Intergovernmental Agreement for Remedial Investigation and Source Control Measures

Source Control Measures Effectiveness Demonstration

City of Portland Outfalls Project

September 2015

PREPARED BY

ENVIRONMENTAL SERVICES
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Abbreviations and Acronyms

AOPC	Area of Potential Concern
As	arsenic
BEHP	bis(2-ethylhexyl)phthalate
BES	Bureau of Environmental Services
Cd	cadmium
City	City of Portland
COC	Certificate of Completion
Cr	chromium
CSO	combined sewer overflow
Cu	copper
CU	Cleanup Program (Oregon Department of Environmental Quality)
DEQ	Oregon Department of Environmental Quality
DQO	data quality objective
ECSI	Environmental Cleanup Site Information
EPA	United States Environmental Protection Agency
EXC	excluded
geomean	geometric mean
Hg	mercury
IGA	Intergovernmental Agreement
JSCS	Joint Source Control Strategy
LWG	Lower Willamette Group
MS4	Municipal Separate Storm Sewer System
MRL	method reporting limit
µg/L	microgram(s) per liter
Municipal Report	*Municipal Stormwater Source Control Report for Portland Harbor*
NA	not applicable
ND	not detected
NEC	No Exposure Certification
NFA	No Further Action
Ni	nickel
NPDES	National Pollutant Discharge Elimination System

O&M	operations and maintenance
ODOT	Oregon Department of Transportation
OF	City outfall
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PBOT	City of Portland, Bureau of Transportation
PCB	polychlorinated biphenyl
PH	Portland Harbor Superfund Site
PH-SCM	Portland Harbor-specific source control measure
Port	Port of Portland
SAP	Sampling and Analysis Plan
SCD	DEQ Source Control Decision
SCE	source control evaluation
SCM	source control measure
SLV	screening level value
SW	stormwater
SWMM	BES Stormwater Management Manual
TBD	to be determined
WOE	weight-of-evidence
WQ	water quality
Zn	zinc

SECTION 1

Introduction

The City of Portland *Municipal Stormwater Source Control Report for Portland Harbor* (Municipal Report; BES, 2013) and the accompanying Closure Report for the City of Portland Outfalls Project document the City's completion of an intergovernmental agreement (IGA) with the Oregon Department of Environmental Quality (DEQ) for remedial investigation and source control in the municipal stormwater conveyance systems in Portland Harbor (DEQ, 2003). At the request of DEQ, and as a final step under the IGA to provide support for a DEQ Source Control Decision for the Outfalls Project, the City evaluated whether sufficient data have been collected to demonstrate that source control measures (SCMs) implemented by the City under the IGA (i.e., Portland Harbor-specific SCMs – "PH-SCMs") are effective.

Within Portland Harbor drainage areas served by City outfalls (i.e., City outfall basins), SCMs were implemented under several different scenarios:

- By the City to meet Portland Harbor objectives;
- By other City programs, such as the Combined Sewer Overflow (CSO) program and the Municipal Separated Storm Sewer (MS4) program, to meet separate regulatory objectives;
- By non-City parties in City storm systems to address offsite migration of contaminants under DEQ authority;
- By non-City parties at specific facilities to meet Portland Harbor objectives under DEQ Cleanup and Water Quality programs; and
- By non-City parties at specific facilities to address other regulatory requirements (such as City redevelopment requirements).

Most basins did not warrant implementation of SCMs to meet Portland Harbor objectives (e.g., basins didn't include sources, basin data didn't indicate elevated levels of contaminants, land use and basin size didn't indicate future source potential, etc.). In some basins where PH-SCMs were implemented, SCM effectiveness has already been demonstrated by the City and/or other parties. In others, effectiveness monitoring is planned or underway. Effectiveness monitoring completed by the City and others helps to demonstrate that the recontamination risk from City stormwater outfalls is low. Determining whether and where additional City stormwater data are needed for this purpose requires an evaluation of each basin using a uniform approach.

1.1 Purpose of Document

The purpose of this document is to demonstrate how SCM effectiveness is being demonstrated for each basin where PH-SCMs were implemented and to identify basins for which additional monitoring by the City is warranted to demonstrate that City-implemented PH-SCMs are

effective.[1] At DEQ's request, the report also includes a weight-of-evidence (WOE) for why additional City monitoring at the basin scale is unwarranted for most basins and to provide support for the City's conclusion that City outfall basins are an unlikely significant current or future pathway for contaminants to reach the Willamette River (i.e., the recontamination potential is low) once identified sources have been controlled. This evaluation, along with the City's commitment to complete the proposed monitoring, supports the forthcoming issuance of a DEQ Source Control Decision (SCD) for the Outfalls Project.

1.2 Report Organization

The remainder of this report is organized as follows.

- *Section 2: Background* — Provides general information about the collaborative work completed under the Outfalls Project, the recent Municipal Report and Closure Report, and current project status.
- *Section 3: SCM Effectiveness Demonstration* — Describes the approach utilized to determine whether additional City data collection by the City is warranted, implements a decision framework to make this determination, and summarizes the existing qualitative and quantitative factors for why future discharges from City outfalls are unlikely to recontaminate river sediment once inriver remediation has been completed.
- *Section 4: Proposed City PH-SCM Effectiveness Monitoring* — Defines monitoring objectives, proposed scope of data collection, anticipated schedule, and planned reporting for basins identified for City data collection.
- *Section 5: Conclusions* — Summarizes the results of the SCM effectiveness evaluation and next steps.
- *Section 6: References*
- *Appendix A: DEQ Stormwater Curves and City Basin Data*
- *Appendix B: Basin Evaluations*
- *Appendix C: Data Quality Objectives and Sampling and Analysis Plan*

[1] Future monitoring work that may be conducted by the City and other parties to support subsequent work phases in Portland Harbor (e.g., Remedial Design/Remedial Action) is not covered in this report as City involvement in that work will be conducted under separate agreements.

SECTION 2

Background

In 2003, the City and DEQ entered into an IGA for the City of Portland Outfalls Project to provide the framework for a collaborative approach to investigating and controlling upland source of contaminants to City stormwater conveyance systems that could adversely affect sediment and surface water quality in Portland Harbor. Although a number of City stormwater source control programs were already in existence at that time, the agencies agreed that a Portland Harbor-specific program was needed due to the unique upland conditions, namely the older industrial areas with legacy site contaminants that were not necessarily being identified or adequately controlled by current site owners or operators. Work conducted by the City under the IGA is separate from work completed by other City programs under different regulatory authorities, such as the MS4 and CSO programs.

The primary objectives of the IGA were twofold. The City and DEQ agreed to work jointly to identify all potentially significant sources of contaminants to City storm systems and to utilize appropriate respective authorities to ensure that all identified sources would be addressed before implementation of inriver remedies, in order to prevent potential sediment recontamination in the harbor from City outfalls.

This section provides a brief overview of the work completed by the City under the Outfalls Project IGA and context for the SCM Effectiveness Demonstration presented in this report.

2.1 Outfalls Project Overview

The Outfalls Project covered thirty-nine City outfalls located in the Portland Harbor Study Area (i.e., River Miles 1.9 to 11.8). More than 400 non-City outfalls are also present in the harbor, most of which are being evaluated under separate agreements between DEQ and the parties that utilize those outfalls. City outfall drainage to the Willamette River represents approximately half of the stormwater drainage to the Study Area, and almost two thirds of this drainage is comprised of Forest Park and other open space. Other land uses served by City outfalls include industrial, major transportation (i.e., State highways), commercial, and residential.

Before issuance of the IGA, the City compiled relevant information for the outfall basins (i.e., the drainage areas to each outfall) in the initial study area, such as land use, facility releases, and other information regarding known and potential source areas within each basin (BES, 2000a and 2000b). This information, along with sediment data collected in the vicinity of City outfalls, was used to develop the IGA framework and subsequently the *Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project* (CH2M HILL, 2004). The work plan prioritized outfall basins for source investigation to ensure that the basins most likely to include sources would be evaluated early, so sources could be controlled in advance of the inriver remedies. Based on the work plan (and previous pilot studies), the City conducted "up-the-pipe" investigations, such as stormwater and inline solids sampling in the City system, and supported DEQ site discovery efforts to identify specific sources within basin

drainage areas. Although all basins were evaluated for their source potential, some basins did not warrant up-the-pipe investigation because factors such as basin size, land use, and sediment quality near the outfall did not indicate that sources warranting control were present.

The City summarized the results of the basin investigations and source control recommendations in more than 50 technical reports that are on file at DEQ. To verify conclusions regarding completion of source tracing for each basin, the City also conducted a comprehensive evaluation of stormwater data collected by the City and others in Portland Harbor (BES, 2010). This evaluation resulted in additional source tracing work in two basins; the City completed all basin source investigations by 2012.

In December of 2013, the City completed a comprehensive report to DEQ (BES, 2013). To support DEQ's Upland Source Control Summary Report (DEQ, 2014), the main report (Municipal Report) provides a summary of various City stormwater source control programs, being implemented City-wide and in the harbor, that are not part of the IGA. To show how the specific requirements of the Outfalls Project IGA have been met, the City also developed and attached a Closure Report. The Closure Report includes individual Outfall Basin Completion Summaries that summarize the investigation approach utilized in each basin, the rationale for concluding that additional City source tracing is not warranted, and the joint plan for controlling identified sources. These summaries also provide a general description of the SCMs that have been implemented (or are planned) in each basin.

2.2 Current Status

The City completed source identification in all basins and all identified sources were referred to an appropriate City, state, or federal program for control (BES, 2013). At the time the Outfalls IGA was developed, the agencies envisioned that source control in City outfall basins may entail a combination of controls implemented at specific sites and controls implemented in the City conveyance system. Approximately one half of the basins were found to include sources, and PH-SCMs have been implemented (or are pending) in these basins. It should be noted that most of the SCMs that were implemented to meet IGA objectives were implemented by the identified sources at those sources, not by the City. Where source controls were warranted in selected portions of the City stormwater conveyance system, other parties implemented some of these controls (e.g., pipe lining or cleaning) in response to offsite migration of contaminants from upland sites. In some basins, the City implemented controls (e.g., abandoning historical connections and cleaning lines for which a responsible party could not be identified).

Following DEQ review of the Closure Report, DEQ met with the City in June 2014 to discuss DEQ's request for a demonstration of the effectiveness of City SCMs implemented under the IGA, the issuance of the SCD, and closure of the IGA. Since then, the City has been working with DEQ on an approach for determining where additional monitoring by the City is needed at this time and DEQ has been developing the Staff Report to support the forthcoming SCD for the Outfalls Project.

SECTION 3

SCM Effectiveness Demonstration

This section describes and implements a methodology for determining where additional City monitoring is needed at this time and summarizes the existing lines of evidence that support the City's conclusion that City outfalls in the harbor do not represent a significant current or future pathway for upland contaminants to reach the river, once identified sources have been controlled.

As summarized in the Closure Report (BES, 2013), each of the 39 outfalls has a unique set of circumstances that did or did not warrant the implementation of PH-SCMs within the respective drainage areas. For example, some outfalls no longer discharge separated stormwater and for others, PH-SCMs were not warranted because sources requiring control were not present. In basins where PH-SCMs were needed, most measures were (or are being) implemented by other parties either on upland sites within the basins or in the City storm system. The parties that implemented those measures are responsible for demonstrating their effectiveness. Basins where the City implemented PH-SCMs warrant demonstration of SCM effectiveness by the City.

3.1 Approach

The City utilized a two-tiered approach for determining whether additional City monitoring is warranted to demonstrate PH-SCM effectiveness in City outfall basins.

The first step in the approach is to summarize how SCM effectiveness is being (or needs to be) demonstrated by applying a standard decision framework to each basin. This process is described in Section 3.2.

The second step in the approach is to summarize the other qualitative and quantitative lines of evidence (WOE) that provide additional rationale for the conclusion that the recontamination potential from each outfall is low. These lines of evidence are described in Section 3.3.

Section 3.4 includes a summary of the results of applying this approach.

3.2 Decision Framework

To identify basins for which additional City monitoring is warranted to demonstrate PH-SCM effectiveness, the decision framework uses a series of yes/no Decision Points to determine which of six different Outcomes applies (see Figure 1).

Decision Points are shown in purple on Figure 1 and are described in the table below.

Decision Point	Description
1. Does the outfall convey separated stormwater?	Operational changes were made to City outfalls over time as conveyance system needs evolved. Some of the 39 City outfalls within the Study Area no longer discharge separated stormwater to the river (i.e., there is no affiliated stormwater drainage basin). Examples are outfalls that now only function as relief points for the CSO tunnels or outfalls that serve only as a relief point for an unlikely pump station failure. These outfalls are regulated under the City CSO program.
2. Does the outfall discharge to an Area of Potential Concern (AOPC)?	EPA identified AOPCs for Portland Harbor to indicate areas where elevated concentrations of contaminants in sediment are present (EPA, 2010). DEQ utilized these AOPCs to direct upland source control work and as a conservative line of evidence for evaluating recontamination potential (DEQ, 2014). The presence of sediment contamination in the vicinity of an outfall may indicate that the outfall is a potential pathway for upland sources. The absence of sediment contamination indicates the outfall is an unlikely historical or current pathway.
3. Were Portland Harbor-specific SCMs implemented (or planned) in the basin by the City or by sites?	Basin evaluations and source investigations under the IGA resulted in the implementation of PH-SCMs in some basins (i.e., at sites discharging to the conveyance system and/or in the conveyance system itself), but not all. In some basins, PH-SCMs were not warranted because uncontrolled sources are not present.
4. If Portland Harbor-specific SCMs were implemented in the basin, were any implemented by the City?	City-implemented PH-SCMs include measures like targeted line cleaning to remove legacy contaminated solids for which a responsible party could not be identified and abandoning historical connections that were no longer needed, but that could represent a current or future pathway for contaminant discharges to City storm systems.
4a. If Portland Harbor-specific SCMs were implemented in the basin by the City, are there post-SCM data that indicate that the SCMs are effective?	In most basins where the City implemented PH-SCMs, data have already been collected that demonstrate the effectiveness of those measures. If not, additional monitoring may be warranted.
5. If Portland Harbor-specific SCMs were implemented in the basin, were any implemented by sites?	Site-implemented PH-SCMs include measures like removal actions, capping, line cleaning, and installation of stormwater treatment on upland properties under DEQ or EPA oversight. Site-implemented PH-SCMs can also include measures implemented in the City conveyance system to address offsite migration of site-related contaminants (e.g., line cleanouts to remove contaminated solids or pipe lining to control contaminated groundwater infiltration).
5a. If Portland-Harbor-specific SCMs were implemented in the basin by sites, does the site SCM-effectiveness monitoring completed in the basin provide sufficient certainty for basin-scale effectiveness?	Parties that implement the PH-SCMs are responsible for demonstrating the effectiveness of the measures. Where effectiveness monitoring has been completed by sites in a given basin, the collective effectiveness data set may not provide sufficient certainty that SCMs implemented throughout the basin are adequate at the basin scale. For example, data may only evaluate a subset of the measures implemented.

Applying the decision framework to each basin results in an Outcome, shown on Figure 1 in blue and described in the table below.

Outcome	Description
Outcome 1	No SCMs were needed because the outfall does not (or will not) convey separated stormwater. Therefore, effectiveness monitoring is not applicable.
Outcome 2	The outfall does not discharge to an AOPC so there is no indication that historical discharges were a significant pathway for upland site contaminants. Inriver sediment remediation is not anticipated in the vicinity of these outfalls. Therefore, effectiveness monitoring is not needed.
Outcome 3	The outfall discharges to an AOPC, but the outfall basin evaluation determined that PH-SCMs were not needed in the basin. Therefore, effectiveness monitoring is not applicable.
Outcome 4	The City implemented PH-SCMs in the basin, but post-SCM data have already been collected that demonstrate that SCMs are effective. Therefore, additional effectiveness monitoring is not needed.
Outcome 5	Sites implemented (or will be implementing) PH-SCMs in the basin, and SCM effectiveness monitoring conducted by sites will provide sufficient certainty that PH-SCMs are effective at the basin scale. Therefore, additional effectiveness monitoring by the City is not needed.
Outcomes 4 and 5	In some basins, the City *and* sites implemented (or will be implementing) PH-SCMs, the City already collected data to demonstrate effectiveness, and site demonstration of effectiveness has either been completed or will be done. Therefore, additional effectiveness monitoring by the City is not needed.
Outcome 6	Additional stormwater data collection by the City is warranted to demonstrate the effectiveness of PH-SCMs implemented by the City or, in basins where PH-SCMs were implemented by sites and performance monitoring has been completed, to add additional certainty that the PH-SCMs implemented by sites within the basin are effective.

Figure 1 also indicates where additional lines of evidence (i.e., the green boxes) support the outcomes of the decision framework. This information is discussed in Section 3.3.

Table 1 provides a summary of the inputs utilized to generate the outcomes. The inputs include information from the Completion Summaries (BES, 2013) and from the DEQ Summary Report (DEQ, 2014) regarding where PH-SCMs were implemented and by whom. Note that in many basins, source control evaluations are still underway at identified sources and the need for those sources to implement PH-SCMs has yet to be determined (i.e., these sites are shown as "TBD" in Table 1).

Also note that the framework was applied to the current/immediate future basin drainage areas. Drainage areas for several City outfalls changed dramatically during the course of the Outfalls Project due to completion of the CSO Abatement Program and as a result of sites abandoning connections to City storm systems to control site pathways to the river. Because the decision framework is designed to evaluate the need for effectiveness data on PH-SCMs implemented to address current and future discharges from the outfalls, Table 1 does not

include information related to PH-SCMs implemented in areas that no longer drain to the outfall. For example, in Basin 43 the City and sites implemented PH-SCMs in an area that is no longer served by the outfall; these PH-SCMs are not included in Table 1.

3.3 Existing WOE for Outfall Pathway Insignificance

As a second step in the approach and to assist DEQ with development of the Source Control Decision, the City summarized the other qualitative and quantitative WOE that provides additional support for the conclusion that the recontamination potential from each outfall is low. Relevant lines of evidence for each outfall basin are summarized in Table 2 and described below.

3.3.1 Qualitative Lines of Evidence

Qualitative lines of evidence that support the City's conclusions regarding outfall recontamination potential include information related to the outfall drainage basin characteristics or setting. Examples of qualitative factors include such things as: the absence of an AOPC, basin land use, basin size, the absence of sources in a basin, the presence of structural stormwater controls, and the applicability of other regulatory mechanisms [e.g., National Pollutant Discharge Elimination System (NPDES) industrial stormwater permits] that are likely to have a controlling effect on current and future stormwater discharges from the outfall. Information utilized to determine the qualitative WOE was derived from the Completion Summaries (BES, 2013).

3.3.2 Quantitative Lines of Evidence

Quantitative lines of evidence include such things as basin source investigation data, basin stormwater data, PH-SCM effectiveness data, and spatial distribution of inriver sediment data. Data sources for basin source investigation, stormwater characterization, and effectiveness monitoring are summarized in the Completion Summaries (BES, 2013).

In 2010, the City evaluated stormwater data collected from City outfall basins in the harbor (BES, 2010). To utilize this data set as a quantitative line of evidence, along with subsequent data sets collected from City basins by the City and other parties, the City developed a summary of basin stormwater (see Appendix A).

The figures in Appendix A (i.e., Figures A-1 through A-12) include data, representative of stormwater discharged from City outfalls, plotted on the DEQ guidance curves (DEQ, 2009) for specific contaminants. Geometric means (geomeans) were calculated and plotted as an indicator of central tendency and to allow for a streamlined evaluation of basin concentrations and selected comparison levels (see Table A-1). Geomeans are utilized as part of the implementation of NPDES industrial stormwater permits to help account for the inherent variability in stormwater data. As indicated in Table A-1, a conservative approach was used to calculate the geomeans, in that non-detect values were set to the value of the method reporting limit (MRL).[2] The green and blue coding shown on the plotted geomeans and on Table A-1 refers to the basin source investigation findings summarized in the Municipal Report (BES,

[2] See Note 2 on Table A-1 for specific methodology on calculating geomeans for total PAHs and total PCBs.

2013): green identifies basins for which no significant sources were identified and blue denotes basins for which sources were identified and referred to an appropriate program for control.

Figures A-1 through A-12 also show various comparison levels for each contaminant, including DEQ Background (DEQ, 2002), Portland Harbor Joint Source Control Strategy Screening Level Values (JSCS SLVs; DEQ and EPA, 2005), former and current NPDES benchmarks from the DEQ NPDES General Permit No. 1200-Z (DEQ, 2007 and 2012), and the approximate knee of DEQ Stormwater Guidance Curves (DEQ, 2009). Although all relevant comparison levels are shown on the figures, for the purpose of utilizing the stormwater data as a line of evidence, the City selected a comparison level for each contaminant and screened basin data against it (see Table A-1). In addition, the City screened all individual data points against the comparison levels and identified basins in which more than one sample exceeded the selected comparison level (see Table A-2). Tables A-1 and A-2 summarize the results of this data screening, data sources, and data evaluation considerations. The rationale for selected comparison levels is described below.

Metals:

The City selected the higher of either the JSCS SLV or the DEQ Background concentration for metals, with the exception of copper, lead, and zinc. Municipal drainage areas include industrial sites that discharge stormwater under NPDES permits issued by DEQ. These permits allow for copper, lead, and zinc concentrations in industrial stormwater discharges up to established benchmark concentrations (see table below).

Metal	DEQ 1200-Z Permit Benchmark Effective July 1, 2007	DEQ 1200-Z Permit Benchmark Effective July 1, 2012
Copper	100 µg/L	20 µg/L
Lead	400 µg/L	40 µg/L
Zinc	600 µg/L	120 µg/L

Most of the stormwater data collected from City outfall basins were collected during a time period in which older (higher) benchmarks were in place. Now that lower benchmarks are in place, along with a permit provision to minimize off-site tracking of raw, final, or waste materials, concentrations of copper, lead, and zinc in stormwater discharged from City outfalls are anticipated to be lower. This premise is supported by the Basin 19 Stormwater Quality Trend Analyses, Effectiveness of City Stormwater Source Control Efforts technical memorandum prepared for the BES MS4 program (BES, 2011), which found that metals concentrations in basin stormwater are decreasing and are likely to decrease further as individual industrial stormwater dischargers are subject to current and future NPDES 1200-Z requirements.

Although concentrations in the City data set reflect permitted discharges under the higher benchmarks, the City selected the current NPDES benchmarks for copper, lead, and zinc as a conservative comparison level.

Total Polycyclic Aromatic Hydrocarbons (PAHs):

There is no SLV or specific reference concentration for total PAHs. Therefore, the City utilized the approximate knee of the DEQ Guidance Curve (i.e., 1.5 µg/L) as the comparison level.

Total Polychlorinated Biphenyls (PCBs):

The NPDES reference concentration for total PCBs is 2.0 µg/L, which is higher than all detections in basin stormwater data, and the JSCS SLV is 0.000064 µg/L which is lower than all detections in basin stormwater data. Therefore, for total PCBs the City selected the approximate knee of the DEQ Guidance Curve (i.e., 0.1 µg/L) as the comparison level.

Bis(2-Ethylhexyl)phthalate (BEHP):

The City utilized the JSCS SLV (i.e., 2.2 µg/L) as a comparison level for BEHP data. However, because most SLVs are conservative for stormwater-related media, during the City's earlier evaluation of basin stormwater data (BES, 2010) the City only identified exceedances that were greater than ten times the SLV as a high priority for further source tracing. Therefore for this line of evidence, basin data that exceed the JSCS SLV for BEHP were also compared to a value of five times the BEHP SLV as a conservative indicator of potential significance.

3.4 Summary of Results

The results of applying the decision framework to the 39 City outfalls (OF) are shown on Tables 1 and 2 and summarized below.

Outcome 1	OF-23, OF-24, OF-44A, and OF-46
Outcome 2	OF-10A, OF-11, OF-13, OF-14, OF-15, OF-42, OF-53, OF-S5, and OF-S6
Outcome 3	OF-17, OF-19A, OF-22D, OF-47, OF-48, OF-49, OF-50, OF-52A, OF-52C, OF-M2, and OF-S2
Outcome 4 only	OF-43
Outcome 5 only	OF-19, OF-22, OF-52D, OF-53A, OF-M1, OF-M3, and OF-S1
Outcomes 4 and 5	OF-18, OF-22B, OF-22C, OF-44, OF-45, and OF-52
Outcome 6	OF-16

The City developed a synopsis of the SCM Effectiveness Evaluation for each basin in which the City implemented PH-SCMs (see Appendix B). These evaluations provide additional detail on how PH-SCM effectiveness has been (or will be) demonstrated and further explanation of the basin-specific lines of evidence identified in Table 2. These evaluations are intended to complement the Completion Summaries (BES, 2013) previously prepared for each basin.

The basin listed under Outcome 6 (i.e., Basin 16) is the one for which additional City monitoring will be conducted. Monitoring objectives, scope, and schedule are described in Section 4. City effectiveness monitoring for basins listed under the remaining outcomes isn't warranted, has been completed already, or will be completed by the non-City parties implementing the PH-SCMs.

SECTION 4

Proposed City PH-SCM Effectiveness Monitoring

This section presents the specific monitoring objectives for Basin 16 and a general description of the investigation. Appendix C includes a detailed Sampling and Analysis Plan (SAP) for proposed monitoring.

4.1 Monitoring Objectives

The City implemented a Data Quality Objectives (DQO) process to define the decision that will be made with the proposed data, in order to design a monitoring plan suited to those needs. A summary of the Basin 16 DQO process is included in Appendix C. For this basin, the City determined that directly evaluating the effectiveness of the PH-SCM implemented by the City would be of minimal value due to limited applicability of the PH-SCM in the basin (see Appendix C). Instead, the City proposes to collect basin stormwater data downstream of the branch in which the PH-SCM was implemented to represent the branch and the majority of the Basin 16 drainage area. The objective of the proposed data collection is to allow for a comparison of current stormwater quality to the original (2007) stormwater data set, in order to determine if previously elevated contaminant concentrations are trending downward as expected.

