360 | 690 | ug/kg dw | 0.13 | 0.067 |
| **PAHs** | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,2,4-Trichlorobenzene | 0.014 | | mg/kg dw | 2.36 | 0.59 | 0.81 | 1.8 | mg/kg OC | 0.73 | 0.33 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,2,4-Trichlorobenzene | 0.02 | | mg/kg dw | 1.95 | 1 | 0.81 | 1.8 | mg/kg OC | 1.2 | 0.56 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,2-Dichlorobenzene | 0.0092 | | mg/kg dw | 2.36 | 0.39 | 2.3 | 2.3 | mg/kg OC | 0.17 | 0.17 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,2-Dichlorobenzene | 0.013 | | mg/kg dw | 1.95 | 0.67 | 2.3 | 2.3 | mg/kg OC | 0.29 | 0.29 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | 1,2-Dichlorobenzene | 12 | | ug/kg dw | 6.29 | | 35 | 50 | ug/kg dw | 0.34 | 0.24 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | 1,4-Dichlorobenzene | 0.0047 | J | mg/kg dw | 1.97 | 0.24 | 3.1 | 9 | mg/kg OC | 0.077 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,4-Dichlorobenzene | 0.0068 | | mg/kg dw | 2.36 | 0.29 | 3.1 | 9 | mg/kg OC | 0.094 | 0.032 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | 1,4-Dichlorobenzene | 0.0092 | | mg/kg dw | 1.95 | 0.47 | 3.1 | 9 | mg/kg OC | 0.15 | 0.052 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | 1,4-Dichlorobenzene | 5.6 | J | ug/kg dw | 6.29 | | 110 | 120 | ug/kg dw | 0.051 | 0.047 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | 1-Methylnaphthalene | 37 | | ug/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | 1-Methylnaphthalene | 25 | | ug/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | 1-Methylnaphthalene | 200 | | ug/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | 2-Methylnaphthalene | 0.024 | | mg/kg dw | 1.97 | 1.2 | 38 | 64 | mg/kg OC | 0.032 | 0.019 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | 2-Methylnaphthalene | 0.021 | | mg/kg dw | 1.54 | 1.4 | 38 | 64 | mg/kg OC | 0.037 | 0.022 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | 2-Methylnaphthalene | 0.042 | | mg/kg dw | 0.897 | 4.7 | 38 | 64 | mg/kg OC | 0.12 | 0.073 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | 2-Methylnaphthalene | 0.2 | | mg/kg dw | 1.73 | 12 | 38 | 64 | mg/kg OC | 0.32 | 0.19 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | 2-Methylnaphthalene | 62 | | ug/kg dw | 6.29 | | 670 | 1400 | ug/kg dw | 0.093 | 0.044 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Acenaphthene | 0.018 | J | mg/kg dw | 1.54 | 1.2 | 16 | 57 | mg/kg OC | 0.075 | 0.021 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Acenaphthene | 0.036 | | mg/kg dw | 1.97 | 1.8 | 16 | 57 | mg/kg OC | 0.11 | 0.032 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Acenaphthene | 0.19 | | mg/kg dw | 1.73 | 11 | 16 | 57 | mg/kg OC | 0.69 | 0.19 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Acenaphthene | 0.14 | | mg/kg dw | 0.897 | 16 | 16 | 57 | mg/kg OC | 1 | 0.28 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Acenaphthene | 78 | | ug/kg dw | 6.29 | | 500 | 730 | ug/kg dw | 0.16 | 0.11 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Acenaphthylene | 0.015 | J | mg/kg dw | 1.97 | 0.76 | 66 | 66 | mg/kg OC | 0.012 | 0.012 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Acenaphthylene | 0.014 | J | mg/kg dw | 1.54 | 0.91 | 66 | 66 | mg/kg OC | 0.014 | 0.014 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Anthracene | 0.014 | J | mg/kg dw | 1.6 | 0.88 | 220 | 1200 | mg/kg OC | 0.004 | 0.00073 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Anthracene | 0.026 | | mg/kg dw | 1.73 | 1.5 | 220 | 1200 | mg/kg OC | 0.0068 | 0.0013 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Anthracene | 0.043 | J | mg/kg dw | 1.97 | 2.2 | 220 | 1200 | mg/kg OC | 0.01 | 0.0018 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Anthracene | 0.069 | | mg/kg dw | 2.1 | 3.3 | 220 | 1200 | mg/kg OC | 0.015 | 0.0028 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Anthracene | 0.079 | | mg/kg dw | 2.36 | 3.3 | 220 | 1200 | mg/kg OC | 0.015 | 0.0028 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Anthracene | 0.059 | | mg/kg dw | 1.54 | 3.8 | 220 | 1200 | mg/kg OC | 0.017 | 0.0032 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Anthracene | 0.078 | | mg/kg dw | 1.97 | 4 | 220 | 1200 | mg/kg OC | 0.018 | 0.0033 |

Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Anthracene | 0.11 | | mg/kg dw | 2.17 | 5.1 | 220 | 1200 | mg/kg OC | 0.023 | 0.0043 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Anthracene | 0.1 | | mg/kg dw | 1.95 | 5.1 | 220 | 1200 | mg/kg OC | 0.023 | 0.0043 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Anthracene | 0.084 | | mg/kg dw | 0.897 | 9.4 | 220 | 1200 | mg/kg OC | 0.043 | 0.0078 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Anthracene | 86 | | ug/kg dw | 6.29 | | 960 | 4400 | ug/kg dw | 0.09 | 0.02 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Benzo(a)anthracene | 0.02 | | mg/kg dw | 1.6 | 1.3 | 110 | 270 | mg/kg OC | 0.012 | 0.0048 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Benzo(a)anthracene | 0.048 | | mg/kg dw | 1.73 | 2.8 | 110 | 270 | mg/kg OC | 0.025 | 0.01 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(a)anthracene | 0.16 | | mg/kg dw | 2.36 | 6.8 | 110 | 270 | mg/kg OC | 0.062 | 0.025 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(a)anthracene | 0.14 | | mg/kg dw | 1.97 | 7.1 | 110 | 270 | mg/kg OC | 0.065 | 0.026 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Benzo(a)anthracene | 0.19 | | mg/kg dw | 2.1 | 9 | 110 | 270 | mg/kg OC | 0.082 | 0.033 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(a)anthracene | 0.18 | | mg/kg dw | 1.95 | 9.2 | 110 | 270 | mg/kg OC | 0.084 | 0.034 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Benzo(a)anthracene | 0.085 | | mg/kg dw | 0.897 | 9.5 | 110 | 270 | mg/kg OC | 0.086 | 0.035 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Benzo(a)anthracene | 0.2 | | mg/kg dw | 1.97 | 10 | 110 | 270 | mg/kg OC | 0.091 | 0.037 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Benzo(a)anthracene | 0.18 | | mg/kg dw | 1.54 | 12 | 110 | 270 | mg/kg OC | 0.11 | 0.044 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(a)anthracene | 0.31 | | mg/kg dw | 2.17 | 14 | 110 | 270 | mg/kg OC | 0.13 | 0.052 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Benzo(a)anthracene | 120 | | ug/kg dw | 6.29 | | 1300 | 1600 | ug/kg dw | 0.092 | 0.075 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Benzo(a)pyrene | 0.046 | | mg/kg dw | 1.73 | 2.7 | 99 | 210 | mg/kg OC | 0.027 | 0.013 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Benzo(a)pyrene | 0.052 | | mg/kg dw | 1.6 | 3.3 | 99 | 210 | mg/kg OC | 0.033 | 0.016 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Benzo(a)pyrene | 0.04 | | mg/kg dw | 0.897 | 4.5 | 99 | 210 | mg/kg OC | 0.045 | 0.021 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(a)pyrene | 0.24 | | mg/kg dw | 1.97 | 12 | 99 | 210 | mg/kg OC | 0.12 | 0.057 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Benzo(a)pyrene | 0.2 | | mg/kg dw | 1.54 | 13 | 99 | 210 | mg/kg OC | 0.13 | 0.062 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Benzo(a)pyrene | 0.25 | | mg/kg dw | 1.97 | 13 | 99 | 210 | mg/kg OC | 0.13 | 0.062 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(a)pyrene | 0.33 | | mg/kg dw | 2.36 | 14 | 99 | 210 | mg/kg OC | 0.14 | 0.067 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(a)pyrene | 0.3 | | mg/kg dw | 1.95 | 15 | 99 | 210 | mg/kg OC | 0.15 | 0.071 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Benzo(a)pyrene | 0.35 | | mg/kg dw | 2.1 | 17 | 99 | 210 | mg/kg OC | 0.17 | 0.081 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(a)pyrene | 0.41 | | mg/kg dw | 2.17 | 19 | 99 | 210 | mg/kg OC | 0.19 | 0.09 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Benzo(a)pyrene | 62 | J | ug/kg dw | 6.29 | | 1600 | 3000 | ug/kg dw | 0.039 | 0.021 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(b)fluoranthene | 410 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(b)fluoranthene | 800 | | ug/kg dw | 2.17 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Benzo(b)fluoranthene | 630 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(b)fluoranthene | 470 | | ug/kg dw | 2.36 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(b)fluoranthene | 540 | | ug/kg dw | 1.95 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Benzo(b)fluoranthene | 85 | | ug/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Benzo(b)fluoranthene | 140 | J | ug/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Benzo(b)fluoranthene | 82 | | ug/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Benzo(b)fluoranthene | 400 | | ug/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Benzo(b)fluoranthene | 400 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Benzo(b)fluoranthene | 72 | | ug/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Benzo(g,h,i)perylene | 0.011 | J | mg/kg dw | 1.6 | 0.69 | 31 | 78 | mg/kg OC | 0.022 | 0.0088 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Benzo(g,h,i)perylene | 0.048 | | mg/kg dw | 1.97 | 2.4 | 31 | 78 | mg/kg OC | 0.077 | 0.031 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Benzo(g,h,i)perylene | 0.039 | | mg/kg dw | 1.54 | 2.5 | 31 | 78 | mg/kg OC | 0.081 | 0.032 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Benzo(g,h,i)perylene | 0.06 | J | mg/kg dw | 2.1 | 2.9 | 31 | 78 | mg/kg OC | 0.094 | 0.037 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(g,h,i)perylene | 0.14 | | mg/kg dw | 2.36 | 5.9 | 31 | 78 | mg/kg OC | 0.19 | 0.076 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(g,h,i)perylene | 0.12 | | mg/kg dw | 1.95 | 6.2 | 31 | 78 | mg/kg OC | 0.2 | 0.079 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(g,h,i)perylene | 0.18 | | mg/kg dw | 1.97 | 9.1 | 31 | 78 | mg/kg OC | 0.29 | 0.12 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(g,h,i)perylene | 0.24 | | mg/kg dw | 2.17 | 11 | 31 | 78 | mg/kg OC | 0.35 | 0.14 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Benzo(g,h,i)perylene | 15 | J | ug/kg dw | 6.29 | | 670 | 720 | ug/kg dw | 0.022 | 0.021 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(k)fluoranthene | 240 | | ug/kg dw | 1.97 | | | | | | |

Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzo(k)fluoranthene | 480 | | ug/kg dw | 2.17 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Benzo(k)fluoranthene | 490 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(k)fluoranthene | 380 | | ug/kg dw | 2.36 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzo(k)fluoranthene | 250 | | ug/kg dw | 1.95 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Benzo(k)fluoranthene | 74 | | ug/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Benzo(k)fluoranthene | 120 | J | ug/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Benzo(k)fluoranthene | 63 | | ug/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Benzo(k)fluoranthene | 290 | | ug/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Benzo(k)fluoranthene | 360 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Benzo(k)fluoranthene | 65 | | ug/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Benzofluoranthenes (total-calc'd) | 0.137 | | mg/kg dw | 1.73 | 7.9 | 230 | 450 | mg/kg OC | 0.034 | 0.018 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Benzofluoranthenes (total-calc'd) | 0.159 | | mg/kg dw | 1.6 | 9.9 | 230 | 450 | mg/kg OC | 0.043 | 0.022 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Benzofluoranthenes (total-calc'd) | 0.145 | | mg/kg dw | 0.897 | 16 | 230 | 450 | mg/kg OC | 0.07 | 0.036 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzofluoranthenes (total-calc'd) | 0.65 | | mg/kg dw | 1.97 | 33 | 230 | 450 | mg/kg OC | 0.14 | 0.073 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzofluoranthenes (total-calc'd) | 0.85 | | mg/kg dw | 2.36 | 36 | 230 | 450 | mg/kg OC | 0.16 | 0.08 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Benzofluoranthenes (total-calc'd) | 0.76 | | mg/kg dw | 1.97 | 39 | 230 | 450 | mg/kg OC | 0.17 | 0.087 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Benzofluoranthenes (total-calc'd) | 0.79 | | mg/kg dw | 1.95 | 41 | 230 | 450 | mg/kg OC | 0.18 | 0.091 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Benzofluoranthenes (total-calc'd) | 0.69 | | mg/kg dw | 1.54 | 45 | 230 | 450 | mg/kg OC | 0.2 | 0.1 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Benzofluoranthenes (total-calc'd) | 1.12 | | mg/kg dw | 2.1 | 53 | 230 | 450 | mg/kg OC | 0.23 | 0.12 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Benzofluoranthenes (total-calc'd) | 1.28 | | mg/kg dw | 2.17 | 59 | 230 | 450 | mg/kg OC | 0.26 | 0.13 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Benzofluoranthenes (total-calc'd) | 260 | J | ug/kg dw | 6.29 | | 3200 | 3600 | ug/kg dw | 0.081 | 0.072 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Chrysene | 0.033 | | mg/kg dw | 1.6 | 2.1 | 110 | 460 | mg/kg OC | 0.019 | 0.0046 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Chrysene | 0.064 | | mg/kg dw | 1.73 | 3.7 | 110 | 460 | mg/kg OC | 0.034 | 0.008 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Chrysene | 0.095 | | mg/kg dw | 0.897 | 11 | 110 | 460 | mg/kg OC | 0.1 | 0.024 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Chrysene | 0.24 | | mg/kg dw | 1.97 | 12 | 110 | 460 | mg/kg OC | 0.11 | 0.026 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Chrysene | 0.29 | | mg/kg dw | 2.36 | 12 | 110 | 460 | mg/kg OC | 0.11 | 0.026 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Chrysene | 0.31 | | mg/kg dw | 2.1 | 15 | 110 | 460 | mg/kg OC | 0.14 | 0.033 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Chrysene | 0.3 | | mg/kg dw | 1.95 | 15 | 110 | 460 | mg/kg OC | 0.14 | 0.033 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Chrysene | 0.26 | | mg/kg dw | 1.54 | 17 | 110 | 460 | mg/kg OC | 0.15 | 0.037 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Chrysene | 0.31 | | mg/kg dw | 1.97 | 16 | 110 | 460 | mg/kg OC | 0.15 | 0.035 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Chrysene | 0.68 | | mg/kg dw | 2.17 | 31 | 110 | 460 | mg/kg OC | 0.28 | 0.067 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Chrysene | 170 | | ug/kg dw | 6.29 | | 1400 | 2800 | ug/kg dw | 0.12 | 0.061 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Dibenzo(a,h)anthracene | 0.015 | J | mg/kg dw | 1.97 | 0.76 | 12 | 33 | mg/kg OC | 0.063 | 0.023 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Dibenzo(a,h)anthracene | 0.012 | J | mg/kg dw | 1.54 | 0.78 | 12 | 33 | mg/kg OC | 0.065 | 0.024 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Dibenzo(a,h)anthracene | 0.023 | | mg/kg dw | 1.95 | 1.2 | 12 | 33 | mg/kg OC | 0.1 | 0.036 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Dibenzo(a,h)anthracene | 0.027 | J | mg/kg dw | 1.97 | 1.4 | 12 | 33 | mg/kg OC | 0.12 | 0.042 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Dibenzo(a,h)anthracene | 0.039 | | mg/kg dw | 2.36 | 1.7 | 12 | 33 | mg/kg OC | 0.14 | 0.052 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Dibenzo(a,h)anthracene | 0.05 | J | mg/kg dw | 2.17 | 2.3 | 12 | 33 | mg/kg OC | 0.19 | 0.07 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Fluoranthene | 0.04 | | mg/kg dw | 1.6 | 2.5 | 160 | 1200 | mg/kg OC | 0.016 | 0.0021 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Fluoranthene | 0.17 | | mg/kg dw | 1.95 | 8.7 | 160 | 1200 | mg/kg OC | 0.054 | 0.0073 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Fluoranthene | 0.15 | | mg/kg dw | 1.73 | 8.7 | 160 | 1200 | mg/kg OC | 0.054 | 0.0073 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Fluoranthene | 0.23 | | mg/kg dw | 2.36 | 9.7 | 160 | 1200 | mg/kg OC | 0.061 | 0.0081 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Fluoranthene | 0.26 | | mg/kg dw | 1.97 | 13 | 160 | 1200 | mg/kg OC | 0.081 | 0.011 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Fluoranthene | 0.27 | | mg/kg dw | 2.1 | 13 | 160 | 1200 | mg/kg OC | 0.081 | 0.011 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Fluoranthene | 0.34 | | mg/kg dw | 1.54 | 22 | 160 | 1200 | mg/kg OC | 0.14 | 0.018 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Fluoranthene | 0.56 | | mg/kg dw | 1.97 | 28 | 160 | 1200 | mg/kg OC | 0.18 | 0.023 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Fluoranthene | 0.77 | | mg/kg dw | 2.17 | 35 | 160 | 1200 | mg/kg OC | 0.22 | 0.029 |

**Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove**

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Fluoranthene | 0.51 | | mg/kg dw | 0.897 | 57 | 160 | 1200 | mg/kg OC | 0.36 | 0.048 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Fluoranthene | 70 | | ug/kg dw | 0.31 | | 1700 | 2500 | ug/kg dw | 0.041 | 0.028 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Fluoranthene | 490 | | ug/kg dw | 6.29 | | 1700 | 2500 | ug/kg dw | 0.29 | 0.2 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Fluorene | 0.024 | | mg/kg dw | 1.54 | 1.6 | 23 | 79 | mg/kg OC | 0.07 | 0.02 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Fluorene | 0.042 | | mg/kg dw | 1.97 | 2.1 | 23 | 79 | mg/kg OC | 0.091 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Fluorene | 0.048 | | mg/kg dw | 1.73 | 2.8 | 23 | 79 | mg/kg OC | 0.12 | 0.035 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Fluorene | 0.088 | | mg/kg dw | 0.897 | 9.8 | 23 | 79 | mg/kg OC | 0.43 | 0.12 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Fluorene | 110 | | ug/kg dw | 6.29 | | 540 | 1000 | ug/kg dw | 0.2 | 0.11 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Indeno(1,2,3-cd)pyrene | 0.01 | J | mg/kg dw | 1.6 | 0.63 | 34 | 88 | mg/kg OC | 0.019 | 0.0072 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Indeno(1,2,3-cd)pyrene | 0.043 | | mg/kg dw | 1.54 | 2.8 | 34 | 88 | mg/kg OC | 0.082 | 0.032 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Indeno(1,2,3-cd)pyrene | 0.055 | | mg/kg dw | 1.97 | 2.8 | 34 | 88 | mg/kg OC | 0.082 | 0.032 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Indeno(1,2,3-cd)pyrene | 0.068 | | mg/kg dw | 2.1 | 3.2 | 34 | 88 | mg/kg OC | 0.094 | 0.036 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Indeno(1,2,3-cd)pyrene | 0.12 | | mg/kg dw | 1.95 | 6.2 | 34 | 88 | mg/kg OC | 0.18 | 0.07 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Indeno(1,2,3-cd)pyrene | 0.16 | | mg/kg dw | 2.36 | 6.8 | 34 | 88 | mg/kg OC | 0.2 | 0.077 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Indeno(1,2,3-cd)pyrene | 0.16 | | mg/kg dw | 1.97 | 8.1 | 34 | 88 | mg/kg OC | 0.24 | 0.092 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Indeno(1,2,3-cd)pyrene | 0.24 | | mg/kg dw | 2.17 | 11 | 34 | 88 | mg/kg OC | 0.32 | 0.13 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Indeno(1,2,3-cd)pyrene | 13 | J | ug/kg dw | 6.29 | | 600 | 690 | ug/kg dw | 0.022 | 0.019 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Naphthalene | 0.079 | | mg/kg dw | 1.54 | 5.1 | 99 | 170 | mg/kg OC | 0.052 | 0.03 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Naphthalene | 0.047 | | mg/kg dw | 0.897 | 5.2 | 99 | 170 | mg/kg OC | 0.053 | 0.031 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Naphthalene | 0.19 | | mg/kg dw | 1.97 | 9.6 | 99 | 170 | mg/kg OC | 0.097 | 0.056 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Naphthalene | 1.5 | | mg/kg dw | 1.73 | 87 | 99 | 170 | mg/kg OC | 0.88 | 0.51 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Naphthalene | 43 | | ug/kg dw | 6.29 | | 2100 | 2400 | ug/kg dw | 0.02 | 0.018 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Naphthalene | 60 | J | ug/kg dw | 0.31 | | 2100 | 2400 | ug/kg dw | 0.029 | 0.025 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Phenanthrene | 0.025 | | mg/kg dw | 1.6 | 1.6 | 100 | 480 | mg/kg OC | 0.016 | 0.0033 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Phenanthrene | 0.11 | | mg/kg dw | 2.36 | 4.7 | 100 | 480 | mg/kg OC | 0.047 | 0.0098 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Phenanthrene | 0.081 | | mg/kg dw | 1.73 | 4.7 | 100 | 480 | mg/kg OC | 0.047 | 0.0098 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Phenanthrene | 0.11 | | mg/kg dw | 2.1 | 5.2 | 100 | 480 | mg/kg OC | 0.052 | 0.011 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Phenanthrene | 0.12 | | mg/kg dw | 1.95 | 6.2 | 100 | 480 | mg/kg OC | 0.062 | 0.013 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Phenanthrene | 0.13 | | mg/kg dw | 1.97 | 6.6 | 100 | 480 | mg/kg OC | 0.066 | 0.014 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Phenanthrene | 0.13 | | mg/kg dw | 1.54 | 8.4 | 100 | 480 | mg/kg OC | 0.084 | 0.018 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Phenanthrene | 0.25 | | mg/kg dw | 1.97 | 13 | 100 | 480 | mg/kg OC | 0.13 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Phenanthrene | 0.3 | | mg/kg dw | 2.17 | 14 | 100 | 480 | mg/kg OC | 0.14 | 0.029 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Phenanthrene | 0.29 | | mg/kg dw | 0.897 | 32 | 100 | 480 | mg/kg OC | 0.32 | 0.067 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Phenanthrene | 81 | | ug/kg dw | 0.31 | | 1500 | 5400 | ug/kg dw | 0.054 | 0.015 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Phenanthrene | 360 | | ug/kg dw | 6.29 | | 1500 | 5400 | ug/kg dw | 0.24 | 0.067 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Pyrene | 0.16 | | mg/kg dw | 1.73 | 9.2 | 1000 | 1400 | mg/kg OC | 0.0092 | 0.0066 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Pyrene | 0.16 | | mg/kg dw | 1.6 | 10 | 1000 | 1400 | mg/kg OC | 0.01 | 0.0071 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Pyrene | 0.36 | | mg/kg dw | 1.54 | 23 | 1000 | 1400 | mg/kg OC | 0.023 | 0.016 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Pyrene | 0.5 | | mg/kg dw | 1.97 | 25 | 1000 | 1400 | mg/kg OC | 0.025 | 0.018 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Pyrene | 0.67 | | mg/kg dw | 1.97 | 34 | 1000 | 1400 | mg/kg OC | 0.034 | 0.024 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Pyrene | 0.83 | | mg/kg dw | 2.36 | 35 | 1000 | 1400 | mg/kg OC | 0.035 | 0.025 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Pyrene | 0.33 | | mg/kg dw | 0.897 | 37 | 1000 | 1400 | mg/kg OC | 0.037 | 0.026 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Pyrene | 0.83 | | mg/kg dw | 2.17 | 38 | 1000 | 1400 | mg/kg OC | 0.038 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Pyrene | 0.79 | | mg/kg dw | 2.1 | 38 | 1000 | 1400 | mg/kg OC | 0.038 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Pyrene | 0.74 | | mg/kg dw | 1.95 | 38 | 1000 | 1400 | mg/kg OC | 0.038 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Pyrene | 70 | | ug/kg dw | 0.31 | | 2600 | 3300 | ug/kg dw | 0.027 | 0.021 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Pyrene | 370 | | ug/kg dw | 6.29 | | 2600 | 3300 | ug/kg dw | 0.14 | 0.11 |

Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Total HPAH (calc'd) | 0.49 | J | mg/kg dw | 1.6 | 31 | 960 | 5300 | mg/kg OC | 0.032 | 0.0058 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Total HPAH (calc'd) | 0.61 | | mg/kg dw | 1.73 | 35 | 960 | 5300 | mg/kg OC | 0.036 | 0.0066 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Total HPAH (calc'd) | 2.57 | J | mg/kg dw | 1.97 | 130 | 960 | 5300 | mg/kg OC | 0.14 | 0.025 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Total HPAH (calc'd) | 3.03 | | mg/kg dw | 2.36 | 130 | 960 | 5300 | mg/kg OC | 0.14 | 0.025 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Total HPAH (calc'd) | 1.21 | | mg/kg dw | 0.897 | 130 | 960 | 5300 | mg/kg OC | 0.14 | 0.025 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Total HPAH (calc'd) | 2.74 | | mg/kg dw | 1.95 | 140 | 960 | 5300 | mg/kg OC | 0.15 | 0.026 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Total HPAH (calc'd) | 2.12 | J | mg/kg dw | 1.54 | 140 | 960 | 5300 | mg/kg OC | 0.15 | 0.026 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Total HPAH (calc'd) | 2.7 | J | mg/kg dw | 1.97 | 140 | 960 | 5300 | mg/kg OC | 0.15 | 0.026 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Total HPAH (calc'd) | 3.16 | J | mg/kg dw | 2.1 | 150 | 960 | 5300 | mg/kg OC | 0.16 | 0.028 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Total HPAH (calc'd) | 4.81 | J | mg/kg dw | 2.17 | 220 | 960 | 5300 | mg/kg OC | 0.23 | 0.042 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Total HPAH (calc'd) | 140 | | ug/kg dw | 0.31 | | 12000 | 17000 | ug/kg dw | 0.012 | 0.0082 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Total HPAH (calc'd) | 1500 | J | ug/kg dw | 6.29 | | 12000 | 17000 | ug/kg dw | 0.13 | 0.088 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Total LPAH (calc'd) | 0.039 | J | mg/kg dw | 1.6 | 2.4 | 370 | 780 | mg/kg OC | 0.0065 | 0.0031 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Total LPAH (calc'd) | 0.19 | | mg/kg dw | 2.36 | 8.1 | 370 | 780 | mg/kg OC | 0.022 | 0.01 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Total LPAH (calc'd) | 0.17 | J | mg/kg dw | 1.97 | 8.6 | 370 | 780 | mg/kg OC | 0.023 | 0.011 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Total LPAH (calc'd) | 0.18 | | mg/kg dw | 2.1 | 8.6 | 370 | 780 | mg/kg OC | 0.023 | 0.011 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Total LPAH (calc'd) | 0.22 | | mg/kg dw | 1.95 | 11 | 370 | 780 | mg/kg OC | 0.03 | 0.014 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Total LPAH (calc'd) | 0.41 | | mg/kg dw | 2.17 | 19 | 370 | 780 | mg/kg OC | 0.051 | 0.024 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Total LPAH (calc'd) | 0.32 | J | mg/kg dw | 1.54 | 21 | 370 | 780 | mg/kg OC | 0.057 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Total LPAH (calc'd) | 0.61 | J | mg/kg dw | 1.97 | 31 | 370 | 780 | mg/kg OC | 0.084 | 0.04 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Total LPAH (calc'd) | 0.65 | | mg/kg dw | 0.897 | 72 | 370 | 780 | mg/kg OC | 0.19 | 0.092 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Total LPAH (calc'd) | 1.8 | | mg/kg dw | 1.73 | 100 | 370 | 780 | mg/kg OC | 0.27 | 0.13 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Total LPAH (calc'd) | 141 | J | ug/kg dw | 0.31 | | 5200 | 13000 | ug/kg dw | 0.027 | 0.011 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Total LPAH (calc'd) | 680 | | ug/kg dw | 6.29 | | 5200 | 13000 | ug/kg dw | 0.13 | 0.052 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Total PAH (calc'd) | 2740 | J | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Total PAH (calc'd) | 5220 | J | ug/kg dw | 2.17 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Total PAH (calc'd) | 3340 | J | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Total PAH (calc'd) | 3220 | | ug/kg dw | 2.36 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Total PAH (calc'd) | 2960 | | ug/kg dw | 1.95 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Total PAH (calc'd) | 520 | J | ug/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Total PAH (calc'd) | 2180 | J | ug/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Total PAH (calc'd) | 1850 | | ug/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Total PAH (calc'd) | 281 | J | ug/kg dw | 0.31 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Total PAH (calc'd) | 2450 | J | ug/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Total PAH (calc'd) | 3310 | J | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Total PAH (calc'd) | 2500 | | ug/kg dw | 1.73 | | | | | | |
| **Phthalates** | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Bis(2-ethylhexyl)phthalate | 0.095 | | mg/kg dw | 1.6 | 5.9 | 47 | 78 | mg/kg OC | 0.13 | 0.076 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Bis(2-ethylhexyl)phthalate | 0.33 | | mg/kg dw | 1.73 | 19 | 47 | 78 | mg/kg OC | 0.4 | 0.24 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Bis(2-ethylhexyl)phthalate | 0.4 | | mg/kg dw | 1.97 | 20 | 47 | 78 | mg/kg OC | 0.43 | 0.26 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Bis(2-ethylhexyl)phthalate | 0.42 | | mg/kg dw | 1.54 | 27 | 47 | 78 | mg/kg OC | 0.57 | 0.35 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Bis(2-ethylhexyl)phthalate | 0.7 | | mg/kg dw | 2.17 | 32 | 47 | 78 | mg/kg OC | 0.68 | 0.41 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 1 | | mg/kg dw | 2.36 | 42 | 47 | 78 | mg/kg OC | 0.89 | 0.54 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 0.83 | | mg/kg dw | 1.97 | 42 | 47 | 78 | mg/kg OC | 0.89 | 0.54 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 1.8 | | mg/kg dw | 2.1 | 86 | 47 | 78 | mg/kg OC | 1.8 | 1.1 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 0.9 | | mg/kg dw | 0.897 | 100 | 47 | 78 | mg/kg OC | 2.1 | 1.3 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Bis(2-ethylhexyl)phthalate | 2.4 | | mg/kg dw | 1.95 | 120 | 47 | 78 | mg/kg OC | 2.6 | 1.5 |

**Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove**

| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Bis(2-ethylhexyl)phthalate | 92 | | ug/kg dw | 0.31 | | 1300 | 1900 | ug/kg dw | 0.071 | 0.048 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Bis(2-ethylhexyl)phthalate | 1800 | | ug/kg dw | 6.29 | | 1300 | 1900 | ug/kg dw | 1.4 | 0.95 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Butyl benzyl phthalate | 0.016 | | mg/kg dw | 1.6 | 1 | 4.9 | 64 | mg/kg OC | 0.2 | 0.016 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Butyl benzyl phthalate | 0.02 | | mg/kg dw | 1.54 | 1.3 | 4.9 | 64 | mg/kg OC | 0.27 | 0.02 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Butyl benzyl phthalate | 0.034 | | mg/kg dw | 1.97 | 1.7 | 4.9 | 64 | mg/kg OC | 0.35 | 0.027 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Butyl benzyl phthalate | 0.038 | | mg/kg dw | 1.97 | 1.9 | 4.9 | 64 | mg/kg OC | 0.39 | 0.03 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Butyl benzyl phthalate | 0.046 | J | mg/kg dw | 2.17 | 2.1 | 4.9 | 64 | mg/kg OC | 0.43 | 0.033 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Butyl benzyl phthalate | 0.071 | | mg/kg dw | 2.1 | 3.4 | 4.9 | 64 | mg/kg OC | 0.69 | 0.053 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Butyl benzyl phthalate | 0.093 | J | mg/kg dw | 2.36 | 3.9 | 4.9 | 64 | mg/kg OC | 0.8 | 0.061 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Butyl benzyl phthalate | 0.098 | J | mg/kg dw | 1.95 | 5 | 4.9 | 64 | mg/kg OC | 1.02 | 0.078 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Di-n-butyl phthalate | 0.021 | | mg/kg dw | 1.6 | 1.3 | 220 | 1700 | mg/kg OC | 0.0059 | 0.00076 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Di-n-butyl phthalate | 0.031 | J | mg/kg dw | 1.95 | 1.6 | 220 | 1700 | mg/kg OC | 0.0073 | 0.00094 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Di-n-butyl phthalate | 0.042 | J | mg/kg dw | 2.36 | 1.8 | 220 | 1700 | mg/kg OC | 0.0082 | 0.0011 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Di-n-butyl phthalate | 0.045 | J | mg/kg dw | 2.1 | 2.1 | 220 | 1700 | mg/kg OC | 0.0095 | 0.0012 |
| **PCBs** | | | | | | | | | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Aroclor-1242 | 630 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Aroclor-1242 | 40 | | ug/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Aroclor-1242 | 1100 | | ug/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Aroclor-1242 | 330 | | ug/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Aroclor-1242 | 38 | | ug/kg dw | 0.31 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Aroclor-1242 | 110 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Aroclor-1242 | 130 | | ug/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Aroclor-1248 | 1400 | | ug/kg dw | 2.36 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Aroclor-1248 | 2100 | | ug/kg dw | 1.95 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Aroclor-1254 | 210 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Aroclor-1254 | 47 | | ug/kg dw | 2.17 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Aroclor-1254 | 1900 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Aroclor-1254 | 1700 | | ug/kg dw | 2.36 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Aroclor-1254 | 3300 | | ug/kg dw | 1.95 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Aroclor-1254 | 210 | | ug/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Aroclor-1254 | 1300 | | ug/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Aroclor-1254 | 760 | | ug/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Aroclor-1254 | 90 | | ug/kg dw | 0.31 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Aroclor-1254 | 85 | | ug/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Aroclor-1254 | 240 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Aroclor-1254 | 320 | | ug/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Aroclor-1260 | 140 | | ug/kg dw | 1.97 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | Aroclor-1260 | 38 | | ug/kg dw | 2.17 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | Aroclor-1260 | 840 | | ug/kg dw | 2.1 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Aroclor-1260 | 1200 | | ug/kg dw | 2.36 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | Aroclor-1260 | 1300 | | ug/kg dw | 1.95 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | Aroclor-1260 | 190 | | ug/kg dw | 1.6 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | Aroclor-1260 | 530 | | ug/kg dw | 6.29 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | Aroclor-1260 | 290 | | ug/kg dw | 0.897 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | Aroclor-1260 | 81 | | ug/kg dw | 0.31 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | Aroclor-1260 | 58 | | ug/kg dw | 1.54 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | Aroclor-1260 | 140 | | ug/kg dw | 1.97 | | | | | | |

**Appendix 2. Sampling Results for Subsurface Sediment: Ash Grove**

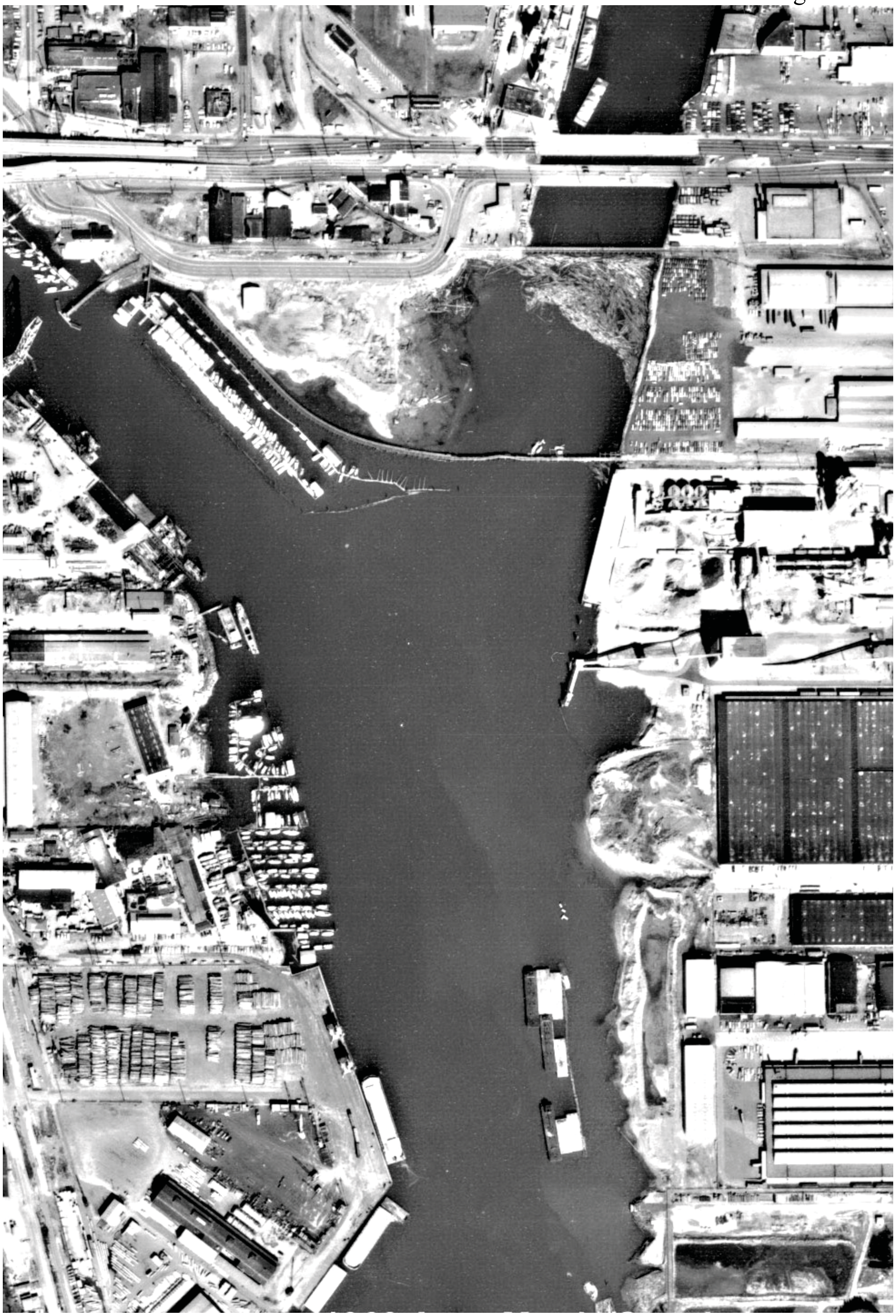
| Sampling Event | Sample Location | Depth Interval | Year | Chemical | Concentration | | Concentration Units | TOC (% DW) | OC normalized Concentration | SQS [1] | CSL [1] | Criteria Units | SQS Exceedance Factor [2] | CSL Exceedance Factor [2] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | Aroclor-1260 | 150 | | ug/kg dw | 1.73 | | | | | | |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | PCBs (total calc'd) | 0.085 | | mg/kg dw | 2.17 | 3.9 | 12 | 65 | mg/kg OC | 0.33 | 0.06 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 0 to 1 | 2006 | PCBs (total calc'd) | 0.143 | | mg/kg dw | 1.54 | 9.3 | 12 | 65 | mg/kg OC | 0.78 | 0.14 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 1 | 2006 | PCBs (total calc'd) | 0.35 | | mg/kg dw | 1.97 | 18 | 12 | 65 | mg/kg OC | 1.5 | 0.28 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 1 to 2 | 2006 | PCBs (total calc'd) | 0.49 | | mg/kg dw | 1.97 | 25 | 12 | 65 | mg/kg OC | 2.1 | 0.38 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 2 to 4 | 2006 | PCBs (total calc'd) | 0.44 | | mg/kg dw | 1.6 | 28 | 12 | 65 | mg/kg OC | 2.3 | 0.43 |
| LDW Subsurface Sediment 2006 | LDW-SC4 | 2 to 4 | 2006 | PCBs (total calc'd) | 0.6 | | mg/kg dw | 1.73 | 35 | 12 | 65 | mg/kg OC | 2.9 | 0.54 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 0 to 2 | 2006 | PCBs (total calc'd) | 3.4 | | mg/kg dw | 2.1 | 160 | 12 | 65 | mg/kg OC | 13 | 2.5 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 0 to 2 | 2006 | PCBs (total calc'd) | 1.38 | | mg/kg dw | 0.897 | 150 | 12 | 65 | mg/kg OC | 13 | 2.3 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | PCBs (total calc'd) | 4.3 | | mg/kg dw | 2.36 | 180 | 12 | 65 | mg/kg OC | 15 | 2.8 |
| LDW Subsurface Sediment 2006 | LDW-SC1 | 1 to 2 | 2006 | PCBs (total calc'd) | 6.7 | | mg/kg dw | 1.95 | 340 | 12 | 65 | mg/kg OC | 28 | 5.2 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 4 to 6 | 2006 | PCBs (total calc'd) | 209 | | ug/kg dw | 0.31 | | 130 | 1000 | ug/kg dw | 1.6 | 0.21 |
| LDW Subsurface Sediment 2006 | LDW-SC2 | 2 to 4 | 2006 | PCBs (total calc'd) | 2900 | | ug/kg dw | 6.29 | | 130 | 1000 | ug/kg dw | 22 | 2.9 |

