PORTLAND HARBOR RI/FS

ROUND 3A WINTER 2007 HIGH-FLOW SURFACE WATER DATA REPORT

DRAFT

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October 15, 2007

Prepared for
The Lower Willamette Group

Prepared by
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LIST OF ACRONYMS

Axys	Axys Analytical Services, Ltd.
CAS	Columbia Analytical Services
CD	compact disk
cfs	cubic feet per second
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
EQuIS	Environmental Quality Information System
FSP	field sampling plan
FSR	field sampling report
HHRA	human health risk assessment
HSP	health and safety plan
ICP	inductively coupled plasma
ISA	initial study area
LWG	Lower Willamette Group
NOAA	National Oceanic and Atmospheric Administration
PAHs	polycyclic aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PCDD/F	polychlorinated dibenzo-p-dioxin/furan
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RI/FS	remedial investigation/feasibility study
RM	river mile
SCRA	Site Characterization and Risk Assessment
SOP	standard operating procedure
SVOC	semivolatile organic compounds
SDG	sample delivery group
TSS	total suspended solids

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1.0 INTRODUCTION

The remedial investigation and feasibility study (RI/FS) for the Portland Harbor Superfund Site in Portland, Oregon includes several rounds of field sampling activities to investigate the nature and extent of contamination in the in-water portion of the Site, assess potential risk to human health and the environment, and develop cleanup alternatives.

The Round 2A surface water investigation consisted of three sampling events: November 2004, March 2005, and July 2005. These sampling events focused on data collection in the initial study area (ISA) of the lower Willamette River and areas immediately upstream and downstream of the ISA. The Round 2A investigation included surface water data collection to characterize the nature and extent of contamination, assess water quality adjacent to amphibian habitats to support the ecological risk assessment (ERA), assess water quality in swimming areas to support the human health risk assessment (HHRA), and collect chemistry and conventional water quality data to support the FS. Results from the Round 2A surface water investigation are presented in the Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report (Integral et al. 2007).

The first of four surface water sampling events proposed during the Round 3A surface water investigation occurred during a high-flow event from January 19 to 21, 2006, and is described in the Addendum to the Round 2A Surface Water Field Sampling Plan (FSP; Integral 2006a). Additional Round 3A surface water investigations included a low-flow sampling event from September 4-13, 2006 (Integral 2006b), a stormwater-impacted sampling event from November 2 to 5, 2006 (Integral 2006c, 2006d), and high-flow events during January 15 and 17- to 18, 2007, and February 21 to March 10, 2007 (Integral 2006c).

Summaries of the Round 3A high-flow (January 2006), low-flow (September 2006), stormwater-impacted (November 2006), and high-flow (winter 2007) surface water sample collection events are included in their respective field sampling reports (FSRs; Integral 2006e, f; 2007a, c). The Round 3A January 2006 High-Flow Surface Water Data Report (Integral 2006e) summarized the results from the January 19 to 21, 2006 sampling event and was submitted to the U.S. Environmental Protection Agency (EPA) in October 2006. The Round 3A Low-Flow and Stormwater-Impacted Surface Water Data Report summarized the results from the September and November 2006 sampling events and was submitted to the EPA in May 2007 (Integral 2007b). These three sampling events will not be discussed further in this document. This report summarizes only the results of the winter 2007 high-flow sampling event, which was the last of four surface water sampling events planned for the Round 3A surface water sampling program.

Except where noted, all surface water field activities, including navigational positioning, sample collection, sample handling and processing, and data management, followed guidelines specified in the Addendum to Round 2A FSP Surface Water

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Sampling (Integral 2006a), the Round 3A FSP (Integral 2006c) and addenda (Integral 2006b,d), the Round 2 Quality Assurance Project Plan (QAPP; Integral and Windward 2004), the Round 2 QAPP Addendum 1 (Integral 2004b), and the Round 2 Health and Safety Plan (HSP; Integral 2004a).

1.1 ROUND 3A SAMPLING OBJECTIVES

The primary objectives of the Round 3A surface water sampling effort were to:

- Assess water quality conditions in the ISA and adjacent areas under various flow conditions
- Collect data to support the FS evaluation of remedial alternatives, including monitored natural recovery, potential recontamination of sediment surface from surface water, and background conditions
- Continue to evaluate nature and extent of chemicals in surface water
- Refine the conceptual site model
- Provide additional water quality data to further support the food-web modeling effort for the ERA and HHRA.