4.2 Data Collection Scope and Use

Stormwater grab samples will be collected from one location in Basin 16 during four qualifying storm events, as described in more detail in the SAP in Appendix C. The proposed analytical suite was selected to meet the monitoring objectives defined in Section 4.1, and will include PCB congeners, PAHs, total copper, total zinc, and total suspended solids.

Analytical results from each event will be reviewed for data quality, and upon completion of the SAP, data will be evaluated to confirm that DQOs have been met.

4.3 Schedule

The City anticipates implementing the SAP as soon as it is approved by DEQ, with the intent of completing stormwater monitoring activities during the fall and winter of 2015-2016.

4.4 Reporting

Data from the 4 events will be compiled into a summary report that will include a description of the storm events sampled, field notes, photos, analytical results, deviations from the SAP, and an evaluation of analytical results. The report will be submitted to DEQ upon its completion.

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SECTION 5

Conclusions

The City evaluated each outfall basin to determine whether additional data collection by the City is warranted to demonstrate the effectiveness of SCMs implemented for Portland Harbor. Based on this evaluation, one basin has been identified for monitoring. This report provides the justification for this recommendation. It identifies:

- Basins in which PH-SCMs were implemented and the ways in which SCM effectiveness has, or will be, demonstrated.
- Additional lines of evidence that support the conclusion that the recontamination potential via stormwater discharges from City outfalls is low.
- Data quality objectives and a proposed monitoring plan for the basin identified for City effectiveness monitoring under the IGA.

The City concluded its source investigations in City outfall basins in 2012 (BES, 2013). PH-SCMs were not warranted in most basins, and in basins where they were needed, most measures were implemented by other parties, who will be evaluating their effectiveness for DEQ.

Following DEQ review and approval of this effectiveness monitoring plan, the City will implement the SAP in Appendix C and DEQ will proceed with issuance of a Source Control Decision for the Outfalls Project.

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SECTION 6

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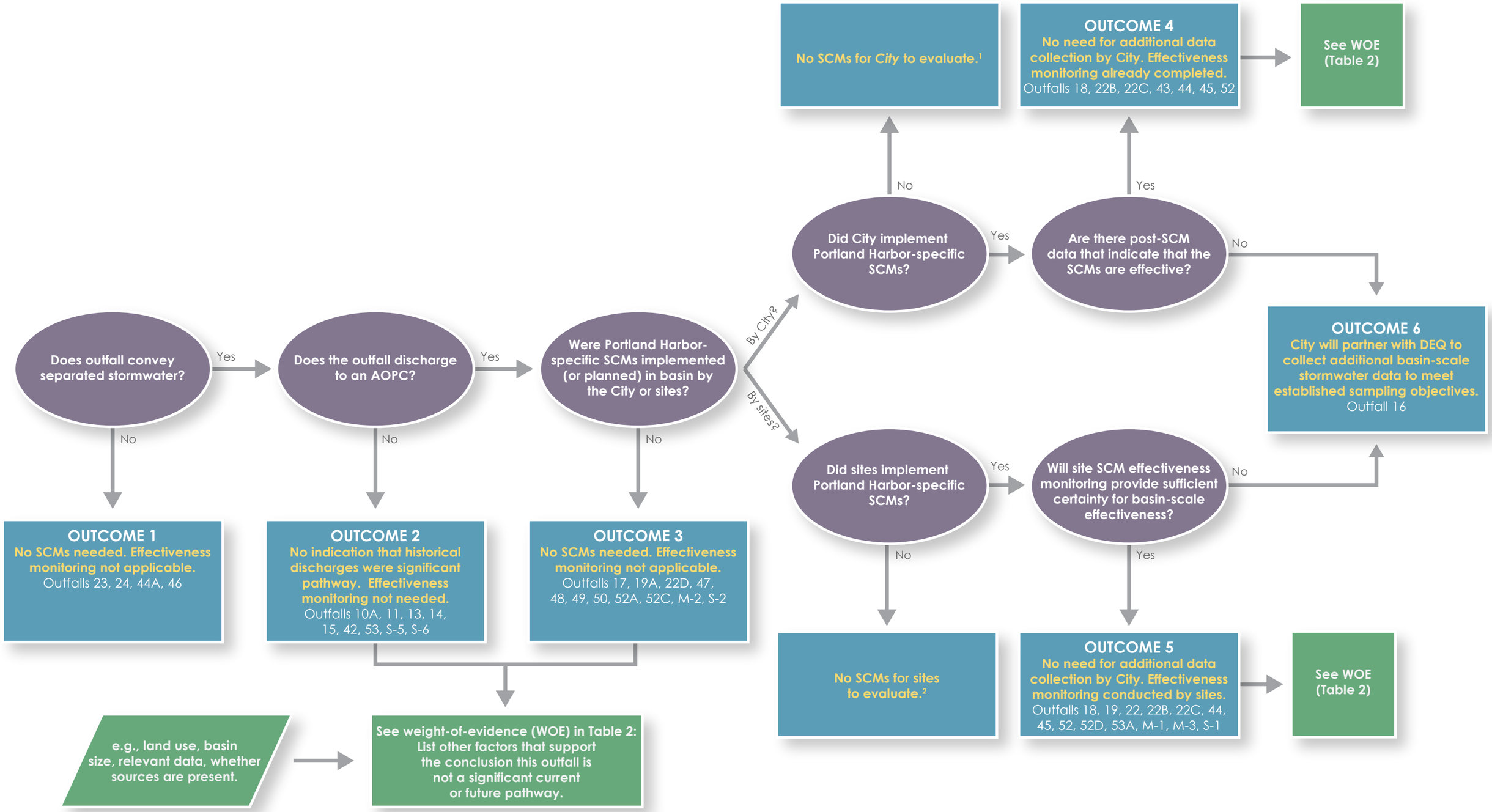
EPA. 2010. Letter from EPA to Mr. Bob Wyatt, Chairman, Lower Willamette Group Re: Portland Harbor Superfund Site; Administrative Order on Consent for Remedial Investigation and Feasibility Study; Docket No. CERCLA-10-2001-0240. Portland Harbor Feasibility Study Source Tables. November 23, 2010.

Figure

FIGURE 1

Demonstrating Effectiveness of Portland Harbor Source Control Measures Implemented in City Basins

Decision Framework for Identifying Where Additional Basin-Scale Monitoring Data are Needed



LEGEND

- Decision Points
- Weight of Evidence
- Outcomes

NOTES:

[1] In Basins 19, 22, 52D, 53A, M-1, M-3, and S-1 Portland Harbor-specific SCMs were implemented, but only by sites and not the City.

[2] In Basin 43, Portland Harbor-specific SCMs were implemented, but only by the City and not by sites.

\\PDX\Projects\Portland\110 - BES\005 - SC\RI\b1 - Basin Completion Reports\SCM Effectiveness Demonstration\Figures

Tables

Table 1. Source Control Measure (SCM) Effectiveness Monitoring Needs

Outcome Category	OF Basin	Does OF Convey Separated SW?	Does OF Discharge to an AOPC? (1)	SCMs Implemented by City?		SCMs Implemented by Sites?(1)		Additional PH-Specific SCMs Planned by City or Sites? (2)	Has Effectiveness Been Demonstrated for PH-SCMs?		Monitoring Needed by City to Demonstrate Effectiveness of PH-SCMs?	Rationale for Determination of SCM Effectiveness Monitoring Needs (3)
				PH-Specific	Basin-specific Measures by Other City Programs	PH-Specific	Other Programs		Implemented by City?	Implemented by Sites? (2)		
		If No, Outcome 1	*If No, Outcome 2*	*If No City or Site PH-Specific SCMs have been Implemented in current basin, Outcome 3*					*If Yes, Outcome 4*	*If Yes, Outcome 5*	*If Yes, Outcome 6*	
Outcome 1	23	No	NA	NA	CSO: diverted entire basin.	NA	NA	NA	NA	NA	No	No SW discharge from OF.
	24	No	NA	NA	CSO: diverted entire basin.	NA	NA	No	NA	NA	No	No SW discharge from OF.
	44A	Yes, but to be abandoned in 2015	Yes, but to be abandoned in 2015	None	CSO: diverted entire basin except small area on private property.	None	DEQ WQ: NPDES 1200-A Permittee	No	NA	NA	No	OF to be abandoned in 2015.
	46	No	NA	NA	CSO: diverted entire basin.	NA	NA	NA	NA	NA	No	No SW discharge from OF.
Outcome 2	10A	Yes	No	None	None	*Waterfront Pearl (#4535)*	MS4: SWMM requirements.	No	NA	Yes. *#4535* – NFA	No	No AOPC. Also, no City PH-SCMs implemented.
	11	Yes	No	None	MS4: Four WQ swales constructed along Highway 26. PBOT: SW treatment constructed in conjunction with rebuilding NW Lovejoy ramp and Portland Streetcar expansion.	*Centennial Mills (#5136)* *Hoyt St. Railyard – The Fields (#5443)* *Hoyt St. Railyard – Former (#1080)* *Hoyt St. Railyard – Pearl Court (#1624)* *Pearl Block (#4960)* *Union Station Horse Barn (#2407)* *Union Station – Parcel A North (#1962)* *Union Station – Parcel B South (#1885)* *Union Station – Track #5 (#1414)* *US Postal Service Processing & Dist. Center (#2183)*	DEQ WQ: NPDES Permittees. MS4: SWMM requirements.	*Aband. Tanner Crk. Sewer (#5328)* – TBD *ODOT (#5437)* - TBD	NA	Yes/Pending. *#1080* – COC *#1414* – NFA *#1624* – COC *#1885* – NFA *#1962* – NFA *#2183* -- NFA *#2407* – NFA *#4960* – NFA *#5136* – SCD *#5328* – TBD *#5443* – NFA *#5437* -- TBD	No	No AOPC. Also, no City PH-SCMs implemented, and site SCM effectiveness demonstration is/will be sufficient.
	13	Yes	No	None	MS4: Two WQ swales on NW Front Ave.	*Port T1 South (#2642)*	DEQ CU: *Rapid Transfer (#5870)* – redevelopment pending. MS4: SWMM requirements.	*#5870* - TBD	NA	Yes/Pending. *#2642* – NFA *#5870* - TBD	No	No AOPC. Also, no City PH-SCMs implemented, and site SCM effectiveness demonstration is/will be sufficient.
	14	Yes	No	None	None	*Port T1 South (#2642)*	MS4: SWMM requirements.	No	NA	Yes. *#2642* – NFA	No	No AOPC. Also, no City PH-SCMs implemented, and site SCM effectiveness demonstration is sufficient.

Table 1. Source Control Measure (SCM) Effectiveness Monitoring Needs

Outcome Category	OF Basin	Does OF Convey Separated SW?	Does OF Discharge to an AOPC? (1)	SCMs Implemented by City?		SCMs Implemented by Sites?(1)		Additional PH-Specific SCMs Planned by City or Sites? (2)	Has Effectiveness Been Demonstrated for PH-SCMs?		Monitoring Needed by City to Demonstrate Effectiveness of PH-SCMs?	Rationale for Determination of SCM Effectiveness Monitoring Needs (3)
				PH-Specific	Basin-specific Measures by Other City Programs	PH-Specific	Other Programs		Implemented by City?	Implemented by Sites? (2)		
		If No, Outcome 1	*If No, Outcome 2*	*If No City or Site PH-Specific SCMs have been Implemented in current basin, Outcome 3*					*If Yes, Outcome 4*	*If Yes, Outcome 5*	*If Yes, Outcome 6*	
	15	Yes	No	None	None (basin is all on private property).	*Sulzer (#1235)*	DEQ WQ: NPDES permittee.	No	NA	Pending. *#1235* -- TBD	No	No AOPC. Also, no City PH-SCMs implemented, and site SCM effectiveness demonstration, if needed, will be sufficient.
	42	Yes	No	None	MS4: WQ swale that treats the majority of the basin.	NA	MS4: SWMM requirements.	No	NA	NA	No	No AOPC. Also, no City PH-SCMs implemented, and no significant sources in basin.
	53	Yes	No	None	MS4: WQ swale along N. Reno Ave.	NA	MS4: SWMM requirements.	No	NA	NA	No	No AOPC. Also, no City PH-SCMs implemented, and no significant sources in basin.
	S-5	Yes	No	None	MS4: Five WQ swales along N. Channel.	NA	DEQ WQ: NPDES permittee and NECs. MS4: SWMM requirements and City Discharge Authorization.	No	NA	NA	No	No AOPC. Also, no PH-SCMs implemented, and no significant sources in basin.
	S-6	Yes	No	None	MS4: WQ swale along N. Channel.	*EWH (#5685)*	DEQ WQ: NPDES permittees and NECs. MS4: SWMM requirements.	*Portland Shipyard OU1 (#271)* – site to disconnect from basin. *EWH (#5685)* – TBD.	NA	Pending. *#271* – TBD *#5685* -- TBD	No	No AOPC. Also, no City PH-SCMs implemented, and site SCM effectiveness demonstration, if needed, will be sufficient.
Outcome 3	17	Yes	Yes	None	CSO: diverted the majority of basin industrial area.	None	DEQ WQ: NPDES permittee and NECs. MS4: SWMM requirements and City Discharge Authorization.	*BNSF (#100)* – permanent abandonment of all connections to basin in 2015. *ODOT (#5437)* - TBD	NA	Pending. *#5437* -- TBD	No	No PH-SCMs implemented by the City or by sites. Site SCM effectiveness demonstration, if needed, will be sufficient.
	19A	Yes	Yes	None	None	NA	NA	NA	NA	NA	No	No PH-SCMs implemented by the City or by sites (no upland sites in basin).
	22D	Yes	Yes	None	None	None	MS4: SWMM requirements.	*ODOT (#5437)* – TBD	NA	Pending. *#5437* -- TBD	No	No PH-SCMs implemented by the City or by sites. Site SCM effectiveness demonstration, if needed, will be sufficient.

Table 1. Source Control Measure (SCM) Effectiveness Monitoring Needs

Outcome Category	OF Basin	Does OF Convey Separated SW?	Does OF Discharge to an AOPC? (1)	SCMs Implemented by City?		SCMs Implemented by Sites?(1)		Additional PH-Specific SCMs Planned by City or Sites? (2)	Has Effectiveness Been Demonstrated for PH-SCMs?		Monitoring Needed by City to Demonstrate Effectiveness of PH-SCMs?	Rationale for Determination of SCM Effectiveness Monitoring Needs (3)
				PH-Specific	Basin-specific Measures by Other City Programs	PH-Specific	Other Programs		Implemented by City?	Implemented by Sites? (2)		
		If No, Outcome 1	*If No, Outcome 2*	*If No City or Site PH-Specific SCMs have been Implemented in current basin, Outcome 3*					*If Yes, Outcome 4*	*If Yes, Outcome 5*	*If Yes, Outcome 6*	
	47	Yes	Yes	None	MS4: SWMM requirements at new Swan Island Pump Station.	None	DEQ WQ: NPDES NEC. MS4: SWMM requirements and City Discharge Authorization.	No	NA	NA	No	No PH-SCMs implemented by the City or by sites.
	48	Yes	Yes	None	CSO: added stormwater treatment facility for the whole basin.	NA	NA	No	NA	NA	No	No PH-SCMs implemented by the City or by sites (no upland sites in basin).
	49	Yes	Yes	None	CSO: added stormwater treatment facility for the whole basin. MS4: Two WQ swales along N. Decatur.	None	NA	*ODOT (#5437)* – TBD	NA	Pending. *#5437* – TBD	No	No PH-SCMs implemented by the City or by sites. Site SCM effectiveness demonstration, if needed, will be sufficient.
	50	Yes	Yes	None	CSO: added stormwater treatment facility for majority of basin. MS4: Five WQ swales along N. Ivanhoe (ODOT Highway 30).	None	DEQ CU: *BES Water Pollution Control Laboratory (#2452)* – NFA. DEQ WQ: NPDES NEC. MS4: SWMM requirements and City Discharge Authorization.	*Crawford Street (#2363)* –TBD *ODOT (#5437)* – TBD	NA	Pending. #2452 -- NFA *#2363* -- TBD *#5437* – TBD	No	No PH-SCMs implemented by the City or by sites. Site SCM effectiveness demonstration, if needed, will be sufficient.
	52A	Yes	Yes	None	MS4: Three WQ swales along N. Ivanhoe and N. Edison.	None	DEQ WQ: NPDES NEC. MS4: SWMM requirements and City Discharge Authorization.	No	NA	NA	No	No PH-SCMs implemented by the City or by sites.
	52C	Yes	Yes	None	None	None	DEQ WQ: NPDES permittee and NEC. MS4: City Discharge Authorization.	No	NA	NA	No	No PH-SCMs implemented by the City or by sites.
	M-2	Yes	Yes	None	None	None	DEQ WQ: NPDES permittees and NECs. MS4: SWMM requirements and City Discharge Authorizations.	No	NA	NA	No	No PH-SCMs implemented by the City or by sites.

Table 1. Source Control Measure (SCM) Effectiveness Monitoring Needs

Outcome Category	OF Basin	Does OF Convey Separated SW?	Does OF Discharge to an AOPC? (1)	SCMs Implemented by City?		SCMs Implemented by Sites?(1)		Additional PH-Specific SCMs Planned by City or Sites? (2)	Has Effectiveness Been Demonstrated for PH-SCMs?		Monitoring Needed by City to Demonstrate Effectiveness of PH-SCMs?	Rationale for Determination of SCM Effectiveness Monitoring Needs (3)
				PH-Specific	Basin-specific Measures by Other City Programs	PH-Specific	Other Programs		Implemented by City?	Implemented by Sites? (2)		
		If No, Outcome 1	*If No, Outcome 2*	*If No City or Site PH-Specific SCMs have been Implemented in current basin, Outcome 3*					*If Yes, Outcome 4*	*If Yes, Outcome 5*	*If Yes, Outcome 6*	
	S-2	Yes	Yes	None	MS4: WQ swale along N. Ballast.	None	DEQ CU: *Automatic Vending (#1430)* - NFA. *Portland Shipyard OU3 (#271)* – SCD. DEQ WQ: NPDES permittee and NECs. MS4: SWMM requirements and City Discharge Authorizations.	No	NA	Yes. *#271 (OU3)* – SCD #1430 -- EXC	No	No PH-SCMs implemented by the City or by sites.
Outcome 4	43	Yes	Yes	Cleaned portions of system in 2012.	DEQ CU: Remediated *Tucker Building (#3036)* under a separate agreement with DEQ. CSO: East Side CSO tunnel construction project cleaned portions of system in 2007.	None	DEQ WQ/CU: NPDES NEC and permittee. Permittee is operator of *Cargill (#5561)* and is conducting monitoring to support future SCD.	No	Yes. Post-cleaning stormwater data in 2012.	NA	No	Post-SCM effectiveness demonstration completed by City is sufficient.
Outcome 5	19	Yes	Yes	No	DEQ CU: Under a separate agreement re: purchase of the *PGE Forest Park (#2406)* - site, the City abandoned inactive storm lines adjacent to the PGE Forest Park site in 2006.	*Anderson Brothers (#970)* *Anderson TL 200 (#5529)* *Brazil & Co. (#1026)* *Calbag Metals (#2454)* *Chevron Asphalt (#1281)* *Greenway Recycling (#4655)* *Kittridge Dist. Center (#2442)* *Mt. Hood Chem. Corp. (#81)* *Penske (#5055)* *PGE Forest Park (#2406)*	DEQ CU: *Dura Industries (#111)* *Mt. Hood Chemical Property (#1328)* DEQ WQ: NPDES permittees and NECs. MS4: SWMM requirements.	*Brazil (#1026)* – TBD *Calbag (#2454)* – TBD *Front Ave. LP (#1239), Tube Forgings parcel* – TBD *Mt. Hood Chem. Corp. (#81)* – TBD *ODOT (#5437)* – TBD *Unocal Willbridge/Phillips 66 (#1549/177)* – TBD *Willbridge Railyard (#3395)* - TBD	NA	Yes/Pending. *#111* – EXC *#970* – NFA *#1281* – SCD *#2406* – NFA *#2442* – NFA *#4655* – NFA *#5055* – NFA *#5529* – NFA *#81* – TBD *#1026* - TBD *#1239* – TBD *#1549/177* – TBD *#2454* – TBD *#3395* – TBD	No	Post-SCM effectiveness demonstration completed by sites is/will be sufficient.
	22	Yes	Yes	No	BES Construction Engineering: special considerations in system design due to presence of contaminated groundwater.	*Chevron Asphalt (#1281)* *Chevron Willbridge (#25)* *McCall Oil (#134)* *Unocal Willbridge/Phillips 66 (#1549/177)*	DEQ WQ: NPDES permittees. MS4: SWMM requirements.	*Chevron Willbridge* (#25) – TBD *ODOT (#5437)* – TBD *Unocal Willbridge/Phillips 66* (#1549/177) – TBD	No	Yes/Pending. *#134* - SCD *#1281* – SCD *#25* - TBD *#1549/177* - TBD *#5437* – TBD	No	Post-SCM effectiveness demonstration completed by sites is/will be sufficient.

Table 1. Source Control Measure (SCM) Effectiveness Monitoring Needs

Outcome Category	OF Basin	Does OF Convey Separated SW?	Does OF Discharge to an AOPC? (1)	SCMs Implemented by City?		SCMs Implemented by Sites?(1)		Additional PH-Specific SCMs Planned by City or Sites? (2)	Has Effectiveness Been Demonstrated for PH-SCMs?		Monitoring Needed by City to Demonstrate Effectiveness of PH-SCMs?	Rationale for Determination of SCM Effectiveness Monitoring Needs (3)
				PH-Specific	Basin-specific Measures by Other City Programs	PH-Specific	Other Programs		Implemented by City?	Implemented by Sites? (2)		
		If No, Outcome 1	*If No, Outcome 2*	*If No City or Site PH-Specific SCMs have been Implemented in current basin, Outcome 3*					*If Yes, Outcome 4*	*If Yes, Outcome 5*	*If Yes, Outcome 6*	
	52D	Yes	Yes	No	None	*RoMar (#2437)*	DEQ WQ: NPDES permittee and NEC. MS4: City Discharge Authorization.	*Boystun Metal Works (#2362)* – TBD *Portland Container Repair (#2375)* – TBD *RoMar (#2437)* – TBD *SBIP (#5324)* – TBD	NA	Pending. *#2362* – TBD *#2375* – TBD *#2437* – TBD *#5324* – TBD	No	Post-SCM effectiveness demonstration by sites will be sufficient.
	53A	Yes	Yes	No	None	*Consolidated Metco (#3295)* *Oregon Steel Mills (#141)*	DEQ WQ: NPDES permittees and NECs. MS4: SWMM requirements.	*Consolidated Metco (#3295)* – TBD *JR Simplot (#3343)* - TBD *Oregon Steel Mills (#141)*- TBD	NA	Pending. *#141* – TBD *#3295* – TBD *#3343* - TBD	No	Post-SCM effectiveness demonstration by sites will be sufficient.
	M-1	Yes	Yes	No	None	*Fred Devine Diving and Salvage (#2365)* *Freightliner TMP (#2366)* *Roadway Express (#3807)*	DEQ WQ: NPDES permittees and NECs. MS4: SWMM requirements and City Discharge Authorizations.	*Fred Devine Diving and Salvage (#2365)* – TBD *Freightliner (#2366)* – TBD *U.S. Navy and Marine Reserve Center (#5109)* – TBD (EPA)	NA	Pending. *#2365* – TBD *#2366* – TBD *#3807* – TBD *#5109* – TBD	No	Post-SCM effectiveness demonstration by sites will be sufficient.
	M-3	Yes	Yes	No	None	*Freightliner PMP (#115)*	DEQ CU: *Fred Meyer (#44)* DEQ WQ: NPDES permittees and NECs. MS4: SWMM requirements and City Discharge Authorizations.	*Freightliner PMP (#115)* – TBD	NA	Yes/Pending. *#44* – NFA/EXC *#115* – TBD	No	Post-SCM effectiveness demonstration by sites will be sufficient.
	S-1	Yes	Yes	No	None	*EWH (#5685)* *Vigor Industrial/Swan Island Portland Shipyard OU1 (#271)*	DEQ WQ: NPDES permittees. MS4: SWMM requirements and City Discharge Authorization.	*EWH (#5685)* – TBD *Vigor (#271)* – site to disconnect from basin/TBD.	NA	Pending. *#271* – TBD *#5685* – TBD	No	Post-SCM effectiveness demonstration by sites will be sufficient.

