Annual Stormwater Discharge Monitoring Report

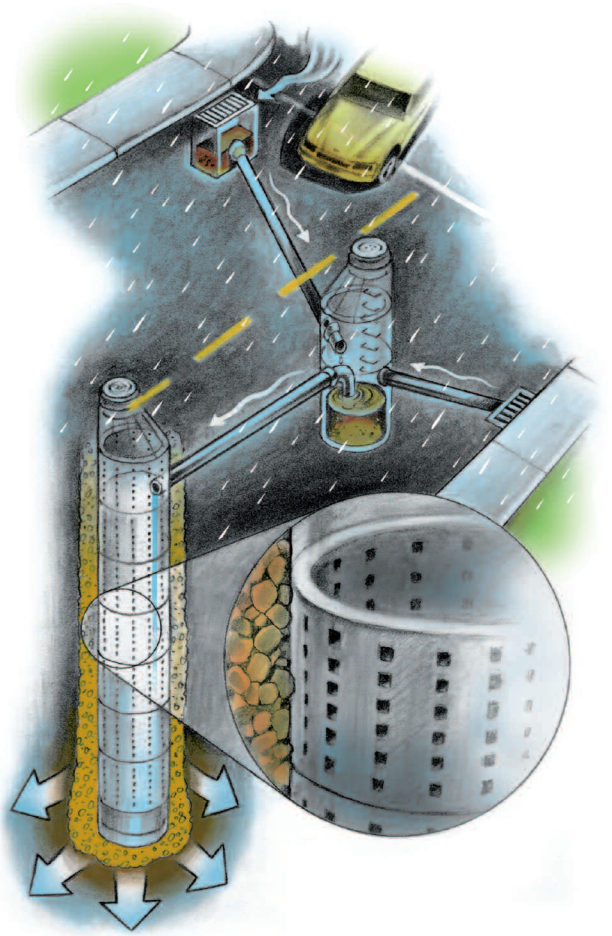
Year 6

October 2010 - May 2011

Water Pollution Control Facilities (WPCF) Permit

Class V Stormwater Underground Injection Control Systems

DEQ Permit Number 102830



July 2011

Prepared by

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

— CITY OF PORTLAND —
ENVIRONMENTAL SERVICES
1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204 ▪ Dan Saltzman, Commissioner ▪ Dean Marriott, Director

July 15, 2011

Ms. Barbara Sellars
Senior Hydrogeologist
Oregon Department of Environmental Quality
2020 Southwest Fourth Avenue, Suite 400
Portland, Oregon 97201

Subject: Permit Required Submittal – Annual Stormwater Discharge Monitoring Report No. 6
City of Portland Water Pollution Control Facilities Permit No. 102830

Dear Barbara:

In accordance with the Oregon Department of Environmental Quality's (DEQ) Water Pollution Control Facilities Permit (WPCF Permit #102830 issued on June 1, 2005) for Class V Stormwater Underground Injection Control Systems (UICs), the City of Portland's Bureau of Environmental Services (City) is pleased to provide DEQ with *Annual Stormwater Discharge Monitoring Report: Year 6 – October 2010 – May 2011.*.

This report presents the results of the Year 6 (October 1, 2010 through May 31, 2011) UIC Monitoring Program. Monitoring was implemented in accordance with the final *Stormwater Discharge Monitoring Plan* (SDMP), submitted to DEQ in August 2006. The monitoring program is representative of the estimated 9,000 City-owned UICs. Forty-six UIC locations were sampled in Year 6 including:

- Thirty UICs selected to implement the required Year 6 monitoring (*i.e.*, compliance monitoring) described in the SDMP:
  - Panel 1 (15 rotating UIC locations)
  - Panel 6 (15 fixed UIC locations)
- Six UIC locations carried over from Year 6 monitoring due to exceedances of the permit-defined maximum allow discharge limit (MADL) for pentachlorophenol and benzo(a)pyrene concentrations
- Ten supplemental UICs located near commercial and industrial sites

The report provides details regarding the UIC sampling program (*e.g.*, UIC locations, sampling and analysis, data quality); individual sampling events; annual mean concentrations; preliminary trend analysis, response actions, and the identification of Category 4 UICs as required by the permit.

Permit compliance is demonstrated in this report by documenting that Year 6 sampling, analyses, data evaluation, and response actions are performed in accordance with the permit, SDMP, and UIC Management Plan (submitted to DEQ in December 2006).

If you have any questions or need additional information to complete your review of this document, please call me at 503-823-5737. We look forward to continuing to work with you on implementing the City's UIC Program.

Sincerely,

Barbara Adkins
UIC Program Manager
Bureau of Environmental Services

Enclosures:

3 Copies: Annual Stormwater Discharge Monitoring Report – Year 6
(Note: Appendices and a full copy of the report are provided on a CD contained in the report)

cc: Rodney Weick, DEQ
Marveita Redding, BES
Matt Criblez, BES
Joel Bowker, R.G., BES
Jan Betz, City Attorney
UIC Program File

City of Portland, Oregon

Water Pollution Control Facilities (WPCF) Permit For
Class V Stormwater Underground Injection Control Systems

Permit Number: 102830

Annual Stormwater Discharge Monitoring Report
Year 6 – October 2010 - May 2011

Underground Injection Control Systems
System Monitoring

FINAL

July 2011

Prepared By:
City of Portland, Bureau of Environmental Services

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Executive Summary

The *Annual Stormwater Discharge Monitoring Report* is required by the Water Pollution Control Facilities (WPCF) permit issued to the City of Portland (City) in June 2005 by the Oregon Department of Environmental Quality (DEQ). The City is required to monitor stormwater entering City-owned Underground Injection Control (UIC) systems throughout the life of the permit and to submit this annual monitoring report.

Year 6 Monitoring Program: The City of Portland's UIC monitoring program was implemented in accordance with the final *Stormwater Discharge Monitoring Plan* (SDMP; City of Portland, 2006a), submitted to DEQ in August 2006 and approved by DEQ in November 2008. The monitoring program was designed to be representative of the estimated 9,000 City-owned UICs, using a statistically robust method to identify a subset of UICs for monitoring. Forty-six UIC locations were sampled in Year 6, including:

- Thirty UICs selected to implement the required Year 6 monitoring (i.e., compliance monitoring) described in the SDMP:
  - Panel 1 (15 rotating UIC locations sampled in permit Years 1 and 6)
  - Panel 6 (15 stationary UIC locations sampled in permit Years 1 through 10)
- Ten supplemental UICs located near commercial/industrial sites [Supplemental Panel 5 (SP5)]
- Six UIC locations carried over from Year 5 monitoring because of exceedances of the permit-defined maximum allow discharge limit (MADL) for pentachlorophenol and benzo(a)pyrene

UIC monitoring locations were selected on the basis of two traffic flow categories: <1,000 trips per day (TPD) and ≥1,000 TPD. Year 6 locations (i.e., Panels 1 and 6, SP5, and six carried-over sites from Year 6) included 24 UIC locations in the <1,000 TPD category and 22 locations in the ≥1,000 TPD category.

Year 6 Results: Five sampling events were completed, as required, between October 2010 and May 2011. Stormwater discharge samples were analyzed for common pollutant analytes (e.g., metals, volatile organic compounds, semivolatile organic compounds, and pesticides), as defined by the permit. Field and laboratory data collected in Year 6 met the SDMP data quality objectives. Testing of priority pollutant screen (PPS) analytes is required only in permit Years, 1, 4, and 9; however, 9 PPS analytes are reported in Year 6 because they are capable of being detected using the U.S. Environmental Protection Agency (EPA) test methods for analysis of the common pollutants.

All 14 common pollutants and 1PPS analyte (2,4-D) were detected in Year 6. Twenty-six ancillary pollutants (i.e., analytes derived from the analytical methods for common pollutants) were detected at low concentrations. The five ancillary pollutants detected at the highest frequencies (>50%) during all individual sampling events are polycyclic

aromatic hydrocarbons (PAHs): phenanthrene, pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and fluoranthene.

MADL Exceedances: Four common pollutants [pentachlorophenol, di(2-ethylhexyl)phthalate (DEHP), benzo(a)pyrene, and lead] were detected in Year 6 at concentrations above their MADLs in at least one sample. Detected concentrations of other common and PPS analytes were below the MADLs. The City reported MADL exceedances to DEQ, as required by the permit.

Annual Geometric Mean Concentrations: Nine UIC locations had annual geometric mean concentrations that exceeded the MADL for at least one pollutant. Eight of the nine UIC locations exceeded the MADL (1.0 µg/L) for pentachlorophenol (PCP); four of these eight UICs also exceeded the MADL (6.0 µg/L) for DEHP. The remaining UIC exceeded only the MADL (0.2 µg/L) for benzo(a)pyrene. Annual geometric means for UICs exceeding a MADL were from 1.02 to 2.24 µg/L for PCP; from 6.09 to 7.09 µg/L for DEHP; and 0.32 µg/L for benzo(a)pyrene. All are only slightly above their MADLs.

The annual geometric mean is calculated for pollutants detected at a concentration >50 percent of the MADL for an individual sampling location in at least one sampling event. Lead was therefore calculated for five UIC locations. The annual geometric means for these locations range from 8.7 to 24.3 µg/L, well below the lead MADL (50 µg/L). Annual geometric mean concentrations were not calculated for any other pollutants because their concentrations were <50 percent of the MADL.

Preliminary Trend Analysis: The following general observations were made:

- Concentration ranges for each variable are similar for Years 1 through 6.
- Patterns for both traffic categories have similar concentration ranges from year to year.
- Annual medians and geometric mean concentrations, in general, are <50 percent of their MADLs.
- Concentrations for the ≥1,000 TPD traffic category have higher median and geometric mean concentrations than the <1,000 TPD traffic category for the evaluated compounds.

Year 6 Response Actions: A source investigation was performed for a UIC in a residential neighborhood because of elevated results for benzo(a)pyrene during Event 4. A site investigation, communication with nearby residents, and UIC system cleaning were conducted. A specific source or responsible party has yet to be identified. No other response actions to address unanticipated stormwater discharge results or observations during UIC sampling activities were completed in Year 6.

Category 4 UICs: Thirteen locations have been identified as Category 4 UICs based on sampling results during years 1 through 6:

- Four UICs (P1_1, P6_1, P6_7, and P6_14) were identified as Category 4 UICs for PCP in Year 2 and have been addressed through corrective actions. Three of these locations are part of stationary panel 6 and are sampled yearly.

- Three UICs (P2_5, P2_13, P2_14) were identified as Category 4 for PCP in Year 3 and have been addressed through corrective actions.

- Two UICs (SP3_6 and SP3_8) were identified as Category 4 for PCP in Year 5 and have been addressed through corrective actions.

- Four new UICs and one previously identified Category 4 UIC had geometric annual mean concentrations that exceeded the MADL for a pollutant for the second consecutive year in Year 6. Three of the newly identified UICs (P5_15, SP4_2, and SP4_10) exceeded the MADL for PCP, and one UIC (P5_5) exceeded the MADL for benzo(a)pyrene. These four UICs have been identified as Category 4 UICs and will be addressed through corrective action. The previously identified Category 4 UIC (P6_1) was addressed through correct action in 2008.

Corrective actions are implemented in accordance with the DEQ-approved *Corrective Action Plan* (CAP; City of Portland, 2006f).

Additional Monitoring: In addition to the Category 4 UICs identified in Year 5, four new UICs had annual geometric mean concentrations that exceeded the MADL for a pollutant for the first time in Year 6.

- Three UICs (P1_10, SP5_9, and SP5_10) exceeded for both PCP and DEHP
- One UIC (SP5_2) exceeded only for PCP

These four locations will be sampled again in Year 7.

Permit compliance is demonstrated in this report by documenting that Year 6 sampling, analyses, data evaluation, and response actions were performed in accordance with the permit, SDMP, and *UIC Management Plan* (UICMP).

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List of Appendices

List of Tables[1]

[1] Except for Tables 6-1 and 6-2, all tables and figures are placed at the end of the report text, following page 8-2.

List of Figures

List of Acronyms

ATSDR	Agency for Toxic Substances and Disease Registry
BES	City of Portland, Bureau of Environmental Services
BMP	best management practice
City	City of Portland
C	Celsius
CAP	Corrective Action Plan
COC	chain-of-custody
CSM	conceptual site model
DEHP	di(2-ethylhexyl)phthalate or bis(2-ethylhexyl)phthalate
DEQ	Oregon Department of Environmental Quality
DFR	daily field report
DQO	data quality objective
EOP	end-of-pipe
EPA	U.S. Environmental Protection Agency
EST	estimated value
FDS	field data sheet
FO	field operations
GIS	geographic information systems
GRTS	Generalized Random Tessellation Stratified
GWPD	Groundwater Protectiveness Demonstration
HYDRA	Hydrological Data Retrieval and Alarm System
IMS	BES Investigation and Monitoring Services
LCS	laboratory control sample
LIMS	BES Laboratory Information Management System
MADL	maximum allowable discharge limit
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MRL	method reporting limit
MS/MSD	matrix spikes and matrix spike duplicates
µmhos/cm	micromhos per centimeter
µg/L	micrograms per liter
OAR	Oregon Administrative Rule
PAH	polycyclic aromatic hydrocarbon
PPS	priority pollutant screen
QA	quality assurance

List of Acronyms (Continued)

QAPP	Quality Assurance Project Plan
QC	quality control
ROW	right(s)-of-way
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SDMP	Stormwater Discharge Monitoring Plan
SIC	standard industrial classification
SOP	Standard Operating Procedures
SP	supplemental panel
TA	Test America
TPD	trips per day
TPH	total petroleum hydrocarbons
TSS	total suspended solids
UIC	underground injection control
UICMP	UIC Management Plan
WPCF	Water Pollution Control Facility
WPCL	Water Pollution Control Laboratory
WQBD	water quality database

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Section 1

1 Introduction and Organization

1.1 Purpose

This *Annual Stormwater Discharge Monitoring Report* presents the results of the City of Portland's (City) sixth year of stormwater sampling, conducted between October 1, 2010 and May 31, 2011, under the *Stormwater Discharge Monitoring Plan* (SDMP) (City of Portland, 2006a). This report is a requirement of the Water Pollution Control Facilities (WPCF) permit issued to the City in June 2005 by the Oregon Department of Environmental Quality (DEQ; Permit Number 102830). The permit requires the City to monitor stormwater entering City-owned or operated (i.e., public) underground injection control (UIC) structures throughout the life of the permit (10 years, or permit term) and to submit this annual report. In this report, the terms "WPCF permit" or "permit" are used to refer to this permit.

Underground Injection Control

UIC, as used in this document, means any Class V underground stormwater control system owned or operated by the City of Portland.

This report includes:

- Sampling data collected during five sampling events in Year 6
- A summary of descriptive information for the UICs sampled (e.g., location, surrounding land use)
- A description of individual storms comprising each sampling event
- Identification of the maximum allowable discharge limits (MADL) concentration exceedances
- Identification and discussion of common and ancillary pollutants detected
- A discussion of Year 6 response actions

1.2 Background

The City currently has an estimated 9,000 Class V UICs, which collect stormwater from public rights-of-way (ROW) and discharge it to the subsurface. UICs are an essential element of the City's comprehensive watershed strategy to use stormwater as a resource by infiltrating it back into the ground.

In the Portland area, groundwater serves as a backup drinking water supply to the Bull Run reservoirs. State regulations require that all groundwaters of the state be protected from pollution that could impair existing or potential beneficial uses for which the natural water quality of the groundwater is adequate, and maintain the existing high quality of groundwater to support beneficial uses, including domestic water supply (Oregon Administrative Rule [OAR] 340-040-0020(3)). The WPCF permit establishes the UIC construction, operation, and maintenance requirements the City must implement to protect groundwater for use as a drinking water resource. The permit is designed to protect groundwater by implementing a comprehensive stormwater management strategy

to prevent, minimize, and control pollutants at the surface before stormwater is discharged to the ground.

The SDMP, which was used to direct Year 6 sampling, consists of the *Sampling and Analysis Plan* (SAP) (City of Portland, 2006b) and the *Quality Assurance Project Plan* (QAPP) (City of Portland, 2006c). Adherence to the SAP and QAPP ensures that the stormwater data collected are of known and acceptable quality and can be used to demonstrate permit compliance. The SDMP was submitted to DEQ in February 2006 and approved in January 2009, and much of the background information in this report is summarized from that document.

1.3 Permit Requirements and Monitoring Program Goals and Objectives

Under the WPCF permit, the City must submit to DEQ by July 15 of each permit year an annual stormwater discharge monitoring report that contains specific monitoring and reporting requirements. Table 1-1 identifies these requirements and where they are met in this annual report. This report demonstrates permit compliance by documenting that Year 6 sampling, analyses, and data evaluation were conducted in accordance with the WPCF permit and SDMP and that results are statistically representative of the City's UIC system.

The permit also requires the City to submit a *UIC Management Plan* (UICMP) annual report by November 1 of each year. Information presented in the annual UICMP report(s) supplements the monitoring report by:

- Identifying traffic or land use changes that would modify sampling protocols or the sampling network.
- Evaluating trends in the cumulative monitoring data.
- Identifying factors that strongly influence the quality of stormwater draining to public UICs to assist in enhancing groundwater protection.
- Presenting a preliminary discussion of response actions.
- Presenting action(s) taken in response to monitoring data.

1.3.1 Monitoring Program Goals

The primary goals of the City's UIC monitoring program relate to complying with the WPCF permit and fulfilling the City Bureau of Environmental Services' (BES) mission.[2] The goals are to:

[2] The Bureau of Environmental Services' mission is to serve the Portland community by protecting public health, water quality, and the environment. BES provides sewage and stormwater collection and treatment services to accommodate Portland's current and future needs. BES protects the quality of surface water and groundwater, and conducts activities that plan and promote healthy ecosystems in Portland's watersheds.

- Demonstrate that the quality of stormwater discharged into City-owned UICs meets permit conditions and that it is protective of groundwater quality (i.e., all beneficial uses).
- Produce results that can be used to ensure that UICs are constructed and operated in a manner that provides multiple watershed benefits and protects groundwater.

UICs are an essential element of a comprehensive watershed strategy to use stormwater as a resource by infiltrating it back into the ground to help restore normative hydrology. Demonstrating permit compliance is important to the City to ensure that UICs continue to help achieve BES's mission.

1.3.2 Monitoring Program Objectives

The UIC monitoring program was designed to satisfy the following specific objectives, which are described in more detail in the SDMP:

- Monitor the quality of stormwater discharged into public UICs and demonstrate that groundwater is protected by meeting MADLs established in the WPCF permit (DEQ, 2005a, Table 1).
- Provide a high degree of confidence that the sampling design used for this program is representative of all UICs covered by the permit.
- Provide data that will be used to conduct trend analysis of the stormwater quality discharged into public UICs.
- Identify factors that strongly influence the quality of stormwater draining to public UICs to assist in enhancing groundwater protection.
- Evaluate the effectiveness of actions implemented to improve stormwater quality and meet MADLs.
- Provide data that can be compared with data collected from previous investigations conducted by the City and/or split/duplicate samples collected by others.

In addition, the monitoring data inform decision-making processes to identify actions that will protect groundwater quality, improve UIC management practices, and improve overall watershed health.

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Section

2

2 Monitoring Design and Locations

This section summarizes the UIC system monitoring design and presents the Year 6 monitoring locations and characteristics. The basis and details of the UIC monitoring program are presented in the SDMP.

2.1 Overview of Monitoring Design

It is not technically practicable or financially feasible to collect and analyze stormwater from each of the estimated 9,000 active City-owned UICs during every storm event (Figure 2-1). Therefore, a statistically robust method, the Generalized Random Tessellation Stratified (GRTS) survey design (Stevens and Olsen, 2004), was used to identify a representative subset of the City's UICs for monitoring. This method, which is described in detail in the SAP, provides a high degree of confidence that a monitored subset is reasonably representative of the entire system. This allows the characteristics of the entire UIC population to be estimated using the measured results of a representative sampling subset.

This section presents background information about the sampling design. Section 2.2 discusses information specific to the Year 6 design.