Key:

| | |
|---|---|
| DW- Dry Weight | OC- Organic Carbon |
| CSL- Cleanup Screening Level | TOC- Total Organic Carbon |
| PAH- Polynuclear Aromatic Hydrocarbon | SQS- Sediment Quality Standard |
| PCB- Polychlorinated Biphenol | SVOC- Semivolatile Organic Compound |

Notes:
1. SQS and CSL values are substituted with AET values for dry weight comparison where organic compounds are not OC-normalized (when TOC% DW is outside of the 0.5-4.0% range).
2. Exceedance factors are the ratio of the detected concentration to the CSL or the SQS (or to AET values where applicable); exceedance factors are shown only if they are greater than 1.

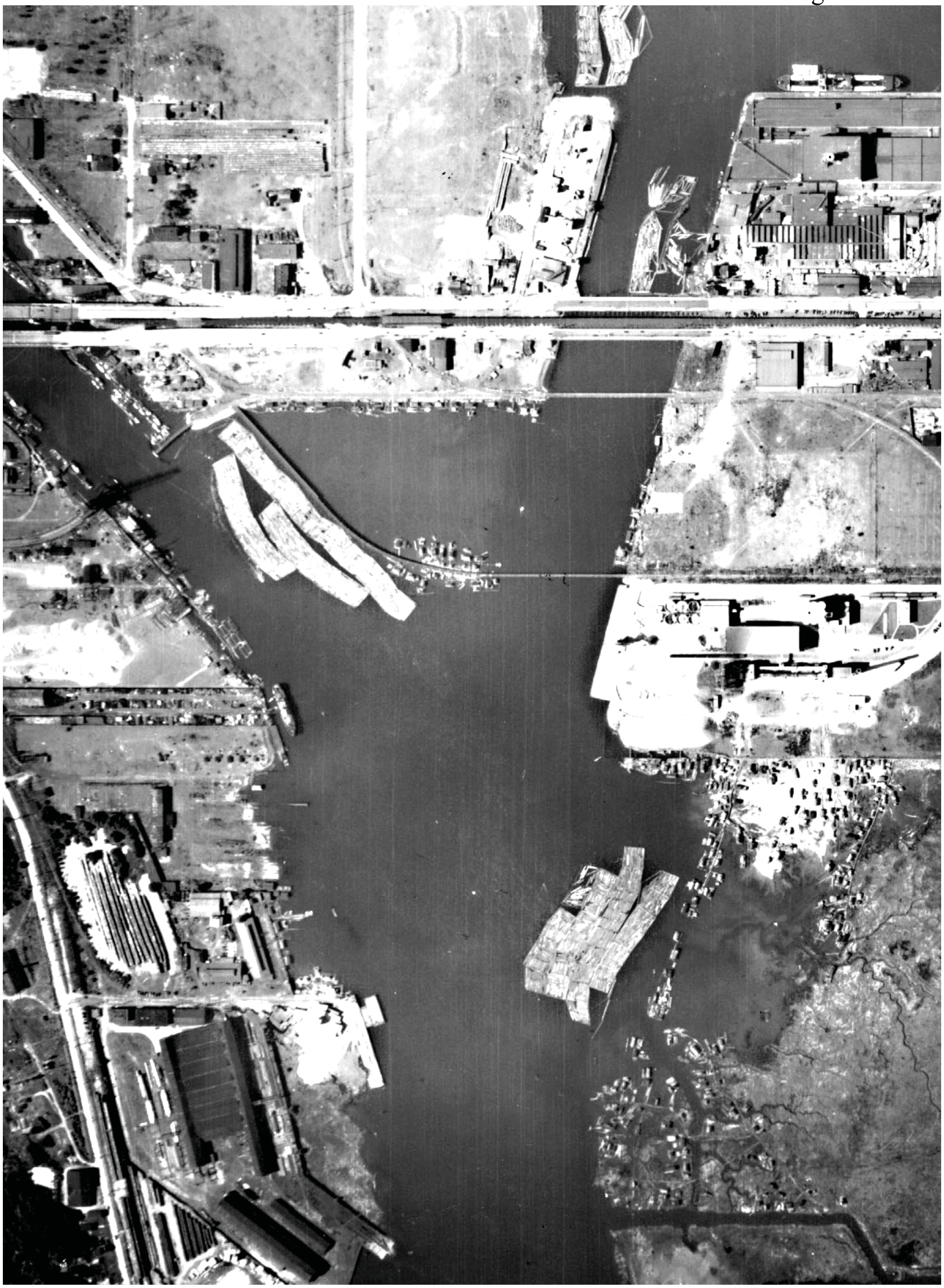
Source:
Lower Duwamish Waterway Group, 2007. Online Lower Duwamish Waterway Group Draft Remedial Investigation Report (November 2007) Database. Http://www.ldwg.org.



P5: Aerial Photo of RM 0.0-0.1 from 1969.