The high-flow surface water sampling event was split into two phases because of a sudden drop in precipitation after the first three days of sampling. The first phase took place January 15 to 18, 2007. On January 18, 2007, the high-flow surface water collection program was superseded due to predicted flows in the Willamette River and continued below 50,000 cubic feet per second (cfs). The second phase resumed on February 21 through March 10, 2007.

1.2 REPORT ORGANIZATION

The remaining sections of this document describe the data collection activities (Section 2); sample analyses, data quality, and data management (Section 3); results for the Round 3A winter 2007 high-flow surface water sample collection events (Section 4); and references (Section 5).

Supporting information is provided in three appendices included here or on the attached compact disk (CD):

- **Appendix A.** Data Quality Summary
- **Appendix B.** Data Validation Reports (on CD)
- **Appendix C.** Site Characterization and Risk Assessment (SCRA) Database, Excel Flat File Format (on CD).

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2.0 DATA COLLECTION ACTIVITIES

This section summarizes the Round 3A surface water data collection activities during the high-flow sampling event, conducted from January 15 to 18, 2007 and February 21 through March 10, 2007.

2.1 SURFACE WATER SAMPLE COLLECTION

Figure 2-1 shows all sampling stations for the Round 3A surface water sampling program. Two types of surface water samples were collected:

- Standard volume (≤20 L) surface water samples were collected using the peristaltic pump method.
- High-volume (168-515 L) surface water samples were collected using the XAD-2 resin column method on two different pump types: Axys Environmental Infiltrex 300 and a Cole-Parmer PR2900 high-volume peristaltic pump.

Table 2-1 includes the sampling stations, station descriptions, and sampling methods used at each station. The sampling methods are described in more detail below. Additional information about sample collection procedures is included in Section 3 of Round 3A Winter 2007 High-Flow FSR (Integral 2007c). River stage and river flows on the Willamette River at Portland, as well as local precipitation levels that occurred during each surface water sampling period, are shown in Table 2-5.

2.1.1 Surface Water Collection with Peristaltic Pump

Surface water samples were collected from six transect locations (10 sampling stations including East and West transect stations at W023 and W025; Table 2-1) and 12 single-point locations between RM 2 and RM 16 (Figure 2-1). All stations identified in the Round 3A Surface Water FSP were sampled. A summary of the total number of samples collected for each sampling event is provided in Table 2-2. Table 2-3 lists each surface water station sampled and the specific analyses conducted on each sample.

Field quality control (QC) samples were collected as required by the Round 2 QAPP Addendum 1: Surface Water (Integral 2004b), the Addendum to the Round 3A Surface Water FSP (Integral 2006b), the Round 3A Surface Water FSP (Integral 2006c), and Addendum 2 to the Round 3A Surface Water FSP (Integral 2006d) (Table 2-4); deviations are detailed in Winter 2007 High-Flow FSR (2007c). Field replicates were generated by collecting an additional volume of surface water at the original target sampling location, not by subsampling composited samples. Field replicates were collected to assess the within-station heterogeneity associated with the overall sampling process from station positioning through sample homogenization. Rinsate blanks were also collected for the winter 2007 high-flow sampling event; deviations are detailed in the FSR (Integral 2007c). In accordance with the surface water FSPs and QAPP,

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surface water samples from all target stations were submitted to analytical laboratories for chemical testing (Section 3.1).

2.1.2 High-Volume Surface Water Sampling with XAD-2 Columns

Two types of high-volume samplers were used during this sampling event: the Infiltrex 300 and the PR2900. Each of the high-volume pumps utilized the XAD-2 resin columns. With the exception of pump PR2900 utilizing Viton™ tubing at the peristaltic pump head, both types of pumps had the same equipment configuration for collection of water samples. Additional detail about these two groups is described in Integral (2007c).