2.1.1 Sample Locations

To perform long-term trend analysis and evaluate permit compliance during the 10-year permit term, UICs needed to be sampled to assess the spatial and temporal range of data. Therefore, the UIC sampling network consists of six sampling panels that are divided into two primary types: stationary and rotating. Each sampling panel consists of 15 UIC locations. Panel 6 locations are stationary (i.e., fixed), and the same locations will be sampled annually for 10 years. The other 5 panels of UICs are rotated, so that each panel will be sampled twice during the 10-year permit term: once in Years 1 through 5, and once in Years 6 through 10. After 5 years, 75 rotating locations (5 different panels x 15 locations per panel) will have been sampled once, and after 10 years they will have been sampled twice. Using this process, a total of 90 unique locations will be monitored during the permit term (15 stationary + 75 rotating locations). Locations were identified using the GRTS survey design.

2.1.2 Sample Size

The sample size, "n", for the UIC monitoring locations is described in detail in the SDMP and was selected to be representative of the City's UIC system. The sample size is based on a specified confidence level, interval width, and the estimated proportion of UICs exceeding the MADL. (Definitions of these measurements are provided in the *Annual Stormwater Discharge Monitoring Report - Year 1*; City of Portland, 2006d.) To limit

the amount of uncertainty around the estimated proportion of exceedances, the confidence interval was set at a 90 percent confidence level and a half-width of 12 percent, as described in the SAP.

The proportion of UICs exceeding a MADL was estimated from stormwater discharge data collected during a pre-permit pilot study (described in the SAP). That study indicated that the proportion of all City-owned UICs estimated to exceed the pentachlorophenol MADL was 8.1 percent. Using the 90 percent confidence interval and a 12 percent precision half-width, 30 UIC locations were selected to be representative of the City's UIC population. The upper confidence limit on the number of UICs that may exceed the pentachlorophenol MADL was estimated to be 20.1 percent.

The results from Year 6 have been consistent with the pre-permit pilot study results. As in the pre-permit pilot study, pentachlorophenol was the most frequently detected pollutant with exceedances above its MADL of 1 microgram per liter (µg/L). The proportion of compliance panel UICs with pentachlorophenol concentrations exceeding the MADL during Year 6 ranged between 3 percent (1 UIC in Event 4) and 16.7 percent (5 UICs in Event 2). The pilot study indicated that 8.1 percent of all City-owned UICs would exceed the MADL with an upper confidence limit of 20.1 percent (based on a 90 percent confidence interval and 12 percent half-width). The Year 6 results are consistent with the proportions estimated during the pre-permit pilot study and with the assumptions used to estimate the sample size.

2.1.3 Stratification

The permit requires the sampled UIC population to be divided into two traffic volume-based sub-populations, which are assumed to be associated with different stormwater qualities. These two traffic volume categories are identified in Table 2 of the WPCF permit and are presented in Table 2-1 of this report. The lower traffic volume category (<1,000 trips per day [TPD]) is presumed to be associated with lower pollutant concentrations. The higher traffic volume category (≥1,000 TPD) is presumed to be associated with higher pollutant concentrations. After the sample size was determined, the sampling design was stratified in accordance with the two identified traffic volume categories. Randomly selecting sampling locations and then stratifying based on traffic category also randomizes information for multiple factors that may affect stormwater quality (including older and newer industrial/commercial office buildings versus commercial salvage yards, etc.).

As explained in the SAP, preliminary work by the City determined that approximately 57 percent of active City-owned UICs are in the <1,000 TPD category and 43 percent are in the ≥1,000 TPD category. To ensure there were enough data points in each traffic category for statistical analysis, 50 percent of the sample locations initially were selected from the <1,000 TPD category, and 50 percent of the sample locations were selected from the ≥1,000 TPD category. Because most active UICs are in the <1,000 TPD

category and are predominantly in residential areas, the sample design is considered to be conservative.

2.2 Year 6 Monitoring Locations and Characteristics

2.2.1 Overview

Forty-six UIC locations were sampled in Year 6:

- Thirty UICs selected to implement the required Year 6 monitoring (i.e., compliance monitoring) described in the SDMP:
  - Panel 1 (15 rotating UIC locations sampled in Years 1 and 6[3])
  - Panel 6 (15 stationary UIC locations sampled in Years 1 through 10)
- Ten supplemental UICs located near commercial/industrial sites [Supplemental Panel 5 (SP5); see Section 5.4]
- Six UIC locations (P5_5, P5_15, SP4_2, SP4_3, SP4_4, and SP4_10) carried over from Year 5 monitoring because of annual geometric mean pentachlorophenol or benzo(a)pyrene concentrations exceeding the MADL (see Section 2.2.6)

In accordance with the SAP, each selected UIC sampling location was inspected in August and September 2010 before sampling began to confirm UIC information (e.g., location, type of construction) and to determine suitability for sampling (e.g., accessibility, potential health and safety concerns). Characteristics of Year 6 UIC monitoring locations are summarized in Tables 2-2 through 2-5. Year 6 sampling locations are shown in Figure 2-2, and detailed maps of all Year 6 locations are shown in Appendix A. The UIC sampling design is described in detail in the SAP.

As discussed in Section 3.2 of the *Stormwater Discharge Monitoring Report – Year 2*, (City of Portland, 2007) sampling locations were selected based on the best traffic information available at the time. However, the City acquired more accurate geographic information systems (GIS) transportation system metadata in 2006, which resulted in the change of traffic categories for two Year 1 Panel 1 UICs from $\geq$1,000 TPD to <1,000 TPD. In order to achieve the target stratification goal described in the SAP, Year 2 Panel 2 UIC monitoring locations were weighted toward the high-traffic locations to achieve the 50/50 percent stratification goal over years 1 and 2 together, instead of individually as in the other years.

[3] The rotating panels are scheduled to be sampled as follows: Panel 1 in Years 1 and 6; Panel 2 in Years 2 and 7; Panel 3 in Years 3 and 8; Panel 4 in Years 4 and 10; and Panel 5 in Years 5 and 9. The sequence of the last two panels in Years 9 and 10 was reversed because the permit requires the priority pollutant screen (PPS) analytes to be sampled in Years 1, 4, and 9. The reverse sequence was implemented so Panel 4 is not sampled twice for PPS analytes in Years 4 and 9. This will result in a more robust data set by adding 15 more discrete locations, for a total of 45 locations for PPS analytes.

As a result, Panel 1 and Panel 6 represent 17 UIC sampling locations in the <1,000 TPD category and 13 locations in the ≥1,000 TPD category. Year 7 will include Panel 2, which will have 14 UIC sampling locations in the <1,000 TPD and 16 locations in the ≥1,000 TPD category.

2.2.2 Rotating Panel (Panel 1)

Fifteen randomly selected UICs in the rotating panel (Panel 1) were sampled during 5 storm events throughout the 2010-2011 wet season. This panel was previously sampled in Year 1 of the permit. Panel 1 includes 9 UICs with traffic counts <1,000 TPD and 6 UICs with traffic counts ≥1,000 TPD. Table 2-2 presents location information, characteristics, and maintenance information for each UIC in Panel 1.

2.2.3 Stationary Panel (Panel 6)

Fifteen randomly selected UICs in the stationary panel (Panel 6) were sampled during 5 storm events throughout the 2010-2011 wet season. These UIC locations also were sampled in Years 1 through 5, and will continue to be sampled throughout the term of the permit (i.e., 10 years). Panel 6 includes 8 UICs with traffic counts <1,000 TPD and 7 UICs with traffic counts ≥1,000 TPD.[4] Table 2-3 presents location information, characteristics, and maintenance information for each UIC in Panel 6.

2.2.4 Oversample Panel

As described in the SAP, an oversample panel of 85 alternate locations was generated previously to develop compliance sampling panels if needed. Unsuitable UICs are replaced by selecting the next location on the oversample panel list with a site in a similar traffic categorization. No replacement locations were needed for compliance monitoring Panels 1 or 6.

A separate oversample panel of 30 commercial industrial locations was randomly generated to replace supplemental panel UICs (SP4, SP5 and SP6) if needed. Seven oversample locations were needed to replace six SP5 locations in Year 6. The original UICs were determined to be unsuitable because of insufficient commercial/industrial activity in the catchment area, traffic control issues, and lack of flow because of the UIC's location (second in a series). Each of these UICs was replaced prior to Event 1 and sampled for 5 events. Appendix B provides further information about the rationale for replacement.

[4] A change in the TPD estimation methodology in Year 1 resulted in recategorizing traffic volume from ≥1,000 TPD to <1,000 TPD at three UIC locations: P6_2, P6_10, and P6_12. New UIC locations in the ≥1,000 TPD traffic category were selected randomly before Year 2 to replace the 3 UIC locations, and sample location codes were retained. See the Year 2 or Year 3 annual reports for more information.

2.2.5 Supplemental Monitoring Near Commercial/Industrial Sites

Similar to the City's volunteer sampling in Years 2 through 4 for UICs located near drinking water wells (SP1 through SP3), the City conducted new voluntary sampling starting in Year 5 at 10 additional UIC locations. The purpose of this new monitoring is to assess the quality of stormwater discharged to UICs from City rights-of-way (ROW) located adjacent to areas zoned commercial/industrial. Supplemental monitoring for this purpose was conducted in Years 5 and 6 and will also be conducted in Year 7. Ten unique UICs will be sampled each year for 3 years, for a total of 30 UICs.

Supplemental monitoring locations were taken from the list of the City-owned UICs in the *Systemwide Assessment* report (City of Portland, 2006e) that are estimated to be located near commercial or industrial sites.[5] Locations were selected randomly from this list, using the GRTS method described in the SDMP, and stratified by traffic category. The final list of supplemental monitoring locations consisted of 5 UICs with estimated traffic counts of <1,000 TPD and 5 locations with estimated traffic counts of ≥1,000 TPD. Locations for Year 6 were inspected in August and September 2010 to determine whether they were suitable for sampling and representative of the associated traffic categories. Supplemental monitoring locations were sampled during all five Year 6 storm events. Sampling and analyses were conducted in accordance with the SDMP.

Section 2.3 presents the statistical basis of the supplemental monitoring. Table 2-4 presents information on the supplemental sampling locations.

2.2.6 Carry-Over Locations from Previous-Year MADL Exceedances

Geometric mean stormwater concentrations were calculated in Years 1 through 6 for locations where the individual analyte was detected in at least one sampling event at a concentration ≥50 percent of the analyte's MADL. If the annual geometric mean concentration exceeded the MADL at a given UIC, the UIC was sampled again (i.e., carried over to) the following year.

In Year 5, there were eleven UIC locations with annual geometric mean concentrations that exceeded the MADL.

Of the 11 sites, 3 UICs (P6_1, P6_7, and P6_14) were previously identified as Category 4 UICs and have received a No Further Action determination from DEQ (DEQ, 2008). Because these three UICs are part of the stationary panel, they are sampled each year.

Two UICs (SP3_6 and SP3_8) were identified as new Category 4 UICs. A Groundwater Protectiveness Demonstration (GWPD) was performed as the corrective action for the

[5] The *Systemwide Assessment* report identified 225 City-owned UICs that are located within 500 feet of commercial or industrial properties and that (based on off-site drainage assessments and on-site field inspections) may receive drainages from these properties. Properties considered under this evaluation are regulated under Superfund Amendments and Reauthorization Act (SARA) Title III, or have a standard industrial classification (SIC) code for a business type that would be expected to result in a direct or indirect discharge to a UIC that may cause a violation of permit conditions.

two new Category 4 UICs; the GWPD determined that a No Further Action was warranted (City of Portland, 2011).

The remaining six UIC locations with an annual geometric mean concentration that exceeded a MADL were carried over into Year 6 for a second year of monitoring. Of the six UICs, two were from Panel 5 (P5_5 and P5_15) and four were from Supplemental Panel 4 (SP4_2, SP4_3, SP4_4, and SP4_10). Table 2-5 presents information on the six carry-over UIC sampling locations.

2.3 Supplemental UIC Monitoring Statistical Basis

The objectives of the new supplemental monitoring are to:

- Assess the quality of stormwater discharged to UICs located near commercial/industrial sites.
- Demonstrate that the results of the citywide annual compliance monitoring program (described in the SDMP) are representative of stormwater discharging to UICs located near commercial/industrial sites.
- Demonstrate through the compliance monitoring and supplemental monitoring programs that stormwater discharges to public UICs near commercial/industrial sites meet permit MADLs and are protective of groundwater quality.

As stated in the *Annual Stormwater Discharge Monitoring Report – Year 2,* [6] the supplemental monitoring program was designed to achieve the 12 percent confidence interval half width for a 90 percent confidence interval specified in the SDMP. This will be accomplished through sampling 10 UICs each year for 3 years for a final sample size of 30 UICs.

[6] Voluntary monitoring of SP1 through SP3 for UICs located near drinking water wells was initiated in Year 2, and implemented in Years 2 through 4.

Section 3

3 Monitoring Implementation

This section describes how key elements of the SDMP were implemented in Year 6. Section 4 presents analytical results.

3.1 Sampling Procedures

Procedures for staffing and coordinating event sampling teams, and for collecting and documenting field data, were conducted in accordance with the SDMP. Appendix B describes field sampling issues encountered during Year 6 monitoring events and includes copies of all data collection and Water Pollution Control Laboratory (WPCL) chain-of-custody (COC) forms. Appendix C documents that field audits of sampling procedures were conducted, as required by the QAPP.

3.2 Analytes

3.2.1 Common Pollutants

The permit requires the common pollutants listed in Table 3-1 to be monitored annually. These pollutants were measured at all UIC monitoring locations during each stormwater sampling event. All samples required by the permit and by the SAP were collected in Year 6. Table 3-2 lists analytical laboratories, analytical methods, method detection limits (MDL), method reporting limits (MRL), and MADLs for common pollutants.

3.2.2 Priority and Ancillary Pollutants

The permit requires the priority pollutant screen (PPS) analytes listed in Table 3-1 to be monitored for the first storm event in Years l, 4, and 9. PPS monitoring was not required in Year 6; however, the permit requires that analytes detected by any of the laboratory methods used in the stormwater monitoring program be reported. Section 4 reports detections.

The permit defines ancillary pollutants as those analytes that are detected during the required monitoring for common pollutant or PPS analytes using Environmental Protection Agency (EPA) approved analytical methods. For the purposes of this report, any ancillary pollutants that also are listed in the permit as PPS analytes are reported as PPS analytes; all other detected pollutants are reported as ancillary. Table 3-3 includes analytical laboratories, analytical methods, MDLs, MRLs, and MADLs for PPS analytes.

3.2.3 Additional Testing

The City conducted the following additional stormwater characterization testing in Year 6:

- Field parameters, including pH (EPA Method SM4500-HB), conductivity (EPA Method SM2510B), and temperature (EPA Method SM2550B), were measured at all UIC monitoring locations during each sampling event.

- Total suspended solids (TSS) were measured at all UIC monitoring locations during each sampling event, using EPA Method SM2540D.
- For each sampling event, dissolved arsenic, cadmium, chromium, copper, lead, zinc, antimony, barium, beryllium, selenium, and thallium were measured at all 46 UIC monitoring locations. Samples were:
    - Collected during each sampling event at end-of-pipe (EOP) for dissolved metal analyses
    - Transported to the WPCL at the end of the sampling day
    - Filtered by WPCL staff within 24 hours of collection, using a 0.45 micron filter
    - Preserved using nitric acid (pH < 2) before analyses
    - Analyzed using the EPA methods specified in the SDMP for metals

3.3 Storm Events

The Storm Event Coordinator worked directly with the City's contract weather forecasting service, Extended Range Forecasting Company, Inc., to obtain weather forecasts and to decide whether to proceed with a stormwater sampling event. To the extent practicable, staff adhered to target storm criteria to help ensure that stormwater runoff would be adequate for sample collection, representative of stormwater runoff, and consistent among sampling events. Before initiating a sampling event, the storm forecast was evaluated against the following three target storm criteria:

- Predicted rainfall amount of $\geq$0.2 inch per storm
- Predicted rainfall duration of $\geq$6 hours
- Antecedent dry period of $\geq$6 hours (as defined by <0.1 inch of precipitation during the previous 6 hours)

Storms meeting these criteria were expected to provide the volume of runoff necessary to implement sampling. Some sampled storms may not have met the criteria when the sampling event was completed.

After a sampling event was completed, the characteristics of the storm (or individual storms comprising the sampling event) were evaluated using data from the City's Hydrological Data Retrieval and Alarm (HYDRA) system rain gage network. Rain gage data are available at http://or.water.usgs.gov/non-usgs/bes/raingage_info/. That website also provides a map of rain gage locations.

Tipping gages used by the City's HYDRA rain gage network were recalibrated in summer 2010. Based on comparison of HYDRA data to rainfall data from other nearby weather stations, there may have been a calibration error, and HYDRA rainfall data may be biased high. BES Investigation and Monitoring Service (IMS) staff are currently attempting to

determine whether or not any corrections to Year 6 rainfall data are necessary. Corrective actions (if any), will be documented in the Year 7 monitoring report.

Precipitation data from the following 13 rain gages across Portland were averaged and used to characterize individual storms for Years 1 through 6:

HYDRA (Rain gage) Station	**Address**
Station #1: Airport Way 52 P.S.	14614 NE Airport Way
Station #2: Arleta School	5109 SE 66th Ave.
Station #3: Astor School	5601 N Yale St.
Station #4: Beaumont School	4043 NE Fremont St.
Station #5: Cascade PCC_02	705 N Killingsworth St.
Station #6: Holgate	4507 SE 136th Ave.
Station #7: Kelly School	9030 SE Cooper St.
Station #8: Mallory	8030 NE Mallory Ave.
Station #9: Open Meadows School	7602 N Emerald Ave.
Station #10: PDX Post Office	7660 NE Airport Way
Station #11: Swan Island	2600 N Going St.
Station #12: Vernon School	2044 NE Killingsworth St.
Station #13: WPCL	6543 N Burlington Ave.

Sampling staff attempted to sample all locations that were scheduled for the 2010-2011 season during discrete storms; however, if rainfall ceased before the collection of all required samples, the sampling event was extended over additional storms (i.e., sample collection period), as necessary. Each of the five Year 6 stormwater sampling events comprised several storms or sample collection periods. The dates of individual sample collection periods for each event are:

- Event 1: 10/9/10, 10/24/10, 10/25/10, 11/1/10, 11/9/10
- Event 2: 11/17/10, 11/30/10, 12/8/10, 12/14/10, 12/28/10
- Event 3: 1/15/11, 2/14/11, 2/15/11, 2/16/11, 2/28/11
- Event 4: 3/3/11, 3/10/11, 3/15/11, 3/16/11, 3/18/11, 3/29/11
- Event 5: 3/29/11, 4/4/11, 4/6/11, 4/13/11, 4/14/11, 4/25/11, 4/28/11, 5/6/11

Tables 3-4 through 3-8 summarize hourly average precipitation records for each storm event. Figures 3-1 through 3-5 provide hydrographs for each storm event. This information was used to estimate the duration, intensity, and antecedent dry period[7] for

[7] The duration of an individual sample collection period was defined as a continuous rainfall event, preceded and followed by 0.0 inch of rain in an hour (i.e., a dry hour). The intensity of an individual sample collection period was defined as the amount of precipitation recorded for the duration of the event. The antecedent dry period for each sample collection period was defined as the number of dry hours before the first measured rainfall in the sampling event.

each sample collection period in each storm event. Table 3-9 summarizes these storm characteristics for Event 1 through Event 5. The *Data Usability Report* in Appendix B provides additional information regarding forecasted rainfall for individual storms in a storm event.

The first predicted storm during the 2010-2011 wet season was targeted for sampling to investigate water quality differences that may be associated with the first significant rainfall of the fall season. The remaining monitoring events (Events 2 through 5) were distributed throughout the monitoring season as storms occurred that met the target storm event criteria.

Table 3-10 summarizes long-term (30-year) and Years 1 through 6 precipitation and temperature records for the Portland area. (See Table 3-10 footnotes for specific data sources used to generate climatological data.) The permit-defined wet-season months are shaded. Figure 3-6 depicts precipitation totals for these time periods graphically. Year 1 had approximately 5.69 inches more precipitation than the long-term average. Though Years 2 through 5 received less precipitation than the long-term average, Year 6 rainfall was again above the average, receiving approximately 13.62 inches more precipitation than normal.