**Appendix 3 – Aerial Photographs**



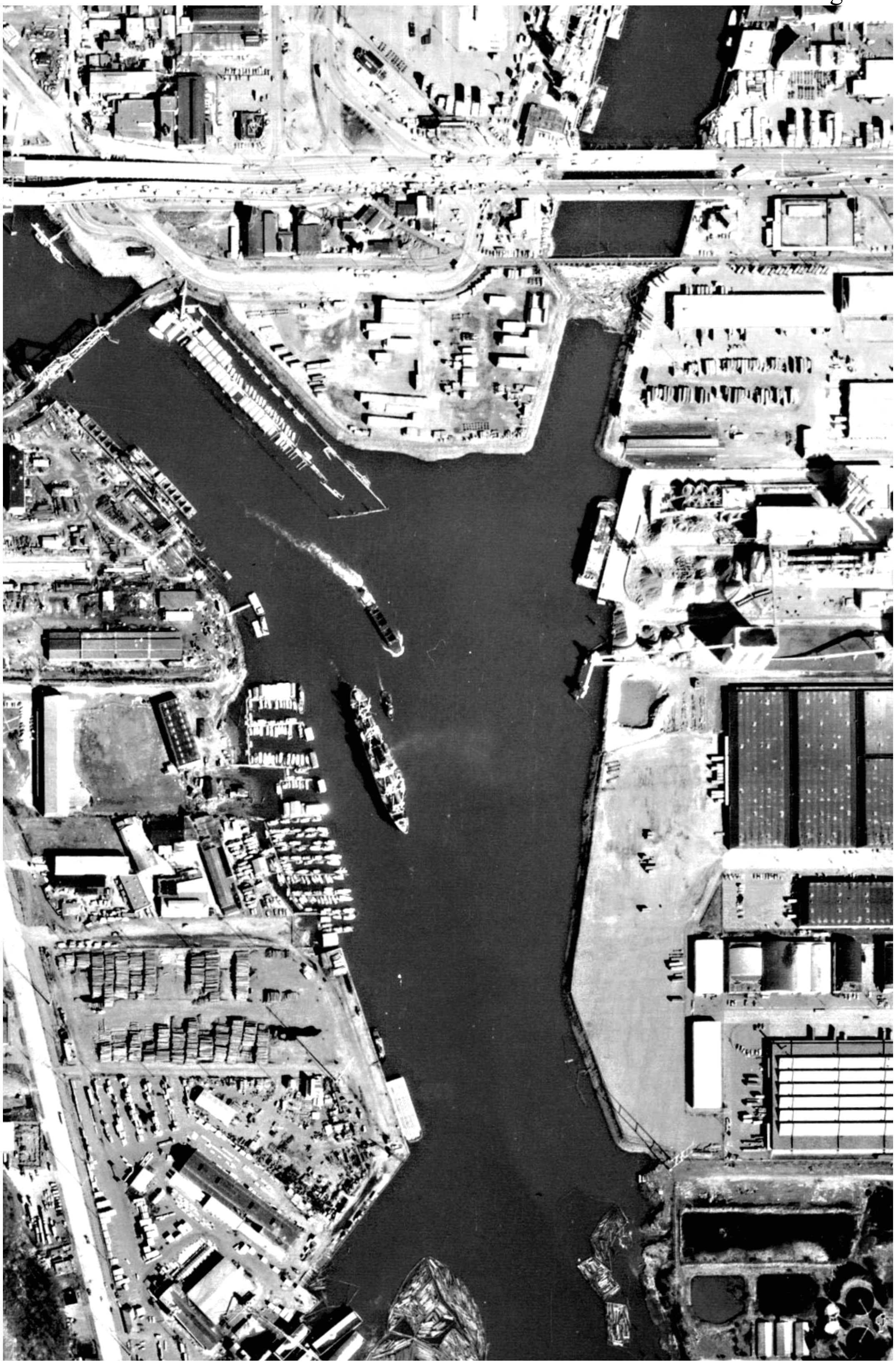


P1: Aerial Photo of RM 0.0-0.1 from 1936.

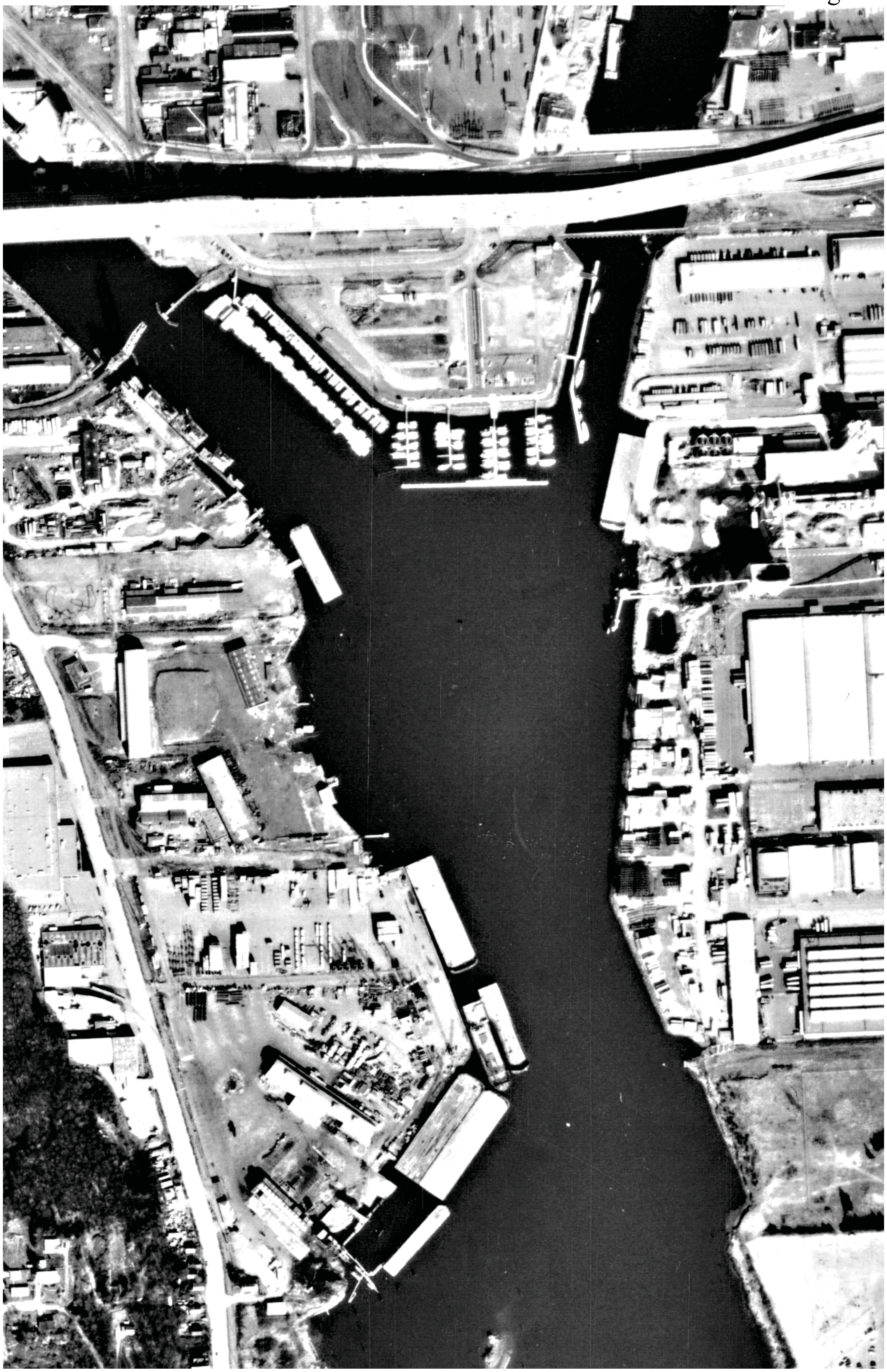
P2: Aerial Photo of RM 0.0-0.1 from 1941.

P3: Aerial Photo of RM 0.0-0.1 from 1946.

P4: Aerial Photo of RM 0.0-0.1 from 1956.