High-volume surface water samples were pumped through a 140-µm stainless-steel pre-filter, a 0.5-µm wound glass fiber filter for particulate extraction, and an XAD-2 column to collect hydrophobic organic compounds for analysis by ultra-low-detection-limit analytical methods. Sample volumes between 300L and 508 L were collected at four near-bottom and near-surface transect locations and the six vertically integrated sample stations along the two targeted transects at RM 2 and 11 (Table 2-6). Sample volumes between 168 and 515 L were collected at 12 near-bottom and near-surface single-point locations in the Willamette River from January 15 to 18, 2007 and February 22 through March 10, 2007 (Table 2-6). All stations identified in the Round 3A Surface Water FSP were sampled. The mid-channel locations in transects W023 and W025 (river miles [RM] 11 and 2) were initially collected during the January 2007 mobilization and were recollected during the February/March mobilization. Table 2-3 includes each high-volume surface water station sampled, the sample date, and the specific analyses conducted on each sample. The total volume for each high-volume XAD-2 sample collected at each sample station is included in Table 2-6.

Field QC samples were collected, as required by the Round 2 QAPP Addendum 1: Surface Water (Integral 2004b), the Addendum to the Round 3A Surface Water FSP (Integral 2006b), the Round 3A Surface Water FSP (Integral 2006c), and Addendum 2 to the Round 3A Surface Water FSP (Integral 2006d) (Table 2-4); deviations are detailed in the FSR (Integral 2007c). System blank samples for high-volume surface water samples, consisting of an XAD-2 column and a 0.5-µm glass fiber filter, respectively, were generated by passing ultra-clean water through the Infiltrex system. Field replicates were also collected during each sampling event; deviations are detailed in the FSR (Integral 2007c). In accordance with the Surface Water FSPs and QAPP, surface water samples from all target stations were submitted to analytical laboratories for chemical testing (Section 3.2).

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3.0 SAMPLE ANALYSES AND DATA MANAGEMENT

This section briefly describes the sample processing and laboratory methods used to analyze the surface water samples. Any deviations from the analytical methods detailed in the Round 2 QAPP Addendum 1 (Integral 2004b) are described below. The data management subsection includes a brief description of how the data validation process occurred from the laboratory data package receipt to a final validated electronic data deliverable (EDD). Furthermore, it describes how the SCRA database was compiled into a series of compatible Excel tables, which were then distributed to the SCRA data users. The data validation reports are provided as Appendix B.

3.1 SURFACE WATER SAMPLE COLLECTION AND DEVIATIONS

The Round 3A Winter 2007 high-flow surface water sample collection and processing generally followed the procedures specified in the Round 3A Surface Water FSP (Integral 2006c), Round 3A Surface Water FSP Addendum 2 (Integral 2006d), Round 2 QAPP (Integral and Windward 2004), and QAPP Addendum 1 (Integral 2004b).

Several minor deviations from sampling methods described in the Surface Water FSPs and their respective addenda occurred during the winter 2007 high-flow surface water sampling event; these minor deviations did not impact the overall objectives and goals of the sampling program. A detailed description of surface water sample handling and processing between the field collection and the analytical laboratory, including any deviations from the QAPP and FSP, is included in Section 3.10 of the High-Flow FSR (Integral 2007c).

3.2 CHEMICAL ANALYSES AND DEVIATIONS

The following subsections describe the analyses conducted and the laboratories responsible for the analyses for the two types of surface water samples collected.

3.2.1 Peristaltic Pump Samples

Columbia Analytical Services (CAS; Kelso, WA) conducted all of the chemical analyses of samples collected using the peristaltic pump. Laboratory analyses for the peristaltic pump samples were conducted according to the Round 3A Surface Water FSP (Integral 2006c), the Round 3A Surface Water FSP Addendum 2 (Integral 2006d), and the Round 2 QAPP Addendum 1 (Integral 2004b), with the modifications identified below:

- Total suspended solids (TSS) were determined using two different filtering procedures. The first analysis was performed using the 0.5-µm filter specified in EPA Method 160.2. An additional TSS analysis was performed using a 0.45-µm glass fiber filter. This is a deviation from the Round 3A Surface Water

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FSP and the Round 2 QAPP Addendum 1, which described only the use of a 0.5-µm glass fiber filter.