3.4 UIC Infiltration Volumes

The permit requires the annual stormwater discharge monitoring report to provide information on the total volume of recharge (i.e., stormwater infiltration) to the subsurface (i.e., aquifer) from City-owned UICs. This section describes the methods used to estimate the volume of water infiltrated to City-owned UICs.

BES estimated the catchment area (i.e., basin drainage area) and impervious surface area (e.g., roofs, parking lots, streets) for each known and active City-owned UIC. The impervious portion is the area of the UIC basin area assumed to provide stormwater runoff to the UIC. It was conservatively assumed that all of the identified impervious areas directed stormwater only to the subject UIC (i.e., no infiltration into pavement, unpaved or curbless areas).

The equation used to calculate infiltration volume for each UIC is:

$$\text{Infiltration Volume (cubic feet)} = AP \times (1\text{ft}/12\text{ inches}) \times IA \times LE \qquad (1)$$

Where:

AP = Annual precipitation (inches)
IA = Impervious area within UIC catchment (square feet)
LE = Loss to evaporation (1.0 – ELF)

Where:

ELF = Evaporative loss factor assumed to be 26 percent (0.26) (Snyder et al., 1994)

Table 3-11 summarizes the total estimated stormwater infiltration volumes calculated for the City-owned UIC system for Years 3 through 6. Infiltration volumes for Years 1 and 2 are available in the annual monitoring reports for Years 1, 2, 3, and 4.

The total volume of stormwater infiltration was estimated using annual precipitation measurements from the National Weather Service Climatological Data for Portland International Airport for the periods between June 1 and May 31 for Year 1 (2005-2006), Year 2 (2006-2007), Year 3 (2007-2008), Year 4 (2008-2009), Year 5[8] (2009-2010) and Year 6 (2010-2011). The estimated long-term annual precipitation totals were presented in section 3.3. The actual precipitation totals for these years were 42.77 (Year 1), 34.41 (Year 2), 33.94 (Year 3), 27.2 (Year 4), 34.59 (Year 5), and 50.7 (Year 6) inches (see Table 3-10).

UIC drainage (i.e., catchment) areas were estimated using GIS, as described in the Years 1 through 3 reports. A number of the delineated drainage areas contained more than one UIC. When this was the case, the effective drainage area was assigned to an individual UIC, and the other UICs were removed from the calculation. Approximately 734 UICs were identified and removed from this category for the Year 6 calculation.

Based on these calculations, the City-owned UICs drain a total area of approximately 702,152,000 square feet (16,100 acres), of which approximately 263,279,700 square feet (6,047 acres) are impervious. Using these values, approximately 37 percent of the drainage area is considered impervious. The average area drained by a UIC system in the City of Portland was estimated to be approximately 93,000 square feet (2.1 acres), of which an average 37 percent or 35,000 square feet (0.80 acre) is impervious. The stormwater infiltration volumes for the City's UIC system were estimated to be approximately:

- 589 million cubic feet (4.4 billion gallons) in Year 1 (June 1, 2005, through May 30, 2006)
- 474 million cubic feet (3.5 billion gallons) in Year 2 (June 1, 2006, through May 30, 2007)
- 477 million cubic feet (3.6 billion gallons) in Year 3 (June 1, 2007, through May 30, 2008)
- 382 million cubic feet (2.9 billion gallons) in Year 4 (June 1, 2008, through May 30, 2009)

[8] The total volume of stormwater infiltration for Year 5 (2009-2010) was estimated using precipitation measurements from an average of 13 City of Portland HYDRA rain gages.

- 564 million cubic feet (4.2 billion gallons) in Year 5 (June 1, 2009, through May 30, 2010)
- 593 million cubic feet (4.4 billion gallons) in Year 6 (June 1, 2010 through May 30, 2011)

The simplified method used in this report to calculate runoff assumes that all rain that falls on impervious areas becomes runoff, and all rain that falls on pervious areas does not. *The method used to estimate stormwater volume described above is believed to yield a conservative estimate of stormwater infiltration volumes*. There are a number of uncertainties inherent in both the underlying information and the method used to estimate the stormwater infiltration volume at each UIC. Uncertainties in the estimates also may be the result of one or more of the following assumptions and factors:

- All stormwater runoff from identified impervious areas is assumed to enter the UIC. This assumption overestimates the recharge volume because some runoff may be distributed to detention or other types of infiltration facilities.
- The evaporative loss factor was assumed to be constant at 26 percent. This value may vary as the result of weather conditions (ambient air temperature, impervious surface temperature, rainfall intensity, rainfall duration, land surface topography, impervious surface type and condition).
- Annual precipitation (except for Year 5) was based on data collected at the Portland International Airport. Total rainfall amounts are known to vary across the Portland metropolitan area. A constant precipitation rate may result in either an overestimate or underestimate of stormwater infiltration volume.
- Storm duration and intensity. (Longer storms will have a higher runoff percentage, as will more intense storms; storm intensity in the Portland area usually is not very high.)
- Antecedent conditions. (There will be more runoff if the ground/pavement is already saturated.)
- Vegetative cover was not included in the stormwater infiltration estimates; therefore, infiltration volumes may be overestimated. The effects of vegetative cover would vary seasonally (e.g., summer versus winter) and spatially (e.g., areas with high density of evergreen trees, areas with significant tree cover over roads, neighborhoods with no mature trees).
- Topography. (Flat areas generally will retain more water than steep slopes.)

Section 4

4 Monitoring Results and Evaluation

This section describes the data collected (e.g., storm event, field parameters), results, and evaluation during the 2010-2011 wet season, in accordance with the permit and SDMP.

4.1 Monitoring Results

4.1.1 Common Pollutants

All 14 common pollutants listed in Table 3-1 were detected during Year 6. Table 4-1 summarizes the information in Appendix D (Table D-1) and includes the number of detections (i.e., ≥MRL), number of samples analyzed, frequency of detection, range of Year 6 concentrations, and maximum percent of the MADL detected (i.e., maximum concentration/MADL *x* 100).

The permit requires detected concentrations of common pollutants in each individual sampling event to be compared to their respective MADLs. Four common pollutants [pentachlorophenol, di(2-ethylhexyl)phthalate (DEHP), benzo(a)pyrene, and total lead] were detected at concentrations above their MADLs in at least one sample; these are discussed further in Section 4.2.

4.1.2 Priority Pollutant Screen Analytes

Nine of the PPS analytes listed in Table 3-1 were derived from the analytical methods for common pollutants and therefore were tested during Year 6. Only one of these PPS analytes, 2,4-D, was detected during laboratory analysis for common pollutants in Year 6. Table 4-1 summarizes the information presented in Appendix D (Table D-2), including the number of detections (i.e., ≥ MRL), the number of samples analyzed, the frequency of detection, the range of Year 6 concentrations, and the maximum percent of the MADL detected (i.e., maximum concentration/MADL *x* 100) during Year 6. Table 4-2 summarizes the PPS analytes that were analyzed but not detected in Year 6, including the number of samples analyzed and the range of Year 6 MRLs.

For more information about the data, see **Appendix**:

- **B**: Data Usability Report (QA/QC results, copies of all field and data forms)
- **C**: Year 6 Field Audit Report
- **D**: Year 6 Pollutant Summary Tables (for field parameters, common pollutants, and PPS pollutants)
- **E**: Year 6 Analytical Laboratory Reports (includes data flags)
- **F**: Year 6 Stormwater Discharge Monitoring Database (on CD) (analytical data and key UIC location characteristics)

The permit requires detected concentrations of PPS analytes from each individual sampling event to be compared to their respective MADLs. No PPS analytes were detected at concentrations above their MADLs.

4.1.3 Ancillary Pollutants

Table 4-3 provides a list of ancillary pollutants detected in Year 6, as well as the analytical method, sampling event number, number of samples analyzed, number of detections, frequency of detection, and minimum and maximum concentrations.

Twenty-six ancillary pollutants were analyzed for five sampling events. All 26 ancillary pollutants were detected in Year 6. Eleven of these pollutants were detected below a maximum frequency of 10 percent. Six were detected at maximum frequencies between 10 percent and 50 percent. The nine pollutants that were detected at the highest frequencies (>50 percent) during the individual sampling events are polycyclic aromatic hydrocarbons (PAHs): chrysene, phenanthrene, naphthalene, pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, fluoranthene, and indeno(1,2,3-cd)pyrene.

The detection of PAH compounds was an expected result because of the presence of numerous sources in an urban environment. PAH sources include, but are not limited to, fresh and used petroleum products (e.g., gasoline, diesel, motor oil, used oil), petroleum and coal combustion, motor vehicle exhaust, tire wear, wood ash, asphalt, insecticides, wood preservatives, used cigarette filters, and air deposition. PAHs tend to adhere to sediment particles rather than dissolve in water. PAHs will continue to be analyzed and reported as ancillary pollutants in future UIC sampling events.

4.1.4 Additional Testing

Dissolved Metals. Table 4-4 summarizes common pollutant and PPS total and dissolved metal analyses conducted in Year 6. This table includes the number of samples analyzed; number of detected values; average (i.e., arithmetic mean) concentration; geometric mean, minimum, and maximum concentrations; and ratio of the dissolved average concentration to the total average concentration. Dissolved copper, lead, mercury, and zinc were detected in most samples at concentrations well below their MADLs. The ratios of dissolved to total metal concentrations ranged from 3 percent (lead) to 33 percent (zinc) for the ≥1,000 TPD traffic category and from 5 percent (lead) to 42 percent (zinc) for <1,000 TPD. For individual metals, the ratio of dissolved to total metal concentrations is generally lower for the high traffic category. Ratios were not determined for mercury because total mercury is analyzed only in PPS monitoring years.

Total Suspended Solids. Table 4-5 summarizes TSS results. TSS in stormwater was analyzed for each UIC location during each of the five sampling events. TSS concentrations ranged from 2 milligrams per liter (mg/L) for UICs with <1,000 TPD to a maximum concentration of 1,100 mg/L for UICs with ≥1,000 TPD. The geometric mean

TSS concentration for UICs with <1,000 TPD was 14.3 mg/L, and the geometric mean concentration for UICs with ≥1,000 TPD was 32.3 mg/L.

Field Parameters. Field data were collected to aid in the interpretation of analytical results. Three field parameters (pH, specific conductivity, and temperature) were measured at all UIC locations during each stormwater sampling event, except as noted in the *Data Usability Report* (Appendix B). Table 4-6 summarizes the results presented in Appendix D (Table D-3).

- **pH**. pH measurements ranged from 5.3 to 9.1 in stormwater discharge during Year 6. The mean pH readings for individual events ranged from 6.4 to 6.6.
- **Conductivity**. Conductivity measurements ranged from 5 to 100 micromhos per centimeter (µmhos/cm) in stormwater discharge during Year 6. The mean conductivity readings for individual sampling events ranged from 16.8 to 33 µmhos/cm.
- **Temperature**. Temperature measurements ranged from 2.9 to 17.9^{o} C in stormwater discharge during Year 6. The mean temperature measurements for individual sampling events ranged from 6.2 to 13.2^{o} C.

4.2 Comparison to Individual MADLs - Exceedances

4.2.1 Common Pollutants

The permit requires detected concentrations of common pollutants in each individual sampling event to be compared to their respective MADLs. Table 4-7 summarizes the comparison of individual detected concentrations to MADL values for common pollutants. Four common pollutants [benzo(a)pyrene, pentachlorophenol, lead, and DEHP] were detected in Year 6 at concentrations above their MADLs in at least one sample, as shown on the following lists:

DEHP

P1_10 (Events 4, 5)
P6_1 (Events 3, 4)
P6_2 (Events 3, 4)
P6_5 (Events 3, 4)
P6_8 (Event 5)
SP4_10 (Event 4)
SP5_2 (Event 4)
SP5_9 (Events 1, 3, 5)
SP5_10 (Events 1, 2, 4)

Pentachlorophenol

P1_1 (Events 1, 2)
P1_10 (All Events)
P5_15 (All events)
P6_1 (Events 1, 2, 5)
P6_7 (Events 2, 3)
P6_14 (Event 2)
SP4_2 (All events)
SP4_10 (All events)
SP4_3 (Event 2)
SP5_2 (Events 1, 2, 3, 4)
SP5_5 (Events 2, 3)
SP5_7 (Event 2)
SP5_9 (All Events)
SP5_10 (Events 2, 5)

Benzo(a)pyrene	**Lead (Pb)**
P5_5 (Events 3, 4, 5)	P6_1 (Events 3, 4)
P6_1 (Events 3, 4)	P6_2 (Event 4)
P6_2 (Event 4)	P6_11 (Event 2)

Pentachlorophenol. Fourteen Year 6 UIC sample locations exceeded the 1.0 µg/L MADL for PCP. Of these, 11 were UICs categorized as ≥1,000 TPD, and 3 were UICs categorized as <1,000 TPD. The fewest number of exceedances (6) occurred during Event 4, and the greatest number of exceedances (14) occurred during Event 2. The maximum exceedance was 5.23 µg/L.

Di(2-ethylhexyl)phthalate. Nine Year 6 UIC sample locations exceeded the 6.0 µg/L MADL for DEHP. Of these, 8 UICs were categorized as ≥1,000 TPD, and 1 UIC was categorized as <1,000 TPD. Exceedances occurred during all events. The fewest number of exceedances (1) occurred during Events 1 and 2, and the greatest number of exceedances (7) occurred during Event 4. The maximum exceedance was 65 µg/L.

Lead. Three Year 6 UIC sample locations exceeded the 50 µg/L MADL for lead. Two locations were categorized as ≥1,000 TPD and 1 as < 1000 TPD. Exceedances occurred during Events 2, 3, and 4. The highest exceedance was 148 µg/L and occurred during Event 4.

Benzo(a)pyrene. Three Year 6 UIC sample locations exceeded the 0.2 µg/L MADL for benzo(a)pyrene. Two locations were categorized as ≥1,000 TPD and 1 as < 1000 TPD. Exceedances occurred at all 3 locations during Event 4. The location categorized as <1000 TPD also had exceedances during Events 3 and 5 and had the highest exceedance of 2.6 µg/L.

As required by the permit, the City reported the observed MADL exceedances of common pollutants from each individual sampling event to DEQ within 7 days following the receipt of validated analytical data. Exceedances were reported to DEQ in the following correspondence:

- MADL Exceedance Notification Year 6 – Event 1, letter dated December 22, 2010
- MADL Exceedance Notification Year 6 – Event 2, letter dated February 28, 2011
- MADL Exceedance Notification Year 6 – Event 3, letter dated April 4, 2011
- MADL Exceedance Notification Year 6 – Event 4, letter dated April 26, 2011
- MADL Exceedance Notification Year 6 – Event 5, letter dated June 6, 2011

Causes of the MADL exceedances are known for some compounds. All compounds detected at concentrations greater than the MADL appear ubiquitous at low concentrations. Likely and potential sources are identified below:

- **Pentachlorophenol**. Leaching from treated wood utility poles (i.e., wood treatment). Poles have been observed near all UIC locations with pentachlorophenol exceedances. A utility pole pathway analysis was conducted during the 2007-2008 storm year and presented in Appendix G of the *Annual Stormwater Discharge Monitoring Report – Year 3* (City of Portland, 2008a). That analysis demonstrated that the utility poles could account for most, if not all, of the pentachlorophenol present in stormwater entering the UICs. Other potential sources include common pesticide (e.g., lindane, hexachlorobenzene) breakdown products, insecticides, fungicides, herbicides, preservatives (e.g., in laundry starch), glues, paper coatings, inks, and incineration of chlorine-containing wastes. Pentachlorophenol is no longer is used as a general herbicide, and new utility poles are the only potential new source of pentachlorophenol.
- **DEHP**. Historically, at least 95 percent of DEHP use has been as a plasticizer (ATSDR, 2002). DEHP is present in auto exhaust, tires, auto belts, used oil, brake pads, vinyl upholstery, air deposition, packing peanuts, paints, leaching and/or incineration from flexible plastic. It is also a common laboratory contaminant.
- **Lead**. Sources include auto batteries, tires, and tire weights.
- **Benzo(a)pyrene**. Sources include incomplete combustion of organic material (e.g., fuel from vehicles, wood- and oil-burning furnaces, and incinerators), component of coal tar, tobacco smoke, charbroiled food.

Section 6 describes City actions taken in response to MADL exceedances.

4.2.2 Priority Pollutant Screen Analytes

2,4-D was the only PPS analyte detected during routine laboratory analysis for common pollutants in Year 6. No PPS analytes were detected at concentrations exceeding their MADLs. Table 4-1 presents the maximum percent of the MADL detected for PPS analytes. Because the concentrations of PPS analytes are significantly less than their MADLs (<50 percent) for all sampling events, response actions or source investigations have not been conducted. This is consistent with the PPS action levels, defined in the permit and presented in Table 4-8.

4.3 Calculation of Annual Mean Concentrations

4.3.1 Method

The permit requires the annual mean MADL concentration to be met at the EOP discharge point after any pretreatment best management practices (BMP) or structural

controls. The annual mean concentration is calculated using the geometric mean of the five storm event concentrations for each pollutant. The QAPP provides additional details about the geometric mean calculation. Based on the considerations outlined in the QAPP, half of the MRL was used to address non-detected values in calculating the geometric mean. In general, all data were used except as noted in Section 7 of this monitoring report.

The annual geometric mean concentration was calculated for pollutants detected in at least one sampling event or individual sampling location at a concentration >50 percent of their MADLs. The annual geometric mean concentration cannot exceed the MADL for analytes detected at concentrations <50 percent of the MADL. Annual geometric mean concentrations were calculated for the following pollutants in Year 6:

- Benzo(a)pyrene
- DEHP
- Lead
- Pentachlorophenol

Table 4-9 presents the annual geometric mean concentrations for these pollutants. Table 4-9 also presents pollutant MADLs; the arithmetic mean (average); and the geometric mean, minimum, and maximum concentrations for reference and comparison. It should be noted that the arithmetic mean can be biased toward higher pollutant concentrations by skewed data points. Because stormwater data usually do not conform to a normal distribution and skewed data may bias the mean, using an arithmetic mean may be inappropriate (DEQ, 2005b).

4.3.2 Common Pollutants

Annual geometric mean concentrations were less than the MADL for the following common pollutant:

- **Lead.** The annual geometric mean concentration for total lead was calculated for 5 UIC locations (P6_1, P6_2, P6_5, P6_11, and SP5_2) where the concentration was ≥50 percent of the 50.0 µg/L MADL in at least 1 sampling event. The annual geometric means for these locations ranged from 8.723 to 24.33 µg/L. All locations had geometric means below ≥50 percent of the MADL.

Annual geometric mean concentrations for the following pollutants exceeded the MADL:

- **DEHP**. The annual geometric mean concentration was calculated for 24 locations where the concentration was ≥50 percent of the 6.0 µg/L MADL for DEHP in at least 1 sampling event. The annual geometric means for these locations ranged from 1.25 to 7.09 µg/L. Four locations (P1_10, P6_1, SP5_9, and SP5_10) had geometric means that exceeded the MADL for DEHP in Year 6. The remaining locations were below the MADL.

- **Benzo(a)pyrene**. The annual geometric mean concentration for benzo(a)pyrene was calculated for 10 UIC locations where the concentration was ≥50 percent of the 0.2 µg/L MADL. The annual geometric mean concentrations for these locations ranged from 0.025 to 0.324 µg/L. The annual geometric mean concentration for 1 UIC location (carryover P5_5) exceeded the MADL.
- **Pentachlorophenol**. The annual geometric mean concentration for pentachlorophenol was calculated for 25 UIC locations where the concentration was ≥50 percent of the MADL (1.0 µg/L) in at least 1 sampling event. The geometric mean concentration for 8 UIC locations (P1_10, P5_15, P6_1, SP4_2, SP4_10, SP5_2, SP5_9, and SP5_10) exceeded the MADL in Year 6. The annual geometric means for these 8 locations ranged from 1.02 to 2.24 µg/L.