Table 1. Source Control Measure (SCM) Effectiveness Monitoring Needs

Outcome Category	OF Basin	Does OF Convey Separated SW?	Does OF Discharge to an AOPC? [1]	SCMs Implemented by City?		SCMs Implemented by Sites?[1]		Additional PH-Specific SCMs Planned by City or Sites? [2]	Has Effectiveness Been Demonstrated for PH-SCMs?		Monitoring Needed by City to Demonstrate Effectiveness of PH-SCMs?	Rationale for Determination of SCM Effectiveness Monitoring Needs [3]
				PH-Specific	Basin-specific Measures by Other City Programs	PH-Specific	Other Programs		Implemented by City?	Implemented by Sites? [2]		
		If No, Outcome 1	*If No, Outcome 2*	*If No City or Site PH-Specific SCMs have been Implemented in current basin, Outcome 3*					*If Yes, Outcome 4*	*If Yes, Outcome 5*	*If Yes, Outcome 6*	
Outcomes 4 and 5	18	Yes	Yes	Cleaned portions of system in 2001, 2004, and 2010.	MS4: Two WQ swales on NW 35th.	*Ashland Chem./Hill Investment (#1076)* *Carson Oil (#1405)* *Christensen Oil (#2426)* *Columbia American Plating (#29)* *Container Management (#4784)* *OBRC/Cont. Recovery (#4015)* *Texaco (#169)* *Trumbull Asphalt (#1160)* *Wilhelm (#69)*	EPA: Removal action at *Columbia American Plating (#29)*; investigation and groundwater controls at *Van Waters & Rogers/Univar (#330)* DEQ CU: *McWhorter (#135)* *Texaco Prod. Pipeline (#2117)* DEQ WQ: NPDES permittees and NECs. MS4: SWMM requirements and City Discharge Authorizations.	*BNSF (#100)* – TBD *Christensen Oil (#2426)* -TBD *Container Management (#4784)* – TBD *Gunderson (#1155)* – TBD *McWhorter (#135)* – TBD *ODOT (#5437)* – TBD *Trumbull Asphalt (#1160)* - TBD *Univar (#330)* – TBD *Wilhelm (#69)* – TBD *Wirfs (#2424)* – TBD	Yes. Post-cleaning solids data collected in 2007, 2009, and 2010 and stormwater data in 2007 – PH-SCM effectiveness not relevant due to uncontrolled sources.	Yes/Pending. *#29* – SCD *#169* – SCD *#1820 (ANRFS)* – EXC *#4015* – SCD *#69* – TBD *#100* – TBD *#135* – TBD *#330* –TBD *#1076* – TBD *#1155* – TBD *#1160* – TBD *#1405* – TBD *#2424* - TBD *#2426* – TBD *#4784* – TBD *#5437* - TBD	No	Post PH-SCM solids data confirm known ongoing sources to the basin, but all identified sources have not yet completed SCMs. Post-SCM effectiveness demonstration by sites will be sufficient.
	22B	Yes	Yes	Cleaned portions of the system in 2004. Abandoned one historical connection.	None	*Metro (#1398)* *Rhone-Poulenc (#155)* *Schnitzer-Doane (#395)*	EPA: remediation and capping at *Gould (#49)* DEQ WQ: NPDES permittees.	*Metro (#1398)* – adding SW treatment. *Rhone Poulenc (#155)* – TBD	Yes. Post-cleaning solids data in 2006 and stormwater data in 2007 and 2011.	Yes/Pending. *#49* – EXC *#155* - TBD *#395* – SCD/TBD *#1398* - TBD	No	Post PH-SCM solids data confirm known ongoing sources to the basin, but all identified sources have not yet completed SCMs. Post-SCM effectiveness demonstration by sites will be sufficient.
	22C	Yes	Yes	Cleaned portions of the system in 2004.	MS4: WQ swales at the base of Forest Park.	*GASCO - Koppers (#84)*	DEQ CU: *V&K Service (#2423)* DEQ WQ: NPDES permittees.	*GASCO-Siltronic (#84)* – TBD *ODOT (#5437)* – TBD *Rhone-Poulenc - Doane Lake (#155)* - TBD	Yes. Post-cleaning solids data in 2006 -- PH-SCM effectiveness not relevant due to uncontrolled source.	Pending. *#2423*- EXC *#84* - TBD *#155* – TBD *#5437* – TBD	No	Post PH-SCM solids data confirm known ongoing sources to the basin, but all identified sources have not yet completed SCMs. Post-SCM effectiveness demonstration by sites will be sufficient.
	44	Yes	Yes	Cleaned portions of the system in 2009.	MS4: Sedimentation manhole installed in N. Loring to meet SWMM requirements for Lower Albina Overcrossing.	*PacifiCorp (#5117)*	DEQ CU: *Valvoline (#3215)* DEQ WQ: NPDES NECs. MS4: City Discharge Authorization.	No	Yes. Post-cleaning inline solids data in 2010 and stormwater data in 2012.	Yes/Pending. *#3215* - NFA *#5117* - TBD	No	Post-SCM effectiveness demonstration completed by City and effectiveness demonstration by sites is/will be sufficient.

Table 1. Source Control Measure (SCM) Effectiveness Monitoring Needs

Outcome Category	OF Basin	Does OF Convey Separated SW?	Does OF Discharge to an AOPC? (1)	SCMs Implemented by City?		SCMs Implemented by Sites?(1)		Additional PH-Specific SCMs Planned by City or Sites? (2)	Has Effectiveness Been Demonstrated for PH-SCMs?		Monitoring Needed by City to Demonstrate Effectiveness of PH-SCMs?	Rationale for Determination of SCM Effectiveness Monitoring Needs (3)
				PH-Specific	Basin-specific Measures by Other City Programs	PH-Specific	Other Programs		Implemented by City?	Implemented by Sites? (2)		
		If No, Outcome 1	*If No, Outcome 2*	*If No City or Site PH-Specific SCMs have been Implemented in current basin, Outcome 3*					*If Yes, Outcome 4*	*If Yes, Outcome 5*	*If Yes, Outcome 6*	
	45	Yes	Yes	Cleaned system in 2008.	MS4: identified and eliminated unauthorized process water discharge.	None	DEQ WQ: NPDES permittee and NEC.	*UPRR – Albina Yard (#178)* - TBD	Yes. Post-cleaning stormwater data in 2008.	Pending. *#178* - TBD	No	Post-SCM effectiveness demonstration completed by City and effectiveness demonstration by site, if needed, will be sufficient.
	52	Yes	Yes	Cleaned portions of the system in 2010.	None	None	*ODOT (#5437)* MS4: storm system includes a sedimentation MH to treat runoff from St. Johns Bridge. DEQ WQ: NPDES NECs. MS4: SWMM requirements and City Discharge Authorization	*Crawford Street (#2363)* – TBD *ODOT (#5437)* - TBD *Peninsula Iron Works (#5686)* –TBD.	Yes. Post-cleaning sediment trap and inline solids data in 2010 - PH-SCM effectiveness not relevant due to uncontrolled sources.	Pending. *#2363* – TBD *#5437* – TBD *#5686* - TBD	No	Post PH-SCM solids data confirm known ongoing sources to the basin, but all identified sources have not yet completed SCMs. Post-SCM effectiveness demonstration by sites will be sufficient.
Outcome 6	16	Yes	Yes	Cleaned portions of system in 2006.	DEQ CU: Remediated *Guilds Lake (#404)* under separate agreement with DEQ. MS4: Provided technical assistance to PBOT for BMPs at Maintenance Yard.	*Calbag (#5059)* *Front Ave. MP (#4008)*	DEQ WQ: NPDES permittees and NECs MS4: SWMM requirements and City Discharge Authorization.	*Calbag (#5059)* – TBD *ODOT (#5437)* – TBD	No	Yes/Pending. *#404* – NFA/EXC *#966 (Nudelman)* -EXC *#4008* – NFA *#5059* – TBD *#5437* - TBD	Yes	City PH-SCM in system, but basin data collected after implementation did not represent this area.

Notes:

(1) Reach of the Willamette River identified by the EPA as an area of potential concern (AOPC) for contaminant concentrations in river sediment. Source: *Re: Portland Harbor Superfund Site; Administrative Order on Consent for Remedial Investigation and Feasibility Study; Docket No. CERCLA-10-2001-0240. Portland Harbor Feasibility Study Source Tables. Letter from EPA to Mr. Bob Wyatt, Chairman, Lower Willamette Group. November 23, 2010* (EPA, 2010).

(2) Site information sourced from *Municipal Stormwater Source Control Report for Portland Harbor* (BES, 2013), *Portland Harbor Upland Source Control Summary Report* (DEQ, 2014), and http://www.deq.state.or.us/lq/ECSI/ecsiquery.asp?listtype=lis&listtitle=Environmental+Cleanup+Site%20Information+Database.

(3) See Table 2 for additional weight-of-evidence (WOE) that supports the conclusion that specific outfalls do not represent a significant current or future pathway to the Willamette River once identified sources have been controlled.

Purple shading indicates factors (decision points) in the decision framework used to determine the need for PH-SCM effectiveness monitoring by the City (i.e., Outcome category). These headings correspond to the ovals of the same color on Figure 1.

Blue shading indicates Outcome determination. These headings correspond to the decision arrows and the blue Outcome boxes on Figure 1.

Gray shading indicates information that is not relevant to the determination of the Outcome category for a particular basin (i.e., that an earlier Outcome for the basin had already been determined).

AOPC = Area of Potential Concern
BES = City of Portland, Bureau of Environmental Services
COC = Certificate of Completion
CSO = Combined Sewer Overflow Abatement Program
DEQ = Oregon Department of Environmental Quality
DEQ CU = DEQ Cleanup Program
EPA = U.S. Environmental Protection Agency
EXC = Excluded (no source/incomplete pathway per DEQ)
MS4 = BES Municipal Separate Storm Sewer System program
NEC = No Exposure Certification
NFA = No Further Action determination
NPDES = National Pollutant Discharge Elimination System
O&M = Operations and Maintenance
ODOT = Oregon Department of Transportation
OF = City of Portland outfall
OU = Operable Unit
PBOT = City of Portland, Bureau of Transportation
PH = Portland Harbor Superfund Site
PH-SCMs = Portland Harbor-specific source control measures
SCD = DEQ Source Control Decision
SCM = Source control measure
SW = Stormwater
SWMM = BES Stormwater Management Manual
TBD = To be determined
WQ = Water quality

Table 2. Existing Weight-of-Evidence (WOE) for Low Recontamination Potential from City Outfalls

Outcome Category (Table 1)	OF Basin	AOPC	Basin SW Data? (1)	Existing WOE that Outfall is Not a Likely Significant Current/Future Pathway	
				Qualitative	Quantitative (2)
Outcome 1	23	NA	NA	• No discharge from outfall.	NA
	24	NA	NA	• No discharge (outfall functions only as an emergency bypass for sanitary sewer overflow, and bypasses have not occurred).	NA
	44A	NA	NA	• Outfall is scheduled to be abandoned in 2015, after which there will be no discharge.	NA
	46	NA	NA	• The entire basin was diverted to wastewater treatment plant in 2011; the outfall no longer discharges SW to the river.	NA
Outcome 2	10A	None	No	• Inriver sediment concentrations – no AOPC. • Basin is small, with no industrial land use. • Residential development has SW treatment/BMPs. • No significant sources in basin.	None.
	11	None	Yes (City: 2008-10)	• Inriver sediment concentrations – no AOPC. • Historical industrial sites in basin all have been remediated under DEQ oversight; redevelopment under SWMM (i.e., requirements for SW treatment) for majority of former industrialized area. Current land use is residential, commercial and open space. • No significant sources in basin. • Possible additional SCMs by ODOT will further improve SW runoff.	• DEQ curves: SW concentrations are in the lower range of concentrations observed in PH industrial areas (i.e., flatter part of DEQ curves).(3) • Comparison values: SW concentrations are also below all selected comparison values for DEQ curve contaminants (see Table A-1).
	13	None	No	• Inriver sediment concentrations – no AOPC. • No significant sources – sole remaining industrial site (ECSI #5870) has been evaluated by DEQ and redevelopment is planned, which will require SW improvements per City Code. • Basin is small and land use consists of new residential development, a restaurant, and one industrial site slated for redevelopment.	None.
	14	None	No	• Inriver sediment concentrations – no AOPC. • Basin land use is mostly commercial and residential, with redevelopment under the SWMM. • No significant sources – industrial operations in the basin do not have extensive outdoor activities and include NPDES NEC coverage.	None.
	15	None	Yes (Sulzer: 2006-08, 2014)	• Inriver sediment concentrations – no AOPC. • Basin is small and entirely within one site (former Sulzer site). • All SW discharges to outfall are being addressed through the Sulzer SCE.	• DEQ curves: SW concentrations are on flatter portion of curves with the exception of Ag, for which all samples were ND. • Comparison values: all SW concentrations are also below selected comparison values.
	42	None	No	• Inriver sediment concentrations – no AOPC. • Basin is small, with no industrial operations. • SW is treated before discharge at the outfall. • No significant sources in basin.	None.
	53	None	Yes (Port: 2007-08; City: 2008)	• Inriver sediment concentrations – no AOPC. • Basin land use is residential. • Source investigation identified offsite migration (e.g., vehicle dragout) from out-of-basin industrial sites, which are identifying appropriate source controls under DEQ Cleanup Program oversight. • No significant sources in basin.	• DEQ curves: SW concentrations are on flatter portion of curves with the exception of BEHP. • Comparison values: all SW concentrations (except BEHP) are also below selected comparison values. The BEHP concentration is biased by one high sample that was flagged due to a duplicate result that was an order-of-magnitude lower and detections in the field blank. All other BEHP results are less than 5X the SLV.

Table 2. Existing Weight-of-Evidence (WOE) for Low Recontamination Potential from City Outfalls

Outcome Category (Table 1)	OF Basin	AOPC	Basin SW Data? [1]	Existing WOE that Outfall is Not a Likely Significant Current/Future Pathway	
				Qualitative	Quantitative [2]
	S-5	None	Yes (City: 2007)	• Inriver sediment concentrations – no AOPC. • Basin land use is light industrial and commercial (office space). • No significant sources in basin – most industrial operations take place within buildings; industrial operations in the basin are covered by NPDES 1200Z permit and NECs.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations (except Zn) are also below selected comparison values. Zn data were below the NPDES benchmark in place at the time of collection and are expected to be lower now that a lower benchmark and offsite tracking provisions are in place under the 1200-Z.
	S-6	None	Yes (City: 2007)	• Inriver sediment concentrations – no AOPC. • Source investigations confirmed that Vigor and EWH are the only significant sources in basin; Vigor is disconnecting from basin, and EWH will be implementing SCMs. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations (except Cu and Zn) are also below selected comparison values. Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z.
Outcome 3	17	20	No	• Basin is mostly Forest Park drainage, and remaining industrialized basin area is small (i.e., ~2% of basin drainage)[4]. • No significant sources in basin – a portion of industrialized basin is covered by NPDES NECs, and other industrial sites are inspected by BES Industrial Stormwater.	None. SW monitoring of whole basin is impeded by system elevation and configuration.
	19A	18	Yes (City: 2009-10)	• No upland sites in basin. • Basin is small (1.7 acres) and almost entirely composed of paved rights-of-way. • Adjacent sites all either have been remediated or are in DEQ Cleanup Program and addressing SW pathway including potential offsite migration to Basin 19A (e.g., via overland flow, vehicle drag-out). • Future SW concentrations are expected to be lower once SCMs are implemented at adjacent remaining sources.	• DEQ curves: SW concentrations are on flatter portion of curves with the exception of Cr. • Comparison values: all SW concentrations (including Cr, but except Cu and Zn) are also below selected comparison values. Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z.
	22D	9D	Yes (City: 2008)	• Basin is mostly (92%) open space and the remainder is mostly residential. • No significant sources in basin – no industrial discharge to basin.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values.
	47	23	Yes (City: 2008)	• Basin is small (9.5 acres) and only has two sites in it; land use at both sites is light industrial. • No significant sources in basin – one site (Swan Island Pump Station) redeveloped under SWMM; remaining site covered by NEC.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations (except Cu, Zn, and BEHP) are also below selected comparison values. Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. All the BEHP samples are less than 5X the SLV.
	48	15	Yes (City: 2007)	• Basin is small and land use consists entirely of residential streets and a SW treatment facility. • Basin SW is routed through treatment facility. • No significant sources in basin.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values.
	49	13	Yes (LWG: 2007-08)	• Basin is small and consists of residential streets and a SW treatment facility. • Basin SW is routed through treatment facility. • No significant sources in basin.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values.
	50	12	Yes (City: 2007)	• Basin industrial areas redeveloped to commercial/residential land uses. • Basin SW is routed through treatment facility. • No significant sources in basin – ODOT discharges are treated, basin includes areas redeveloped under SWMM and an NEC, and the largest site (BES Water Pollution Control Lab) has SW treatment.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values.
	52A	11	Yes (City: 2007)	• Majority of land use in basin is light industrial, residential, and open space. • No significant sources in basin – industrial sites covered by NECs and BES Industrial Stormwater inspections.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values.

Table 2. Existing Weight-of-Evidence (WOE) for Low Recontamination Potential from City Outfalls

Outcome Category (Table 1)	OF Basin	AOPC	Basin SW Data? [1]	Existing WOE that Outfall is Not a Likely Significant Current/Future Pathway	
				Qualitative	Quantitative [2]
	52C	6	Yes (Port: 2005, 2007-08)	• Basin land use is light industrial, ~80% Port-owned parking. • Source investigation identified offsite migration (e.g., vehicle dragout) from out-of-basin industrial sites, which are identifying appropriate source controls under DEQ Cleanup Program oversight. • No significant sources in basin – sites covered by NECs, City Discharge Authorizations, and/or BES Industrial Stormwater inspections.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values.
	M-2	17S	Yes (City: 2007)	• Basin land use is light industrial. • No significant sources – majority of industrial sites covered by NPDES NECs. City Discharge Authorizations, and/or SWMM requirements.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations (except Zn) are also below selected comparison values. Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z.
	S-2	17S	Yes (City: 2007)	• Basin land use is primarily light industrial, with sites covered by NPDES NECs. • No significant sources – majority of industrial sites covered by NPDES NECs, City Discharge Authorizations, and/or BES Industrial Stormwater inspections.	• DEQ curves: SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations (except Zn) are also below selected comparison values. Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z.
Outcome 4	43	25	Yes (City: 2008-09, 2012)	• Basin land use is predominantly light industrial and comprised mostly of artist studios, parking areas, and rights-of-way. • Majority of remaining industrial areas covered by DEQ Cleanup Program (ECSI #3036 and #5561) and/or NPDES NEC. • Line cleaning removed legacy contaminated inline solids.	• DEQ curves: SW data collected before and after City PH-SCM implemented in basin, and concentrations are on flatter portion of curves. • Comparison values: SW data collected before and after City PH-SCM implemented in basin are also below selected comparison values.
Outcome 5	19	18	Yes (City: 1999-2011; LWG: 2007)	• Basin land use is predominantly open space (~70%). • Majority of industrial area being evaluated/addressed under DEQ Cleanup Program authority. • Historical piped pathways abandoned from ECSI #1026 and #2406. • Most industrial sites covered by NPDES permits, NECs, SWMM requirements, and/or BES Industrial Stormwater inspections. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• Source investigations identified significant current sources (e.g., ECSI #1026, #2454, and #5529). If SCMs are/were implemented, effectiveness monitoring was/will be conducted by sites. • SW data trends: trends analysis of long-term City SW data (1999-2010) and site-specific data indicated reductions in metals concentrations resulting from NPDES program implementation. • DEQ curves: all SW concentrations (except BEHP) are on flatter portion of curves. • Comparison values: all SW concentrations (except Zn and BEHP) below selected comparison values. Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. The BEHP concentration is biased high by elevated MRLs for samples where BEHP was not detected and one high sample for which a parallel analysis under a different method yielded a result that was more than 50X lower than the plotted results[5]; all other detected concentrations are less than 2X the SLV.
	22	16	Yes (LWG: 2007-08; Chevron: 2010-11)	• Entire area where sources were identified is being evaluated/addressed under DEQ Cleanup Program authority. • Industrial sites in source area all covered by NPDES permits, and most industrial drainage area is subject to SW treatment. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• Source investigations confirmed significant current sources (e.g., ECSI #25 and #177). SCM implementation is in progress and effectiveness monitoring was/will be conducted by sites. • DEQ curves: SW data collected before PH-SCMs implemented at identified sources – all concentrations (except As) on flatter portion of curves. SW data collected after PH-SCMs implemented and all concentrations (except Ag and total PCBs) on flatter portion of curves. • Comparison values: SW data collected before SCMs implemented – all concentrations (except As, Cu, and Zn) below selected comparison values. SW data collected after PH-SCMs implemented at identified sources – all concentrations (including As, Cu, and Zn but except Ag, BEHP, and Total PCBs) below selected comparison values. All Ag and PCB samples were ND. All BEHP data are less than 5X the SLV.

Table 2. Existing Weight-of-Evidence (WOE) for Low Recontamination Potential from City Outfalls

Outcome Category (Table 1)	OF Basin	AOPC	Basin SW Data? [1]	Existing WOE that Outfall is Not a Likely Significant Current/Future Pathway	
				Qualitative	Quantitative [2]
	52D	3	Yes (Schnitzer: 2012-2014)	• Entire basin being evaluated by Schnitzer (ECSI #5324) under DEQ oversight. • Basin area is small – consists almost entirely of three sites that have all been subject to individual DEQ Cleanup program involvement in addition to investigation under ECSI #5324. • All three sites covered by an NPDES permit, NEC, and/or BES Industrial Stormwater inspection. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• DEQ curves: SW data collected before PH-SCMs implemented at suspected sources – all concentrations (except Ag, Cr, and BEHP) on flatter portion of curves. • Comparison levels: all SW concentrations (including Ag and Cr, but except Cu, Zn, and BEHP) below selected comparison values. Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. All BEHP samples are less than 5X the SLV.
	53A	1	Yes (City: 2008, 2010)	• Sources identified (ECSI #141 and #3295) are being evaluated/addressed by DEQ. Both sources have implemented PH-SCMs. • Majority of basin area has recently redeveloped under SWMM. • All active industrial sites in the basin are covered by NPDES permits or NECs. • Only industrial site not covered by DEQ Cleanup or WQ programs is vacant and for sale, indicating the future property transfer may result in redevelopment and/or NPDES permit coverage.	• Source investigations identified significant current sources (e.g., ECSI #141 and #3295). SCM implementation is complete and effectiveness monitoring was/will be conducted by sites. • DEQ curves: SW data collected before PH-SCMs implemented at identified sources - all concentrations (except As and Cr) on flatter portion of curves. Post-SCM data – all concentrations (including As but except Cr) on flatter portion of curves. • Comparison values: SW data collected before SCMs implemented – all concentrations (except As, Cu, and Zn) below selected comparison values. SW data collected after PH-SCMs implemented at identified sources – all concentrations (including As and Cu, but except Zn) below selected comparison values. Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. • Although outfall discharges to an AOPC, review of in-river sediment data does not indicate outfall is a significant pathway for contaminants (concentrations adjacent to the outfall were either similar to or lower than upstream concentrations, suggesting an upriver source).
	M-1	17S	Yes (City: 2007)	• Identified sources (e.g., ECSI #2365, #2366, and #5109) being evaluated/addressed under DEQ Cleanup or EPA authority. • Redevelopment under the SWMM at a number of industrial sites. • Almost every site covered by an NPDES permit, NEC, City Discharge Authorization, and/or BES Industrial Stormwater inspection. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• Source investigation identified sources (ECSI #2365, #2366, and #5109). If SCMs are implemented, effectiveness monitoring will be conducted by sites. • DEQ curves: all SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations (except Zn) are also below selected comparison values. Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z.
	M-3	17S	Yes (City: 2007)	• Redevelopment under the SWMM at two sites. • Almost every site covered by an NPDES permit, NEC, City Discharge Authorization, and/or BES Industrial Stormwater inspection.	• DEQ curves: all SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations (except Zn) are also below selected comparison values. Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z.
	S-1	17S	Yes (City: 2007, 2011)	• Basin area is small and consists of two sites (and a small portion of a third), one of which is planning to disconnect from basin. • Both sites identified as sources (ECSI #271 and #5685) being evaluated/addressed under DEQ Cleanup authority. • Entire basin area covered by NPDES permits and City Discharge Authorization. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• If SCMs are implemented at identified sources (ECSI #271 and #5685) effectiveness monitoring will be conducted by sites. • DEQ curves: all SW concentrations (except Total PAHs) are on flatter portion of curves. • Comparison values: all SW concentrations (except Cu, Zn, and Total PAHs) are also below selected comparison values. Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. Total PAHs data reflect presence of known uncontrolled sources for which controls are anticipated.

Table 2. Existing Weight-of-Evidence (WOE) for Low Recontamination Potential from City Outfalls

Outcome Category (Table 1)	OF Basin	AOPC	Basin SW Data? [1]	Existing WOE that Outfall is Not a Likely Significant Current/Future Pathway	
				Qualitative	Quantitative [2]
Outcomes 4 and 5	18	19	Yes (LWG: 2007)	• Majority (60%) of basin is open space. • Majority of industrial sites in developed area are being (or have been) investigated under EPA/DEQ authority. • Majority of industrialized basin is covered by NPDES permits, NECs, City Discharge Authorizations, and/or BES Industrial Stormwater inspection. • Line cleaning removed legacy contaminated soil from storm line adjacent to known sources (e.g., ECSI #4784, #69, and #29). • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• Source investigations identified a number of significant sources that implemented/are implementing PH-SCMs; effectiveness monitoring conducted by sites that implemented the SCMs. • DEQ curves: all SW concentrations (except BEHP) on flatter portion of curves. Note that these data were collected before PH-SCMs implemented at most sites. • Comparison values: all SW concentrations (except Cu, Zn, and BEHP) are also below selected comparison values. Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. All BEHP samples are less than 5X the SLV.
	22B	14	Yes (LWG: 2007; Air Liquide: 2011)	• Every site in basin being evaluated/addressed by EPA/DEQ. • Entire conveyance system, including private conveyance systems draining to it, was cleaned and lined as part of an SCM implemented by an identified source to the basin. • Connections from historical source areas have been abandoned. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• Source investigation identified three significant sources (ECSI #395, #155, and #1398). SCMs have been implemented and SCM effectiveness monitoring is being conducted by sites. • DEQ curves: SW data collected before and after PH-SCMs implemented at identified sources – concentrations all on flatter portion of curves. • Comparison values: SW data collected before PH-SCMs implemented in basin and at some sources – concentrations below selected comparison values (with the exception of As, Cd, Cu, Pb, Zn, and/or Total PAHs). SW data collected after SCMs implemented at most sources - concentrations of all formerly elevated contaminants significantly lower and below comparison values with the exception of Zn and BEHP. Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. All the BEHP samples are less than 5X the SLV.
	22C	14	Yes (City: 2008)	• Basin is mostly (~94%) open space. • Potential significant sources (ECSI #84, #155, and #5437) being evaluated/addressed by DEQ. • Contaminated solids removed from the storm lines were associated with a site (ECSI #84) that has since abandoned piped connections to the basin.	• Source investigation identified three significant sources (ECSI #84, #155, and #5437). If SCMs are implemented, effectiveness monitoring will be conducted by sites. • DEQ curves: all SW concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values.
	44	25	Yes (City: 2008-09, 2012)	• Source identified (ECSI #5117) and pathways from it to Basin 44 have been controlled; SW no longer discharges to basin from this site. • Catch basin and line cleaning in the Basin 44 conveyance system removed legacy contaminated soil. • Portion of basin SW is subject to treatment. • No significant sources – majority of sites in basin are being evaluated/addressed by DEQ or are covered by NPDES NECs, City Discharge Authorizations, and/or BES Industrial Stormwater inspections.	• Source investigation led to one significant source (ECSI #5117) that implemented SCMs for PH and demonstrated SCM effectiveness. • DEQ curves: SW data collected before and after PH-SCMs implemented at identified source and in basin - concentrations are on flatter portion of curves. • Comparison levels: SW data collected before PH-SCMs implemented – all concentrations (except Cu, Zn, and PCBs) are below selected comparison values. SW data collected after PH-SCMs implemented confirmed effectiveness of City and site PH-SCMs at basin scale for PCBs; Cu and Zn pre-SCM concentrations were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z.
	45	25	Yes (City: 2008)	• Potential significant source (ECSI #178) being evaluated/addressed by DEQ. • Land use at non-ECSI sites mostly consists of indoor operations with minimal industrial exposures to SW. • Line cleaning removed legacy contaminated soil. • Future SW concentrations are expected to be lower if SCMs are implemented at remaining source.	• Source investigation underway at ECSI #178. If SCMs implemented effectiveness monitoring will be conducted by site. • DEQ curves: SW data collected after line cleanout - concentrations are on flatter portion of curves (except for Cr and Ni). • Comparison values: all concentrations (including Cr and Ni) are also below selected comparison values (with the exception of Cu, Zn, and BEHP). Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. The BEHP concentration is biased by one high sample for which a parallel analysis under a different analytical method (and lower MRL) indicated that the concentration was an order-of magnitude lower[5]; all other samples are less than 5X the SLV.