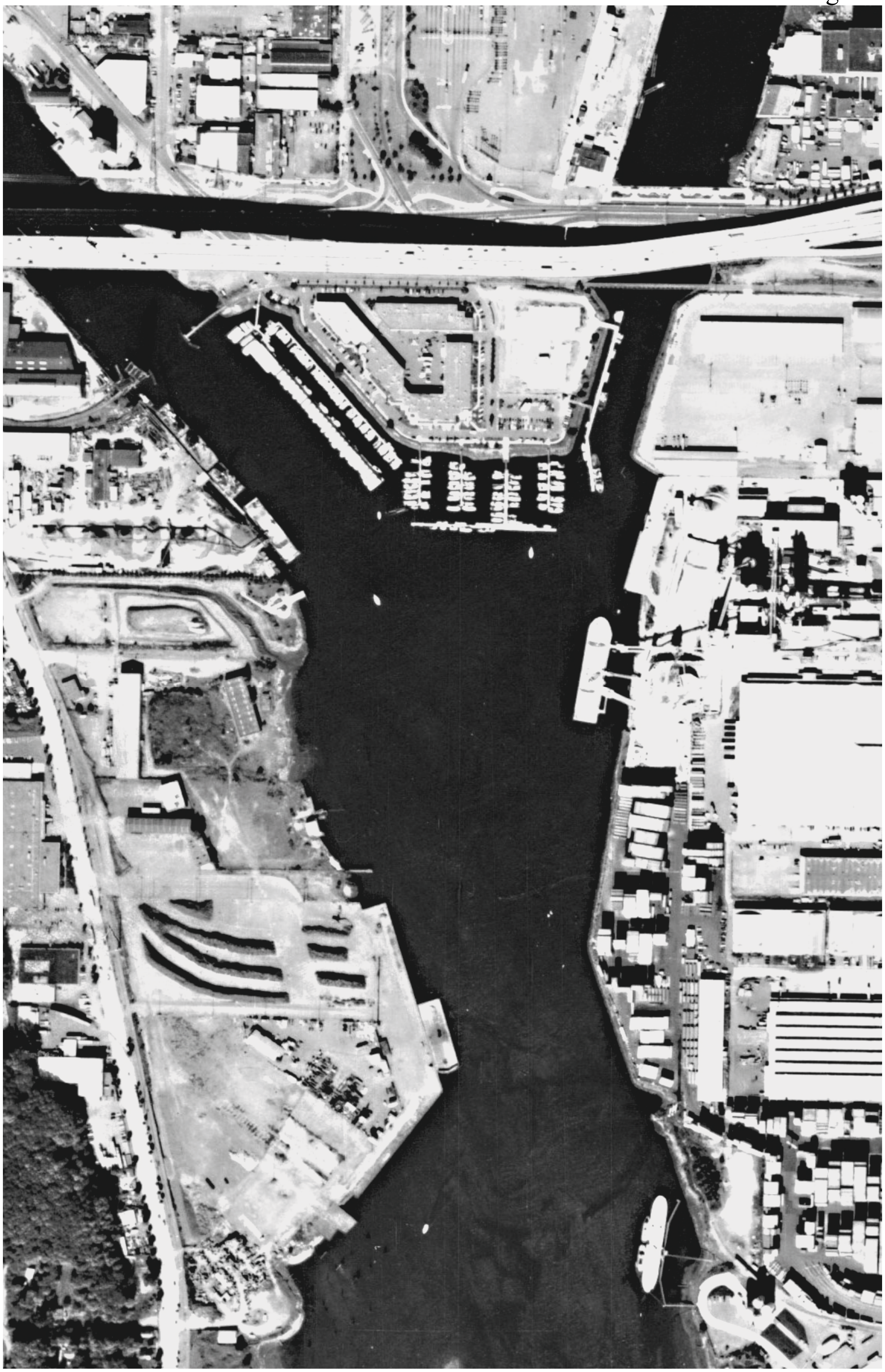


P6: Aerial Photo of RM 0.0-0.1 from 1974.

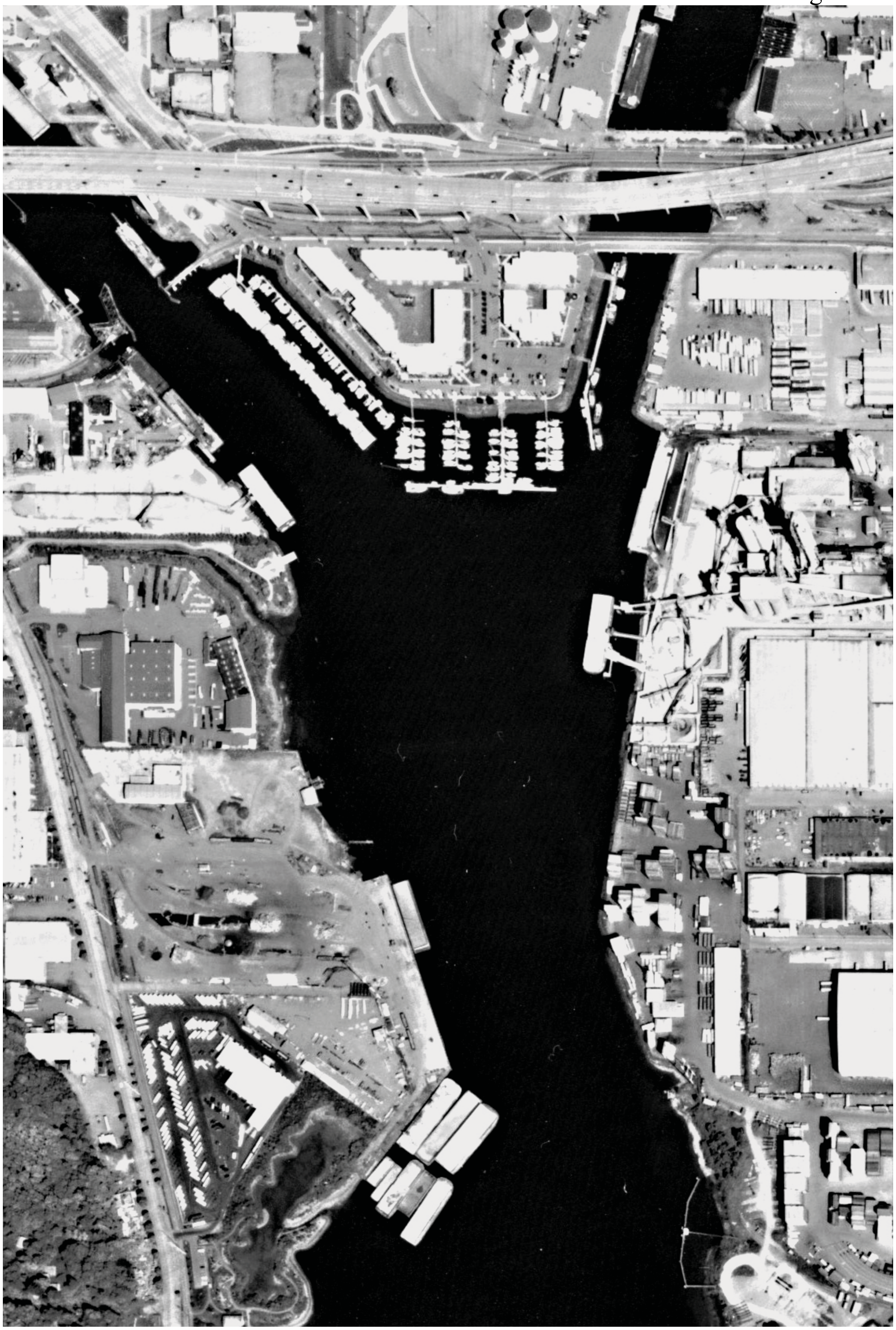


P8: Aerial Photo of RM 0.0-0.1 from 1985.

P9: Aerial Photo of RM 0.0-0.1 from 1990.



P10: Aerial Photo of RM 0.0-0.1 from 1995.



P11: Aerial Photo of RM 0.0-0.1 from 2004.