4.3.3 Priority Pollutant Screen Analytes

No individual PPS analytes were detected at concentrations ≥50 percent of their MADLs.

4.4 Evaluation of Year 6 Results

This section evaluates Year 6 data using statistical and graphical methods to look for potential differences or similarities among sample panels, sampling events, and traffic categories. Box plots were produced to present the results of selected analytes. Box plots are an effective way to convey information that otherwise might require multiple graphs; they can depict the range of stormwater concentrations, percentiles (25th, 50th, 75th), skewness, and outliers. Presenting box plots side-by-side allows the general magnitude of the observations (i.e., stormwater concentrations) in each plot to be ascertained and general comparisons to be made regarding the data sets. Figure 4-1 illustrates and defines the components of a box plot.

With the exception of arsenic, box plots were prepared only for analytes detected in Year 6 where the stormwater concentration in at least one sampling event was detected at a concentration ≥50 percent of the MADL. Although arsenic was not detected in Year 6 at concentrations ≥50 percent of the MADL, it is included for evaluation because of detections in previous years.

4.4.1 Year 6 Concentration Data by Traffic Category

The box plots were prepared using Year 6 stormwater discharge data, including non-detect values. For concentrations reported as non-detect (<MRL), the MRL was used to generate the box plots to avoid any distortion of the data distribution caused by substituting a value other than the MRL. Figures were prepared to illustrate analyte concentrations by traffic category (<1,000 TPD and ≥1,000 TPD). Figure 4-2 presents box plots for the following five pollutants:

- Lead
- DEHP

- Benzo(a)pyrene
- Pentachlorophenol
- Arsenic

The following general observations are made regarding this information:

- Pentachlorophenol, lead, arsenic, and DEHP generally appear to be symmetric on a log scale. However, several plots appear to be truncated by the non-detect values [e.g., benzo(a)pyrene, DEHP].
- The ≥1,000 TPD traffic category has a slightly higher median concentration than the <1,000 TPD category for the pollutants evaluated.
- The means and geometric means of the evaluated pollutants are, in general, <50 percent of the applicable MADLs.
- Some individual event concentrations detected above their MADLs are identified as potential outliers by the box plot methodology [for arsenic, benzo(a)pyrene, DEHP, lead]. The non-detects for benzo(a)pyrene have the effect of creating more outliers than is reasonable.

4.4.2 Individual UIC Location Concentration Data by Sampling Event

Dot plots (i.e., Trellis Displays) were prepared for:

- Arsenic (Figure 4-3)
- Benzo(a)pyrene (Figure 4-4)
- DEHP (Figure 4-5)
- Lead (Figure 4-6)
- Pentachlorophenol (Figure 4-7)

These plots depict the pollutant concentration for each UIC sampling location in Year 6 by sampling event and traffic category. The UIC locations on these plots are ordered according to increasing average concentration along the *x*-axis. Concentrations reported as non-detect (<MRL) were plotted at the MRL. The following general observations are made regarding these plots:

- Most individual sample concentrations (by event and by location) are below the applicable MADLs.
- Concentrations at most individual UIC locations are within a narrow concentration range.
- Concentrations appear slightly higher in UICs categorized as ≥1,000 TPD.

4.4.3 Year 6 Concentration Data by Sampling Event

Box plots showing the concentrations by sampling event were prepared using Year 6 stormwater discharge data, including non-detect values. Box plots were prepared for the following analytes (Figure 4-8):

- Pentachlorophenol
- Lead
- Benzo(a)pyrene
- DEHP
- Arsenic

Box plots were generated using data from 46 UIC monitoring locations for each sampling event. For concentrations reported as non-detect (<MRL), the MRL was used to generate the box plot. The following general observations are made regarding these plots:

- Most individual sample concentrations (by event and by location) are below the MADL.
- There is no consistent relationship between concentration and event.

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Section 5

5 Preliminary Trend Analysis

5.1 General

This section presents stormwater discharge monitoring data for Years 1 through 6 using statistical and graphical methods to identify potential differences or similarities among permit years, traffic categories, and monitoring panels. Year 1 through Year 5 results are presented in their respective annual stormwater discharge monitoring reports (City of Portland, 2006d, 2007, 2008a, 2009, 2010).

Box plots were prepared to present the results of selected analytes for Years 1 through 6. These plots are presented side-by-side to show both the general magnitude of stormwater concentrations and the distribution in each plot and to allow general comparisons to be made regarding the data sets.

In general, plots were prepared for pollutants where the stormwater concentration in at least one sampling event was detected at a concentration greater than 50 percent of the MADL. Plots were generated using data from all six permit years, including values reported by the analytical laboratories as non-detect and flagged (i.e., estimated) data. Concentrations reported as non-detect (<MRL) were replaced with a value equal to the MRL in order to generate the box plots.

Additional data evaluation and analysis may be conducted and discussed in the UICMP annual report, as appropriate.

5.2 Permit Year

Plots were prepared for Panel 6 (stationary panel) and Panel 1 to compare stormwater discharge concentrations of selected analytes by permit year. Figure 5-1 presents the plot comparisons for pentachlorophenol, lead, benzo(a)pyrene, DEHP, and arsenic. The following observations are made regarding Figure 5-1:

- Concentration ranges and distributions are very similar among years.
- Most annual geometric mean concentrations of the evaluated compounds are <50 percent of their respective MADLs for all years.

5.3 Traffic Categories

Plots were prepared for Panel 6 and Panel 1 to compare the concentrations of selected analytes by traffic category (<1,000 TPD and ≥1,000 TPD) for Years 1 through 6. Figure 5-2 presents the box plots for pentachlorophenol, lead, benzo(a)pyrene, DEHP, and arsenic. The following observations are made regarding Figure 5-2:

- Patterns for both traffic categories have similar concentration ranges from permit year to permit year.

- Distributions of DEHP and benzo(a)pyrene are consistent with a lognormal model that has been truncated at the detection limit (i.e., data are skewed by the non-detect values).
- Most annual median and geometric mean concentrations of the evaluated compounds are <50 percent of their MADLs.
- The ≥1,000 TPD traffic category has higher geometric mean and median concentrations than the <1,000 TPD category for the evaluated compounds.

Summary: Box plots were prepared to identify potential differences in pollutant concentrations among permit years and traffic categories. In general, data are similar for each variable for Years 1 through 6. For most of the evaluated pollutants, the concentration ranges were generally narrow, and geometric means were well below their MADLs (i.e., <50 percent). Pollutant concentrations appear to be higher in the ≥1,000 TPD traffic category than in the <1,000 TPD category and similar among sample panels.

5.4 Supplemental Data

Plots were prepared to compare SP5 data (commercial and industrial sites) with sites in the general UIC population. Figure 5-3 present box plots of Year 6 data from Panel 1, Panel 6, and SP5. The following observations are made regarding Figure 5-3:

- Concentration ranges for SP5 data are similar to data from Panels 1 and 6.
- There is some indication that SP5 concentrations may be somewhat higher for pentachlorophenol. More robust statistical analysis will be conducted at the end of Year 7 to better evaluate and determine whether there are differences among panels.

Section 6

6 Response Actions

This section summarizes the actions taken during Year 6 to further understand pollutant sources, prevent pollutants of concern from exceeding their MADLs, and respond to conditions identified during implementation of the SDMP.

6.1 Response Actions for Individual Exceedances

Source investigations may be conducted when new data are inconsistent with previous results or observations.

6.1.1 Source Investigations

During Year 5 monitoring, UIC location P5_5 had an annual geometric mean that exceeded the MADL for benzo(a)pyrene. This was the first location to exceed a MADL for a pollutant other than PCP.

Year 6 benzo(a)pyrene analytical results for Events 1 and 2 were less than the MADL of 0.2 µg/L. Event 3 (collected on February 14, 2011) sampling results (received on March 31, 2011) detected benzo(a)pyrene at 0.52 µg/L, slightly above the MADL. As a result of Event 3 sampling results, a site inspection was performed at P5_5 (ADW558) located near 10331 SE Clinton Street and 2654 SE 103rd on April 6, 2011. Event 4 (collected on March 3, 2011) sampling results (received on April 21, 2011) detected benzo(a)pyrene at 2.6 µg/L, a concentration above the MADL. The elements of this field evaluation are described below:

- On April 6, 2011, City UIC staff visited the UIC location. The resident at 2642 SE 103rd was storing a number of cars in the driveway and yard, but the street, catch basins, and sump showed no evidence of impact.
- On April 25, 2011, City UIC staff revisited the UIC location. Vehicles were still being stored onsite at 2642 SE 103rd, but the street, catch basins, and sump showed no evidence of impact.
- On May 19, 2011, City Source Control staff inspected the site. The streets were dry, but staff found what appeared to be a thin puddle of slightly oily water and a pile of sediment in the catch basin connected to the sump. The sump was dry, but contained some trash.
- Event 5 samples were collected on April 28, 2011; sampling results were received on May 27, 2011. The result for benzo(a)pyrene was 0.34 µg/L, an order of magnitude lower than Event 4, but still slightly above the MADL.
- On June 1, 2011, City Source Control staff reinspected the location. The streets were wet, but there was no evidence of an oily sheen. Sediment remained in the catch basin and garbage in the sump. There was a very slight oily sheen on the surface of the unimproved shoulder of the cross street (SE 103rd).

- On June 7, 2011, UIC staff requested that Source Control contact the residents at 2642 SE 103rd to discuss housekeeping issues. System Maintenance was also requested to clean both UIC systems (ADW558) near 10331 SE Clinton Street and the UIC (ADS586) around the corner near 2642 SE 103rd.
- On June 8, 2011, Source Control staff contacted the homeowner at 2642 SE 103rd. The homeowner stated that he did not work on the vehicles on his property and does not park them in the street. He stated that his neighbor at 10331 SE Clinton Street regularly parks semi-trucks on the street and performs auto repair work in the driveway. Staff attempted to contact the homeowner at 10331 SE Clinton, but there was no one home. Follow-up will be performed.
- The investigation will continue and will be presented in the UICMP annual report submitted on November 1, 2011.

6.1.2 UIC System Cleaning

As a result of observations during pre-sampling inspections or during stormwater event sampling, the City's UIC program requested selected UICs to be cleaned by City Bureau of Maintenance crews or through the City's response contract. Cleaning activities were conducted in general accordance with the *Surface Stormwater Facilities Maintenance Management Manual* (prepared for BES by Brown and Caldwell, 1997) and the UICMP submitted to DEQ in December 2006.

Tables 2-2 through 2-5 identify recent cleaning and/or maintenance activities conducted at Year 6 UIC sampling locations. Cleaning has been requested for those UICs that have not been maintained within the last 4 years.

6.1.3 Other

One of the goals of the permit and the SDMP is to identify factors that have a substantive effect on the quality of stormwater entering City-owned UICs. To identify these factors, potential associations and relationships among stormwater quality, potential sources of pollution, traffic category, land use, etc., can be evaluated. As data are collected in successive years and a larger data set becomes available, the City will consider if such analysis is needed (e.g., detailed trend analysis, correlations, or logistic regression). If conducted, this type of evaluation and analysis will be included in the UICMP annual report(s). Types of analyses that may be conducted include:

- Investigate potential relationships between:
    - TSS and selected pollutants
    - Presence of treated wood utility poles and pentachlorophenol
    - Traffic volume (i.e., TPD) and selected pollutants
    - Pollutants (e.g., lead and arsenic, lead and antimony, DEHP and PAHs, lead and PAHs)
- Comparison of data groups to determine if they are statistically different (e.g., concentrations between traffic categories)

6.2 Response Actions for Previously Identified Category 4 UICs

6.2.1 Pentachlorophenol Response Actions

Pentachlorophenol has been detected above the MADLs in the 6 years of the UIC SDMP. The permit defines Category 4 UICs as those that become non-compliant by failing to meet the annual geometric mean MADL within one wet season after the initial exceedance. Since permit issuance, annual geometric mean concentrations have exceeded the MADL in 2 consecutive years for 13UICs, which have been identified as non-compliant Category 4 UICs and reported in the annual monitoring reports. Four Category 4 UICs were identified in Year 2, 3 UICs in Year 3, none in Year 4, and 2 UICs in Year 5 (City of Portland, 2007, 2008a, 2009, and 2010, respectively). Four new Category 4 UICs were identified in Year 6 and are discussed in Section 6.3.

The recommended corrective actions for the Category 4 UICs were identified and evaluated in accordance with the DEQ approved *Corrective Action Plan* (CAP; City of Portland, 2006f). The recommended corrective action for each Category 4 UIC was a groundwater protectiveness demonstration (GWPD) (i.e., risk assessment) or No Further Action determination, as allowed by the permit [Schedule C(11)(a)].

The City developed the *Decision Making Framework for Groundwater Protectiveness Demonstrations* (Framework, City of Portland, 2008b). The purpose of the Framework is to provide a consistent, streamlined decision-making structure for evaluating the potential impacts (i.e., risks) to groundwater quality associated with the discharge of urban ROW stormwater into permitted City-owned UICs. The Framework includes a groundwater protectiveness tool for assessing the potential risk to groundwater. The Framework was submitted to DEQ in June 2008 and approved by DEQ in October 2008.

Scope of GWPD Analyses. The City conducted GWPDs in accordance with the protocols defined in the CAP and Section 10 of the Framework. The GWPDs evaluated the fate and transport of pentachlorophenol in stormwater discharged to Category 4 UICs using a one-dimensional mathematical fate and transport equation and site-specific parameter values (e.g., soil type, contaminant concentration). The analyses evaluated whether stormwater pollutant concentrations entering the UIC are reduced to levels protective of drinking water at the point the infiltrated stormwater reaches groundwater. Specific activities included:

- Preparing a conceptual site model (CSM) of potential transport pathways for pentachlorophenol discharge to a UIC.
- Assessing the fate and transport of pentachlorophenol in unsaturated soil under a range of geologic conditions and under a range of stormwater discharge concentrations.

Results. Results of fate and transport analyses demonstrated that unsaturated subsurface soil attenuates (i.e., treatment/removal) pentachlorophenol in stormwater discharges to the subject

UICs to levels protective of beneficial uses of groundwater, public health, and the environment, as required by OAR 340-040.

The UIC monitoring data for Years 1 through 6 indicate that pentachlorophenol is generally present at low concentrations and within a narrow concentration range (between 0.04 and 6.3 µg/L). The analyses indicated that beneficial uses of groundwater are protected. Pentachlorophenol concentrations are not expected to increase significantly in the future because the source is strongly suspected to be leaching or weathering of treated wood utility poles, as demonstrated in the pentachlorophenol pathway analysis presented in Appendix G of the *Annual Stormwater Discharge Monitoring Report – Year 3* (City of Portland, 2008a).

The City submitted site-specific GWPDs for Year 2 Category 4 UICs to DEQ for review and approval in spring 2008 (GSI, 2008a, 2008b). DEQ issued No Further Action determinations for the four Year 2 Category 4 UICs in a letter dated May 30, 2008 (DEQ, 2008). The City performed site-specific GWPDs for the three Year 3 and two Year 5 Category 4 UICs and submitted No Further Action determinations to DEQ on March 30, 2009 and April 4, 2011, respectively.

6.3 Response Actions for UICs Exceeding the Annual Geometric Mean Concentration in Year 6

6.3.1 Annual Geometric Mean Exceedances

Nine UIC locations had annual geometric mean concentrations that exceeded the MADL for at least one pollutant in Year 6.

6.3.2 Category 4 UICs/GWPDs

As stated previously, the WPCF permit requires the City to identify UICs at which the annual geometric mean concentrations exceed the MADL for 2 consecutive years as Category 4 UICs.

In Year 6, the annual geometric mean concentration exceeded the MADL for a second consecutive year at five monitored UICs: four UICs for pentachlorophenol and one UIC for benzo(a)pyrene. One of the five sites, P6_1, was previously identified as a Category 4 UIC for pentachlorophenol in Years 2, 3, 4 and 5, as noted in Section 6.2.1. Tables 6-1 and 6-2 show the four new Year 6 Category 4 UICs.

Table 6-1: New Category 4 UICs for Pentachlorophenol

Location Code	Approximate Address	BES UIC No.	Traffic Category (trips per day)	Separation Distance [a] (ft)	Year 5 Annual Geometric Mean Pentachlorophenol Concentration (µg/L)	Year 6 Annual Geometric Mean Pentachlorophenol Concentration (µg/L)
P5_15	5190 N Vancouver Ave	ADP960	≥1000	129	2.69	2.24
SP4_2	8335 SE Division St	ADP094	≥1000	106	2.44	2.2
SP4_10	10475 SE Division St	ADW349	≥1000	97	2.15	1.93

Table 6-2: New Category 4 UIC for Benzo(a)pyrene

Location Code	Approximate Address	BES UIC No.	Traffic Category (trips per day)	Separation Distance [a] (ft)	Year 5 Annual Geometric Mean Benzo(a)pyrene Concentration (µg/L)	Year 6 Annual Geometric Mean Benzo(a)pyrene Concentration (µg/L)
P5_5	10331 SE Clinton St	ADW558	<1000	84	0.25	0.324

Notes:

[a] The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC minus 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design.

6.3.3 Benzo(a)Pyrene Response Actions

Over the first 5 years of the SDMP, benzo(a)pyrene has been detected above the MADL at individual sampling events at five UICs. Year 5 was the first time the annual geometric mean exceeded the MADL (at monitoring site P5_5). As required, P5_5 was sampled again in Year 6. The geometric mean for benzo(a)pyrene at P5_5 was exceeded again in Year 6, resulting in a Category 4 UIC for a pollutant other than pentachlorophenol.

In accordance with the CAP and as outlined above in Section 6.2.1, the recommended corrective action for the four new Category 4 UICs is a GWPD (i.e., risk assessment) or No Further Action determination, as allowed by the permit [Schedule C(11)(a)].

6.3.4 Groundwater Protectiveness Demonstration for Year 6 Category 4 UICs

Year 6 benzo(a)pyrene and pentachlorophenol results fall within the concentrations determined to be protective of groundwater quality for UICs with a separation distance greater than 5 feet of vertical separation to seasonal high groundwater, as presented in Table 8.1 of the Framework. The City will perform a groundwater protectiveness demonstration for the UICs identified as Category 4 UICs for benzo(a)pyrene and

pentachlorophenol and submit it to DEQ under separate cover within the required timeline.

6.3.5 Additional Monitoring

In addition to the locations identified as Category 4 UICs, there were four locations where the annual geometric mean concentration exceeded the MADL for a constituent in Year 6: one for pentachlorophenol (SP5_2), and three for both pentachlorophenol and DEHP (P1_10, SP5_9, and SP5_10). These four UIC locations will be sampled again in Year 7.

Section 7

7 Data Management and Validation

This section summarizes the types of information managed and maintained during Year 6 of the Stormwater Discharge Monitoring Program. It also summarizes the results of data validation conducted in the field and analytical laboratory data collected during the 2010-2011 wet season. The QAPP describes specific procedures for data management and data validation.

7.1 Data Management

Technical data that were collected and used in the *Data Usability Report* (Appendix B) include:

- Field data (described below)
- Analytical laboratory data (described below)
- UIC construction data
- UIC locations (described in Section 2)
- Sedimentation manhole depth to sediment measurements (described in Section 2)
- Traffic volume data (described in Section 2)
- Land use
- Sampling event data (described in Section 3)
- Calculated or manipulated data

During the 2010-2011 wet season, there were no deviations from specific data management procedures described in the QAPP.

Additional technical data types are identified in the QAPP, but not specifically presented in this report. That information will be presented and discussed in other reports as appropriate.

7.1.1 Field Data

Field data were recorded on project-specific paperwork, as described in the SAP. BES maintains field records in both hard copy and electronic (pdf file) formats. Appendix B contains copies of the daily field reports (DFR), field data sheets (FDS), and WPCL COC forms for Event 1. WPCL COCs for Events 2 through 5 and Test America (TA) COCs are included with the analytical laboratory data packages (see below). WPCL COCs were attached to final laboratory reports as part of implementation of Element, a new Laboratory Information Management System (LIMS), in November 2010.