Table 2. Existing Weight-of-Evidence (WOE) for Low Recontamination Potential from City Outfalls

Outcome Category (Table 1)	OF Basin	AOPC	Basin SW Data? (1)	Existing WOE that Outfall is Not a Likely Significant Current/Future Pathway	
				Qualitative	Quantitative (2)
	52	11	Yes (City: 2007)	• Potential significant sources (ECSI #2363, #5437, and #5686) being evaluated/addressed by DEQ. • Some industrial sites covered by NPDES NECs, City Discharge Authorizations, and/or BES Industrial Stormwater inspections. • Basin land use includes large areas of commercial and residential development. • Catch basin and line cleaning removed legacy contaminated soil. • Portion of basin SW is routed through treatment. • Future SW concentrations are expected to be lower once SCMs are implemented at remaining sources.	• Source investigation identified three significant sources (ECSI #2363, #5437, and #5686). If SCMs are implemented, effectiveness monitoring will be conducted by sites. • DEQ curves: SW data collected before PH-SCMs implemented at identified sources and in basin – concentrations are on flatter portion of curves. • Comparison values: all SW concentrations are also below selected comparison values (with the exception of Cu, Zn, and BEHP). Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. All BEHP samples are less than 5X the SLV. • Basin solids data collected after implementation of City PH-SCM in basin confirm source locations for which additional site PH-SCMs have not yet been implemented.
Outcome 6	16	20	Yes (LWG: 2007)	• Source identified (ECSI #5059) and being evaluated/addressed under DEQ Cleanup authority. • Majority of basin industrial area covered by NPDES permits or NECs, and/or redeveloped under SWMM. • Line cleaning removed legacy contaminated soil from storm line adjacent to ECSI #4008. • Current and future SW concentrations are expected to be lower now that SCMs implemented at identified source.	• Source investigation identified a significant source (ECSI #5059) that implemented PH-SCMs and is monitoring SCM effectiveness. • DEQ curves: all SW concentrations (except Cu and Total PCBs) are on flatter portion of curves. Note that these data were collected before PH-SCMs at ECSI #5059. • Comparison values: all concentrations (except Cu, Zn, and Total PCBs) are below selected comparison values. Cu and Zn data were below the NPDES benchmarks in place at the time of collection and are expected to be lower now that lower benchmarks and offsite tracking provisions are in place under the 1200-Z. Total PCBs data reflect presence of an uncontrolled source (ECSI #5059) for which controls have since been implemented.

Notes:

(1) Stormwater data representative of discharges from the entire basin.

(2) Quantitative evidence includes City outfall basin SW geometric mean concentrations (geomeans) for purposes of comparison to reference concentrations (i.e., comparison values). The geomeans and comparison values are listed in Table A-1 and shown on Figures A-1 through A-12. The individual SW event concentrations from which the geomeans are calculated also are shown on Figures A-1 through A-12. Basins with more than one data point above comparison levels are identified in Table A-2.

(3) Graphs of concentrations for selected contaminants detected in stormwater (and solids) from a large number of industrial sites throughout the Portland Harbor, compiled by DEQ and provided in DEQ's *Guidance for Evaluating the Stormwater Pathway at Upland Sites* (dated January 2009; updated October 2010) to assist with stormwater data evaluation. These curves are compiled for As, BEHP, Cd, Cr, Cu, Pb, Hg, Ni, Ag, total PAHs, total PCBs, total suspended solids, and Zn.

(4) Percentage reflects pending permanent removal of 39 acres of industrial land affiliated with the Burlington Northern Guilds Lake Rail Yard and recent re-delineation of the industrial area on the west side of NW Yeon Avenue following review of connection records.

(5) Semivolatile organics concentrations were analyzed via two methods (8270-SIM and 8270C). Where both tests were run, plotted values reflect the 8270-SIM method which typically results in lower detection limits, but not in all cases. Analytical results are included in the Stormwater Evaluation Report (BES, 2010).

AOPC = Area of Potential Concern
As = Arsenic
BES / City = City of Portland, Bureau of Environmental Services
BEHP = Bis(2-ethylhexlyl)phthalate
Cd = Cadmium
Cr = Chromium
Cu = Copper
DEQ = Oregon Department of Environmental Quality
ECSI = DEQ Environmental Cleanup Site Inventory
EPA = U.S. Environmental Protection Agency
Hg = Mercury
NA = Not applicable
LWG = Lower Willamette Group
NEC = No Exposure Certification
NPDES = National Pollutant Discharge Elimination System
ODOT = Oregon Department of Transportation
OF = City of Portland Outfall
Pb = Lead
ND = Not detected
Ni = Nickel
PAH = Polycyclic aromatic hydrocarbon
PCB = Polychlorinated biphenyl
PH = Portland Harbor Superfund Site
PH-SCMs = Portland Harbor-specific source control measures
Port = Port of Portland
SCE = Source control evaluation
SCM = Source control measure
SLV = Screening level value
SW = Stormwater
SWMM = BES Stormwater Management Manual
WOE = Weight of evidence
WQ = Water quality
Zn = Zinc

APPENDIX A

City Basin Data and DEQ Guidance Curves

City Basin Data and DEQ Guidance Curves

Materials included in this Appendix have been developed to provide quantitative lines of evidence in Table 2 of the main report.

Appendix A includes:

Table A-1: Basin Stormwater Data Summary	Provides geomean concentrations for each basin screened against selected comparison levels, the data sources, and the nature of the data set used to calculate the geomean.
Table A-2: Screening Summary of Basin Stormwater Data against Selected Comparison Levels	Provides the results of screening geomean and individual concentrations against selected comparison levels for contaminants covered by DEQ guidance curves, as well as data evaluation considerations.
Figures A-1 through A-12: DEQ Guidance Curve for [contaminant] in Stormwater at Portland Harbor Heavy Industrial Sites and City Outfalls Data	Displays stormwater data collected representative of City basins (individual data points and calculated geomeans) on DEQ guidance curves, along with relevant comparison values.

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Table A-1. Basin Stormwater Data Summary

	Metals (µg/L)[1]									SVOCs (µg/L)[1]				
Basin	**As**	**Cd**	**Cr**	**Cu**	**Pb**	**Hg**	**Ni**	**Ag**	**Zn**	**BEHP**	**Total PAHs[2]**	**Total PCBs (µg/L)[1][2]**	**Data Source[3]**	**Notes**
Green: Significant sources not present in basin; basin not a significant current or future pathway														
10A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	None	
11	NA	0.16	NA	7.30	2.85	0.04	NA	NA	32.2	1.09	0.710	0.00257	Tanner Creek WQ Char. Rpt	Geomean of 5 grab samples except for Cd, BEHP, PAHs, and PCBs (3 samples).
13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	None	
14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	None	
19A	1.94	0.57	**11.6**	48.2	27.1	0.067	8.48	0.139	247	1.61	1.16	0.03188	OF Basin 19A Tech Memo	Geomean of 4 grab samples.
22D	0.43	0.14	2.58	5.35	3.05	0.007	1.47	0.1 U	35.4	1.32	0.30	0.0037	Stormwater Eval. Report	Geomean of 4 grab samples.
42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	None	
44A	0.91	0.44	4.18	25.3	10.8	0.017	4.3	0.161	192	1.92	0.60	0.0091	OF Basin 44A Report	Geomean of 4 grab samples.
47	1.09	0.44	8.97	24.4	17.0	0.012	6.6	0.1 U	178	3.18	1.28	0.0097	Stormwater Eval. Report	Geomean of 4 grab samples.
48	0.50	0.1 U	0.76	7.72	1.65	0.005	5.31	0.1 U	26.1	1.27	0.15	0.0049	Stormwater Eval. Report	Geomean of 4 grab samples.
49	0.33	0.08	1.23	8.03	2.42	0.03 U	1.4	0.026	39.2	1.76	0.09	0.0014	Stormwater Eval. Report	Geomean of 4 composite samples for metals, BEHP and PAHs. For PCBs, geomean of 3 composite samples.
50	0.90	0.13	1.02	6.04	2.06	0.006	1.6	0.1 U	99.8	1.32	0.09	0.0051	Stormwater Eval. Report	Geomean of 4 grab samples.
52A	1.08	0.14	1.38	9.4	3.94	0.010	1.68	0.1 U	118	1.3	1.19	0.0080	Stormwater Eval. Report	Geomean of 4 grab samples.
M-2	1.89	0.32	2.17	13.9	4.25	0.009	2.53	0.16	129	0.88	0.18	0.0051	Stormwater Eval. Report	Geomean of 4 grab samples.
M-3	0.63	0.22	1.74	16.2	3.25	0.005	1.67	0.1 U	175	1.22	0.21	0.0032	Stormwater Eval. Report	Geomean of 4 grab samples.
S-2	0.52	0.27	2.83	14.5	2.58	0.005	1.9	0.1 U	248	2.08	0.16	0.0084	Stormwater Eval. Report	Geomean of 4 grab samples.
S-5	0.84	0.22	2.61	19.1	4.1	0.008	2.33	0.1 U	284	1.00	0.39	0.0037	Stormwater Eval. Report	Geomean of 3 grab samples.
Blue: Significant sources determined to be present in basin and referred to programs for control														
15	1.03	0.747	1.78	6.49	2.10	0.121 U	2.76	**0.796 U**	19.1	1.57	0.0663	0.033 U	Source Control Evaluation, Sulzer Pumps Facility	Geomean of 3 grab samples for As. Geomean of 5 grab samples for Cd, Hg, Ni, Ag, PCB Aroclors and BEHP. Geomean of 6 grab samples for Cr, Cu, Pb, Zn and PAHs.
16	0.60	0.65	6.1	**50.4**	26.9	0.046	5.27	0.068	183	NA	0.75	**0.134**	Stormwater Eval. Report	Geomean of 5 composite samples for metals and PAHs. For PCBs, geomean of 3 composite samples.
17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	None	Basin stormwater data collection not feasible.
18	1.63	0.92	8.02	28.5	37.0	0.040	6.77	0.075	245	**4.3**	0.49	0.0511	Stormwater Eval. Report	Geomean of 3 composite and one grab sample for PAHs, PCBs and BEHP. For metals, geomean of 4 composite samples.
19	1.27	0.32	5.56	18.3	18.8	0.034	4.58	0.087	204	**6.86**	0.49	0.0280	Stormwater Eval. Report	Geomean of 15 composite samples.
22	**3.24**	0.39	4.98	22.8	15.2	0.046	4.31	0.036	213	NA	1.25	0.0203	Stormwater Eval. Report	Geomean of 3 composite samples for metals. Geomean of 3 composite and one grab sample for PAHs, BEHP and PCBs.
22 - Post SCM	1.28	0.23	1.58	1.47	2.31	0.05 U	1.63	**2.3 U**	82.1	2.6	0.66	**0.21 U**	NW Doane Avenue Stormwater Evaluation Report	Geomean of 5 grab samples.
22B	**3.64**	**1.60**	7.36	31.4	**81.7**	0.185	7.94	0.175	293	NA	**1.96**	0.0829	Stormwater Eval. Report	Geomean of 4 composite samples for metals. Geomean of 4 composite and one grab sample for PAHs, BEHP and PCBs.
22B - Post SCM	1.6	0.40	3.0	12.9	11.3	0.05	4.1	0.07	141	3.9	0.22	0.0083	Stormwater Source Control Evaluation Report (Air Liquide Portland Facility)	Geomean of 2 grab samples.
22C	1.25	0.1 U	0.8	1.63	0.69	0.004	0.83	0.1 U	4.5	0.85	1.01	0.0025 U	Stormwater Eval. Report	Geomean of 4 grab samples.
43	1.01	0.56	3.19	18.6	8.93	0.011	2.97	0.1 U	118	1.51	0.43	0.016	OF Basin 43 Report	Geomean of 4 grab samples (Western Branch only).
43 - Post SCM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0603	OF Basins 43 and 44 Tech Memo	Geomean of 3 grab samples.
44	1.85	0.57	6.27	22	17.9	0.021	4.8	0.108 U	173	1.67	0.73	**0.249**	OF Basin 44 Report	PCB geomean of 6 stormwater grab events; other geomeans from 5 stormwater events.
44 - Post SCM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0604	OF Basins 43 and 44 Tech Memo	Value is an arithmetic mean of the concentrations for samples from the three main incoming laterals into the sample location.
45	1.42	0.58	**15.2**	29.4	23.2	0.021	**11.8**	0.122	327	3.27	1.02	0.0227	Stormwater Eval. Report	Geomean of 4 grab samples.
52	0.94	0.18	2.11	32.8	5.04	0.011	3.15	0.1 U	147	2.41	0.34	0.0489	Stormwater Eval. Report	Geomean of 4 grab samples.
52C	0.28	0.20	4.68	9.6	18.1	0.055	1.79	0.033	58.9	1.7	0.52	0.045	Stormwater Eval. Report OF Basins 52C and 53 Report	Geomean of 4 composite samples. Note: value shown for PCBs reflect correction to data used in SW Eval. Report.
52D	1.38	0.69	**80.92**	35.3	25.2	0.05 U	6.93	**0.39 U**	225	**5.00**	1.13	0.062	Schnitzer Burgard Industrial Park Basin 21 Tech Memo	Geomean of 3 grab samples. Geomean for PCBs is congener data
53	0.77	0.28	5.88	17.0	28.8	0.030	3.48	0.081	109	5.8	0.73	0.0370	Stormwater Eval. Report	Geomean of 6 composite samples.
53A	**4.46**	0.36	**42.0**	23.1	16.2	0.033	5.82	0.128	459	1.04	0.65	0.0373	Stormwater Eval. Report	Geomean of 4 grab samples.
53A - Post SCM	0.69	0.14	**12**	7.97	4.24	0.0069	2.13	0.1 U	337	NA	NA	0.000278	OF Basin 53A Report	One stormwater grab sample at MH AAA170.
M-1	0.80	0.39	2.28	12.8	6.69	0.007	2.1	0.1 U	186	2.11	0.26	0.0249	Stormwater Eval. Report	Geomean of 4 grab samples.
S-1	0.88	0.36	3.01	34.0	9.84	0.013	3.82	0.1 U	354	1.8	**8.72**	0.0206	Stormwater Eval. Report	Geomean of 9 grab samples. Geomean for total PCBs is from 4 samples analyzed for PCB congeners and 5 samples analyzed for PCB Aroclors.
S-6	0.85	0.24	2.16	34.1	6.32	0.009	3.58	0.1 U	385	1.35	0.78	0.00496	Stormwater Eval. Report	Geomean of 4 grab samples.
Comparison Values (values selected for Weight-of-Evidence evaluation are highlighted)														
DEQ Background	2	<1	1	9	13.3	<.1	5.5	<1	38	--	--	--		From DEQ Human Health Risk Assessment Guidance, Table 1, October 2010
JSCS SLV	0.045	0.094	100	2.7	0.54	0.77	16	0.12	36	2.2	--	0.000064		DEQ/EPA Portland Harbor Joint Source Control Strategy Table 3-1. Dec. 2005, amended July 16, 2007.
Current NPDES Benchmark	--	--	--	20	40	--	--	--	120	--	--	--		DEQ NPDES General Permit 1200-Z for Stornwater Discharge. Effective July 1, 2012.
Former NPDES Benchmark	--	--	--	100	400	--	--	--	600	--	--	--		DEQ NPDES General Permit 1200-Z for Stornwater Discharge. Effective July 1, 2007.
Approx. Knee of DEQ Curve	**2.0**	**1.0**	**10.0**	**50.0**	**40.0**	**0.2**	**10.0**	**0.2**	**500.0**	**4.0**	**1.5**	**0.1**		DEQ Guidance for Evaluating the Stormwater Pathway at Upland Sites, 2009 (amended 2010).

Refers to Figure 3-5 of the Municipal Stormwater Source Control Report for Portland Harbor. City of Portland, Bureau of Environmental Services (BES). December 2013.
Refers to Figure 3-5 of the Municipal Stormwater Source Control Report for Portland Harbor (BES, December 2013).
Indicates geomean exceeds selected comparison value.
bold Indicates geomean is above the approximate knee of respective DEQ guidance curve.

Notes:

U= undetected -- = not available
NA= not analyzed < = less than

(1) For the purpose of calculating the geomean concentrations, non-detect results are set to the value of the MRL, except as noted in Note 2. Duplicate samples from a single storm event were first averaged (each duplicate sample averaged together with its corresponding primary sample), and the average concentration was then included as a single value in the basin geomean calculations.

(2) Total PCB and total PAH geomean concentrations for results including one or more detections of an individual constituent were calculated by assigning a value of zero to non-detected concentrations. For results in which no individual constituents were detected, the total concentration is reported as the highest MRL among the individual constituents.

(3) Additional reference information provided below as needed, in order of appearance.

Sources:

Outfall Basin 19A Stormwater and Solids Investigation. Technical Memorandum No. OF 19A-1. BES. November 22, 2011.
Stormwater Evaluation Report. BES. February 2010.
Outfall Basin 44A Source Investigation Report. BES. March 2011.
Source Control Evaluation, Sulzer Pumps Facility. Prepared for Sulzer Pumps (US) Inc by GeoDesign, Inc. June 1, 2012.
NW Doane Avenue Stormwater Evaluation Report. Prepared for the Chevron Environmental Management Company by ARCADIS. January 2012.
Stormwater Source Control Evaluation Report. Portland Facility (ECSI #395). Prepared for Air Liquide America Specialty Gases LLC by CH2M HILL. December 2012.
Outfall Basin 43 Source Investigation Report. BES. December 2011.
Outfall Basins 43 and 44 Stormwater Investigations. Technical Memorandum No. OF43/44-1. BES. October 2012.
Outfall Basins 52C and 53 North Lombard Street PCB Source Investigation Report. BES. September 2012.
Outfall Basin 44 Source Investigation Report. BES. June 2011.
Basin 21 Storm Water and Storm Water Solids Sampling and Analysis Data. March/April Sampling Events. Source Control Evaluation. Burgard Industrial Park. Bridgewater Group, Inc. June 6, 2014.
Outfall Basin 53A Source Investigation Report. BES. May 2012.

Table A-2. Screening Summary of Basin Stormwater Data against Selected Comparison Levels

Contaminant	Selected Comparison Level (µg/L)	Basin Geomeans > Comparison Levels	Basin Post-SCM Data < Comparison Levels[1]	Additional Basins with more than one Individual Data Point > Comparison Levels	Data Evaluation Considerations[2]
Arsenic	DEQ Background[3] (2.0)	22, 22B, 53A	22, 22B, 53A	19, 19A, 44	• Post-SCM data show SCM effectiveness in all 3 basins where geomeans exceeded the comparison level. • Arsenic is not identified as a COI for the AOPCs affiliated with Basins 19, 19A, and 44.
BEHP	JSCS SLV[3] (2.2)	18, 19, 22, 22B, 45, 47, 52, 52D, 53	None	M-1, S-1, S-2	• All basin geomeans <5X the comparison level. • BEHP not identified as a COI for any of the AOPCs affiliated with basins with geomean exceedances except for Basin 18. Sources of BEHP in Basin 18 have been identified and source controls are not complete. • BEHP is not identified as a COI for the AOPC affiliated with Basins M-1, S-1, and S-2.
Cadmium	DEQ Background[3] (1.0)	22B	22B	None	• Post-SCM data show SCM effectiveness in the one basin where the geomean exceeded the comparison level. • No additional basins with more than one data point above the comparison level.
Chromium	JSCS SLV[4] (100)	None	NA	52D	• All basin data (except Basin 52D) are below the comparison level. • Chromium is not identified as a COI for the AOPC affiliated with Basin 52D. Source(s) are present in the basin.[5]
Copper	Current NPDES Benchmark[6] (20)	16, 18, 19A, 22, 22B, 44, 44A, 45, 47, 52, 52D, 53A, S-1, S-6	22, 22B, 53A	19	• Post-SCM data show SCM effectiveness in Basins 22, 22B, and 53A. • All basin data are below relevant NPDES benchmark (i.e., 100 µg/L) at time of collection. • Known sources in and adjacent to basins are implementing controls and conducting monitoring to meet new lower NPDES benchmark (Basins 16, 18, 19, 19A, 45, 52D, S-1, S-6). • Site industrial exposures eliminated (i.e., issuance of NPDES NECs) following basin data collection (Basins 44, 47, 52). • OF-44A slated for abandonment in 2015.
Lead	Current NPDES Benchmark[6] (40)	22B	22B	18, 19	• Post-SCM data show SCM effectiveness in the only basin where the geomean exceeded the comparison level. • All basin data are below relevant NPDES benchmark (i.e., 400 µg/L) at time of collection. • Lead is not identified as a COI for the AOPCs affiliated with Basins 18 and 19. Known sources in and adjacent to basins are implementing controls and conducting monitoring to meet new lower NPDES benchmark.
Mercury	JSCS SLV[4] (0.77)	None	NA	None	• All basin geomeans (and almost all data) are below the comparison level. • No additional basins with more than one data point above the comparison level.
Nickel	JSCS SLV[4] (16)	None	NA	45	• All basin geomeans (and almost all data) are below the comparison level. • Nickel is not identified as a COI for the AOPC affiliated with Basin 45.
Silver	DEQ Background[3] (1.0)	22 (Post-SCM)	NA	15	• The only geomean that exceeded the comparison level (i.e., Basin 22) was based solely on non-detected results. • The only other basin with more than one data point above the comparison level (i.e., Basin 15) had no detected concentrations of Ag.
Total PAHs	Approximate Knee of Curve[7] (1.5)	22B, S-1	22B	22C, 47, 52D	• Post-SCM data show SCM effectiveness in Basin 22B. • Sources of PAHs in Basins S-1, 22C, and 52D have been identified and source controls are not complete. • PAHs are not identified as a COI for the AOPC affiliated with Basin 47. • Site industrial exposures eliminated (i.e., issuance of NPDES NEC) in Basin 47 following basin data collection.
Total PCBs	Approximate Knee of Curve[7] (0.1)	16, 22 (Post-SCM), 44	22B, 44, 53A	18, 19, 22B, 52D	• Post-SCM data show SCM effectiveness in Basins 22B, 44, and 53A. • Sources of PCBs in Basins 16, 18, 19, and 52D have been identified and source controls are not complete. • Basin 22 (post-SCM) geomean was based solely on non-detected results and pre-SCM concentrations were below the comparison level.
Zinc	Current NPDES Benchmark[6] (120)	16, 18, 19, 19A, 22, 22B, 44, 44A, 45, 47, 52, 52D, 53A, M-1, M-2, M-3, S-1, S-2, S-5, S-6,	22	43, 50, 52A	• Post-SCM data show SCM effectiveness in Basins 22, 22B, and 53A. • Almost all basin data are below relevant NPDES benchmark (i.e., 600 µg/L) at time of collection. • Known sources in and adjacent to basins are implementing controls and conducting monitoring to meet new lower NPDES benchmark (Basins 16, 18, 19, 19A, 45, 52D, M-1, M-2, M-3, S-1, S-5, S-6). • Site industrial exposures eliminated (i.e., issuance of NPDES NECs) following basin data collection (Basins 44, 47, 50, 52, 52A, S-2, S-5). • Factor of exceedance for Basin 43 is low (i.e., only two samples that exceeded were less than 2X comparison level). OF-44A slated for abandonment in 2015.

Notes:

(1) Post-Source Control Measure implementation (Post-SCM) data collected at location representative of basin discharges.

(2) AOPC information obtained from the *Portland Harbor Upland Source Control Summary Report*. Oregon Department of Environmental Quality. November 21, 2014. Information on sources and NPDES coverage from the *Municipal Stormwater Source Control Report for Portland Harbor* (BES, 2013) except where otherwise noted.

(3) Source: DEQ Human Health Risk Assessment Guidance, Table 1. October 2010.

(4) DEQ/EPA Portland Harbor Joint Source Control Strategy, Table 3-1. Dated December 2005 and amended July 16, 2007.

(5) Source: *Basin 21 Storm Water and Storm Water Solids Sampling and Analysis Data, March/April Sampling Events, Source Control Evaluation, Burgard Industrial Park*. Prepared for Schnitzer and DEQ by the Bridgewater Group. June 6, 2014.

(6) Source: DEQ NPDES General Permit 1200-Z for Stormwater Discharge. Effective July 1, 2012.

(7) Approximate point of inflection on DEQ Guidance Curves. "Tool for Evaluating Stormwater Data" - Appendix E to Guidance for Evaluating the Stormwater Pathway at Upland Sites. DEQ, January 2009 (updated October 2010).