3.2.2 Infiltrex Pump Samples

Axys Analytical Services, Ltd (Axys; Sydney, B.C., Canada) extracted and analyzed the XAD-2 resins and 0.5-µm glass fiber filters. Laboratory analysis for the high-volume XAD samples was conducted according to the Round 3A Surface Water FSP (Integral 2006c), the Round 3A Surface Water FSP Addendum 2 (Integral 2006d), and the Round 2 QAPP Addendum 1 (Integral 2004b), with the modifications identified below:

- For the XAD samples, polychlorinated biphenyls (PCB) congeners were analyzed by high-resolution gas chromatography/mass spectrometry. Round 2 QAPP Addendum 1 (Integral 2004b) specified PCB Aroclor analysis for these extracts; however, the method was changed during the Round 2A sampling events because of interference encountered during the PCB Aroclor analyses.
- Phthalate esters were not analyzed on the XAD extract. Laboratory contamination resulted in extensive qualification of the XAD phthalate data during Round 2A. The one-sixth portion of the extract that could be designated for phthalate analysis was consumed for the PCB congener analysis. Phthalate esters were analyzed at each station from the peristaltic pump samples, as specified in the Round 3A Surface Water FSP Addendum (Integral 2006d).

3.2.3 Laboratory Deviations from the Round 2 FSPs and QAPP

Samples were analyzed as described in the Round 2 QAPP (Integral and Windward 2004), and QAPP Addendum 1 (Integral 2004b), with the exceptions noted above and in the FSR (Integral 2007c).

3.3 DATA VALIDATION

As required by the Round 2 QAPP (Integral and Windward 2004), approximately 10% of the surface water data were fully validated (Level 4), and the remaining data were subjected to Level 3 data validation, which includes the evaluation and assessment of the sample results and applicable QC results reported by the laboratory. The data validation subcontractor for the Round 3A surface water data was EcoChem, Inc., located in Seattle, WA.

The inorganic, organic, PCB congener, and polychlorinated dibenzo-p-dioxin/furan (PCDD/F) data were validated in accordance with guidance specified by the *U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic and Organic Data Review* (EPA 1994, 1999), by EPA Region 10 standard operating procedures (SOPs) for validation of PCB congener data and PCDD/F data (EPA 1995, 1996), and by *Guidance on Environmental Data Verification and Validation* (EPA

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2002). Modifications were made to the functional guidelines to accommodate quality assurance/quality control (QA/QC) requirements of the non-Contract Laboratory Program methods that were used for this project. Data qualifiers were assigned during data validation if applicable control limits were not met, in accordance with the EPA data validation guidelines and the QC requirements included in the referenced methods. The data validation qualifiers and definitions are summarized in Table 3-1. The following laboratory deliverables were reviewed during Level 3 and full data validation:

- The case narrative discussing analytical problems (if any) and procedures.
- Chain-of-custody documentation and laboratory sample receipt logs.
- Instrument calibration results.
- Method blank results.
- Results for laboratory QC samples required by the referenced method, including laboratory control sample/laboratory control sample duplicate analyses, matrix spike/matrix spike duplicate analyses, surrogate recoveries, and other method specific QC samples (e.g., serial dilutions for inductively coupled plasma [ICP] analyses).
- Results for field QC samples (i.e., equipment blanks, field duplicates).
- Analytical results for the surface water samples.
- For data packages subjected to full validation, in addition to review and assessment of the documentation identified above, the validation included verification of reported concentrations for the field and QC samples, verification of intermediate transcriptions, and review of instrument data such as mass spectra to verify analyte identification procedures.

After completing the data validation activities for each surface water sample type, a data quality report and a tabular summary of qualified data were generated by EcoChem (Appendix B). EcoChem chemists added data validation qualifiers that were assigned during validation to the laboratory report forms and EDDs. The revised EDDs and hard-copy data validation reports were submitted as the project deliverable. The revised EDDs were then incorporated into the project database, as described in Section 3.5.

3.4 DATA QUALITY AND USABILITY

Data generated in the field and at the laboratories were verified and validated according to the criteria and procedures described in the Round 2 QAPP (Integral and Windward 2004). Data quality and usability were evaluated based on the results of the data validation and the data quality objectives for the Round 2A and Round 3A data. The performance criteria in the QAPP included project analytical goals for precision, accuracy, representativeness, completeness, and comparability (PARCC) of the data.