7.1.2 Laboratory Data

The LIMS functions as the BES database for data storage, sample tracking, and reporting. In November 2010 (after Event 1 was complete and before Event 2 began), the WPCL began using Element by Promium as its LIMS. Before Element was implemented, analytical laboratory data (sample information and analytical results from both the WPCL and TA) were manually entered into the LIMS. Following implementation of Element, most analytical results (nitrates, metals, and organics) were uploaded directly to the LIMS from the instruments via DataTool, a function of Element.

A WPCL chemist conducted manual checks of analytical data sheets and results of laboratory quality control (QC) samples to ensure that the QC statistics were within control limits and that appropriate corrective actions were taken if control limits were exceeded. The chemist also flagged or provided comments on results that did not strictly meet QC criteria. The WPCL formerly applied an EST (estimated value) to qualify results. With the new LIMS, the WPCL uses customized flags to qualify results when necessary. TA used customized flags to communicate detailed QC issues; these flags are included on the TA analytical laboratory reports.

WPCL staff verified the accuracy of data entry into the LIMS system against original hardcopy and electronic records and did not release data until the data validation process was complete. Once data were released, they were uploaded overnight to the Water Quality Database (WQDB), an Access© Database. After Year 6 Event 1, data from TA were no longer manually entered into the LIMS. TA currently provides electronic data deliverables (EDDs), which are used for transferring herbicide data directly to the WQDB. The LIMS system and WQDB were backed up on a daily basis. Appendix E contains electronic copies of the TA and WPCL analytical data reports.

The WPCL maintains project files containing any records necessary to reconstruct the analytical events associated with this project. All procedures for storage of hard copy and electronic data comply with the *WPCL Quality Manual* (City of Portland, 2005). Records related to analytical laboratory data that are maintained include:

- COC forms (copies included in analytical laboratory reports are presented in Appendix E)
- Instrument calibration and tuning records (as applicable)
- Analytical standards preparation logs
- Method Standard Operating Procedures (SOP)
- Analytical QC results (including method blanks, internal standards, surrogates, replicates, spikes, and spike duplicate results, as applicable)
- Raw data, specifically instrument printouts
- Bench worksheets and/or quantification reports
- Corrective action reports (if any)

- Details of the quality assurance/quality control (QA/QC) program in place at the time the project analyses were conducted

Laboratory data were extracted from the WQDB system to generate Year 6 summary tables, in an electronic format, by UIC location and analytical constituent. Appendix F includes a copy of the Access© Database containing a compilation of Years 1 through 6 monitoring data. Tables were checked against copies of the original final data sheets before data analyses. Data are tabulated as they are shown on the original data sheets. However, specific data flags by TA are not included in the Access© Database. Noteworthy laboratory QC issues are included in the comments section of the spreadsheet.

7.1.3 Management Data

Management data included information that must be tracked to monitor, manage, and document the performance of the UIC program, such as schedules, cost estimates, and project reports. All original data, calculations, drawings, etc., were systematically filed as they were collected and are maintained by BES.

7.1.4 Data Storage

All technical and management data described above will be retained indefinitely, and no other records will be destroyed without prior permission of the City's UIC Program Manager and notification of the DEQ UIC Permit Manager, as specified in the QAPP.

7.2 Data Quality Objectives (DQO)

DQOs are defined for environmental sampling and laboratory activities as qualitative and quantitative statements that specify the quality of the data required to support the project objectives. DQOs provide the driving force for the level of QC required for any particular sampling or analytical task. The key DQOs for the City's UIC monitoring program are to provide environmental data that are of known and acceptable quality, are scientifically defensible, and demonstrate compliance with the WPCF permit. The quality of data is known when all components associated with data generation are thoroughly documented. Data are of acceptable quality when a rigorous QA/QC program is implemented and the QC indicators fall within predefined limits of acceptability. The project QAPP describes the methods of data documentation and the mechanisms to be used to attain data of acceptable quality.

Table 7-1 summarizes the project DQOs for analytical data. DQOs for Year 1 were carried forward into Years 2 through 6 without change. The QAPP provides additional information on DQOs.

Field and laboratory data collected during Year 6 were determined to meet the DQOs described in the QAPP and to be of known and acceptable quality. All data are considered usable as reported or with qualifiers.

7.3 Data Validation

This section summarizes the procedures used to review field and analytical data. The purpose of this review is to ensure that data collection and evaluation were conducted according to procedures specified in the SDMP. Deficiencies in field or analytical data, if any, are noted, as are the cause of these deficiencies. If these deficiencies required a corrective action, it is described in Section 7.4 of this report.

7.3.1 Field Data

Deviations from field procedures outlined in the SAP are noted in this section. Field data were collected in general accordance with the procedures described in the SDMP. The following paragraphs describe key components of the field program used to validate field data. All field data were determined to be valid and of acceptable quality.

Sample Locations. Pre-sampling investigations were conducted to determine whether any of the proposed UIC locations were unsuitable for sampling. Though Panel 1 UIC locations were already scouted prior to Year 1, they were included in Year 6 pre-sampling investigations to ensure that sample locations were still accessible and suitable for sampling. The SAP describes the factors used in this evaluation. As a result of these investigations, six proposed commercial/industrial supplemental locations and one oversample panel location were determined to be unsuitable for sampling because of primarily residential land use or because the UIC was the second in series. UICs that were second in series were scouted during rain events in October 2010 to confirm there was insufficient flow for routine sampling. These substitutions were made mostly before initiating Year 6 storm event sampling or before completion of Event 1 for sites that required wet weather reconnaissance.

Sample Stratification. UIC monitoring locations are stratified by traffic category ($\geq$1,000 or <1,000 TPD). As discussed in Section 2.2.1, more accurate GIS transportation system metadata in 2006 resulted in the change of traffic categories for two Panel 1 UICs from $\geq$1,000 TPD to <1,000 TPD. To achieve the target stratification goal, Panel 2 UIC monitoring locations were weighted toward the high traffic locations to achieve the 50/50 percent stratification goal over Years 1 and 2 together. Therefore, Panel 1 and Panel 6 represent 17 UIC sampling locations in the <1,000 TPD category and 13 locations in the $\geq$1,000 TPD category. Year 7 will include Panel 2, which will include 14 UIC sampling locations in the <1,000 TPD and 16 locations in the $\geq$1,000 TPD category.

Precipitation Events. Five sampling events were completed successfully between October 2010 and May 2011. Table 3-9 describes the sampled precipitation events in more detail. Storms targeted for sampling met the criteria identified in the SAP to the extent practicable and were determined to be acceptable.

Sample Collection Procedures. No issues associated with sample collection procedures occurred during the 2010-2011 wet season.

Field Data Documentation. Both the BES Field Leader and the Monitoring Coordinator review field documentation to ensure that sample collection was conducted according to procedures specified in the SDMP and that documentation is complete. Field records document:

- Adherence to SAP protocols
- Field corrective actions tracking and inherent data uncertainties
- Field procedures do not affect samples (i.e., collection of appropriate QC samples)
- Safe work practices are followed (i.e., adherence to the Health and Safety Plan)

Specific field records maintained by BES include the following:

- DFRs, FDSs, and COC forms
- Health and Safety Plan
- Field meter calibration and maintenance records (as applicable)
- Sample collection standard operating procedures
- Storm event information
- Sampling event summaries

Field data documentation for sampling met the objectives identified in the SAP to the extent practicable and was determined to be acceptable.

7.3.2 Laboratory Data

Year 6 analytical data validation included, but was not limited to, a review of the following:

- **Timeliness.** Verified that laboratory analyses were conducted within the recommended analytical holding times. Samples not extracted or tested within the specified period were noted or flagged.
- **Detection Limits**. Verified that analytical detection limits for each analysis met the project-specific limits. Sample MRLs were less than the MADLs

specified in the permit and met the MRLs proposed in the QAPP, except as noted in Appendix B.

- **Chain-of-Custody**. Verified that COC procedures were followed by the laboratory.
- **Reagent Blanks/Trip Blanks**. Verified that blanks did not contain any analytes. Analytes detected in the reagent blank indicate laboratory-introduced contamination that can be identified and flagged.
- **Matrix Spikes and Matrix Spike Duplicates** (MS/MSD). Verified that the percent recoveries between the spike quantity recovered and the known spike value were acceptable. The relative percent difference (RPD) was calculated using the duplicate analyses results.
- **Surrogate Spike Analyses**. Verified that the percent recoveries were within the acceptable range for the analytical laboratories database.
- **Blind Duplicates**. Verified that the RPD between the original sample and the blind duplicate was acceptable.
- **Equipment Blanks/Field Decontamination Blanks**. Verified that blanks did not contain any analytes. Analytes detected in the blank indicate introduced contamination from field or decontamination processes that can be identified and flagged.

Year 6 analytical data were determined to meet the identified DQOs and to be of acceptable quality. Except as noted in Section 7.3, all planned data were collected and analyzed, and all data were considered usable. Year 6 monitoring resulted in a data completeness that exceeded the 95 percent goal set in the QAPP. Table 7-2 summarizes data QA/QC issues identified during the data validation process, as described below. Appendices B, E, and F include the following information used for data validation:

- WPCL Laboratory Analysis Reports
- TA Laboratory Analysis Reports
- Data Usability Report
- Year 6 Analytical Data (e.g., Access© Database, City of Portland Janus database)

Validation occurred throughout the sample collection and analytical process. Initial validation was conducted during sample receipt and log-in and included the following steps: examination of the integrity of sample containers and labels, including suitability of containers for requested analyses; examination of the COC form for the presence of all required information and signatures; and verification of sample container identification numbers against those listed on the COC form.

Laboratory data validation also occurred during sample analysis and was carried out at the instrument by the analyst. This phase of validation involved performing and maintaining instrument calibration and assessing precision and accuracy of the data via the analysis of the appropriate QC checks by the individual laboratories. The analyst ensured that the QC statistics were within control limits and took appropriate corrective actions during analysis if control limits were exceeded.

Laboratory data validation also included checking the data reduction and transcription/ data entry operations used to calculate final results. An analyst or chemist other than the one who conducted the analysis, but who is fully knowledgeable about the analysis, conducted this validation. Results were verified against the raw data, including checking calculations, use of correct units and/or conversion factors, and use of correct sample preparation conditions. The technical reviewer also confirmed that all relevant previous validation checks were applied correctly and that QC statistics were within control limits.

Results that did not meet quality criteria were flagged by TA, WPCL, WPCL QA Coordinator, or IMS staff. Selected samples were flagged by the WPCL QA Coordinator using EST or customized flags, as described in the comments section of the WPCL Laboratory Analysis Reports and database. TA used customized flags to communicate QC issues. Definitions for these data flags are included in the TA data reports (see Appendix E). Data qualifiers were assigned through project data validation and are defined in the *Data Usability Report* (see Appendix B). Most laboratory-assigned flags were carried through using project-specific data qualifiers, and additional qualifiers were assigned through data usability assessment.

The analytical data were entered into BES LIMS and hard copies of the entered data were checked for data entry errors. After sample results (TA and WPCL) had undergone technical and data entry review, the WPCL QA Coordinator electronically marked the sample in LIMS. The mark indicates that all analyses for that sample are complete and have been checked for errors. At that point, the data were released to the UIC program for use.

Table 7-2 summarizes all noteworthy laboratory QC issues identified during the 2010-2011 wet season. The WPCL QA and IMS Monitoring Coordinators reviewed all QC issues. These issues are discussed in the comments section of the WPCL Laboratory Analysis Reports (see Appendix E) and/or the *Data Usability Report* (Appendix B). Additional detailed flags may be found on the TA Laboratory Analysis Reports. (Note: This information is not transferred to the WPCL Laboratory Analysis Reports comment section or database if it does not affect interpretation of the data.) Intermittent DEHP QC issues were encountered during Year 6, though these issues were not nearly as pervasive as in Year 2 (see *Annual Stormwater Discharge Monitoring Report – Year 2* [City of Portland, 2007]). DEHP QC issues consisted primarily of elevated laboratory control sample (LCS) and MS/MSD recoveries resulting from laboratory-introduced contamination. These QC issues typically resulted in DEHP analytical results that were

biased high. DEHP QC issues and associated data qualifiers are described in the *Data Usability Report* (see Appendix B) and in Table 7-2.

7.4 Monitoring Program Corrections

Any unusual condition that occurred during a monitoring event and could affect the monitoring results was noted and, if necessary, corrected. These conditions may be classified as a deviation, nonconformance, or occurrence.[9] This section discusses conditions or issues related to field sampling and laboratory activities.

7.4.1 Deviations, Nonconformance, and Occurrences

No deviations, nonconformance, or occurrences were noted during the 2010-2011 wet season.

7.4.2 Field Corrective Actions

A field corrective action was initiated if problems associated with field measurements or field sampling equipment were observed. No corrective action was taken during the 2010-2011 wet season.

7.4.3 Laboratory Corrective Actions

The QAPP requires a laboratory corrective action to be initiated if problems associated with laboratory procedures or equipment are observed. These problems and associated corrective actions would be documented on a corrective action report specific to the laboratory in question. No corrective action was taken during the 2010-2011 wet season.

[9] A deviation is a planned or unplanned departure from a procedure deemed reportable and tracked by the City's UIC Program Manager. Nonconformance is a deficiency in characteristics, documentation, or procedures that renders the quality of an item or activity unacceptable or indeterminate. An occurrence is any condition or event that could affect the health and safety of the public, have an adverse effect on the environment, endanger the health and safety of workers, affect the operations and intended purpose of a facility, or result in loss or damage of property.

Section 8

8 References

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Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

7. **Monitoring Reporting**. The Permittee must submit to the Department annual monitoring reports in accordance with Schedule C.19. At a minimum, each annual monitoring reports must address the following conditions [2]:	**Report Section**
a. Provide a summary of the monitoring data for the preceding wet season being reported. At a minimum, the summary must include:	
i. Data pertinent to each storm event sampled, including but not limited to:	Section 3 Tables 3-4 through 3-10 Appendix B
(1) A description of the date and duration of storm event sampled;	
(2) Precipitation estimates of the storm event;	
(3) Duration and intensity of the storm event; and	
(4) The duration in days between storm events sampled and the previous storm event;	
ii. A summary table for the injection systems being sampled that includes, but not limited to:	
(1) DEQ ID number for the public UIC;	Table 2-2 - Year 6 Panel 1 Table 2-3 - Year 6 Panel 6 Table 2-4 Supplemental Panel 5 Table 2-5 Carry Over Sites
(2) Latitude and longitude of each sample location;	
(3) Street location;	
(4) The traffic volume, traffic pattern and type of land use in accordance with Table 2 for each public UIC injection system sampled;	
(5) Type of pretreatment, if any, for the public UIC sampled;	Table 2-2 - Year 6 Panel 5 Table 2-3 - Year 6 Panel 6 Table 2-4 Supplemental Panel 5 Table 2-5 Carry Over Sites
(6) Depth to groundwater from ground surface based on USGS estimated depths to groundwater. Site specific data shall be used if available;	
(7) Date of the last maintenance and type of maintenance performed;	Table 2-2 - Year 6 Panel 1 Table 2-3 - Year 6 Panel 6 Table 2-4 Supplemental Panel 5 Table 2-5 Carry Over Sites Section 6
(8) Date of last maintenance and inspection;	
(9) The level of the sediment in a sediment manhole, if the injection system has a sediment manhole as part of the pretreatment. If no sediment manhole is present, report the sediment level in the associated catch basins and in the bottom of the public UIC.	Table 2-2 - Year 5 Panel 5 Table 2-3 - Year 5 Panel 6 Table 2-4 Supplemental Panel 4 Table 2-5 Carry Over Sites
(10) The estimated total volume of recharge to the aquifer by public UICs.	Section 3 Table 3-11

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

iii. A map showing the location of the public UIC injection systems sampled in relation to the Permittee's other public UIC systems authorized by this permit and any domestic wells and public water system wells;	Figures 2-1 and 2-2 Appendix A Systemwide Assessment Report (July 2006)
iv. A map of sufficient scale that clearly shows the location of the specific public UIC being sampled;	Appendix A
v. Identification and discussion of any exceedance of an individual storm event MADL and any annual mean MADL concentration, including:	Section 4 Tables 4-7 and 4-9
(1) A discussion of any potential cause of the exceedance, to the extent practicable and if known, and	Appendix B Section 4
(2) Actions taken during the wet season to reduce the concentration of the pollutant of concern;	Section 6
vi. Identification and discussion of any detected PPS pollutant during a PPS screen sampling event, including:	Section 4 Table 4-1
(1) The pollutant concentration:	Tables 4-1 and 4-2 Appendices D, E , and F
(2) The public UIC at which the detection occurred;	
(3) A discussion of the cause of the detection, if known; and	Section 4, Appendix B
(4) actions taken; and	Section 6
vii. A discussion of compliance response actions taken to correct a MADL annual mean exceedance.	Section 6
b. Provide a summary table of all laboratory monitoring data for the reporting period wet season, including:	Appendices D, E, and F
i. Ancillary pollutants derived from the approved analytical method;	Tables 3-2 and 3-3 Section 4 Table 4-3 Appendices D, E, and F
ii. MRLs; and	
iii. Analytical method used.	
c. Discuss any unusual conditions that occurred during a monitoring event that may impact the monitoring results.	Appendix B Sections 4 and 7

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

d. Include an analysis of the trends in the cumulative monitoring data, including water quality improvements or degradations for each annual report after the first year of reporting.	Section 5 Figures 5-1, 5-2 and 5-3
e. Explain any outliers in the data used to determine the annual mean MADL concentration. If the outlier data was not used in the mean annual MADL concentration, provide an explanation of why the data was omitted from the determination.	Section 4
f. Include a statement that sampling and measurements taken as required herein are representative of the traffic volume and traffic patterns of the monitored discharge weighted or stratified in accordance with the Department-approved SDMP.	Sections 2 and 7
g. Discuss any annual mean MADL exceedance in accordance with Schedule C.10.	Section 4
h. Discuss, in accordance with Schedule C.8, any PPS pollutant detection during a PPS sampling event. This condition applies to the 1st, 4th and 9th year PPS sampling events, or whenever the Permittee samples for the presence of PPS pollutants.	Section 4 Tables 4-1, 4-2 and 4-3
i. In the event conditions occur beyond the reasonable control of the Permittee as identified in Schedule B.3, the Permittee must explain the circumstances in the annual monitoring report. The explanation must include why the sampling event or sample analysis was missed and (if applicable) any corrective actions to prevent the occurrence from happening again.	Section 7
j. For Category 4 public UICs, as defined in Schedule D.11, the Permittee must report in the annual monitoring report the following:	Sections 4 and 6 Category 4 UICs are defined as public UICs that become non-compliant by failing to meet the annual mean MADL within one wet season after the exceedance, or fails to satisfy any groundwater protection conditions of Schedule A of the permit.
i. Provide a list of the Category 4 public UICs;	
ii. A brief description of the public UICs;	
iii. The location of the public UIC at which the non-compliant condition occurred, including traffic volume and the nature of land uses that may drain to the public UIC;	
iv. The nature and concentration of the pollutant that exceeded the annual mean MADL concentration;	
v. The vertical separation distance to groundwater;	
vi. The proposed corrective action, which may include a risk assessment that meets Department risk assessment protocols;	
vii. Discuss the corrective action(s) completed;	
viii. Discuss on-going corrective action(s), or corrective actions to be implemented, including but not limited to:	
(1) The type of corrective action;	
(2) Implementation date;	
(3) Completion date; and	
(4) Other pertinent information regarding the public UIC or its corrective action obtained during the reporting period.	