Notes (continued…)

AOPC = Area of Potential Concern
BEHP = Bis(2-ethylhexyl)phthalate
COI = Contaminant of concern
DEQ = Oregon Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
JSCS = Joint Source Control Strategy
NEC = No Exposure Certificate
NPDES = National Pollution Discharge Elimination System
PAH = Polycyclic aromatic hydrocarbon
PCB = Polychlorinated biphenyl

Figure A-1
DEQ Guidance Curve for Arsenic in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

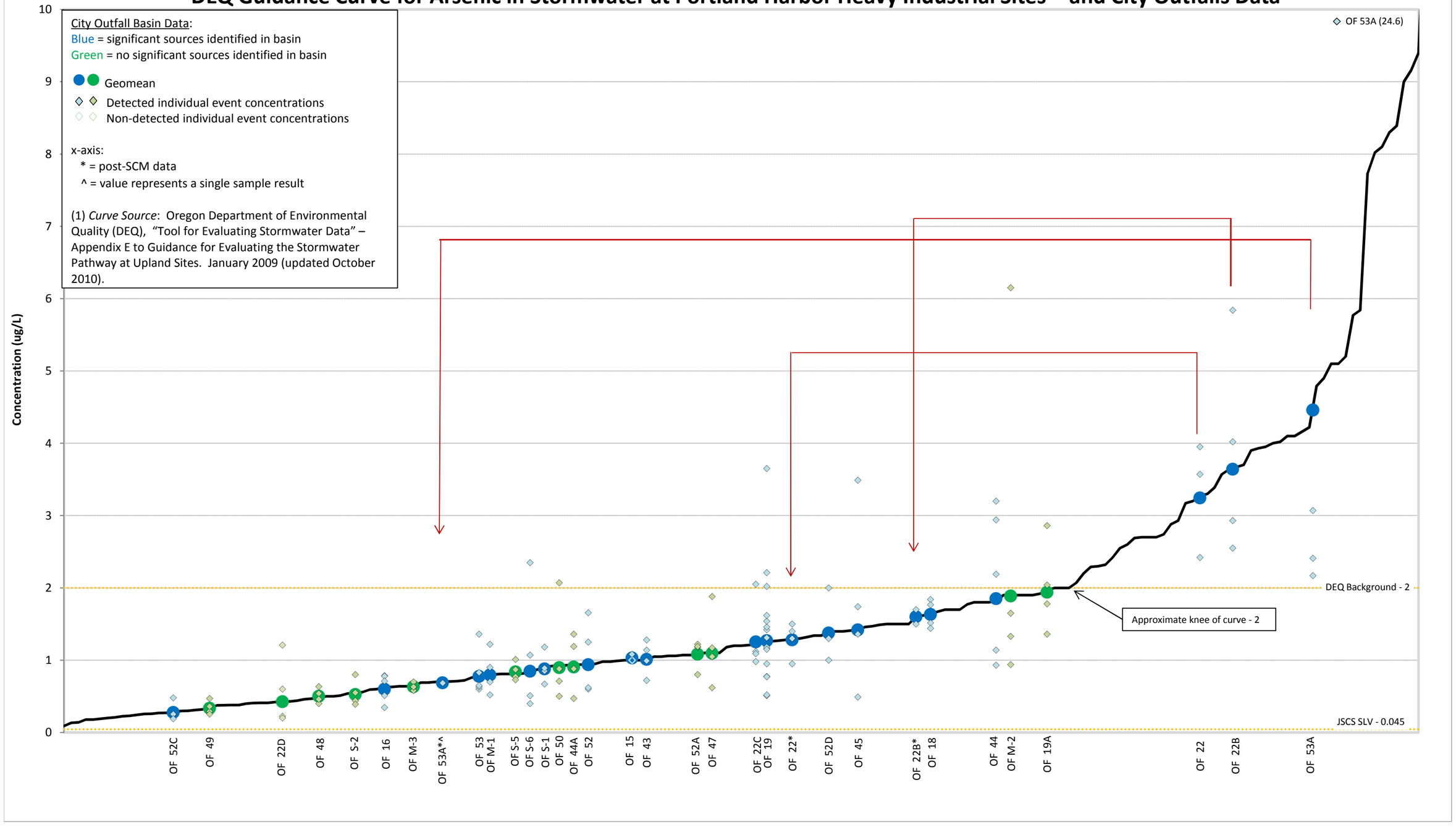

Figure A-2
DEQ Guidance Curve for BEHP in Stormwater at Portland Harbor Heavy Industrial Sites(1,2) and City Outfalls Data

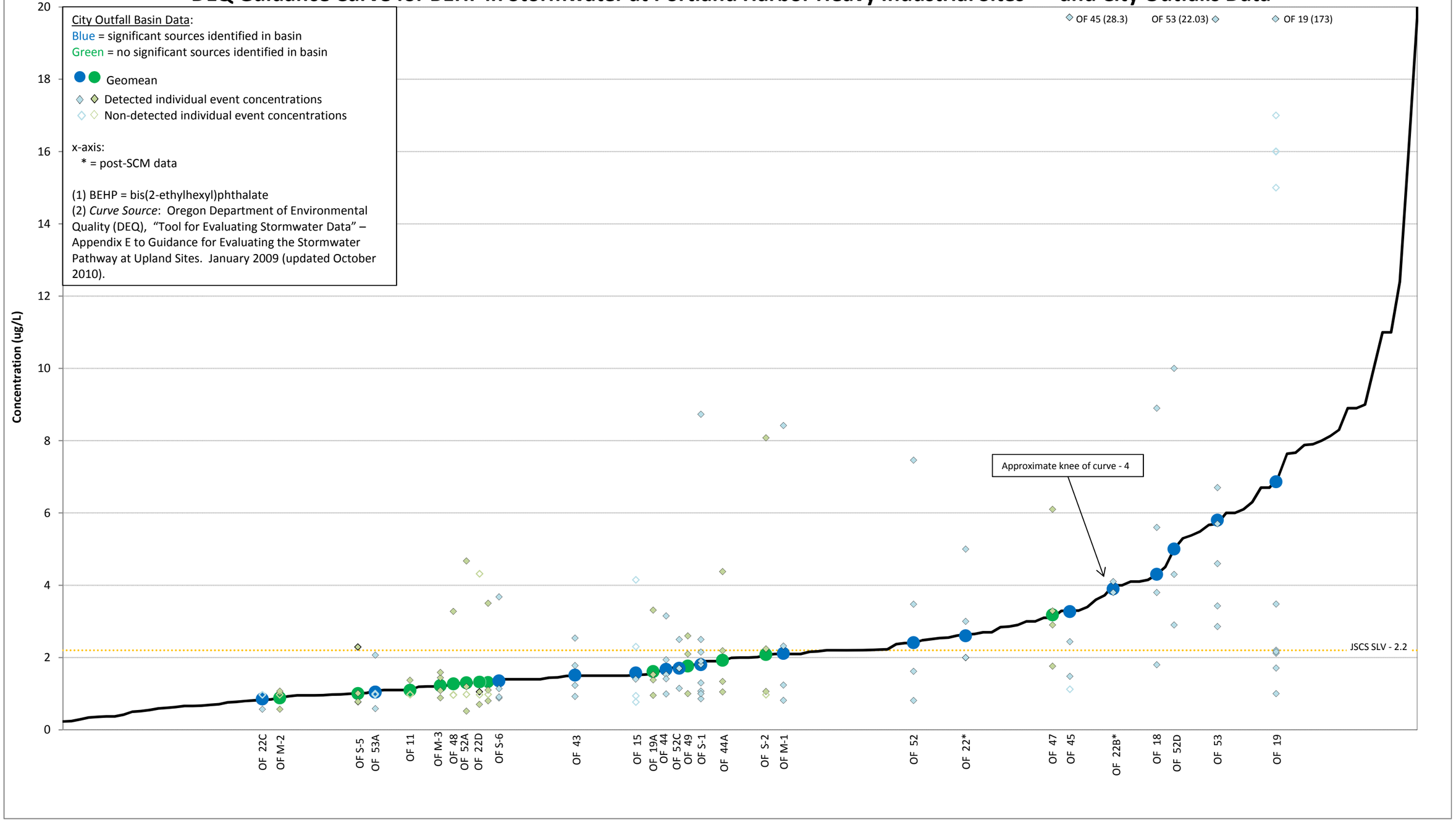

Figure A-2: BEHP

Figure A-3
DEQ Guidance Curve for Cadmium in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

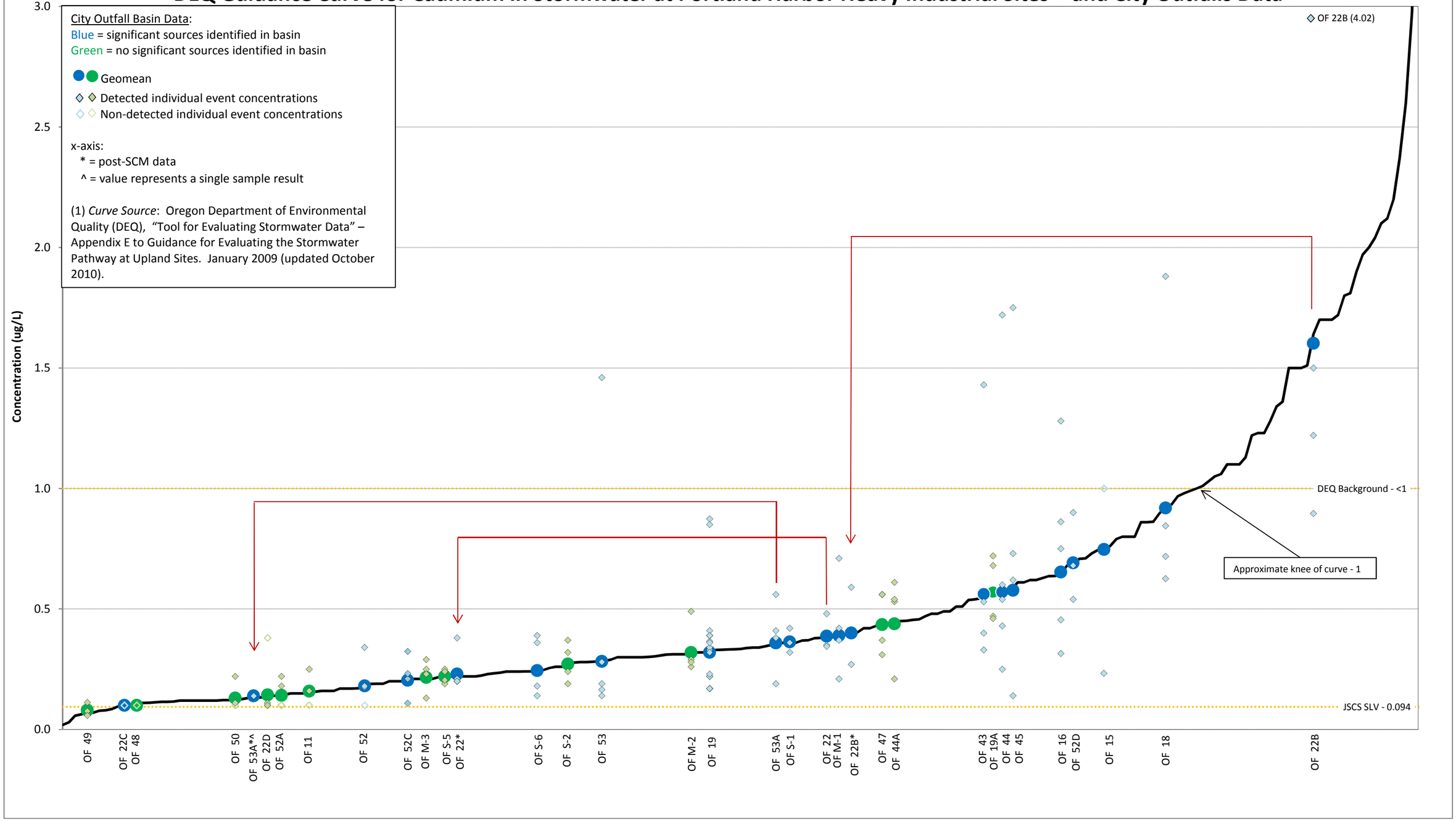

Figure A-3: Cadmium

Figure A-4

DEQ Guidance Curve for Chromium in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

JSCS SLV above chart at 100 ug/L

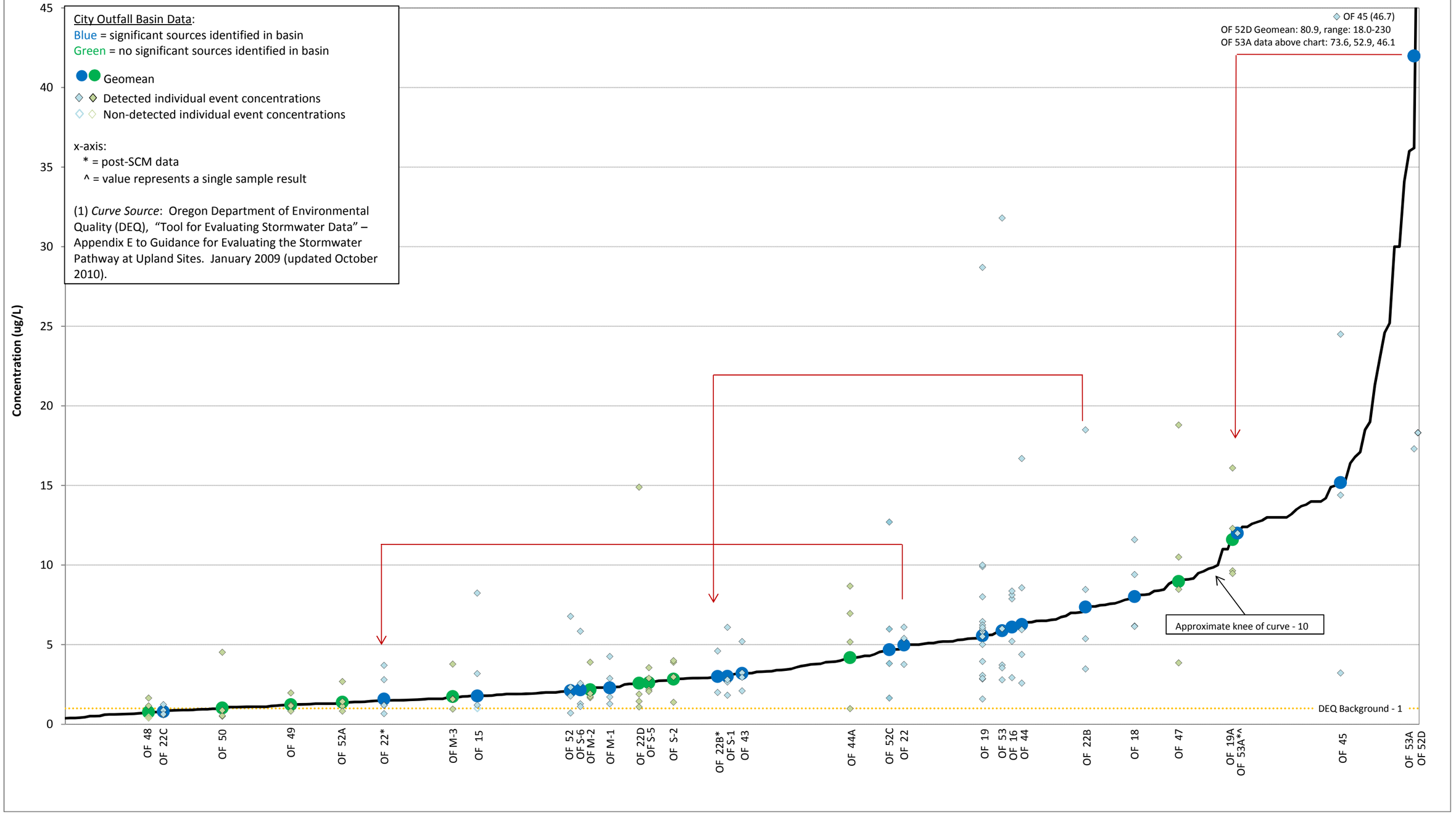

Figure A-4: Chromium

Figure A-5
DEQ Guidance Curve for Copper in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

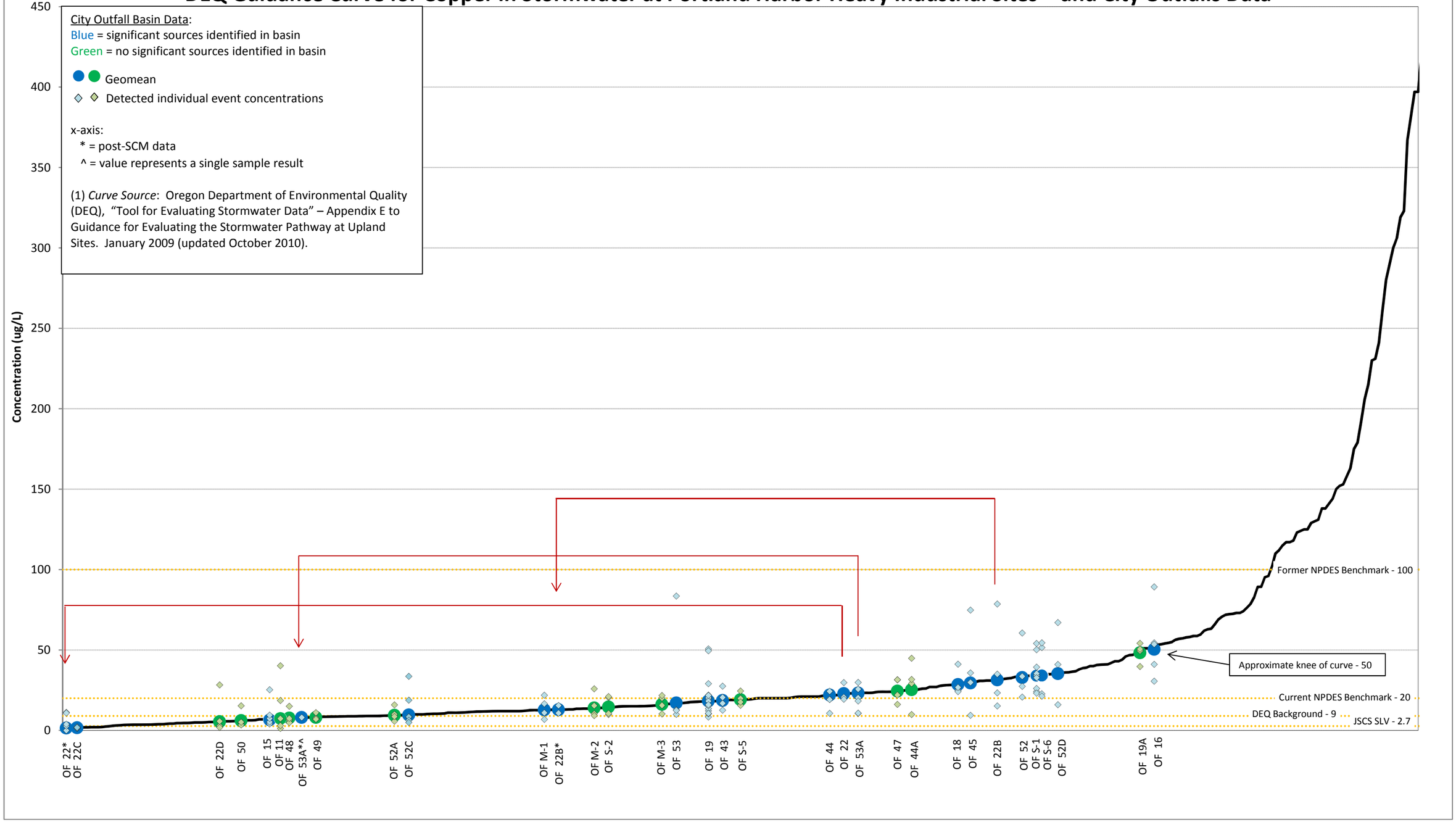

Figure A-5: Copper

Figure A-6
DEQ Guidance Curve for Lead in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

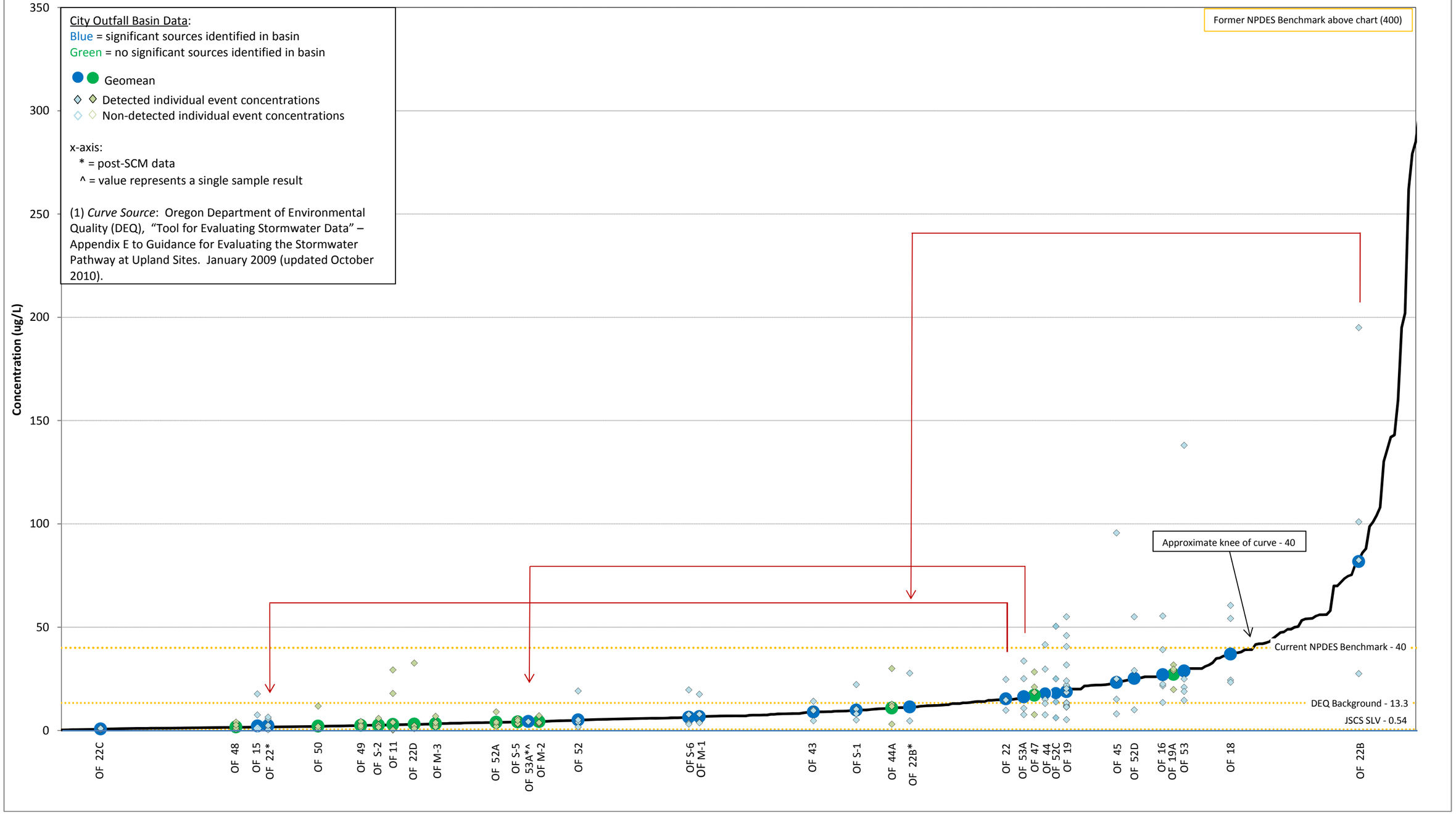

Figure A-7
DEQ Guidance Curve for Mercury in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

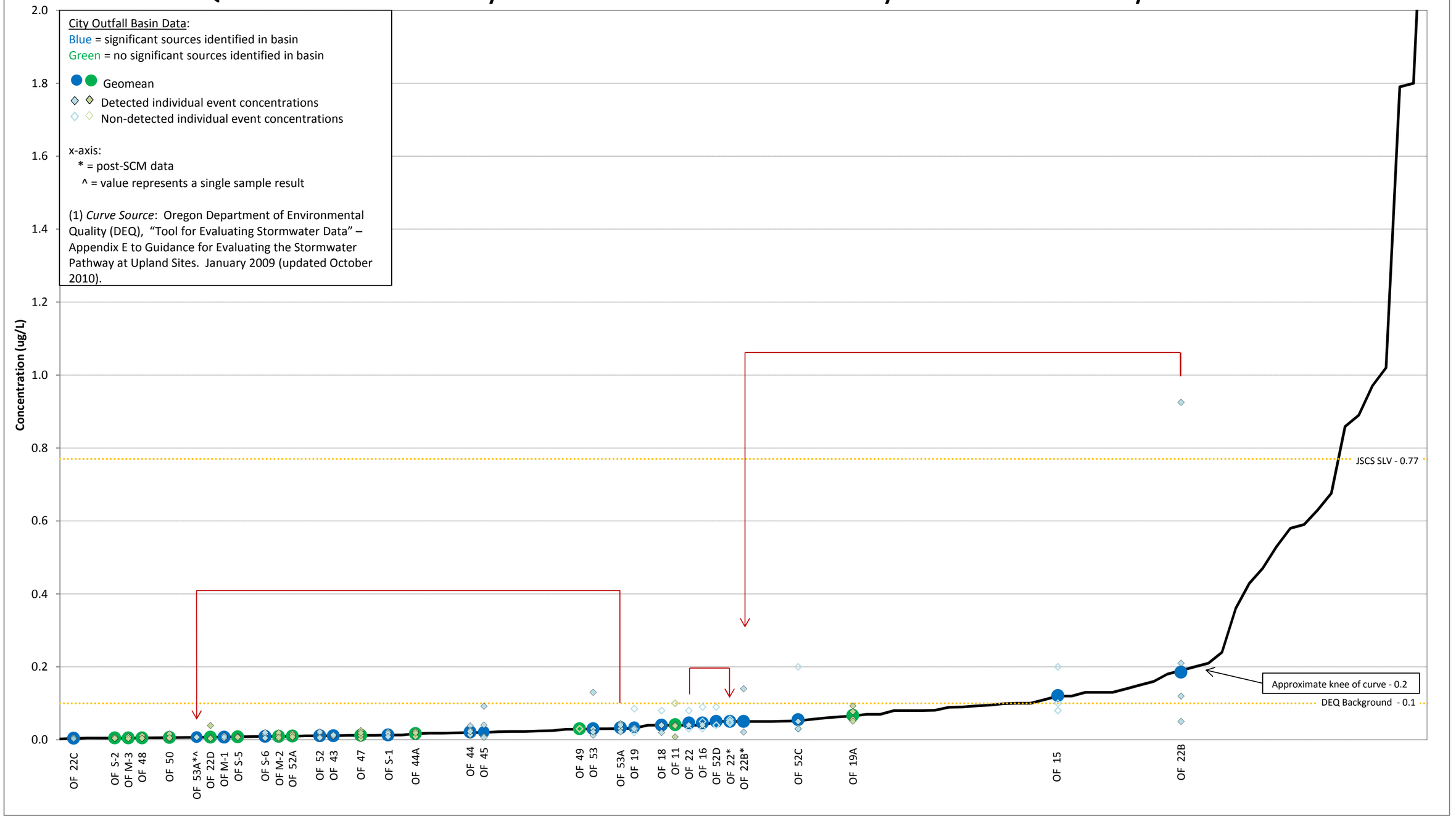

Figure A-8
DEQ Guidance Curve for Nickel in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