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The precision, accuracy, representativeness, and comparability of the data were assessed during data validation, as described in the Round 2 QAPP (Integral and Windward 2004). Completeness is calculated by comparing the total number of acceptable data (non-rejected data) to the total number of data points generated. Completeness for the Round 3A winter 2007 high-flow surface water chemistry data, hereafter referred to as the Round 3A data, was >99% overall, which exceeds the Round 3A surface water completeness objective of 95%. Completeness for the Round 3A data is summarized by sampling event, parameter group, and sample type in Table 3-2. Completeness for the high-flow sampling event ranged from 99 to 100% for the various parameter groups and sample types.

The EcoChem data validation report (Appendix B) provides detailed information on the data quality issues and data validation qualifiers for each parameter group for each laboratory data package. Qualified data for the high-flow surface water sampling event are included in Tables 4-2 and 4-3. A complete list of qualified results with reason codes is provided in the data validation reports in Appendix B. The Round 3A surface water data, excluding the rejected data, are usable for all project purposes. Overall, the data qualify was acceptable and meets program objectives and goals for the RI/FS.

3.4.1 Field Quality Control Samples

Field QC samples are used to assess sample variability (field replicates), evaluate potential sources of contamination (equipment rinsate blanks), or confirm proper storage conditions (temperature blanks). Addendum 1 of the Round 2 QAPP (Integral 2004b) required collection of the following field QC samples:

- Field replicates – 5% of the sample total
- Equipment rinsate blanks – 5% of the sample total
- Decon blank – 1 per sampling event
- Temperature blanks – 1 per cooler.

The field QC samples were collected at the frequency specified in the QAPP as detailed in Table 2-4.

Prior to the start of sample collection activities, decon blanks of the peristaltic pump sampling equipment were generated by Battelle's laboratory and submitted for chemical analysis. Two rinsate blanks were collected for each sampling event for the peristaltic pump samples. System blank samples for high-volume surface water samples, consisting of an XAD-2 resin column and a 0.5-µm glass fiber filter, respectively, were generated by passing ultra-clean water through the Infiltrex system for each sampling event. Peristaltic pump rinsate blank samples and high-volume (Infiltrex 300, Infiltrex L, and Cole Parmer PR2900) pump system blank samples were submitted for analysis to the laboratories. Selected data points were qualified based on rinsate or system blank results (see Appendix A Data Quality Summary, Tables A-6a and b).

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Three field replicate samples were collected for peristaltic pump surface water samples, and four field replicate samples were collected for high-volume surface water samples during the high-flow sampling event. Field splits were not requested by EPA or any other party during this sampling event and therefore were not collected. The field replicates were submitted blindly to the laboratories as separate samples for analysis. Surface water data were not qualified based on the field replicate results. (Field replicate results are summarized in Tables A-8a and b of Appendix A.)

3.4.2 Summary of Qualified Data

Selected data not meeting the data quality criteria were qualified as undetected, estimated, tentatively identified, or rejected during validation, in accordance with the Round 2 QAPP and the Round 2 QAPP Addendum 1 (Integral and Windward 2004, Integral 2004b). A tabular summary of the results, with the data qualifiers, is included in Tables 4-2 and 4-3. A complete list of qualified results with reason codes is provided in Appendix B (on CD). Data qualified as undetected are usable for all intended purposes. Data qualified as estimated or tentatively identified are usable for all intended purposes, with the knowledge that these data may be less precise or less accurate than unqualified data. Rejected data are not usable for any purpose and have been flagged as "not reportable" in the database. The Round 3A surface water data, excluding the rejected data, are usable for all project purposes. Overall, the data quality was acceptable and meets program objectives and goals for the RI/FS.

3.5 DATA MANAGEMENT

Once the laboratories completed their internal QA/QC checks, they exported the analytical data (sample, test, batch, and result information) into comma-delimited text files with data columns arranged in an order that was recognized by the project's Environmental Quality Information System (EQuIS) database. These EDDs were e-mailed to Integral where they were checked for proper EQuIS structure and appended with specific information that was unknown by the labs, such as sampling location, composite information, and field replicate information. If any problems were found in the structure of the EDDs, then the laboratory was notified and asked to correct the problem and resubmit the EDD. Each emailed EDD transmission, with the original, unaltered EDD attachment, was stored to document and track the laboratories' delivery of electronic data to Integral.