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

k. In the event the Permittee undertakes groundwater monitoring, the Permittee must provide the following:	Not applicable for Year 6. Groundwater monitoring was not performed in Year 6.
i. Monitoring well locations with street location and latitude and longitude in decimal degrees;	
ii. Water level measurements and gradient;	
iii. As-built monitoring well construction details for any monitoring well installed during the reporting period;	
iv. The pollutant(s) being monitored;	
v. All groundwater monitoring data and other data pertinent to groundwater monitoring;	
vi. Any other pertinent data to groundwater monitoring obtained during the reporting period;	
vii. A discussion of the following:	
(1) Monitoring data;	
(2) Pollutant concentrations, including concentrations at background and compliance monitoring wells;	
(3) Compliance with Table 1 for groundwater;	
(4) Actions taken or to be taken by the Permittee with respect to groundwater monitoring;	
(5) An analyses of the data; and	
(6) Conclusions with respect to potential or demonstrated groundwater contamination from public UICs; and	
viii. If applicable, a discussion of any Department-approved groundwater corrective actions, including, but not limited to:	Not applicable for Year 6. Need for groundwater Corrective Action was not identified in Year 6.
(1) Nature of the action(s);	
(2) Status of the action(s);	
(3) All laboratory results related to the action;	
(4) Analyses of the data with respect to achieving the corrective action goal; and	
(5) Milestones reached.	
8. **Permittee Monitoring Responsibility**. The Permittee is responsible to protect groundwater quality while operating its public UICs. At a minimum, the Permittee must:	
a. Ensure data and information acquired through implementation of the SDMP is representative of the Permittee's entire public UIC system;	SDMP (August 2006) Section 2
b. Ensure the results of the system-wide assessment, required under Schedule D.8, are incorporated into the SDMP as appropriate;	SDMP (August 2006)
c. Notify the Department in the annual monitoring report of significant land use changes which change traffic volume or patterns which may affect public UICs in the SDMP. Significant land use changes include, but are not limited to:	Section 4
i. Zoning changes that result in an increase of 1,000 trips per day or more;	None
ii. A change in type of traffic, i.e. increase in truck traffic; or	None

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

iii. A change that may cause or causes an adverse impact to a BMP such that the BMP no longer performs as intended to meet the conditions of this permit;	None
d. Notify the Department when information or data indicates additional pollutants should be added to Table 1;	SDMP (August 2006)
e. Implement modifications to the permit, including the addition of pollutants that the Department deems necessary to incorporate into the SDMP or other actions under this permit as directed by the Department; and	SDMP (August 2006)
f. Ensure other verifiable data or information, which may indicate a potential that groundwater may be endangered by stormwater injection, is reported in a timely manner to the Department.	SDMP (August 2006)

Notes:

[1] The report section provides a reference to the sections, tables, or figures in the annual SDM report that best address given requirements.

[2] Conditions taken verbatim from Section B(7) of DEQ issued "Water Pollution Control Facilities Permit for Class V Stormwater Underground Injection Control Systems." [DEQ Permit (No. 102830), issued June 1, 2005].

Table 2-1: Vehicle Trips per Day and Predominant Land Use

Vehicle Trips per Day (TPD)	Predominant Land Use
< 1,000	Residential Streets; Small Parking Lots
≥ 1,000	Residential Feeder Streets; Commercially Zoned Areas; Transportation Corridors; Industrial Areas

Table 2-2: UIC Summary Information - Rotating Panel, Year 6, Panel 1

Location Code	Approximate Address[a]	Estimated Trips per Day (TPD)[b]	Traffic Category (TPD)[b,c]	Predominant Land Use[d]	DEQ UIC ID	BES UIC ID[e]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance (feet)[f]	Distance to Nearest Well (feet)[g]	Within Two-year Time of Travel from public drinking water well?	Date of Last Maintenance	Maintenance Performed	Sediment Level (feet)[h]
P1_1	6940 N MACRUM AVE	325	<1000	SFR	10102-2235	AAG769	45.58146	-122.7366	31	Sediment manhole	63	4252	No	Sep-2007	CLEAN SUMP & SED	1.5 FT
P1_2	2510 N BUFFALO ST	248	<1000	SFR	10102-2659	ADP173	45.57536	-122.6933	30	Sediment manhole	76	6370	No	Sep-2007	CLEAN SUMP & SED	5 FT
P1_3	3716 NE 112TH AVE	1187	≥1000	SFR	10102-4037	ADQ980	45.55024	-122.5475	26	Sediment manhole	105	1288	No	May-2010	CLEAN SUMP & SED	5 FT
P1_4	7120 SE 67TH AVE	707	<1000	SFR	10102-4997	ADT881	45.47135	-122.5942	31	Sediment manhole	71	3638	No	Jun-2008	CLEAN SUMP & SED	2 FT
P1_5	7002 SE 45TH AVE	6164	≥1000	SFR	10102-5143	ADT773	45.47259	-122.616	30	Sediment manhole	87	2973	No	Apr-2006	CLEAN SUMP & SED	3.5 FT
P1_6	1840 SE 164TH AVE	107	<1000	SFR	10102-7170	ADS508	45.50927	-122.4952	21.5	Sediment manhole	34	1083	No	Sep-2008	CLEAN SUMP & SED	3 FT
P1_7	6501 NE TILLAMOOK ST	1960	≥1000	POS	10102-4564	ADR184	45.53736	-122.5966	30	Sediment manhole	122	957	No	Sep-2009	CLEAN SUMP & SED	3.1 FT
P1_8	20 SE 160TH AVE	578	<1000	MFR	10102-8121	ADS110	45.52151	-122.499	30	Sediment manhole	54	1438	No	May-2010	CLEAN SUMP & SED	3 FT
P1_9	4740 NE 57TH AVE	385	<1000	SFR	10102-1796	ADQ277	45.55773	-122.6044	30.5	Sediment manhole	124	2534	No	Jun-2010	CLEAN SUMP & SED	5 FT
P1_10[i]	10647 E BURNSIDE ST	9519	≥1000	MFR	10102-8165	ADR905	45.52248	-122.5533	21.5	No Pretreatment	118	2034	No	Dec-2006	CLEAN SUMP & SED	4.5 FT
P1_11	1160 SE 140TH AVE	1200	<1000	SFR	10102-1418	ADT118	45.51475	-122.5197	30	Sediment manhole	66	2333	No	Jul-2008	CLEAN SUMP & SED	3 FT
P1_12	15839 E BURNSIDE ST	7704	≥1000	MFR	10102-884	ANB209	45.52234	-122.5004	Unknown	No Pretreatment	65	1046	No	Oct-2009	CLEAN SUMP & SED	2.4 FT
P1_13	7105 N NEWELL AVE	212	<1000	SFR	10102-2240	ADN651	45.58215	-122.7352	30.8	Sediment manhole	69	4257	No	Jun-2010	CLEAN SUMP & SED	5 FT
P1_14	7380 NE PRESCOTT ST	8844	≥1000	SFR	10102-3967	ADQ898	45.55542	-122.587	27.8	Sediment manhole	102	2080	No	Jun-2008	CLEAN SUMP & SED	2.9 FT
P1_15	6115 N MISSISSIPPI AVE	356	<1000	SFR	10102-1785	ADP561	45.56741	-122.6759	31	Sediment manhole	100	5582	No	Aug-2008	CLEAN SUMP & SED	2 FT

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC Street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied upon for accurate locating of UICs.

b Traffic category information provided by Portland Bureau of Transportation at the time of the systemwide assessment in 2006.

c As noted in SDM Annual Report -Year 1, Section 3.1.2, the trips per day calculation method was modified and resulted in 6 Panel 1 locations categorized as ≥1000 TPD and 9 Panel 1 locations categorized as < 1000 TPD. To allow for trend analysis the sites were retained in Year 6. Panel 2 locations (will be sampled again in Year 7) include 9 locations with ≥1000 TPD and 6 locations with <1000 TPD.

d COM = Commerical; POS = Parks and Open Space; SFR = Single Family Residential; MFR = Multifamily Residential; IND = Industrial

e BES ID number is obtained from the BES Hansen database.

f The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as “Depth to groundwater” (UIC Database Report) for inclusion in DEQ’s UIC database. Reported to nearest foot. Separation distances are based on December 2008 USGS depth to groundwater data (Snyder, D.T., 2008, Estimated depth to ground water and configuration of the water table in the Portland, Oregon area: U.S. Geological Survey Scientific Investigations Report 2008-5095, 40p. (Available at http://pubs.usgs.cov/sir/2008/5059).

g Horizontal distance to nearest groundwater drinking water well (e.g., muncipal, domestic, irrigation).

h Sediment level represents the feet of sediment removed from cleaning.

i Site P1_10 at 10647 E Burnside ownership has changed to Metro since the original site selection and Year 1 monitoring. The site was retained for Year 6 monitoring to allow for trend analysis.

Table 2-3: UIC Summary Information - Stationary Panel, Year 6, Panel 6

Location Code	Approximate Address[a]	Estimated Trips per Day (TPD)[b]	Traffic Category (TPD)[b, c]	Predominant Land Use[d]	DEQ UIC ID	BES ID[e]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance (feet)[f]	Distance to Nearest Well (feet)[g]	Within Two-year Time of Travel from public drinking water well?	Date of Last Maintenance	Maintenance Performed	Sediment Level (feet)[h]
P6_1	3500 SE 112TH AVE	25,838	≥1000	COM	10102-6707	ADW577	45.49676	-122.54801	22.5	Sediment Manhole	58	1443	No	Jun-2011	CLEAN SUMP & SED	2 FT
P6_2	3740 SE 104TH AVE	2,354	≥1000	POS	10102-662	ADT394	45.49511	-122.55601	29.2	Sediment Manhole	62	2048	No	May-2011	RAISED TO GRADE	2 FT
P6_3	4541 NE 80TH AVE	130[i]	<1000	SFR	10102-3192	ADQ337	45.55605	-122.58071	30	Sediment Manhole	80	3436	No	Mar-2011	CLEAN SUMP & SED	0 FT
P6_4	9090 SE CLAYBOURNE ST	393	<1000	SFR	10102-5070	ADT961	45.47471	-122.56991	30	Sediment Manhole	12	4292	No	Sep-2000	CLEAN SUMP & SED	1 EA
P6_5	2513 SE 153RD AVE	36,904	≥1000	MFR	10102-6590	ADS740	45.50410	-122.50598	30.1	Sediment Manhole	27	688	No	Jun-2009	CLEAN SUMP & SED	5 FT
P6_6[j]	5201 N EMERSON DR	<100[i]	<1000	SFR	10102-9396	ANS742[j]	45.56055	-122.69661	30	Sediment Manhole	23	8787	No	Jan-2006	CLEAN SUMP & SED	6 FT
P6_7[k]	640 NE 87TH AVE	729	<1000	MFR	10102-236	AMU771[k]	45.52784	-122.57361	30	Sediment Manhole	144	3474	No	Mar-2008	CONSTRUCTED SUMP	
P6_8	10064 SE WOODSTOCK BLVD	795	<1000	IND	10102-5448	ADV169	45.47613	-122.56014	25.8	Sediment Manhole	5	2710	No	Feb-2010	CLEAN SUMP & SED	2.5 FT
P6_9	3617 SE 168TH AVE	557	<1000	SFR	10102-6117	ADT531	45.49604	-122.48968	30	Sediment Manhole	31	1093	No	Nov-2008	CLEAN SUMP & SED	3 FT
P6_10	5502 NE 13TH AVE	12,028	≥1000	MFR	10102-3074	ADP732	45.56285	-122.65206	31.3	Sediment Manhole	140	6206	No	Jun-2010	CLEAN SUMP & SED	5.75 FT
P6_11	1406 NE SKIDMORE ST	648	<1000	SFR	10102-3605	AAU014	45.55440	-122.65157	30	Sediment Manhole	157	7353	No	Nov-2009	CLEAN SUMP & SED	11 FT
P6_12	550 SE 130TH AVE	3,536	≥1000	SFR	10102-7667	ADT061	45.51824	-122.52998	28.7	Sediment Manhole	82	716	No	Mar-2010	CLEAN SUMP & SED	6 FT
P6_13	14350 NE KNOTT ST	291	<1000	SFR	10102-4296	ADW213	45.54245	-122.51430	19.6	No Pretreatment	97	1259	No	Mar-2000	CLEAN SUMP & SED	1 EA
P6_14	4289 NE PRESCOTT ST	8,100	≥1000	COM	10102-3510	ADQ252	45.55559	-122.61931	30.5	Sediment Manhole	156	1494	No	Sep-2007	CLEAN SUMP & SED	6 FT
P6_15	13500 NE GLISAN ST	19,380	≥1000	POS	10102-8422	ADR767	45.52646	-122.52461	28.7	Sediment Manhole	104	543	No	May-2010	CLEAN SUMP & SED	5 FT

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC Street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied upon for accurate locating of UICs.

b Traffic category information provided by Portland Bureau of Transportation at the time of the systemwide assessment in 2006.

c As noted in SDM Annual Report - Year 1, Section 3.1.2, the trips per day calculation method was modified and resulted in 6 Panel 1 locations categorized as ≥1000 TPD and 9 Panel 1 locations categorized as < 1000 TPD. To allow for trend analysis the sites were retained in Year 6. Panel 2 locations (will be sampled again in Year 7) include 9 locations with ≥1000 TPD and 6 locations with <1000 TPD.

d COM = Commerical; POS = Parks and Open Space; SFR = Single Family Residential; MFR = Multifamily Residential; IND = Industrial

e BES number is obtained from the BES Hansen database.

f The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as “Depth to groundwater” (UIC Database Report) for inclusion in DEQ’s UIC database. Reported to nearest foot. Separation distances are based on December 2008 USGS depth to groundwater data (Snyder, D.T., 2008, Estimated depth to ground water and configuration of the water table in the Portland, Oregon area: U.S. Geological Survey Scientific Investigations Report 2008-5095, 40p. (Available at http://pubs.usgs.cov/sir/2008/5059).

g Horizontal distance to nearest groundwater drinking water well (e.g., muncipal, domestic, irrigation).

h Sediment level represents the feet of sediment removed from cleaning.

i No traffic count available. Value estimated from nearby street(s).

j P6_6 was originally ADV395. A sedimentation manhole (ANS741) was added to this sump system in November 2007. A second UIC sump (ANS742) was installed between the new sedimentation manhole and the original sump (ADV395). The new sump was installed to a depth of 30 feet. The new sump (ANS742) is designed to overflow into the original sump (ADV395). The sampling point was moved to the new sump (ANS742) after installation.

k P6_7 was previously ADV645. ADV645 was the original monitoring site. AMU771 (640 NE 87th) was installed in 2007 and ADV645 (608 NE 87th) was converted to a Sed MH (decommissioned) and retained the ADV645 ID. AMU771 was originally referenced with the same address as ADV645 but updated to current address (640 NE 87th) in 2010.

Table 2-5: UIC Summary Information - Carry-over Sites from Year 5 for Year 6

Location Code	Approximate Address[a]	Estimated Trips per Day (TPD)[b]	Traffic Category (TPD)[b]	Predominant Land Use[c]	DEQ UIC ID	BES ID[d]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance (feet)[e]	Distance to Nearest Well (feet)[f]	Within Two-year Time of Travel from public drinking water well?	Date of Last Maintenance	Maintenance Performed	Sediment Level (feet)[g]
P5_5[h]	10331 SE CLINTON ST	208	<1000	SFR	10102-7062	ADW558	45.50265	-122.5565	21	No Pretreatment	84	959	No	Nov-2006	CLEAN SUMP & SED	6 FT
P5_15	5190 N VANCOUVER AVE	5761	≥1000	MFR	10102-3269	ADP960	45.56036	-122.6684	25	Sediment manhole	129	7381	No	May-2009	CLEAN SUMP & SED	4.3 FT
SP4_2	8335 SE DIVISION ST	23226	≥1000	COM	10102-6803	ADP094	45.50475	-122.5769	27	Sediment manhole	106	939	No	Mar-2010	CLEAN SUMP & SED	5 FT
SP4_3	8029 N DENVER AVE	8154	≥1000	COM	10102-2438	ADN871	45.58152	-122.6869	30	Sediment manhole	44	3594	No	Aug-2009	CLEAN SUMP & SED	0 FT
SP4_4	8006 SE LAFAYETTE ST	800	<1000	MFR	10102-6229	ADT312	45.49617	-122.5807	28	Sediment manhole	79	3712	No	Jun-2010	CLEAN SUMP & SED	4 FT
SP4_10	10475 SE DIVISION ST	47006	≥1000	COM	10102-7325	ADW349	45.50432	-122.5547	19.6	No Pretreatment	97	1372	No	Mar-2010	CLEAN SUMP & SED	6 FT

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC Street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied upon for accurate locating of UICs.

b Traffic category information provided by Portland Bureau of Transportation at the time of the systemwide assessment in 2006.

c COM = Commerical; POS = Parks and Open Space; SFR = Single Family Residential; MFR = Multifamily Residential; IND = Industrial

d BES number is obtained from the BES Hansen database.

e The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as "Depth to groundwater" (UIC Database Report) for inclusion in DEQ's UIC database. Reported to nearest foot. Separation distances are based on December 2008 USGS depth to groundwater data (Snyder, D.T., 2008, Estimated depth to ground water and configuration of the water table in the Portland, Oregon area: U.S. Geological Survey Scientific Investigations Report 2008-5095, 40p. (Available at http://pubs.usgs.cov/sir/2008/5059).

f Horizontal distance to nearest groundwater drinking water well (e.g., muncipal, domestic, irrigation).

g Sediment level represents the feet of sediment removed from cleaning.

h P5_5 started as site ADN893 (1528 N Farragut). It was replaced with ADU940 (6126 SE 65th) prior to sampling. ADU940 was sampled in Event 1 but due to low flow replaced with ADW558 (10331 SE Clinton). ADW558 was sampled for events 2-5. Due to annual mean exceedance ADW558 will be sampled again in Year 6.

Table 2-4: UIC Summary Information - Supplemental Panel, Year 6, Panel 5

Location Code	Approximate Address[a]	Estimated Trips per Day (TPD)[b]	Traffic Category (TPD)[b]	Predominant Land Use[c]	DEQ UIC ID	BES ID[d]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance (feet)[e]	Distance to Nearest Well (feet)[f]	Within Two-year Time of Travel from public drinking water well?	Date of Last Maintenance	Maintenance Performed	Sediment Level (feet)[g]
SP5_1	5533 N GAY AVE	228	<1000	SFR	10102-2788	ADP515	45.56329	-122.6893	30.5	Sediment Manhole	85	8898	No	Dec-2008	CLEAN SUMP & SED	4.0 FT
SP5_2	17020 SE DIVISION ST	28534	≥1000	COM	10102-6644	ADS798	45.50452	-122.4871	30	Sediment Manhole	32	976	No	Mar-2009	CLEAN SUMP & SED	2.4 FT
SP5_3	430 NE BRYANT ST	736	<1000	MFR	10102-2696	AAL004	45.57324	-122.6605	30	Sediment Manhole	73	2438	No	Aug-2008	CLEAN SUMP & SED	4.0 FT
SP5_4	5305 SE 77TH AVE	471	<1000	MFR	10102-5858	ADU617	45.48431	-122.5841	30	Sediment Manhole	59	3948	No	Jun-2008	CLEAN SUMP & SED	1.7 FT
SP5_5	9724 SE ANKENY ST	436	<1000	IND	10102-480	ADR865	45.52174	-122.563	20.3	Sediment Manhole	165	1345	No	Jun-2009	CLEAN SUMP & SED	3.6 FT
SP5_6	740 N KILLINGSWORTH CT	4696	≥1000	COM	10102-521	AMT147	45.56186	-122.6748	32.1	Sediment Manhole	109	7269	No	Jun-2010	CLEAN SUMP & SED	5.0 FT
SP5_7	7232 SE HAROLD ST	8294	≥1000	COM	10102-5852	ADU610	45.48308	-122.589	30	Sediment Manhole	69	4946	No	Nov-2010	CLEAN SUMP & SED	10.0 FT
SP5_8	3626 NE 44TH AVE	344	<1000	SFR	10102-3865	ADQ796	45.5495	-122.6184	28.5	Sediment Manhole	185	3163	No	Apr-2008	CLEAN SUMP & SED	5.5 FT
SP5_9	14741 SE STARK ST	24544	≥1000	COM	10102-272	AMP103	45.51926	-122.5107	21	No Pretreatment	78	2626	No	Feb-2001	CLEAN SUMP & SED	1.0 FT
SP5_10	3341 SE 122ND AVE	20660	≥1000	COM	10102-6445	ADW625	45.49737	-122.5377	20	No Pretreatment	32	1213	No	Aug-2010	CLEAN SUMP & SED	0.0 FT

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied upon for accurate locating of UICs.

b Traffic category information provided by Portland Bureau of Transportation at the time of the systemwide assessment in 2006.

c COM = Commerical; POS = Parks and Open Space; SFR = Single Family Residential; MFR = Multifamily Residential; IND = Industrial

d BES ID number is obtained from the BES Hansen database.

e The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as “Depth to groundwater” (UIC Database Report) for inclusion in DEQ’s UIC database. Reported to nearest foot. Separation distances are based on December 2008 USGS depth to groundwater data (Snyder, D.T., 2008, Estimated depth to ground water and configuration of the water table in the Portland, Oregon area: U.S. Geological Survey Scientific Investigations Report 2008-5095, 40p. (Available at http://pubs.usgs.cov/sir/2008/5059).

f Horizontal distance to nearest groundwater drinking water well (e.g., muncipal, domestic, irrigation).

g Sediment level represents the feet of sediment removed from cleaning.