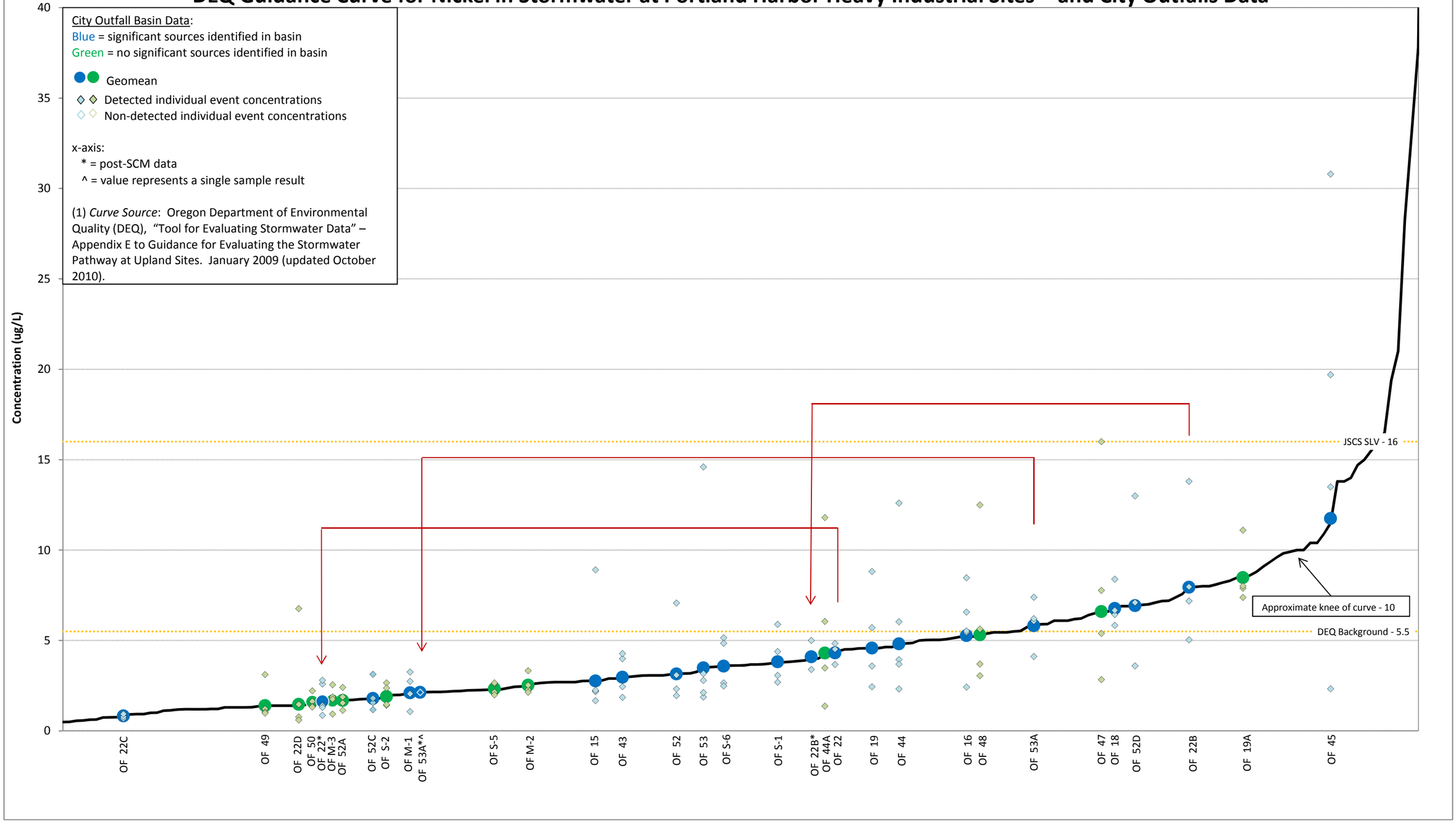

Figure A-9

DEQ Guidance Curve for Silver in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

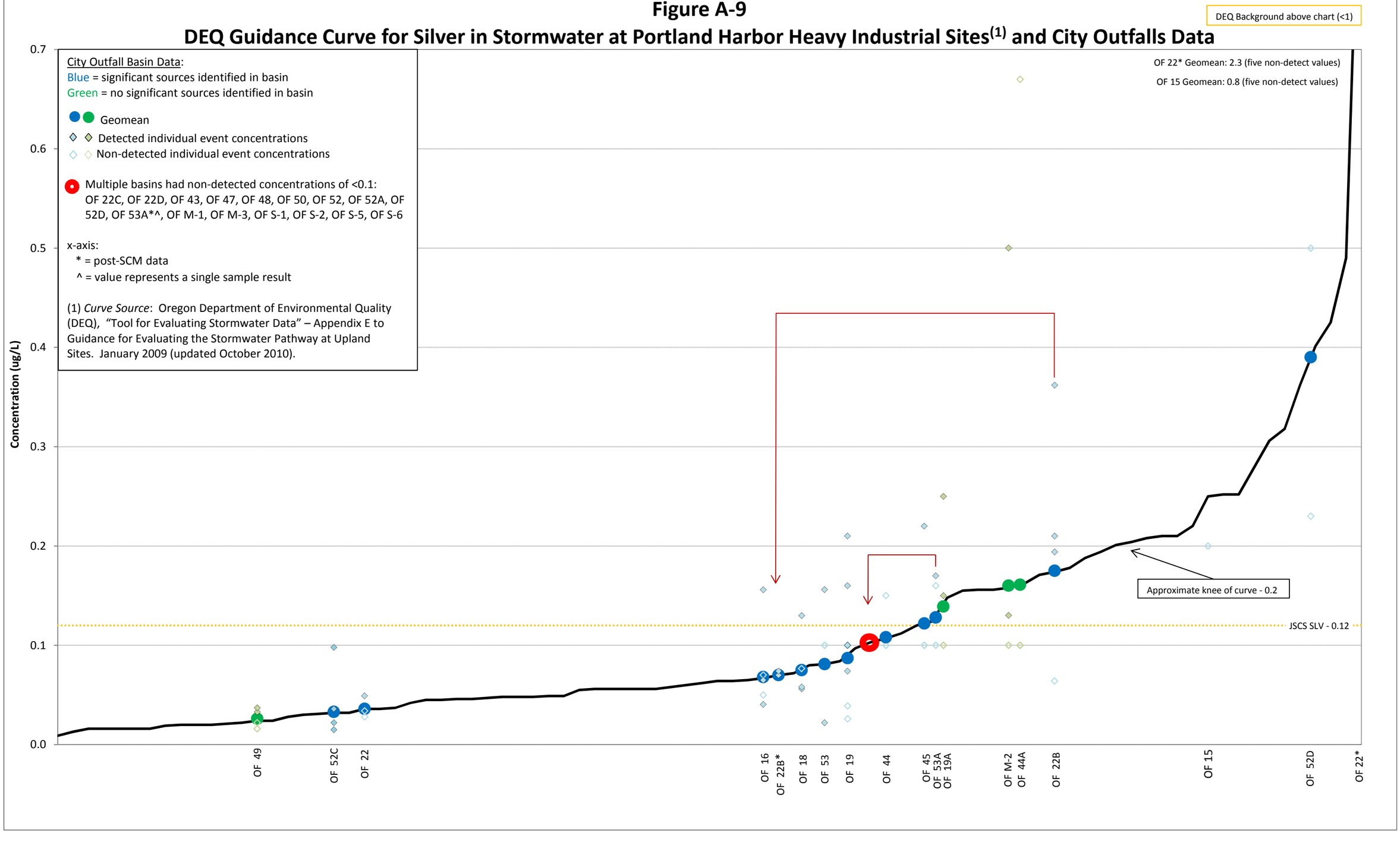

Figure A-9: Silver

Figure A-10

DEQ Guidance Curve for Total PAHs in Stormwater at Portland Harbor Heavy Industrial Sites[1,2] and City Outfalls Data

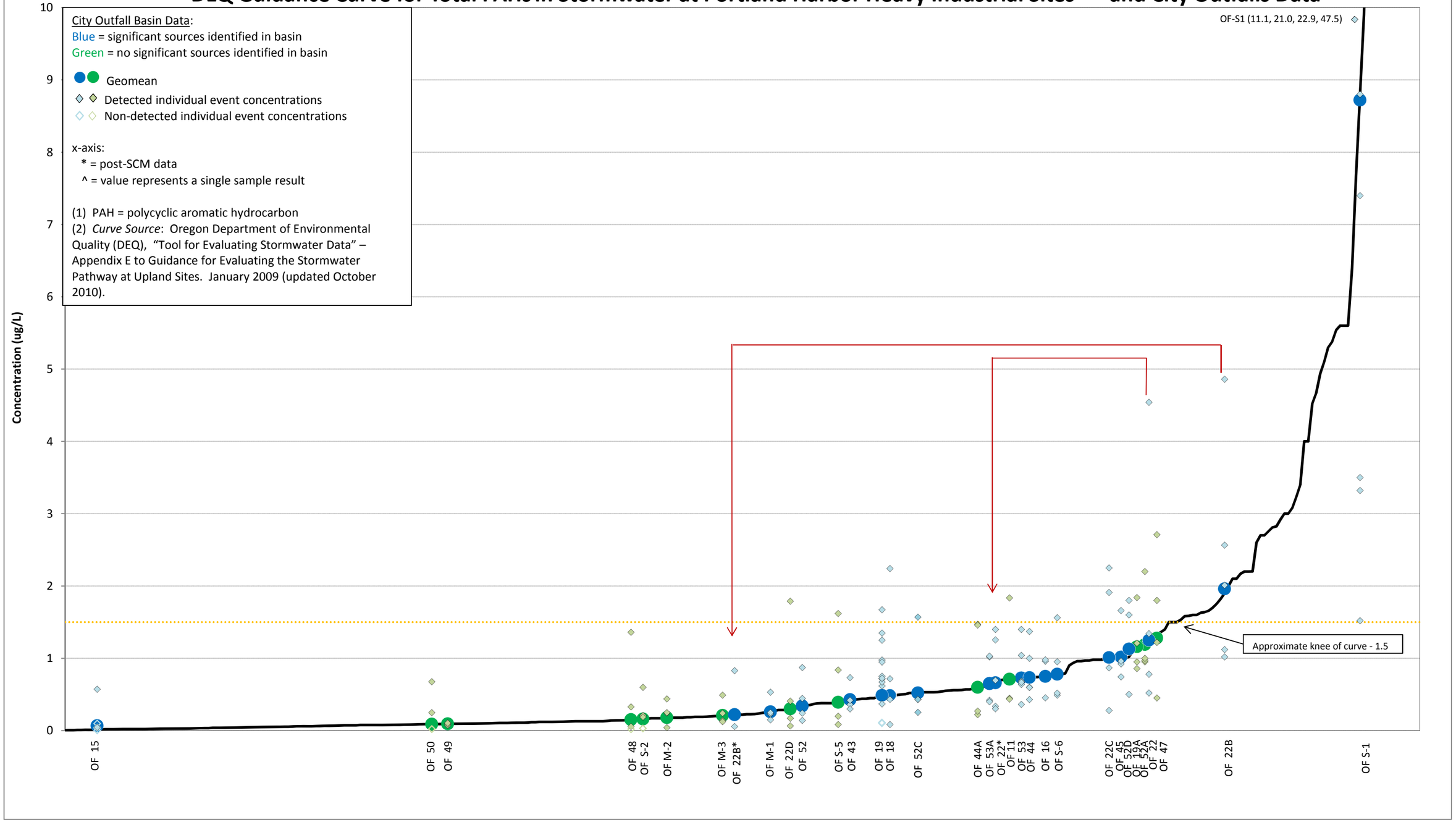

Figure A-10: Total PAHs

Figure A-11

DEQ Guidance Curve for Total PCBs in Stormwater at Portland Harbor Heavy Industrial Sites(1,2) and City Outfalls Data

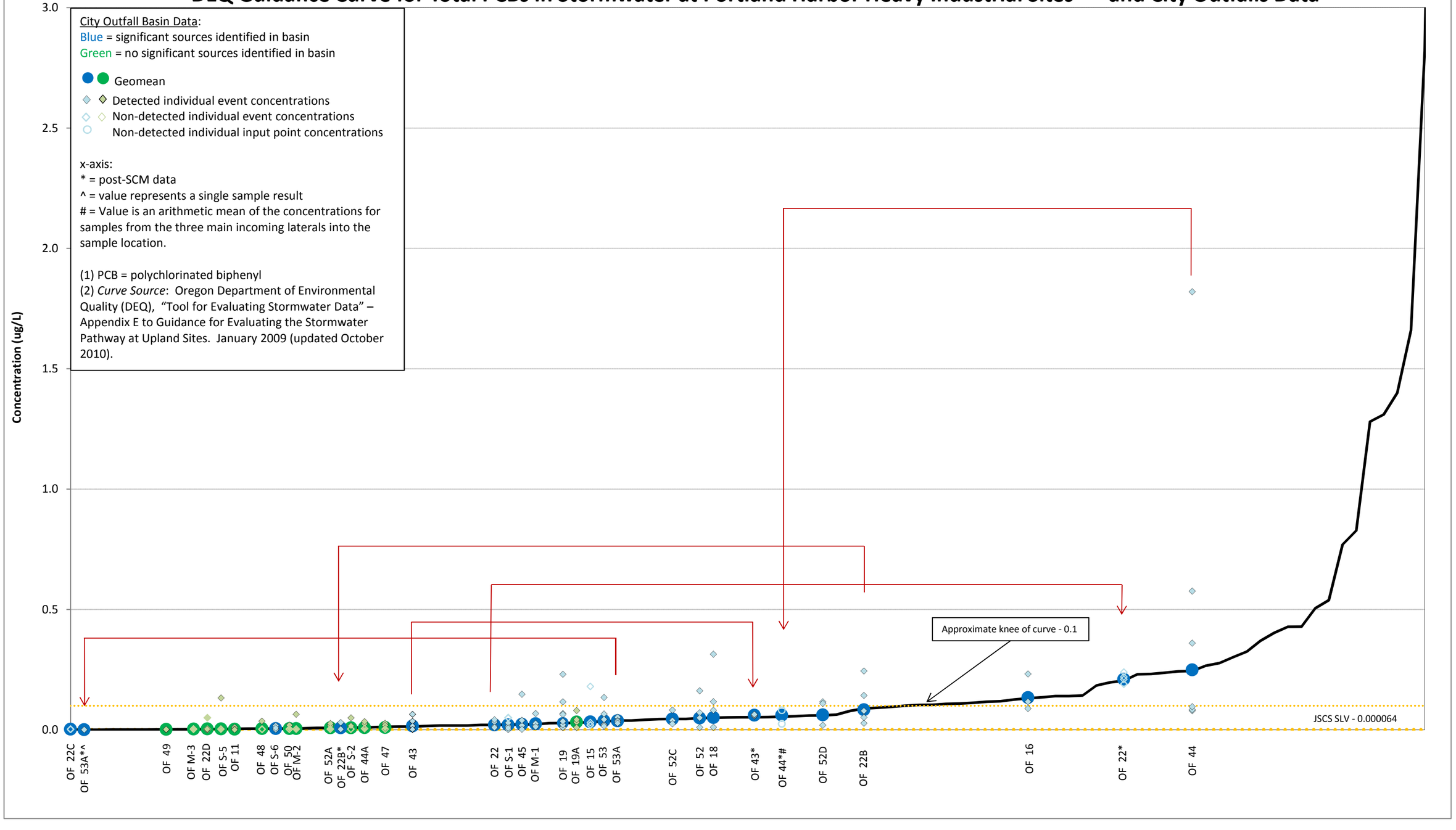

Figure A-11: Total PCBs

Figure A-12
DEQ Guidance Curve for Zinc in Stormwater at Portland Harbor Heavy Industrial Sites(1) and City Outfalls Data

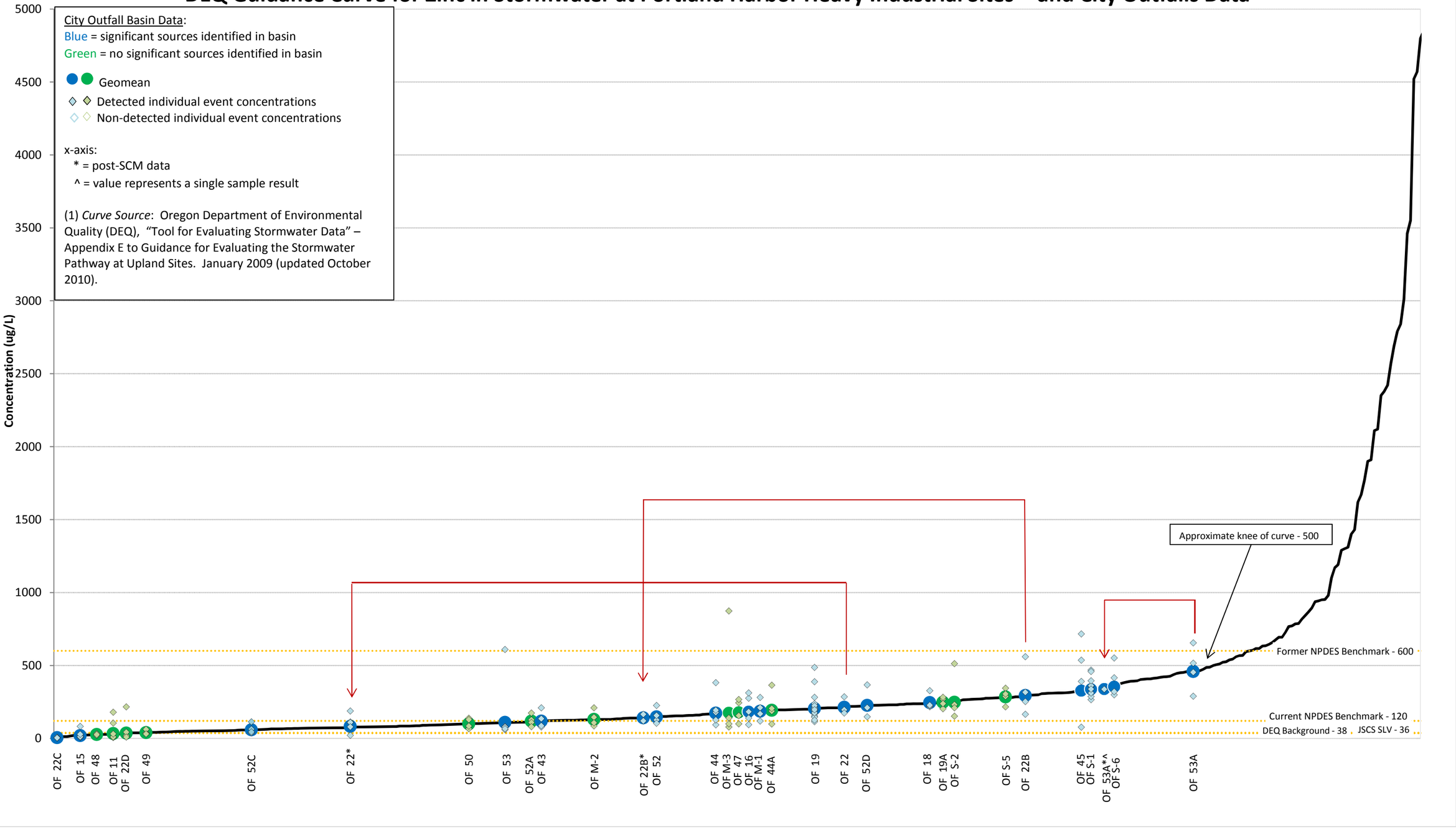

Figure A-12: Zinc

APPENDIX B

Basin Evaluations

Basin Evaluations

Appendix B includes more detailed effectiveness evaluations for the basins in which the City implemented Portland Harbor-specific source control measures under the IGA. These basins include:

- Basin 16
- Basin 18
- Basin 22B
- Basin 22C
- Basin 43
- Basin 44
- Basin 45
- Basin 52

The evaluations provide additional details for the information listed in Tables 1 and 2 of the main report, and are intended to complement the Completion Summaries (BES, 2013) previously prepared for each basin.

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Outfall Basin 16
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 16 (OF-16) discharges to Balch Creek Cove, located on the west side of the Willamette River at approximately river mile 9.7. The cove is in an area of potential concern (AOPC 20) identified by the U.S. Environmental Protection Agency (EPA) based on elevated concentrations of polychlorinated biphenyls (PCBs), metals, and other contaminants in river sediment.

OF-16 conveys runoff from an approximate 71-acre stormwater basin in the Guilds Lake industrial area. The entire basin is developed and is occupied by industrial facilities (trucking, warehouse/distribution, automotive service, metals recycling, manufacturing operations, and a storage yard) and commercial properties. Land use also includes major transportation (a section of State Highway 30).

To evaluate whether discharges from OF-16 were contributing to elevated contaminant concentrations detected in Balch Creek Cove sediments, the City conducted a comprehensive phased investigation of the basin, which included collecting and analyzing inline solids, stormwater, and dry-weather flow samples to identify major sources and pathways to the basin. Results of these investigations identified the Calbag Metals site (ECSI #5059) as a major source of PCBs and metals via stormwater discharges to the City conveyance system. As a result of these investigations, Calbag entered the Oregon Department of Environmental Quality (DEQ) Cleanup Program, implemented source controls, and currently is evaluating the effectiveness of those controls.

Basin Stormwater Data Observations

Basin stormwater data collected in 2007[1] indicate that copper, zinc, and total PCBs geometric mean (geomean) concentrations were elevated above relevant comparison values (see Appendix A). As discussed above, City source tracing identified a major source of PCBs and metals in Basin 16.[2] Basin data were collected from the branch conveying discharges from this site, and were collected prior to improvements to site stormwater source control measures (SCMs) under DEQ Cleanup Program oversight. It should be noted that basin concentrations of copper and zinc were below the National Pollutant Discharge Elimination System (NPDES) industrial stormwater permit benchmarks in place at that time, and that the basin includes permittees that were authorized to discharge these metals at concentrations that were five times the current NPDES benchmarks (the relevant comparison values for these metals).[3] With the implementation of DEQ's revised NPDES 1200-Z permit in July 2012, concentrations of copper and zinc in basin stormwater likely are lower now.

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[1] BES. 2010a. *Stormwater Evaluation Report*. City of Portland, Bureau of Environmental Services. February 2010.
[2] BES. 2010b. *Outfall Basin 16 Inline Solids Investigation*. Technical Memorandum No. OF 16-1. City of Portland, Bureau of Environmental Services. October 2010.
[3] NPDES benchmarks in 2007 were 100 µg/L for copper and 600 µg/L for zinc. Current respective benchmarks are 20µg/L and 120 µg/L.

Screening of individual data points did not identify any other contaminants as having more than one result over the comparison value (see Table A-2).

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the 2003 intergovernmental agreement (IGA) with DEQ, the City implemented PH-SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. The PH-SCM that the City implemented in Basin 16, and any affiliated monitoring of the effectiveness of that measure, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2006, the City cleaned out solids accumulated in the 8-inch diameter storm line along NW Front Avenue (shown on Figure C-1 in Appendix C) adjacent to the former Front Avenue MP site (ECSI #4008), after SCMs were implemented at the site (removal of contaminated soil and cleanout of catch basins and associated piping). The purpose of the line cleaning was to remove legacy solids discharged from historical industrial operations at the site because this work had not been done during site remediation. Inline solids collected in 2005 both upstream and downstream of the site indicated some elevated metals and a low detection of PCBs (54 µg/kg) downstream of the site.[4]	None. Basin inline solids data were not collected from the 8-inch-diameter line following line cleanout and basin stormwater data do not represent this branch of the conveyance system.

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 16 is warranted because the City implemented a PH-SCM in Basin 16 (2006 line cleanout along NW Front Avenue to remove legacy solids) and no data have been collected in or downstream of this 8-inch diameter line to demonstrate effectiveness.

Inline solids data from the NW Front Avenue line would provide a basis for evaluating SCM effectiveness of the City action. However, given that this 8-inch line drains only a few properties (see Figure C-1 in Appendix C), these data would have limited value in understanding discharges from the basin. Previous stormwater data collected in the basin represent most of the basin drainage, but the sample collection point was upstream of the Front Avenue branch. In lieu of collecting an inline solids sample to measure the effectiveness of the cleanout of the 8-inch line, the City proposes to collect stormwater data in the main trunk line downstream of the Front Ave branch to better represent the entire basin.

[4] BES. 2008. *Phase I Report and Inline Sampling Results for the City of Portland Basin 16*. City of Portland, Bureau of Environmental Services. June 2008.

Data quality objectives and a proposed stormwater sampling and analysis plan are included in Appendix C. Table 2 in the main report includes a summary of the additional weight-of-evidence (WOE) that discharges from OF-16 are not likely to be a significant future contaminant pathway to the river once identified sources have been controlled.

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Outfall Basin 18
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 18 (OF-18) is located in the Guilds Lake Industrial Area and discharges to the west side of the Willamette River at approximately river mile 8.8. OF-18 conveys runoff from an approximately 470-acre basin, the majority of which is comprised of Forest Park. Heavy industrial land use represents most of the remaining drainage area, with a section of major transportation land use (Highway 30) and a small residential component.