When the EDDs were corrected and complete, they were checked electronically by loading them into the temporary section of Integral's Lower Willamette Group (LWG) project database. In the process of loading, EQuIS checked the EDDs for correct lookup codes (e.g., analytes, test methods, and sample matrices); proper relationships for results, tests, batches, and samples (to ensure all results matched with a test, tests with samples, and sample/test pairs with batches); and corresponding parent samples for all derived samples (e.g., replicates and matrix spikes).

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In addition to these checks, EQuIS also checked "less important" characteristics, such as date and time formats and text field lengths, to ensure consistency throughout the database. Any error prevents the EDD from loading until the error is corrected. If errors were found that were related to the way the laboratory reported the data or constructed the EDD, then the laboratory was notified and asked to correct the problem and resubmit the EDD. If errors were related to Excel automatically formatting date and time fields, for example, then the error was corrected and steps were taken to avoid repeats of the problem (such as changing default settings in the software). Successfully loaded EDDs were saved and loaded into Integral's LWG project database.

Each verified and accurate EDD was provided to EcoChem for data review and validation. These EDDs were also stored in a temporary section of the project database, where they could be queried and examined, if desired, until validation was complete. As EcoChem completed validation of the data by sample delivery group (SDG) or small groups of SDGs, the validator qualifiers and reason codes were applied to the data in the temporary section of the database. The validated data were then merged into the permanent project database. During the merging process, all previously performed electronic checks were repeated to ensure that nothing was incorrectly modified with the application of the validation results.

Several queries were set up in the permanent project database to translate the data structure to a form compatible with the National Oceanic and Atmospheric Administration (NOAA) Query Manager. The data translation included creating station and sample identifiers, converting the sample type code, and changing the date format. The translated data were imported into an Access file provided by NOAA that contained template tables for the Query Manager structure.

Integral's LWG project database contained all of the data reported by the analytical laboratories. This included field and lab replicates, lab dilutions, results for the same analyte from multiple analytical methods (e.g., SW8270 and SW8270-SIM), and laboratory QA samples such as matrix spikes, surrogates, and method blanks.

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4.0 ROUND 3A RESULTS

Round 3A chemistry results for the winter 2007 high-flow surface water sampling event are presented in this section. Review and evaluation of the surface water data in conjunction with other data types (e.g., sediment), evaluation of spatial trends in the distribution of contaminants in surface water, source evaluation, and risk analyses will be presented in the draft RI report.

All surface water samples collected by peristaltic pump methods were analyzed for conventionals, metals (total/dissolved), butyltins, chlorinated herbicides, semivolatile organic compounds (SVOCs), phenols, phthalate esters, and polycyclic aromatic hydrocarbons (PAHs). In addition to the standard chemical suite, samples from W011 (transect) and W033 (single-point station) were analyzed for hexavalent chromium and perchlorate. All transect and four additional station (W031, W033, W035) surface water samples collected by the XAD system were analyzed for PCDD/Fs, PCB congeners, organochlorine pesticides, and PAHs. PCBs only were analyzed at nine stations. Water quality parameters (temperature, dissolved oxygen, specific conductance, pH, turbidity, and oxidation reduction potential) were also measured at all stations in the field.

Analytical chemistry results are tabulated by sampling method. Field surface water quality parameters are summarized in Table 4-1. Results for the high-flow surface water samples collected by peristaltic pump and Infiltrex pump are displayed in Tables 4-2 and 4-3, respectively.

4.1 SUMMARY OF PERISTALTIC PUMP RESULTS

CAS performed all chemical analysis of samples collected using the peristaltic pump. Results for the peristaltic pump samples are summarized in Table 4-2.

4.2 SUMMARY OF XAD RESULTS

Axys performed all chemical analyses of high-volume surface water samples collected using the Infiltrex pump. Results for the Infiltrex pump samples are summarized in Table 4-3.

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