Table 3-10: Climate Data Summary for Years 1-6 and Long-term Average

		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Year	
Temperature[3]	Long Term Average[1]	63.3	68.1	68.5	63.2	54.5	46.1	40.2	39.6	43.4	47.3	50.9	57.1	53.5	
	Year 1	62.0	70.3	70.7	62.5	56.3	44.0	39.8	45.5	42.0	46.1	53.1	59.8	54.3	
	Year 2	66.4	71.0	69.2	65.2	54.0	47.4	40.0	38.1	44.2	50.1	51.7	58.6	54.7	
	Year 3	62.8	70.7	68.3	62.4	53.1	44.8	40.9	38.8	44.9	45.4	48.5	58.9	53.3	
	Year 4	61.8	68.8	69.6	65.2	53.5	49.2	37.5	40	41.3	45.3	52.3	60.1	53.7	
	Year 5	65.7	73.6	69.9	66.1	54.7	47.7	35.6	45	46.6	48.2	51.0	55	54.9	
	Year 6	56.3	59.5	60.2	59.7	53.0	44.7	44.5	42.3	40.6	45.1	44.9	50.2	50.1	
Precipitation[3]	Long Term Average[2]	1.59	0.72	0.93	1.65	2.88	5.62	5.71	5.07	4.18	3.71	2.64	2.38	37.08	
	Year 1	2.21	0.41	1.05	1.71	3.40	4.98	7.52	10.92	2.15	2.96	2.46	3.00	42.77	
	Year 2	0.93	0.47	0.10	0.86	1.40	11.92	5.86	2.74	3.47	3.20	2.01	1.45	34.41	
	Year 3	1.08	0.55	0.46	2.04	3.26	4.25	7.57	4.71	2.19	3.71	2.09	2.03	33.94	
	Year 4	1.00	0.29	1.23	0.48	1.74	4.15	3.52	4.50	1.36	3.36	2.31	3.26	27.2	
	Year 5	1.30	0.34	0.76	1.40	3.02	5.13	3.76	4.94	2.76	3.58	2.92	4.68	34.59	
	Year 6	4.27	0.59	0.23	3.36	3.87	6.63	8.35	4.73	4.28	6.43	5.04	2.92	50.7	
Precipitation difference from normal[4]	Year 1	0.62	-0.31	0.12	0.06	0.52	-0.64	1.81	5.85	-2.03	-0.75	-0.18	0.62	5.69	
	Year 2	-0.66	-0.25	-0.83	-0.79	-1.48	6.30	0.15	-2.33	-0.71	-0.51	-0.63	-0.93	-2.67	
	Year 3	-0.51	-0.17	-0.47	0.39	0.38	-1.37	1.86	-0.36	-1.99	0.00	-0.55	-0.35	-3.14	
	Year 4	-0.59	-0.43	0.30	-1.17	-1.14	-1.47	-2.19	-0.57	-2.82	-0.35	-0.33	0.88	-9.88	
	Year 5	-0.29	-0.38	-0.17	-0.25	0.14	-0.49	-1.95	-0.13	-1.42	-0.13	0.28	2.30	-2.49	
	Year 6	2.68	-0.13	-0.70	1.71	0.99	1.01	2.64	-0.34	0.10	2.72	2.40	0.54	13.62	

Notes:

[1] Mean Monthly temperatures at Portland Airport from www.ocs.oregonstate.edu/index.html

[2] Monthly Totals/Averages. Portland International Airport. Period 1971 - 2000. From NOWData - NOAA Online Weather Data at http://nowdata.rcc-acis.org/PQR/pubACIS_results.

[3] Preliminary Local Climatological Data - Portland Oregon. From http://www.weather.gov/climate/index.php?wfo=pqr

[4] A positive values indicates that the measured precipitation total for that month exceeds the monthly mean.

Shaded area indicates permit "wet season"

Table 3-11: UIC Stormwater Discharge Volume[a]

Ownership	Total of UICs [b]	Sum of Total UIC Catchment Area [c] (ft^2)	Sum of Total Impervious Area Drainage[c] (ft^2)	Sum of Total UIC Catchment Area[c] (acre)	Sum of Total Impervious Area Drainage[c] (acre)	Adjusted Sum of Total UIC Catchment Area[f] (ft^2)	Adjusted Sum of Impervious Area Drainage[f] (ft^2)	Adjusted Sum of Total UIC Catchment Area[f] (acre)	Adjusted Sum of Impervious Area Drainage[f] (acre)	Year 3 Annual Infiltration Volume[g,h,i] (ft^3)	Year 4 Annual Infiltration Volume[g,i,n] (ft^3)	Year 5 Annual Infiltration Volume[g,h,i] (ft^3)	Year 6 Annual Infiltration Volume[g,i,m] (ft^3)
City Operated	9,186	702,152,000	261,232,000	16,100	6,000	607,410,400	227,688,000	13,900	5,230	476,543,390	381,908,670	563,755,470	593,222,110
Water	7	- [d]	76,500	- [d]	1.8	- [d]	76,500	- [d]	1.8	160,110	128,320	189,410	199,310
UC[j]	91	- [d]	1,971,200	- [d]	45.3	- [d]	1,971,200	- [d]	45	4,125,660	3,306,360	4,880,690	5,135,800
Others[k]	244	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]
Sum	9,528	702,152,000	263,279,700	16,100	6,047	607,410,400	229,735,700	13,900	5,280	480,829,160	385,343,350	568,825,570	598,557,220
Average per UIC[e]	-	93,000	35,000	2.1	0.8	-	-	-	-	NA	NA	NA	NA
Adjusted Average per UIC[f]	-	-	-	-	-	76,400	28,900	1.73	0.7	60,490	48,470	71,560	75,300

Notes:

[a] The volume of stormwater infiltrated estimated to discharge into the City's UIC is based on unverified subcatchment delineations. These delineations are likely to change due to refined mapping or modeling, or due to changes in the field. This table looks back at what the infiltration would have been for each "current condition" (e.g., total UICs, total UIC catchment, and total impervious area). Year 1 and 2 Annual Infiltration Volume is not included in this table to save space; however, it is available in Annual Stormwater Discharge Monitoring Reports - Years 1, 2, 3, and 4.

[b] Approximately 530 BES UICs are identified in the UIC database to have a service status of "ABAN" (Abandoned); these were not included in the catchment/impervious area calculation or discharge volume estimation.

[c] 244 non-BES UICs with "Unknown" or "N/A" impervious/catchment drainage areas were not calculated. In addition, 734 BES UICs were not included in calculation because they were identified as being inside a catchment area with at least one other UIC.

[d] Denotes no UIC Catchment Area/Impervious Area Drainage reported for this classification of UIC.

[e] Average values for UICs with reported catchment areas > 0.

[f] Adjusted average values calculated by inserting "average" catchment areas for those reported as 0. In addition, several large UIC catchment areas and impervious area outlier values appeared anomalous - too high. These values were greater than two times the standard deviations. These values were also changed to average values: 93,000 and 35,000 square feet, respectively.

[g] Infiltration volume = Annual Precipitation (inches) * 1ft/12in *Impervious Area (ft^2)*(1-Evaporative Loss Factor).

[h] Based on estimated Permit Year precipitation totals. Average of 13 rain gages in N, NE, and SE Portland, reported in inches.

[i] Infiltration volume calculation assumes that 26 percent of precipitation falling on impervious surfaces is lost to evaporation and 74 percent drains to the UIC (Snyder, D.T. and Others, 1994).

[j] UC = UICs that are under construction with an estimated drainage area.

[k] Others = Bureau ownership other than BES: Bureau of General Services (BGS), Portland Fire Bureau (FIRE), Portland Parks (PARKS), Water Bureau (WTR).

[m] Based on estimated Permit Year precipitation totals. Monthly National Weather Service climatological for Portland International Airport.

Table 3-2: Stormwater Quality Analytes – Common Pollutant Analyses

Analyte	Analytical Laboratory	Method	Method Detection Limit	Method Reporting Limit	MADL
Benzene	WPCL[1]	EPA 8260B	0.04 µg/L [2]	0.2 µg/L	5.0 µg/L
Toluene	WPCL	EPA 8260B	0.04 µg/L [2]	0.5 µg/L [3]	1,000 µg/L
Ethylbenzene	WPCL	EPA 8260B	0.05 µg/L [2]	0.5 µg/L	700 µg/L
Xylenes	WPCL	EPA 8260B	0.12 µg/L [2]	1.0 µg/L	10,000 µg/L
Pentachlorophenol	TA[4]	EPA 515.3[5]	0.014 µg/L [2]	0.04 µg/L	1.0 µg/L
Di(2-ethylhexyl) phthalate	WPCL[6]	EPA 8270-SIM[6]	0.5 µg/L [2]	1.0 µg/L [2]	6.0 µg/L
Benzo(a)pyrene	WPCL[6]	EPA 8270-SIM[6]	0.01 µg/L	0.01 µg/L	0.2 µg/L
Total Arsenic	WPCL	EPA 200.8[7]	0.00134 µg/L	0.045 µg/L	10.0 µg/L
Total Cadmium	WPCL	EPA 200.8[7]	0.00078 µg/L	0.1 µg/L	5.0 µg/L
Total Chromium	WPCL	EPA 200.8[7]	0.00963 µg/L	0.4 µg/L	100 µg/L
Total Copper	WPCL	EPA 200.8[7]	0.00179 µg/L	0.2 µg/L	1300 µg/L
Total Lead	WPCL	EPA 200.8[7]	0.00045 µg/L	0.1 µg/L	50.0 µg/L
Total Zinc	WPCL	EPA 200.8[7]	0.00424 µg/L	0.5 µg/L	5000 µg/L
Nitrate-Nitrogen	WPCL	EPA 300.0[8]	0.0041 mg/L	0.1 mg/L	10 mg/L

Notes:

[1] WPCL indicates BES Water Pollution Control Laboratory.

[2] Method and/or limits changed from QAPP, see PY6 Data Usability Report in Appendix B.

[3] Values are corrected from QAPP –Table 5-1.

[4] TA indicates Test America. (North Creek Analytical, identified in the SDMP, was acquired by Test America in early 2006).

[5] Preparation: Adjust pH of a 40 milliliter sample to 12 with sodium hydroxide. Let stand for 1 hour. Acidify the sample with sulfuric acid and extract with MTBE. Derivitize the sample with diazomethane. Remove the diazomethane with nitrogen. Analyze the extract using GC/ECD.

[6] Preparation: Sample is extracted with DCM and taken to final volume. The extract is analyzed using GC/MS. Analysis was performed at WPCL beginning in PY6.

[7] Preparation: hot block digestion.

[8] Preparation: sample filtered by WPCL using a 0.45 micron filter.

Table 3-3: Stormwater Quality Analytes – Priority Pollutant Screen Analyses

Analyte	Analytical Laboratory	Method	Method Detection Limit	Method Reporting Limit	MADL
Total Antimony	WPCL[1]	EPA 200.8[2]	0.00111 µg/L	0.1 µg/L	6.0 µg/L
Total Barium	WPCL	EPA 200.8[2]	0.00575 µg/L	0.1 µg/L	2000 µg/L
Total Beryllium	WPCL	EPA 200.8[2]	0.00210 µg/L	0.1 µg/L	4.0 µg/L
Total Selenium	WPCL	EPA 200.8[2]	0.0127 µg/L	0.5 µg/L	50.0 µg/L
Total Thallium	WPCL	EPA 200.8[2]	0.00099 µg/L	0.1 µg/L	2.0 µg/L
Total (inorganic) Mercury	WPCL	WPCL SOP M-10.02[3]	0.0009 µg/L	0.002 µg/L [5]	2.0 µg/L
Total Cyanide	WPCL	SM 4500-CN-E[5]	0.01 mg/L	0.01 mg/L	0.2 mg/L
Alachlor	TA[4]	EPA 8270C	0.01 µg/L [5]	0.5 µg/L [5]	2.0 µg/L
Atrazine	TA	EPA 8270C	0.2 µg/L [5]	0.5 µg/L [5]	3.0 µg/L
Carbofuran	TA	EPA 531.1[5]	0.026 µg/L [5]	0.9 µg/L [5]	40.0 µg/L
Carbon Tetrachloride[6]	WPCL	EPA 8260B	0.05 µg/L [5]	0.2 µg/L	5.0 µg/L
Chlordane (tech)	TA	EPA 8081	0.5 µg/L	1.0 µg/L	2.0 µg/L
Chlorobenzene[6]	WPCL	EPA 8260B	0.05 µg/L [5]	0.2 µg/L	100 µg/L
2,4-D[6]	TA	EPA 515.3	0.02 µg/L [5]	0.1 µg/L	70.0 µg/L
Dalapon	TA	EPA 552.2	0.36 µg/L [5]	1.0 µg/L	200 µg/L
o-Dichlorobenzene[6]	WPCL	EPA 8260B	0.06 µg/L [5]	0.5 µg/L [5]	600 µg/L
p-Dichlorobenzene[6]	WPCL	EPA 8260B	0.06 µg/L [5]	0.5 µg/L [5]	75.0 µg/L
1,3-Dichlorobenzene[6]	WPCL	EPA 8260B	0.04 µg/L [5]	0.5 µg/L [5]	5.5 µg/L
Bis(2-chloroisopropyl) ether	TA	EPA 8270C	0.1 µg/L [5]	0.5 µg/L [5]	0.80 µg/L
Bis(2-chloroethyl) ether	TA	EPA 8270C	0.1 µg/L [5]	0.5 µg/L [5]	0.30 µg/L
Dinoseb[6]	TA	EPA 515.3	0.08 µg/L [5]	0.1 µg/L	7.0 µg/L
Diquat	TA	EPA 549.2	0.37 µg/L [5]	0.4 µg/L	20.0 µg/L
Endothall	TA	EPA 548.1	2.0 µg/L [5]	9.0 µg/L [5]	100 µg/L
Glyphosate	TA	EPA 547	1.2 µg/L [5]	6.0 µg/L [5]	700 µg/L
Lindane	TA	EPA 8081	0.05 µg/L	0.1 µg/L	0.2 µg/L
Picloram[6]	TA	EPA 515.3	0.08 µg/L [5]	0.4 µg/L	500 µg/L
1,2,4-Trichlorobenzene[6]	WPCL	EPA 8260B	0.04 µg/L [5]	0.5 µg/L [5]	70.0 µg/L

Notes:

[1] WPCL indicates BES Water Pollution Control Laboratory.

[2] Preparation: hot block digestion.

[3] Preparation: WPCL SOP M-05.01; Analysis performed under alternative test procedure as described in PY 6 Data Usability Report in Appendix B.

[4] TA indicates Test America. (North Creek Analytical, identified in the SDMP, was acquired by Test America in early 2006).

[5] Method and/or limits changed from QAPP, see PY 4 Data Usability Report in Appendix B.

[6] Indicates PPS pollutants analyzed during Year 4 as part of routine common pollutant testing and reporting.

Table 3-4: City of Portland HYDRA Rain Gage[1] Data, Year 6, Event 1

Date	Hours																							Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
10/6/2010																									0
10/7/2010																									0
10/8/2010																									0
10/9/2010	0.02	0.05	0.09	0.15	0.07	0.01		0.03	0.06	0.08	0.06	0.06	0.09	0.07	0.02			0.01							0.86
10/10/2010			0.13	0.12	0.06	0.06	0.25	0.11	0.08	0.1	0.09	0.04													1.05
10/11/2010																									0.01
10/12/2010																									0.01
10/13/2010																									0
10/14/2010																					0.01				0.01
10/15/2010																									0
10/16/2010																									0
10/17/2010																									0
10/18/2010																									0
10/19/2010																									0
10/20/2010																									0
10/21/2010																									0
10/22/2010																							0.04		0.05
10/23/2010									0.02							0.02		0.03	0.02	0.05	0.15	0.12	0.06	0.1	0.58
10/24/2010	0.09	0.06	0.03	0.07		0.17	0.1	0.01	0.13		0.07	0.05	0.04	0.06	0.09	0.01	0.01	0.12	0.09	0.11	0.23	0.08	0.02	0.01	1.65
10/25/2010	0.01		0.02	0.04	0.01	0.05	0.02		0.01			0.05	0.01	0.01	0.02	0.04	0.05	0.02			0.02	0.08			0.46
10/26/2010		0.03	0.07	0.01	0.01		0.01									0.01									0.13
10/27/2010																									0.01
10/28/2010	0.01					0.02	0.04	0.03	0.02	0.03	0.02	0.02	0.01	0.03	0.02				0.04	0.04	0.01	0.02	0.04	0.07	0.46
10/29/2010	0.03	0.01																							0.04
10/30/2010												0.03	0.02	0.02						0.01		0.04	0.13	0.15	0.4
10/31/2010	0.07	0.04																							0.11
11/1/2010		0.01												0.01	0.06	0.14	0.22	0.17	0.13	0.13	0.03				0.89
11/2/2010																									0
11/3/2010																									0
11/4/2010																									0
11/5/2010																									0
11/6/2010			0.02		0.01			0.01									0.01	0.04	0.09	0.09	0.13	0.14	0.16	0.17	0.86
11/7/2010	0.04	0.03				0.01								0.03			0.01		0.01	0.03					0.17
11/8/2010														0.01	0.01										0.03
11/9/2010								0.01	0.05	0.11	0.07	0.03	0.01	0.02	0.07	0.04	0.06	0.01	0.01	0.05	0.03	0.14	0.05	0.02	0.77

Notes:

Sample Collection Period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 3-5: City of Portland HYDRA Rain Gage[1] Data, Year 6, Event 2