OF-18 discharges to AOPC 19, identified by EPA based on elevated concentrations of PCBs, pesticides, metals, polycyclic aromatic hydrocarbons (PAHs), bis(2-ethylhexly)phthalate (BEHP), and other contaminants in river sediment. To evaluate whether discharges from OF-18 were contributing to elevated contaminant concentrations detected in river sediment, the City conducted a comprehensive phased investigation of the basin, which included collecting and analyzing inline solids and erodible soil samples, to identify major sources and pathways to the basin. The City also collaborated with DEQ on site discovery efforts within the basin and evaluated stormwater, dry-weather flow, and solids data collected from the basin by other parties. Results of these investigations identified a number of significant contaminant sources and pathways to the City conveyance system.

Seventeen sites have been working with DEQ and EPA to determine whether SCMs are warranted to control site sources and pathways. Although DEQ Source Control Decisions (SCDs) have been issued for some identified sources, the source control evaluations (SCEs) are still underway at most sites and SCM effectiveness has not yet been demonstrated (see Table 1 in the main report).

Basin Stormwater Data Observations

Basin stormwater data collected in 2007[1] indicate that copper, zinc, and BEHP geomean concentrations were elevated above relevant comparison values (see Appendix A). It should be noted that copper and zinc geomeans were below the NPDES industrial stormwater permit benchmarks in place at that time, which were five times the current NPDES benchmarks.[3] The basin includes permittees that were authorized to discharge these metals at the former NPDES benchmark concentrations. With the implementation of DEQ's revised NPDES 1200-Z permit in July 2012, concentrations of copper and zinc in basin stormwater likely are lower now.

Phthalates are a contaminant of interest at a number of sites in the basin that are completing SCEs under DEQ oversight. BEHP concentrations were less than five times the Joint Source Control Strategy[5] screening level value (JSCS SLV) (see Figure A-2) and stormwater data were collected before SCMs were implemented at identified BEHP sources (e.g., Container

[5] DEQ and EPA. 2005 (amended 2007). *Portland Harbor Joint Source Control Strategy*. Prepared by the Oregon Department of Environmental Quality and the U.S. Environmental Protection Agency. December 2005 (Table 3-1 updated July 2007).

Management – ECSI #4784, Carson Oil – ECSI #1405, and Columbia American Plating – ECSI #29).

Screening of individual data points also identified lead and total PCBs as having more than one result over the comparison value (see Table A-2 and Figures A-6 and A-11). Similar to copper and zinc as described above, NPDES permit benchmarks for lead were much higher at the time of data collection (400 µg/L) than they are now (40 µg/L). The basin includes approximately 20 current and/or historical NPDES permittees and known sources of lead, many of which are still in the process of identifying and implementing controls under DEQ Cleanup and/or Water Quality program oversight. Concentrations of lead in basin stormwater are likely lower now that the new 1200-Z permit is in effect. In addition, lead has not been identified as a contaminant of interest (COI) for AOPC 19. In terms of PCBs, the City has identified sources of PCBs in Basin 18 (e.g., the Container Management site) and referred those sources to DEQ for investigation and control. Source control implementation is not complete at identified sources in the basin (see Table 1 in the main report).

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the IGA, the City implemented SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. PH-SCMs that the City implemented in Basin 18, and any affiliated monitoring of the effectiveness of those measures, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2001 and 2004, the City cleaned out solids accumulated in storm lines in the west-central subbasin, adjacent to and downstream of the Container Management (ECSI #4784) and Wilhelm Trucking (ECSI #69) sites. Data collected as part of that work resulted in the referral of those two sites to the DEQ Cleanup Program.[6]	The City collected sediment trap data in 2007 and 2009 from this branch of the system; data confirmed that uncontrolled sources of PCBs, pesticides, metals, and SVOCs (including BEHP) were still present.[7]
In 2010, the City cleaned lines in the east-central subbasin, upstream of the Van Waters & Rogers site (ECSI #330), to remove contaminated inline solids identified during source tracing and in order to determine whether unknown sources were present.	The City and representatives of the Van Waters & Rogers site (ECSI #330) collected sediment trap and inline solids data in 2010 from cleaned portions of the system. Post-SCM data indicated that although concentrations of PCBs, pesticides, and metals had been reduced, there were continuing sources to the east-central branch of Basin 18.[8]

[6] BES. 2006. *Inline Solids Sampling in the Vicinity of Container Management Services and Wilhelm Trucking Co*. Technical Memorandum No. OF 18-1. City of Portland, Bureau of Environmental Services. March 21, 2006.
[7] BES. 2010. *Outfall Basin 18 Inline Solids Investigation*. Technical Memorandum No. OF 18-2. City of Portland, Bureau of Environmental Services. July 2010.
[8] BES. 2012. *Outfall Basin 18 East-Central Subbasin Source Investigation Report*. City of Portland, Bureau of Environmental Services. May 2012.

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 18 is not warranted. This is because data have already been collected following the implementation of PH-SCMs, but also because, as described below, the effectiveness of the PH-SCMs cannot be demonstrated due to the presence of ongoing sources to the portions of the Basin 18 system where the City implemented these measures.

There are a number of known sources that have not yet completed PH-SCMs and others that have implemented SCMs but have not completed a demonstration of their effectiveness (see Table 1). Site implementation of PH-SCMs and subsequent SCM effectiveness demonstration by sites that implemented them is anticipated to take several years. The PH-SCMs implemented by the City in the west-central and east-central subbasins removed legacy contaminated inline solids, but subsequent post-SCM investigations confirmed that ongoing sources are present. Sources have been identified, are in the process of implementing PH-SCMs, and will be required to demonstrate the effectiveness of the measures implemented to control those sources. Therefore, additional data collection by the City to demonstrate PH-SCM effectiveness is not warranted. Table 2 in the main report includes a summary of the additional WOE that discharges from OF-18 are not likely to be a significant future contaminant pathway to the river once identified sources have been controlled.

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Outfall Basin 22B
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 22B (OF-22B) discharges to the west side of the Willamette River at approximately river mile 6.9. The drainage area for this outfall is roughly 29 acres, located within the Doane Lake industrial area. Land use in Basin 22B is heavy industrial and currently includes three sites: a Metro regional waste transfer station (ECSI #1398), a specialty gas manufacturing operation and shredder residue landfill (Schnitzer Doane/Air Liquide - ECSI #395), and vacant land primarily consisting of the remediated Gould Superfund Site (ECSI #49). Two former herbicide and/or pesticide manufacturing facilities (Rhone-Poulenc – ECSI #155 and Arkema – ECSI #398) are located immediately adjacent to the basin, and a portion of the Arkema site formerly discharged to Basin 22B. The Basin 22B conveyance system is downgradient of a contaminated groundwater plume originating at the Rhone-Poulenc (now SLLI) site.

OF-22B discharges to an area of potential concern (AOPC 14) identified by EPA based on elevated concentrations of PCBs, pesticides, metals and other contaminants in river sediment. To evaluate whether discharges from OF-22B were contributing to elevated contaminant concentrations detected in river sediment, the City conducted a comprehensive phased investigation of the basin to identify major sources and pathways. Source tracing focused on PCBs, pesticides, select metals, and phthalates based on elevated concentrations of one or more of these contaminants detected in conveyance system solids, dry-weather flow, adjacent erodible soils, and/or stormwater samples. Investigations verified that contaminants were being discharged to the basin via stormwater and groundwater pathways.

All properties within or historically connected to the basin are DEQ Cleanup Program sites (and one also is an EPA Superfund site). The Gould site completed cleanup activities under the federal Superfund program. DEQ issued SCDs for the other two sites in the current basin; implementation of SCMs is still underway at one site (Metro), and demonstration of SCM effectiveness has not yet been completed at either site. Additionally, the two DEQ Cleanup Program sites adjacent to the basin (Arkema and Rhone-Poulenc/SLLI) are implementing or have implemented SCMs to minimize offsite contaminant migration to the City's system; the former by disconnecting from the City's system and the latter by implementing measures (cleaning and lining the entire City system and the private systems connected to it) to prevent contaminated groundwater from infiltrating the system as a preferential pathway. SLLI currently is conducting effectiveness monitoring in the OF-22B conveyance system to evaluate these groundwater controls.

Basin Stormwater Data Observations

Basin stormwater data collected in 2007[1] indicate that arsenic, cadmium, copper, lead, total PAHs, and zinc geomean concentrations were elevated above relevant comparison values (see Appendix A). As discussed above, SLLI cleaned and lined the entire Basin 22B system and all private systems discharging to it in the period following the 2007 basin stormwater data

collection. In addition, the Arkema and Schnitzer Doane/Air Liquide sites implemented site source controls after the 2007 basin stormwater data collection. One of these sites collected stormwater data from OF-22B in 2011 after many of these controls had been implemented. The results comparison below indicates metals and total PAH concentrations are lower in 2011 than in 2007. With the exception of zinc, concentrations of these contaminants have fallen below relevant comparison values (see Appendix A).

Contaminant Concentrations in Basin 22B Stormwater Before and After PH-SCMs.

Analyte	2007 Geomean (µg/L) (1)	2011 Geomean (µg/L) (1)
Arsenic	3.6	1.6
Cadmium	1.6	0.4
Copper	31.4	12.9
Lead	81.7	11.3
Total PAHs	2.0	0.2
Zinc	293	141

Notes:
(1) Data sources and reduction described in Appendix A (Table A-1).

It should be noted that at the time of data collection for both sets of stormwater data, the only two sites in the basin with active industrial operations were authorized to discharge zinc in stormwater at concentrations up to 600 µg/L under the NPDES General Industrial 1200-Z permit issued by DEQ. In 2012, DEQ issued a revised permit that lowered the zinc benchmark from 600 µg/L to 120 µg/L, likely resulting in further reductions in zinc (and other metals) concentrations in basin stormwater.

BEHP data were not collected in 2007, but the 2011 BEHP data exceeded the comparison value. BEHP has not been identified as a COI for AOPC 14, and the exceedance factor for stormwater is low (1.8).[9] BEHP has been identified as a COI for the Metro site (ECSI #1398)[10] and concentrations will likely be reduced when SCM implementation is complete at that site.

Screening of individual data points for other contaminants identified only total PCBs as having more than one result over the comparison value (see Table A-2). Sources of PCBs in Basin 22B have been identified, controls have been implemented at some sources, and stormwater data collected in 2011 indicate that source controls are effective (see Table A-1 and Figure A-11).

[9] The BEHP geomean for the 2011 data was 3.9 µg/L; the JSCS SLV is 2.2 µg/L. See Appendix A.
[10] URS. 2013. *Draft Stormwater Source Control Evaluation Report*. Metro Central Transfer Station. Prepared by URS for Metro and submitted to DEQ. October 8, 2013.

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the IGA, the City implemented SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from programmatic measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. PH-SCMs that the City implemented in Basin 22B, and any affiliated monitoring of the effectiveness of those measures, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2004, the City cleaned the 48-inch-diameter stormwater lines that extend from the vicinity of the Guilds Lake Pump station to Outfall 22B.[11] Inline solids were removed from approximately 1,200 feet of pipe. This portion of the Basin 22B conveyance system receives stormwater runoff from the entire basin drainage area.	Following the City line cleaning in 2004, SLLI cleaned the Basin 22B system again in 2006 under an authorization agreement from the City and analyzed solids that were removed. Analytical results from the 2006 cleaning indicated that concentrations of metals, pesticides, and total PAHs were lower than concentrations of those same contaminants in the solids that the City removed from this portion of the system in 2004.[11] Note that not all known sources of metals, pesticides, and PAHs had been controlled by 2006.
In May 2007, the City abandoned a connection from a historical catch basin on the south side of NW Front Avenue, adjacent to the Air Liquide parcel. This was done as a precautionary measure to ensure that legacy contaminated soil adjacent to the site did not have a current or future pathway to the basin.	Two sets of stormwater data were collected from the basin following implementation of the City's PH-SCM. As described above and in Appendix A, the most recent data (2011), which were collected after SCMs had been implemented by some sites, demonstrate that PH-SCMs in the basin have been effective at reducing contaminant concentrations in stormwater.

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 22B is not warranted because data have already been collected that demonstrate the effectiveness of the PH-SCMs implemented by the City, and because SCM implementation and effectiveness monitoring by identified sources is underway and will provide sufficient certainty that the measures implemented in the basin are effective. Table 2 in the main report includes a summary of the additional WOE that discharges from OF-22B are not likely to be a significant future contaminant pathway to the river once identified sources have been controlled.

[11] BES. 2008. *City Outfall 22B Inline Solids Evaluation*. Technical Memorandum No. OF22B-3. City of Portland, Bureau of Environmental Services. January 22, 2008.

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Outfall Basin 22C
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 22C (OF-22C) discharges to the west side of the Willamette River at approximately river mile 6.8. The drainage area for this outfall is approximately 1,100 acres, most of which (94 percent) is open space within Forest Park. The rest of the basin is located within the Doane Lake industrial area, and land use in this portion of the basin includes a small parking lot, railroad corridor, City Police Bureau vehicle impoundment yard, bulk product distribution facility, drop box rental company, electrical substation, auto repair shop, service station, truck/equipment storage, residences, and vacant land. The portion of Highway 30 within the basin (part of the Oregon Department of Transportation [ODOT] Portland Harbor sites / ECSI #5437) as well as most of the basin on the east side of the highway (part of the GASCO site / ECSI #84) are being investigated under DEQ Cleanup Program oversight. In addition, the former Rhone-Poulenc (now SLLI) site (ECSI #155), which is outside of Basin 22C, is evaluating offsite migration of contaminants to North Doane Lake, which drains to OF-22C.

OF-22C discharges to an area of potential concern (AOPC 14) identified by EPA based on elevated concentrations of PCBs, pesticides, metals and other contaminants in river sediment. To evaluate whether discharges from OF-22C were contributing to elevated contaminant concentrations detected in river sediment, the City conducted a comprehensive phased investigation of the basin to identify major sources and pathways. Source tracing focused on PAHs, which were detected at significantly elevated concentrations in stormwater solids collected from the portion of the system near the GASCO site. The City's data collection, along with review of data collected by sites in the basin (including dry-weather flow data from the OF-22C system), verified that contaminants were being discharged to the basin via stormwater and groundwater pathways and confirmed that there were no previously unidentified major sources of PAHs or other contaminants to the basin.

The three sites identified as significant sources to OF-22C are in the DEQ Cleanup Program (ECSI #84, #155, and #5437). A portion of the GASCO site (former Koppers facility) has rerouted almost all of its stormwater runoff that previously discharged to OF-22C to the sanitary sewer system.[12] All three of these sites are still conducting stormwater SCEs under DEQ oversight, and SCMs for these sites remain to be determined. If SCMs are implemented, effectiveness monitoring will be conducted by the sites that implemented them.

Basin Stormwater Data Observations

Basin stormwater data collected by the City in 2008[1] indicate that all geomeans are below relevant comparison values (see Appendix A). Screening of individual data points identified only total PAHs as having more than one result over the comparison value (see Table A-2 and

[12] Anchor and HAI. 2010. *Final Stormwater Source Control Data Summary Report, NW Natural GASCO Site*. Prepared for NW Natural by Anchor QEA, LLC, and Hahn and Associates, Inc. September 2010.

Figure A-10). Sources of PAHs in Basin 22C have been identified, and source controls are not yet complete. As discussed above, most of the stormwater drainage area that formerly discharged from the Koppers facility to the basin has been rerouted to the sanitary sewer system; this occurred after the City's stormwater sampling at OF-22C and likely has resulted in reductions in PAH concentrations in OF-22C stormwater. PAHs are identified as a COI for the GASCO-Siltronic[13] and GASCO-Koppers[12] facilities as well as for ODOT/Highway 30 (ECSI #5437).[14] PAH concentrations in basin stormwater may be further reduced if stormwater SCMs are implemented at these sites.

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the IGA, the City implemented SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from programmatic measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. The PH-SCM that the City implemented in Basin 22C, and any affiliated monitoring of the effectiveness of that measure, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2004, the City cleaned storm lines in the northern branch of the system, in the vicinity of the Koppers facility, to remove contaminated inline solids.[15]	In 2006, the City conducted post-cleaning inline solids sampling at two locations that were sampled prior to the 2004 cleanout. Results indicated that ongoing sources were still present in the vicinity of the Koppers facility and this information was provided to DEQ.[15] If additional effectiveness monitoring is needed, it will be conducted by sites implementing SCMs under DEQ oversight.

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 22C is not warranted because the City collected data following the implementation of the PH-SCM and verified that ongoing sources were present at that time and had been identified. Future SCM implementation and effectiveness monitoring by identified sources in the basin will provide sufficient certainty that measures implemented in the basin are effective. Table 2 in the main report includes a summary of the additional WOE that discharges from OF-22C are not likely to be a significant future contaminant pathway to the river once identified sources have been controlled.

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[13] MFA. 2010. *Stormwater Source Control Evaluation Report, Siltronic Corporation, Portland, Oregon*. Prepared for Siltronic Corporation by Maul Foster & Alongi, Inc. September 30, 2010.

[14] Herrera. 2015. *Draft Stormwater Assessment for Source Control Evaluation, ODOT Facility in Portland Harbor*. Prepared for the Oregon Department of Transportation by Herrera Environmental Consultants, Inc. March 17, 2015.

[15] BES. 2007. *City Outfall Basin 22C Inline Solids Sampling in the Vicinity of Koppers Industries, Inc*. Technical Memorandum No. OF22C-2.

Outfall Basin 43
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 43 (OF-43) discharges to the east side of the Willamette River at approximately river mile 11.4. The drainage basin for OF-43 was decreased in size and reconfigured during the City's combined sewer overflow (CSO) abatement program that was completed in 2011. The outfall now conveys stormwater from an approximately 14-acre drainage basin located within the Albina area. Current land use in the basin includes light manufacturing operations (e.g., window inserts), artist studios, a portion of a grain distribution facility, light-rail and rail corridors, and parking areas.

OF-43 discharges to an area of potential concern (AOPC 25) identified by EPA based on elevated concentrations of PCBs, metals, and pesticides in river sediment. The City initiated phased investigations in Basin 43 in 2008 to determine whether there were major contaminant sources in the basin that could be contributing to the elevated contaminant concentrations detected in river sediment. The results indicated that there are no major sources in the current basin.[16] [17]

Two DEQ Cleanup Program sites are located in Basin 43. One of these sites, the former Tucker Building site (ECSI #3036), has received an SCD and No Further Action (NFA) determination from DEQ, and the other (Cargill, ECSI #5561) is conducting an SCE. The majority of the Cargill site discharges to the river via non-City outfalls.

Basin Stormwater Data Observations

Basin stormwater data collected in 2008-2009[16] indicated that all geomeans are below relevant comparison values (see Appendix A). Screening of individual data points identified only zinc as having more than one result over the comparison value (see Table A-2). The factors of exceedance for these samples were low (less than 2 times the comparison value for zinc), and the concentrations were also well below the zinc benchmark specified in DEQ's NPDES General Industrial 1200-Z permit in effect when stormwater data were collected. One site (Cargill) was authorized at the time to discharge zinc in stormwater at concentrations up to 600 µg/L under the NPDES General Industrial 1200-Z permit. Metals have been identified as COIs for this site, and zinc concentrations in stormwater data collected for the SCE range from 115 to 990 µg/L.[18] This site is in the process of identifying SCMs to satisfy DEQ Cleanup and Water Quality program requirements. In 2012, DEQ issued a revised permit that lowered the zinc benchmark

[16] BES. 2011. *Outfall Basin 43 Source Investigation Report, City of Portland Outfall Project, ECSI No. 2425*. City of Portland, Bureau of Environmental Services. December 2011.
[17] BES. 2012. *Outfall Basins 43 and 44 Stormwater Investigations*. Technical Memorandum No. OF43/44-1. City of Portland, Bureau of Environmental Services. October 25, 2012.
[18] Foth. 2014. *Stormwater Source Control Evaluation*. Cargill Irving Grain Elevator and Terminal Property. Prepared by Foth Infrastructure & Environment, LLC for Cargill, Inc. July 2014.

from 600 µg/L to 120 µg/L, which likely has resulted in reductions in zinc (and other metals) concentrations in basin stormwater.

In addition, as discussed below, the City cleaned portions of the system in 2012, which removed any possible legacy contaminated solids that may have represented a current source of contaminants at the time of the 2008-2009 stormwater data collection.

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the IGA, the City implemented SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from programmatic measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. The PH-SCM that the City implemented in Basin 43, and any affiliated monitoring of the effectiveness of that measure, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2012, the City cleaned the N. Albina and N. River Street stormwater lines and associated catch basins to remove any residual solids in the conveyance system following completion of the East Side CSO tunnel construction project.[16]	The City collected confirmation stormwater samples from Basin 43 in 2012 following the line cleanout. Results confirmed that there are no current major PCB sources to Basin 43.[17]

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 43 is not warranted because data have already been collected that demonstrate the effectiveness of the PH-SCM implemented by the City. Table 2 in the main report includes a summary of the additional WOE that discharges from OF-43 are not likely to be a significant future contaminant pathway to the river.

Outfall Basin 44
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 44 (OF-44) discharges to the east side of the Willamette River at approximately river mile 11.2. The outfall conveys stormwater from a roughly 16-acre drainage basin located within the Albina area. Current land use in the basin is light industrial and includes an electrical power substation, light manufacturing operations (e.g., window inserts), a recycling facility, commercial buildings, artist studios, and a railroad corridor.

OF-44 discharges to an area of potential concern (AOPC 25) identified by EPA based on elevated concentrations of PCBs, metals, and pesticides in river sediment. The City initiated phased investigations in Basin 44 in 2008 to determine whether there were major contaminant sources in the basin that could be contributing to the elevated contaminant concentrations detected in river sediment. The results indicated that a current source of PCBs was present, but not major sources of other contaminants. Subsequent investigation by the City, and by PacifiCorp at its Albina Substation, indicated that runoff from areas with contaminated erodible soils on and adjacent to the active and former substation properties likely contributed to the elevated PCB concentrations observed in the Basin 44 samples.[19]

PacifiCorp conducted an SCE at the Albina Substation that included implementation of extensive SCMs to control PCB sources to the Basin 44 stormwater conveyance system and post-SCM performance monitoring.[20] Results of confirmation stormwater sampling conducted by the City in 2012, after PacifiCorp implemented the SCMs, indicated no current significant PCB sources in the basin.[17]

Basin Stormwater Data Observations

Basin stormwater data collected in 2008-2009[19] indicated that copper, zinc, and total PCBs geomean concentrations were elevated above relevant comparison values (see Appendix A). As discussed above, PacifiCorp implemented source controls and remedial actions to address the offsite migration of PCBs from the Albina Substation. Following the implementation of these controls, both PacifiCorp and the City collected stormwater data from Basin 44. PacifiCorp samples were collected from inlets at and adjacent to the substation, while the City post-SCM data represent all the incoming lines to the basin monitoring location. The comparison of the two City data sets below indicates that measures implemented by PacifiCorp likely are effective.

[19] BES. 2011. *Outfall Basin 44 Source Investigation Report*. City of Portland, Bureau of Environmental Services. June 2011.
[20] Bridgewater. 2014. *Source Control Evaluation and Source Control Measures Completion Report*. Albina Substation. Prepared by Bridgewater Group, Inc. for PacifiCorp. August 2014.

Total PCB Concentrations in Basin 44 Stormwater Before and After PH-SCMs

Pre-SCM Data[1]			Post-SCM Data[2]		
Date(s)	No. Samples	Concentration Range (µg/L)	Date	No. Samples	Concentration Range (µg/L)
2008 – 2009	6	0.0793 - 1.82	3/15/2012	5 [3]	<0.0250 – 0.0811

Notes:

[1] Total PCB congeners data; reported in BES, 2011. Data collected from location representing whole basin.

[2] Total PCB Aroclor data; reported in BES, 2012. Data collected from all incoming lines to basin monitoring location.

[3] Samples were collected from five separate laterals discharging to the manhole vs. from the line between the manhole and the outfall. PCBs were not detected in four of the five samples. Therefore, the concentration of total PCBs in stormwater discharging from the manhole would have been significantly lower than 0.0811 µg/L.

Copper and zinc concentrations in the 2008-2009 samples were on the flat portions of the DEQ guidance curves (see Appendix A), indicating that concentrations were typical of Portland Harbor industrial areas. Concentrations of these metals were also well below the benchmarks specified in the NPDES General Industrial 1200-Z permit issued by DEQ at that time and preceded the issuance of No Exposure Certifications (NECs), under the NPDES program, to several industries within the basin. Source controls were completed by PacifiCorp and by the City after collection of the 2008-2009 stormwater data. These measures, in addition to removal of exposures to qualify for the NEC permit exemption, likely are resulting in further reductions in copper and zinc being discharged to Basin 44 via industrial stormwater.

Screening of individual data points for other contaminants identified only arsenic as having more than one result over the comparison value (see Table A-2 and Figure A-1). The factors of exceedance for these samples were low (less than 2 times the comparison level) and arsenic is not listed as a COI for AOPC 25.

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the IGA, the City implemented SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from programmatic measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. PH-SCMs that the City implemented in Basin 44, and any affiliated monitoring of the effectiveness of those measures, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2009, the City cleaned the portions of the Basin 44 conveyance system located in the area between the railroad corridor and N. Interstate Avenue, to evaluate if there was a current local source of PCBs within this part of the basin.[19]	The City resampled catch basin solids from this area in 2010, and PCB concentrations in the solids were low, indicating no significant current sources of PCBs to these catch basins.[19]
Also in 2009, as part of a localized source investigation for chlordane, the City cleaned a section of the system on N. Loring Street at N. Randolph Avenue. [19]	Results of resampling of catch basin solids at this location in 2010 indicated no major current source of chlordane.[19]

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 44 is not warranted because data have already been collected that demonstrate the effectiveness of the PH-SCMs implemented by the City, and because SCM effectiveness monitoring by PacifiCorp provides sufficient certainty that SCMs implemented at the Albina Substation site are effective. Table 2 in the main report includes a summary of the additional WOE that discharges from OF-44 are not likely to be a significant future contaminant pathway to the river.

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Outfall Basin 45
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 45 (OF-45) discharges to the east side of the Willamette River at approximately river mile 11. The outfall conveys stormwater from an approximately 10-acre drainage basin located within the Albina area. Current land use in the basin is primarily industrial. The basin includes parcels associated with the Union Pacific Railroad (UPRR) Albina Yard (paved parking areas and unpaved vacant land) and a metals fabrication plant. Other land uses are a party rental business, a dance theater, and the City's Materials Testing Laboratory.

OF-45 discharges to an area of potential concern (AOPC 25) identified by EPA based on elevated concentrations of PCBs, metals, and pesticides in river sediment. The City initiated investigations in the basin in 2007 to determine whether there were major contaminant sources in the basin that could be contributing to the elevated contaminant concentrations detected in river sediment. The results did not indicate the presence of major sources of PCBs or other contaminants in Basin 45.[21] [1]

UPRR is conducting an SCE at the Albina Yard (ECSI #175) under DEQ Cleanup Program oversight, and SCMs for the portion of this site within Basin 45 remain to be determined.[22] If SCMs are implemented, effectiveness monitoring will be conducted by UPRR.

Basin Stormwater Data Observations

Basin stormwater data collected in 2008[1] indicated that copper, zinc and BEHP geomean concentrations were elevated above relevant comparison values (see Appendix A). However, concentrations of copper and zinc (except for zinc in one individual sample) were below the NPDES industrial stormwater permit benchmarks in place at that time, which are five times the current NPDES benchmarks.[3] At the time the samples were collected in 2008, the basin included a permittee that was authorized to discharge these metals at the former NPDES benchmark concentrations. Copper and zinc are also identified as a COI at the UPRR Albina Yard where additional assessment of discharges to Basin 45 have been proposed.[22] DEQ's revised NPDES 1200-Z permit with the lower benchmarks was issued in July 2012, and concentrations of copper and zinc in basin stormwater likely are lower now. In addition, one site in the basin has been issued an NEC subsequent to the 2008 stormwater sampling, and the removal of exposures to qualify for the NEC permit exemption likely has resulted in further reductions in copper and zinc being discharged to Basin 45 via industrial stormwater.

[21] BES. 2008. *Outfall Basin 45 Inline Solids Sampling*. Technical Memorandum No. OF45-1. City of Portland, Bureau of Environmental Services. June 17, 2008.
[22] CH2M HILL. 2012. *Additional Stormwater Investigation Work Plan*. Appendix B to Source Control Measures Monitoring Plan Union Pacific Railroad Albina Yard, Portland, Oregon. Prepared for Union Pacific Railroad by CH2M HILL. August 2012.

BEHP data also exceeded the comparison value (the JSCS SLV). BEHP has not been identified as a COI for AOPC 25. The exceedance factor for the BEHP geomean concentration for OF-45 stormwater was less than 2 times the comparison value and was influenced by one high sample that was collected immediately after line cleanout.

It should be noted that copper, zinc, and BEHP concentrations in most samples were on or close to the flat portions of the DEQ guidance curves (see Figures A-2, A-5, and A-12), indicating that concentrations were typical of Portland Harbor industrial areas.

Screening of individual data points for the other contaminants identified only nickel as having more than one result over the comparison value (see Table A-2 and Figure A-8). Nickel has not been identified as a COI for AOPC 25, and the maximum exceedance factor for nickel in OF-45 stormwater is low (1.9).[23] Implementation of DEQ's revised NPDES 1200-Z permit with lower metals benchmarks, as well as provisions to limit offsite migration of contaminants via vehicle and equipment drag-out, likely has lowered nickel concentrations in the basin as well.

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the IGA, the City implemented SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from programmatic measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. The PH-SCM that the City implemented in Basin 45, and any affiliated monitoring of the effectiveness of that measure, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2008, the City cleaned all the main branches of the Basin 45 conveyance system to remove accumulated inline solids that could represent a current source of legacy contaminants.[21]	The City collected post-cleaning stormwater data in 2008 as part of the City's stormwater screening evaluation.[1] Data did not indicate that major contaminant sources were present.

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 45 is not warranted because data have already been collected that demonstrate the effectiveness of the PH-SCM implemented by the City, and because future SCM implementation and effectiveness monitoring by UPRR will provide sufficient certainty that any additional measures implemented in the basin are effective. Table 2 in the main report includes a summary of the additional WOE that discharges from OF-45 are not likely to be a significant future contaminant pathway to the river once identified sources have been controlled.

[23] The geomean of nickel concentrations in OF-45 stormwater was 11.8 µg/L; the JSCS SLV is 16 µg/L. See Appendix A.

Outfall Basin 52
SCM Effectiveness Monitoring Evaluation

Overview of Outfall Setting, Basin Characteristics, and Source Control Status

Outfall 52 (OF-52) discharges to the east side of the Willamette River at approximately river mile 5.7. The drainage area for this outfall is approximately 24.5 acres, located within the St. Johns district. Land use in Basin 52 is a mix of light industrial and commercial properties, residential areas, a portion of Cathedral Park, and most of the St. Johns Bridge (ODOT Highway 30).

OF-52 discharges to an area of potential concern (AOPC 11) identified by EPA based on elevated concentrations of PCBs, metals, and other contaminants in river sediment. To evaluate whether discharges from OF-52 were contributing to elevated contaminant concentrations detected in river sediment, the City collected and analyzed stormwater samples in 2007 for a broad suite of chemicals to identify stormwater contaminants potentially warranting further source tracing in the basin.[1] Based on the results, the City initiated further source tracing in the basin to identify sources of PCBs and copper. Source tracing investigations in Basin 52 included collection of inline solids and surface soil samples during iterative field investigations between June 2008 and January 2011. The source tracing results identified current sources of PCBs and metals to the basin via the stormwater pathway.[24]

Basin 52 includes three DEQ Cleanup Program sites – ODOT (ECSI #5437), Crawford Street Corporation (ECSI #2363), and Peninsula Iron Works (ECSI #5686). All three are conducting stormwater SCEs under DEQ oversight, with SCMs to be determined accordingly. In addition, Peninsula Iron Works and one non-ECSI site that was identified as a source of metals during the City's source investigations (Independent Marine Propeller) have both made operational changes to remove exposures of site industrial activities to stormwater and qualified for NPDES NECs.

Basin Stormwater Data Observations

Basin stormwater data collected in 2007[1] indicate that copper, zinc and BEHP geomean concentrations were elevated above relevant comparison values (see Appendix A). For copper and zinc, the exceedance factors were low,[25] and all data were on or close to the flat portions of the DEQ guidance curves (see Figures A-5 and A-12), indicating that concentrations were typical of Portland Harbor industrial areas. Two sites have since removed stormwater exposures and received NECs and the Peninsula Iron Works site was able to maintain its NEC after working with the City Industrial Stormwater program to address stormwater exposure concerns that had been observed at the facility. Removal of exposures to qualify for the NEC permit exemptions likely has resulted in reductions in copper and zinc being discharged to

[24] BES. 2012. *Outfall Basin 52 Source Investigation Report*. City of Portland, Bureau of Environmental Services. May 2012.

[25] The geomean for copper was 32.8 µg/L and the comparison value is 20 µg/L (exceedance factor of 1.6). The geomean for zinc was 147 µg/L and the comparison value is 120 µg/L (exceedance factor of 1.2). See Appendix A.

Basin 52 via industrial stormwater. BEHP has not been identified as a COI for AOPC 11, and the exceedance factor in all samples was is low (less than 5 times the comparison value).[26]

Screening of individual data points did not identify any other contaminants as having more than one result over the comparison value (see Table A-2).

Portland Harbor-Specific Source Controls (PH-SCMs) Implemented by the City

Under the IGA, the City implemented SCMs within City conveyance systems where needed as determined through basin-specific source investigations. These SCMs are distinct from programmatic measures that the City has undertaken through other programs that are not specific to Portland Harbor, and are distinct from SCMs being implemented by individual sites to achieve source control. The PH-SCM that the City implemented in Basin 52, and any affiliated monitoring of the effectiveness of that measure, are summarized below.

PH-SCM	Effectiveness Monitoring
In 2010, the City cleaned portions of the north and south branches (the manholes, catch basins, and catch basin laterals along N. Bradford Street) of the conveyance system, after results of catch basin solids sampling in 2008 indicated possible PCB sources in both branches.[24]	After the 2010 line cleanout, the City installed sediment traps at the downstream ends of both these branches. Results indicated no major source of PCBs or other contaminants in the southern branch (and demonstrated the effectiveness of the line cleaning in this branch). Results for the sediment trap sample from the northern branch confirmed current sources of PCBs and metals; these sources were identified and are conducting SCEs under DEQ oversight and/or have eliminated stormwater exposures.

Need for Additional City SCM Effectiveness Monitoring

Figure 1 in the main report summarizes the approach used to determine whether or not additional City monitoring is warranted to demonstrate the effectiveness of PH-SCMs. The evaluation (see Table 1 in the main report) indicates that additional data collection in Basin 52 is not warranted because data have already been collected that demonstrate the effectiveness of the PH-SCM implemented by the City, and because future SCM implementation and effectiveness monitoring by identified sources in the basin will provide sufficient certainty that measures implemented in the basin are effective. Table 2 in the main report includes a summary of the additional WOE that discharges from OF-52 are not likely to be a significant future contaminant pathway to the river once identified sources have been controlled.

[26] In addition, the BEHP geomean was 2.4 µg/L and the comparison value is 2.2 µg/L (exceedance factor of 1.1). See Appendix A.

APPENDIX C

Data Quality Objectives and Sampling and Analysis Plan

Data Quality Objectives: OF-16 PH-SCM Effectiveness Monitoring

DQO Steps

Step 1: State the Problem

After site remediation at Front Ave MP Site (ECSI #4008) , including cleanout of the onsite storm system, the City sampled the adjacent 8-inch Front Ave storm line in 2005 and found slightly elevated metals and low level (54 ppb) PCBs in inline solids downgradient of the Site. The City cleaned out this line in 2006 to remove this legacy contamination likely attributable to the Site. The City did not resample after the cleaning to demonstrate that effectiveness of the action. Resampling of inline solids would be the most direct means to measure the effectiveness but given that 1) this 8-inch line serves a very small portion of the basin (several properties), and 2) the concentrations were relatively low before the cleanout, the value of this data collection would be minimal.

Instead, the City proposes to collect stormwater samples in the main trunk line downgradient of the connection with the 8-inch Front Avenue storm line and representing most of the Basin as a comparison to previous stormwater samples collected from the trunk line. This has greater value to understanding the water quality being discharged to the river via Outfall 16 because the previous trunk line stormwater samples were collected upgradient of the 8-inch line connection. The previous trunk line stormwater samples were collected by the LWG in 2007 at manhole AMZ120, which does not include stormwater conveyed by storm lines on NW Front Ave.

Step 2: Identify the Decision to be Made

Since the 2007 stormwater samples were collected, source control has been implemented at a number of sites within the basin either under DEQ or City authorities, while additional controls are still pending. Collection of stormwater in 2015 would allow a comparison to the 2007 data set to determine if contaminant concentrations are trending downward as expected.

Step 3: Identify the Inputs to the Decision

- Stormwater analytical data for total copper, total zinc, and total PCBs; these are the Basin 16 contaminants exceeding comparison values in 2007 stormwater (see Table A-2).
- Stormwater analytical data for TSS; measurement of TSS will help to evaluate differences between 2007 and 2015/2016 metals and PCB concentrations.
- EPA Method 1668A (PCB congeners) for PCB analysis; this is the method utilized for the 2007 data set - using this method for proposed data will facilitate the most direct comparison of the two data sets and allows for lower method detection limits.
- 4 monitoring events; DEQ Stormwater Guidance requires a minimum of four grab samples to evaluate stormwater quality.
- 24-hour antecedent dry period, predicted rainfall volume ≥0.2”, and storm duration of at least 3 hours; DEQ Stormwater Guidance requires standard storm criteria to ensure stormwater data representativeness and to facilitate comparability with other data sets.
- Verification of presence of stormwater flow at the monitoring location; during high Willamette River elevations, river water could potentially back up into the Basin 16 system at the proposed monitoring location.

Step 4: Define the Boundaries

- A variety of storm conditions, including at least one first-flush sample event (i.e., within the first 30-minutes of full-basin discharge at the monitoring location), should be targeted to better represent the full range of conditions in the basin.
- Detection limit targets should be equal to or lower than those achieved in 2007.
- A monitoring location downgradient of the connection of the NW Front Ave storm lines that will not be inundated with river water for the duration of the wet season.

Step 5: Develop a Decision Rule

If the range and geomeans of the 2007 data set are lower, then the City can conclude that basin source control measures implemented by the City and upland properties have improved stormwater quality.

Step 6: Identify Acceptance Criteria or Decision Errors

Data meet field and lab QC criteria, storm criteria, and are considered representative of Basin 16 stormwater discharge.

Step 7: Optimize the Design

Four grab samples will be collected in 2015/2016 wet season and analyzed for TSS, total copper, total zinc and PCBs congeners. Samples will be collected at a location representative of the majority of the Basin 16 drainage area and will be collected in accordance with target storm criteria. Specific details of the proposed data collection are included in the Sampling and Analysis Plan developed to meet these DQOs.

CITY OF PORTLAND
ENVIRONMENTAL SERVICES

1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204 ▪ Nick Fish, Commissioner ▪ Michael Jordan, Director

September 30, 2015

Alex Liverman
Oregon Department of Environmental Quality
Northwest Region Cleanup Program
700 NE Multnomah St., Suite #600
Portland, OR 97232

Subject: City of Portland Outfalls Project
2015/2016 Sampling and Analysis Plan

Dear Alex:

This letter presents the project-specific Sampling and Analysis Plan (SAP) for conducting stormwater monitoring at one City outfall basin in the Portland Harbor Study Area during the 2015/2016 wet season. The City developed this plan in response to a request from the Oregon Department of Environmental Quality (DEQ) to demonstrate the effectiveness of source control measures (SCMs) that the City implemented under the 2003 Intergovernmental Agreement (IGA) with DEQ for the City of Portland Outfalls Project. In response, the City developed the *Source Control Measure Effectiveness Demonstration* technical memorandum (Effectiveness Demonstration TM), to which this SAP has been appended. The format of this SAP matches the format of previous SAPs submitted to DEQ under the IGA and refers to the amended programmatic Quality Assurance Project Plan (QAPP) and programmatic SAP that were developed for the City of Portland Outfalls Project.

Monitoring Objectives

The Effectiveness Demonstration TM utilized a decision framework to identify outfall basins for which additional City data collection is needed in order to demonstrate effectiveness of SCMs implemented by the City under the IGA. This evaluation identified Basin 16 for City monitoring because the effectiveness of the SCM implemented by the City had not yet been demonstrated. In order to define the specific objectives that the proposed SAP would be designed to meet, the City completed a Data Quality Objectives (DQO) process for Basin 16. A summary of the DQO process is included in Appendix C of the Effectiveness Demonstration TM, along with this SAP. The objective of the proposed data collection in Basin 16 will be to compare contaminant concentrations observed in basin stormwater in 2015/2016 to data concentrations observed in basin stormwater in 2007[1] to determine if concentrations are trending downward as expected.

[1] Appendix A of the Effectiveness Demonstration TM includes a summary of the Basin 16 stormwater data collected in 2007. The City evaluated these data in the *Stormwater Evaluation Report* (February 2010) that was submitted to DEQ. Appendix C-2 of that report includes Basin 16 sample results and mean concentrations.

The City of Portland complies with all non-discrimination laws including Title VI (Civil Rights) and Title II (ADA).
To request a translation, accommodation or additional information, please call 503-823-7740, or use City TTY 503-823-6868, or Oregon Relay Service: 711.

Monitoring Location

Stormwater samples will not be collected directly from Outfall 16 (OF-16) because OF-16 is always at least partially submerged and therefore is not conducive to collecting samples representative of the basin. Manhole locations are available that will represent all or most of the Basin 16 drainage area. However, due to the constructed elevation of the trunk storm lines leading to OF-16 and the seasonal elevation of the river during the wet season, river water backs up in the system under some conditions and can prevent collection of representative samples at some manholes during storm events. Therefore, a proposed monitoring location on the main trunk line has been selected that meets monitoring objectives and is least likely to be inundated during high river stages. Figure C-1 displays the proposed monitoring location for Basin 16.

Additional rationale for the suitability of this location in terms of the DQOs is described below.

Basin	Sampling Location	Rationale
16	Manhole AAX408 Outgoing 48" Pipe	• Represents majority of Basin 16 drainage area. • Is downstream of connection from the 8" line cleaned by the City as an SCM under the IGA. • Is the highest elevation location that still meets monitoring objectives. • Includes the drainage area represented in the 2007 stormwater data set.

Sampling Approach and Schedule

The sampling approach is intended to collect a stormwater data set in accordance with the *Portland Harbor Joint Source Control Strategy* [(JSCS); DEQ/EPA, 2005, as amended 2007] and that can be compared to the data set collected from Basin 16 in 2007 in order to determine trends in the concentrations of contaminants that were elevated in 2007 stormwater.

The 2007 data set collected by the Lower Willamette Group (LWG) from Basin 16 included a mix of composite and grab samples. The JSCS (and subsequent DEQ guidance) supports collection of four stormwater grab samples to evaluate stormwater quality. For Basin 16, stormwater grab samples will be collected from the designated monitoring location during four storm events. At least one of the four events will target "first-flush" conditions. Due to the complexity and size of this conveyance system, first-flush will be defined as being within the first 3 hours of observed runoff to ensure that samples represent contributions from the entire basin rather than only the portions closest to the monitoring location.

The JSCS establishes target storm criteria as follows:

- Antecedent dry period of at least 24 hours (as defined by <0.1" over the previous 24 hours);
- Minimum predicted rainfall volume of >0.2" per event; and
- Expected duration of storm event of at least 3 hours.

Based on the City's experience with stormwater monitoring in this region, smaller storms or those of shorter duration are less likely to generate runoff that would be representative of entire stormwater basins. An effort will be made to select storm events that meet target criteria; however, it is likely that a targeted and sampled storm may not meet optimal criteria when the sampling event is completed, or that unpredicted events will occur that do meet the criteria.

The criteria will be used as general guidance to determine when forecasted storms should be targeted for sampling for this project. Field crews will use best professional judgment to determine whether samples are representative of first-flush conditions and to determine potential storm events for which a shorter antecedent dry period may be acceptable in an effort to collect a full data set this winter. Consultation with the field crew will be made prior to each sample event to ensure that a variety of types of storms (e.g., season, storm size, intensity) comprise the four storm events for the basin.

Following sample collection, rain gage data, field observations and sample times will be evaluated to assess sample representativeness prior to submitting samples for laboratory analyses.

Based on an evaluation of seasonal river gage data and storm line elevations for stormwater SAPs completed previously for the Outfalls Project, the Basin 16 monitoring location has the potential to be impeded by river back-up during high river stages. The invert elevation for the proposed monitoring location is 10.7 feet (City of Portland datum). The table below provides an indication of the likelihood for this location to be inundated, based on an evaluation of a previous location situated at an elevation of 12.4 feet.

	% of Days River Above Invert Elevation[1]									
Invert Elevation (Ft)	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**
12.4	0%	0%	3%	11%	26%	20%	20%	18%	30%	35%

[1]Based on USGS Morrison Bridge Gage Height Daily Means from January 1, 1996 to January 1, 2006, adjusted to COP datum, excluding all values from July through August.

In order to ensure that samples represent Basin 16 stormwater, field crews will make visual observations, such as noting the flow direction of a floatable object, to ascertain whether observed water at the monitoring location represents stormwater flow or standing water. If confirmation cannot be made of storm flow conditions, samples will not be collected at that time.

Quality control samples will include a field decontamination blank for each sampled event as well as field duplicates during one of the four events. Grab samples will be collected in accordance with Standard Operating Procedure (SOP) 2.02b "Grab Sample Collection with Stainless Steel Beaker" in addition to general SOPs that will be utilized by field crews during sample collection for equipment preparation, measurement of field parameters, chain-of-custody, and quality control sampling. All relevant SOPs are included in the programmatic SAP.

Field crews will begin implementation of the SAP following DEQ review and approval and will attempt to collect four stormwater samples before April 30th, and no later than June 30th.

Analytical Approach

All stormwater samples will be analyzed for polychlorinated biphenyl (PCB) congeners, total copper (Cu), total zinc (Zn), and total suspended solids (TSS). Measurements of pH and conductivity will be made in the field.

Proposed methods and laboratory assignments are listed below in priority order, to address the unlikely event that sample volume is limited. Target method reporting limits (MRLs) for each analysis are summarized below based on the 2007 data set. Because the City is in the process of reissuing its contract for outside laboratory services, laboratory assignments will be made upon commencement of sampling activities. Laboratories will be selected to achieve MRLs that will allow for a comparison to the 2007 data set and screening level values listed in the updated Table 3-1 of the JSCS.

Analyte Group	Target MRL	Method
PCB Congeners	5.0 to 30.0 pg/L for individual congeners	EPA 1668A
Total Metals (Cu and Zn)	0.1 and 0.5 µg/L	EPA 200.8
TSS	1 mg/L	SM 2540D

Reporting

Following completion of the data collection and analysis, a report will be developed and submitted to DEQ that summarizes data collection activities, analytical results, and the comparison to the 2007 stormwater data set for Basin 16.

If you have any comments or questions, please call me at 503-823-2296.

Sincerely,

Linda Scheffler
Water Resources Program Manager
Superfund Program

Attachment: Figure C-1 –Outfall Basin 16

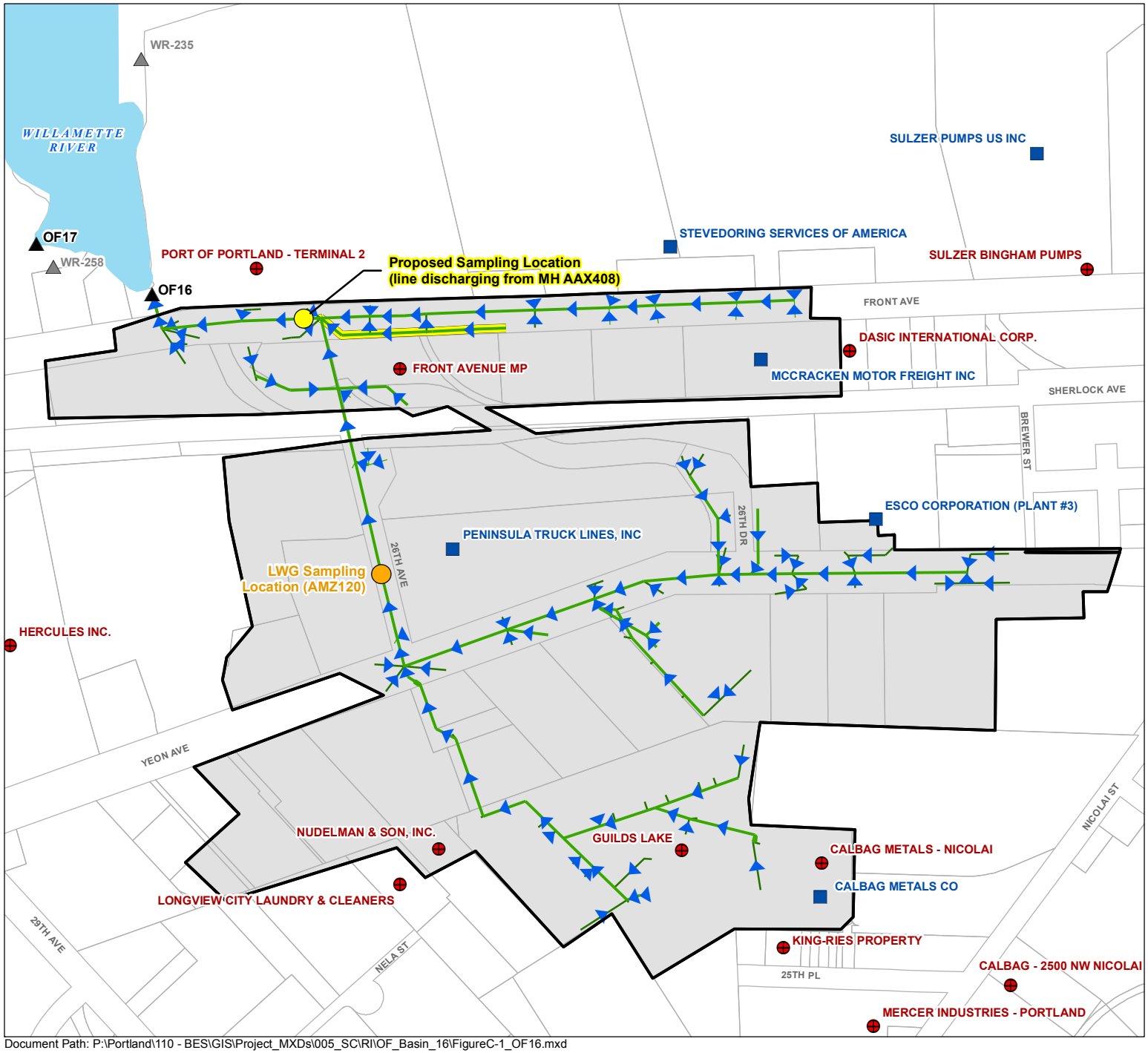


FIGURE C-1

Outfall Basin 16

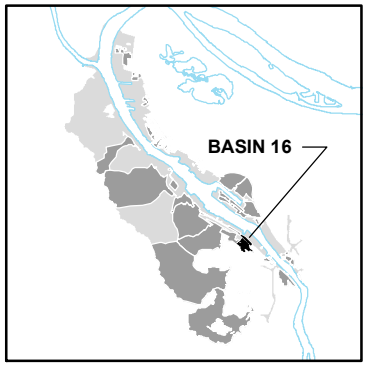
LEGEND

Sample Location

- Proposed
- Existing LWG

All Other Features

- Basin 16
- DEQ ECSI Site
- NPDES Stormwater Permit
- City Outfall
- Non-City Outfall
- Storm Line
- 8-inch Line Cleaned by City, October 2006
- Tax Lot
- Waterbody



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0 100 200 300 400
Feet

MAP NOTES:
Date: September 25, 2015
Data Sources: BES, METRO

GSI Water Solutions, Inc.

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