Date	Hours																							Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
11/14/2010	0.06	0.1	0.08	0.03	0.01	0.01																			0.30
11/15/2010																								0.02	0.04
11/16/2010					0.01	0.01																			0.03
11/17/2010												0.05	0.05	0.03	0.06	0.14	0.22	0.33	0.13	0.14	0.17	0.17	0.12	0.08	1.70
11/18/2010	0.07	0.06	0.04	0.02			0.01					0.01	0.05	0.02	0.02	0.06	0.22	0.01				0.03	0.03	0.01	0.68
11/19/2010													0.04	0.02	0.02	0.01	0.01								0.13
11/20/2010		0.02	0.09	0.06	0.02	0.03	0.03																		0.26
11/21/2010														0.09	0.05	0.06	0.01	0.01		0.01					0.25
11/22/2010								0.01	0.04	0.02		0.04	0.04	0.04	0.01	0.01	0.04	0.03							0.28
11/23/2010																									0
11/24/2010																									0
11/25/2010																									0
11/26/2010						0.03	0.02	0.01				0.02	0.02	0.03	0.01						0.01	0.02	0.02	0.02	0.21
11/27/2010	0.02	0.01	0.01		0.01	0.03	0.01										0.02						0.01	0.01	0.13
11/28/2010		0.01		0.01														0.01	0.01						0.03
11/29/2010																		0.02	0.03	0.05	0.03	0.02			0.16
11/30/2010	0.03	0.06	0.08	0.08	0.06	0.03	0.02	0.04	0.04	0.05	0.04	0.06	0.05	0.06	0.04	0.04	0.04	0.01							0.84
12/1/2010		0.02	0.02	0.03	0.08	0.06	0.02	0.02				0.01	0.01			0.01	0.01								0.31
12/2/2010																									0.01
12/3/2010																									0
12/4/2010																									0
12/5/2010																									0
12/6/2010					0.02	0.03	0.01																		0.07
12/7/2010		0.01	0.04											0.01	0.04	0.08	0.03	0.03	0.02					0.02	0.28
12/8/2010	0.03	0.05	0.09	0.09	0.07	0.06	0.02	0.01	0.04	0.14							0.02					0.03	0.19	0.11	0.96
12/9/2010	0.25	0.09	0.03	0.11	0.01		0.02	0.01	0.02			0.04	0.03	0.12	0.24	0.31	0.43	0.11	0.02	0.03					1.87
12/10/2010					0.01	0.02	0.06	0.06	0.08	0.06	0.01														0.3
12/11/2010						0.02	0.07	0.12	0.11	0.07	0.18	0.15	0.16	0.2	0.08	0.06	0.02	0.09	0.01			0.01	0.02	0.02	1.38
12/12/2010												0.01	0.01	0.03	0.02	0.02	0.02	0.02	0.02				0.02	0.02	0.2
12/13/2010	0.01	0.01										0.01	0.03							0.01	0.01		0.02	0.06	0.17
12/14/2010	0.12	0.12	0.02		0.01	0.01	0.09	0.14	0.01		0.05	0.04	0.04	0.03	0.05	0.02	0.02	0.04	0.01			0.02		0.01	0.84
12/15/2010		0.01	0.01	0.02											0.01	0.01	0.01	0.02	0.03		0.01				0.12
12/16/2010																									0
12/17/2010																									0
12/18/2010		0.01	0.02	0.12	0.09	0.04	0.02	0.01	0.02						0.02		0.02				0.01	0.04	0.04		0.45
12/19/2010																	0.07	0.06	0.02		0.01			0.01	0.18
12/20/2010		0.02	0.04	0.1	0.03	0.02	0.01	0.04	0.03	0.06	0.02	0.04	0.03	0.01									0.02	0.02	0.5
12/21/2010		0.01																							0.01
12/22/2010				0.02	0.02																				0.04
12/23/2010																									0.01
12/24/2010																			0.01		0.01	0.02			0.06
12/25/2010																		0.01	0.08	0.03		0.01			0.14
12/26/2010				0.02				0.07	0.06		0.02		0.01	0.02		0.04	0.04		0.03	0.06			0.02	0.02	0.42
12/27/2010	0.02	0.01	0.01		0.01	0.01	0.01					0.02	0.05	0.05	0.05	0.04	0.05	0.05	0.08	0.18	0.23	0.12	0.07	0.06	1.11
12/28/2010	0.04	0.04	0.02	0.02	0.03	0.03	0.02	0.03	0.05	0.09	0.07	0.06	0.09	0.09	0.08	0.07	0.07	0.05	0.07	0.06	0.07	0.05	0.05	0.02	1.27

Notes:

Sample Collection period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 3-6: City of Portland HYDRA Rain Gage[1] Data, Year 6, Event 3

Date	Hours																							Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
1/12/2011	0.01	0.01	0.01	0.02	0.03	0.02	0.04	0.1	0.15	0.06	0.06	0.06	0.07	0.11	0.02	0.01			0.01	0.03	0.04				0.86
1/13/2011	0.09	0.26	0.1	0.04	0.02								0.01	0.02	0.02			0.01							0.58
1/14/2011																		0.01							0.02
1/15/2011										0.02	0.02	0.05	0.14	0.16	0.09	0.09	0.13	0.09	0.08	0.01	0.02	0.02	0.01	0.04	0.97
1/16/2011			0.02	0.19	0.15	0.04	0.06	0.03	0.04	0.04	0.14	0.01			0.04							0.01			0.78
1/17/2011																									0.01
1/18/2011							0.03	0.03	0.04	0.01	0.02	0.03	0.06	0.05	0.02	0.04	0.08	0.1	0.06	0.01					0.59
1/19/2011																									0
1/20/2011																									0
1/21/2011			0.01	0.03	0.07	0.08	0.06	0.1	0.09	0.08	0.04	0.05	0.01												0.64
1/22/2011																									0
1/23/2011																							0.01	0.01	0.02
1/24/2011																									0
1/25/2011																									0
1/26/2011																									0.01
1/27/2011																									0
1/28/2011																									0
1/29/2011																									0
1/30/2011																		0.02							0.02
1/31/2011																									0
2/1/2011																									0
2/2/2011																									0
2/3/2011																									0
2/4/2011																									0
2/5/2011																			0.02	0.01	0.02	0.01			0.07
2/6/2011																				0.06					0.07
2/7/2011	0.01	0.03	0.02		0.01	0.01													0.01		0.01	0.01			0.12
2/8/2011		0.01					0.01																		0.03
2/9/2011																									0
2/10/2011																									0
2/11/2011																									0
2/12/2011																		0.07	0.17	0.19	0.13	0.01			0.58
2/13/2011																0.01	0.03	0.06	0.02						0.12
2/14/2011								0.05	0.04	0.01			0.03	0.01		0.01	0.14	0.12	0.05	0.01		0.04	0.01		0.51
2/15/2011		0.01	0.02	0.04	0.08	0.06	0.05	0.11	0.09	0.07		0.04				0.01					0.01	0.01			0.61
2/16/2011						0.01	0.04	0.08	0.09	0.02						0.02			0.03			0.01			0.33
2/17/2011																									0.01
2/18/2011											0.01	0.01	0.03	0.01	0.01	0.02	0.03	0.05	0.02	0.01					0.21
2/19/2011																									0
2/20/2011																									0
2/21/2011					0.01																		0.01	0.01	0.04
2/22/2011						0.01	0.01		0.03	0.02	0.01		0.01			0.01									0.1
2/23/2011						0.01	0.01						0.03	0.04							0.01		0.01		0.12
2/24/2011										0.09	0.02			0.01			0.01								0.13
2/25/2011																									0
2/26/2011																									0
2/27/2011																	0.02	0.01	0.02	0.01	0.02	0.04	0.06	0.09	0.27
2/28/2011	0.13	0.08	0.08	0.02	0.01	0.2	0.25	0.24	0.17	0.09	0.06	0.03	0.06	0.07	0.07	0.03	0.07	0.04	0.03	0.04	0.03	0.05	0.06	0.06	1.96

Notes:

Sample Collection period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 3-7: City of Portland HYDRA Rain Gage[1] Data, Year 6, Event 4

Date	Hours																							Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
2/28/2011	0.13	0.08	0.08	0.02	0.01	0.2	0.25	0.24	0.17	0.09	0.06	0.03	0.06	0.07	0.07	0.03	0.07	0.04	0.03	0.04	0.03	0.05	0.06	0.06	1.96
3/1/2011	0.05	0.07	0.06	0.04	0.05	0.09	0.09	0.08	0.08	0.07	0.04	0.01		0.01											0.75
3/2/2011			0.01	0.01	0.03	0.02	0.02	0.01			0.01	0.04	0.02	0.01											0.20
3/3/2011						0.01	0.01	0.06	0.02	0.02	0.01			0.02		0.06	0.01	0.01	0.01						0.24
3/4/2011																	0.05	0.18	0.05	0.02	0.04	0.04	0.01	0.01	0.41
3/5/2011	0.01	0.04																				0.01	0.01		0.08
3/6/2011																									0
3/7/2011																									0.01
3/8/2011	0.02	0.02	0.04	0.03	0.01																	0.01	0.03	0.02	0.20
3/9/2011			0.02			0.01					0.01	0.03	0.01	0.01			0.02	0.02	0.09	0.09	0.06	0.01	0.08	0.04	0.51
3/10/2011	0.03	0.09	0.15	0.11	0.22	0.1	0.01		0.01	0.05	0.02		0.05												0.86
3/11/2011																									0
3/12/2011								0.03	0.05	0.07	0.1	0.04	0.01												0.29
3/13/2011						0.01		0.02	0.03	0.02	0.03	0.04	0.04		0.01	0.2	0.11	0.01		0.03	0.08	0.01			0.64
3/14/2011		0.02	0.03	0.03	0.05	0.02	0.01			0.01	0.02														0.19
3/15/2011	0.07	0.07	0.02	0.02	0.04	0.01	0.01				0.01	0.02	0.04	0.11	0.07	0.06	0.12	0.04	0.02	0.02	0.04	0.11	0.04		0.94
3/16/2011			0.01				0.01	0.02	0.02		0.05	0.01		0.01				0.05	0.06	0.08	0.06	0.01	0.01	0.01	0.43
3/17/2011	0.06			0.01						0.02	0.03	0.02				0.03			0.09						0.27
3/18/2011								0.08	0.04	0.02				0.01					0.02	0.04					0.21
3/19/2011																		0.01		0.01					0.03
3/20/2011																				0.01					0.02
3/21/2011	0.01		0.01						0.01				0.01	0.01	0.01										0.07
3/22/2011																									0.02
3/23/2011																					0.08	0.13			0.22
3/24/2011				0.02	0.01									0.01		0.03	0.16	0.04							0.28
3/25/2011										0.02	0.01		0.02										0.01		0.06
3/26/2011			0.02	0.06	0.12	0.08	0.01		0.01						0.01			0.03	0.02	0.01					0.39
3/27/2011						0.01		0.01	0.01		0.01	0.05	0.02	0.02	0.01	0.01									0.14
3/28/2011																					0.02	0.03	0.03	0.05	0.12
3/29/2011	0.05	0.05											0.03	0.08	0.04	0.02	0.04	0.05	0.04	0.03	0.03	0.03	0.03	0.04	0.56

Notes:

Sample Collection period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 3-8: City of Portland HYDRA Rain Gage[1] Data, Year 6, Event 5

Date	Hours																							Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
3/26/2011			0.02	0.06	0.12	0.08	0.01		0.01						0.01			0.03	0.02	0.01					0.39
3/27/2011						0.01		0.01	0.01		0.01	0.05	0.02	0.02	0.01	0.01									0.14
3/28/2011																					0.02	0.03	0.03	0.05	0.12
3/29/2011	0.05	0.05											0.03	0.08	0.04	0.02	0.04	0.05	0.04	0.03	0.03	0.03	0.03	0.04	0.56
3/30/2011																									0.01
3/31/2011																									0
4/1/2011																							0.08	0.06	0.15
4/2/2011	0.06	0.03	0.01						0.01			0.01		0.02											0.14
4/3/2011																									0
4/4/2011						0.01	0.04	0.04	0.04	0.06	0.04	0.05	0.03	0.02	0.02	0.03	0.04	0.08	0.09	0.08	0.02				0.70
4/5/2011																									0.02
4/6/2011	0.01	0.08	0.03		0.01						0.01	0.05			0.01	0.01		0.02			0.01	0.04			0.28
4/7/2011																									0
4/8/2011																									0
4/9/2011																									0
4/10/2011			0.04	0.05	0.05	0.02	0.01	0.01													0.03	0.04	0.03	0.02	0.3
4/11/2011	0.06	0.03											0.01	0.01											0.12
4/12/2011																									0
4/13/2011								0.01	0.01		0.02			0.03	0.02			0.02		0.01	0.03				0.17
4/14/2011			0.01	0.05	0.04	0.12	0.09	0.07	0.03		0.01		0.01	0.01	0.02	0.09	0.01	0.01	0.12	0.09	0.06	0.04	0.07	0.03	0.97
4/15/2011	0.06	0.06	0.02	0.01	0.03	0.03	0.03	0.04	0.03	0.04	0.07	0.06	0.04	0.06	0.06	0.05	0.04	0.04	0.05	0.04	0.06	0.03	0.02	0.01	1.01
4/16/2011		0.01																							0.02
4/17/2011																									0
4/18/2011																									0.02
4/19/2011																									0
4/20/2011																			0.01	0.01					0.02
4/21/2011													0.04	0.02	0.08	0.01	0.01								0.18
4/22/2011																									0
4/23/2011																									0
4/24/2011				0.01	0.04	0.02	0.02	0.01	0.01			0.01				0.01	0.01	0.02	0.01	0.03				0.02	0.23
4/25/2011	0.05	0.08	0.06	0.03	0.07	0.08	0.08	0.22	0.07				0.01	0.01											0.78
4/26/2011	0.01	0.03	0.04	0.01									0.04	0.03	0.01	0.01	0.01								0.19
4/27/2011																			0.01	0.08	0.03				0.12
4/28/2011													0.01	0.04	0.04	0.05	0.02	0.01	0.02	0.03					0.22
4/29/2011																									0
4/30/2011																									0
5/1/2011																									0
5/2/2011																									0
5/3/2011											0.01														0.02
5/4/2011																									0
5/5/2011						0.02	0.02		0.02																0.05
5/6/2011						0.01										0.01	0.07	0.07	0.04	0.03	0.01				0.26

Sample Collection period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 3-9: UIC Permit Year 6 Stormwater Sampling Rainfall Data

Event	Start date of sampled storm	Daily		Individual sampled storm			
		Predicted rainfall [1] (inches)	Actual daily rainfall total [2] (inches)	Antecedent dry period [3] (hours)	Actual storm rainfall total[2] (inches)	Duration (hours)	Intensity (inches[2] per hour)
1	10/9/2010	0.44 - 0.71	0.86	3 (> 72[5])	0.86	18	0.01 - 0.15
	10/24/2010	1.18 - 1.57+	1.65	2 (> 72[5])	2.21	11	0.01 - 0.23
	10/25/2010	0.62 - 0.88+	0.46	7	0.3	11	0.01 - 0.08
	11/1/2010	0.67 - 0.91+	0.89	37	0.88	8	0.01 - 0.22
	11/9/2010	0.45 - 0.58+	0.77	55	0.77	17	0.01 - 0.14
2	11/17/2010	0.23 - 0.32+	1.7	> 72	1.9	20	0.01 - 0.33
	11/30/2010	0.67 - 0.92+	0.84	> 72[6]	0.99	25	0.01 - 0.08
	12/8/2010	0.26 - 0.37+	0.96	8[6]	0.63	11	0.01 - 0.14
	12/14/2010	0.28 - 0.37+	0.84	3 (30[5])	0.93	24	0.01 - 0.14
	12/28/2010	0.85 - 1.12+	1.27	0 (16[5])	2.58	45	0.01 - 0.23
3	1/15/2011	0.83 - 1.17+	0.97	55	1.74	30	0.01 - 0.19
	2/14/2011	0.23 - 0.37+	0.51	13	0.51	16	0.01 - 0.14
	2/15/2011	0.43 - 0.57+	0.61	0 (6[6])	0.61	21	0.01 - 0.11
	2/16/2011	0.18 - 0.27+	0.33	19	0.33	17	0.01 - 0.09
	2/28/2011	0.48 - 0.71+	1.96	0 (> 72[5])	2.87	46	0.01 - 0.25
4	3/3/2011	0.14 - 0.23+	0.24	26	0.24	14	0.01 - 0.06
	3/10/2011	0.87 - 1.13	0.86	3 (34[6])	1.28	21	0.01 - 0.22
	3/15/2011	0.43 - 0.61+	0.94	7	0.7	13	0.01 - 0.12
	3/16/2011	0.17 - 0.41+	0.43	12	0.48	19	0.01 - 0.08
	3/18/2011	0.15 - 0.32+	0.21	15	0.21	13	0.01 - 0.08
4/5[4]	3/29/2011	0.19 - 0.32+	0.56	12	0.46	12	0.02 - 0.08
5	4/4/2011	0.42 - 0.58+	0.7	28	0.7	16	0.01 - 0.09
	4/6/2011	0.24 - 0.38+	0.28	9	0.16	12	0.01 - 0.09
	4/13/2011	0.22 - 0.37+	0.17	55	0.17	14	0.01 - 0.03
	4/14/2011	0.37 - 0.61+	0.97	0 (> 72[5])	1.99	48	0.01 - 0.12
	4/25/2011	0.23 - 0.38+	0.78	0 (18[6])	0.8	15	0.01 - 0.22
	4/28/2011	0.18 - 0.64+	0.22	16	0.22	8	0.01 - 0.05
	5/6/2011	0.03 - 0.07+	0.26	> 72	0.25	6	0.01 - 0.07

Notes:

[1] Predicted rainfall from Extended Range Forecasting, Inc. daily reports

[2] Rainfall totals average of 13 rain gauges (see Section 3.0, Year 5 Data Usability Report presented in Appendix B)

[3] Antecedent dry period = < 0.1" in 6 hours

[4] Next UIC sampling event was started the same day previous sampling event was finished (see Data Usability Report).

[5] middle or 2nd half of storm caught, started raining previous evening or early morning.

[6] Tail end of storm caught, started raining previous evening or early morning.

Table 3-1: UIC Stormwater Analytes

Common Pollutants	**Benzene**[1] **Toluene** **Ethylbenzene** **Xylenes**[3]	**Pentachlorophenol** **Di(2-ethylhexyl)phthalate**[2] **Benzo(a)pyrene**	**Arsenic (Total)** **Cadmium (Total)** **Chromium (Total)** **Copper (Total)** **Lead (Total)** **Zinc (Total)** **Nitrate-nitrogen**
Priority Pollutant Screen	Antimony (Total) Barium (Total) Beryllium (Total) Cyanide (Total) Mercury (inorganic) Selenium Thallium	Alachlor Atrazine Carbofuran **Carbon Tetrachloride** Chlordane **Chlorobenzene** **2,4-D** Dalapon **o-Dichlorobenzene**[4] **p-Dichlorobenzene**[5] **1,3-Dichlorobenzene**	Bis(2-chloroisopropyl)ether Bis(2-chloroethyl)ether **Dinoseb** Diqat Endothall Glyphosate Lindane **Picloram** **1,2,4-Trichlorobenzene**

Notes:
[1] Bold text indicates that the analyte was analyzed during Year 6.
[2] Di(2-ethylhexyl)phthalate is also known as bis(2-ethylhexyl)phthalate or DEHP.
[3] Xylenes is equal to o-xylene + m,p-xylene.
[4] o-Dichlorobenzene is also known as 1,2-dichlorobenzene.
[5] p-Dichlorobenzene is also known as 1,4-dichlorobenzene.

Table 4-1: Frequency of Detected[1] Common and Priority Pollutant Screen Analytes[2] - Year 6

Analyte	MADL (µg/L)	Event	Exceedances of MADL[2]	Number of Detections[2]	Number of Samples[2]	Frequency of Detection	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Maximum Percent of MADL Detected (Maximum concentration/ MADL] (%)
Common Pollutants									
Arsenic (total)	10	1	0	46	46	100	0.11	2.15	22%
		2	0	46	46	100	0.05	1.4	14%
		3	0	46	46	100	0.07	1.33	13%
		4	0	46	46	100	0.09	2.48	25%
		5	0	46	46	100	0.08	2	20%
Cadmium (total)	5	1	0	13	46	28.3	< 0.1 [3]	0.24	5%
		2	0	10	46	21.7	< 0.1	0.466	9%
		3	0	13	46	28.3	< 0.1	0.707	14%
		4	0	21	46	45.7	< 0.1	1	20%
		5	0	16	46	34.8	< 0.1	0.262	5%
Chromium (total)	100	1	0	37	46	80.4	< 0.4	2.71	3%
		2	0	39	46	84.8	< 0.4	7.36	7%
		3	0	41	46	89.1	< 0.4	21.1	21%
		4	0	41	46	89.1	< 0.4	32.1	32%
		5	0	40	46	87.0	< 0.4	6.38	6%
Copper (total)	1300	1	0	46	46	100	1.83	18.7	1%
		2	0	46	46	100	1.22	33.9	3%
		3	0	46	46	100	1.08	83.6	6%
		4	0	46	46	100	1.30	108	8%
		5	0	46	46	100	1.67	23	2%
Lead (total)	50	1	0	46	46	100	0.25	15.2	30%
		2	**1** [4]	46	46	100	0.49	76.5	153%
		3	**1**	46	46	100	0.47	54.5	109%
		4	**2**	46	46	100	0.82	148	296%
		5	0	46	46	100	0.47	18.6	37%
Zinc (total)	5000	1	0	46	46	100	5.13	104	2%
		2	0	46	46	100	7.52	159	3%
		3	0	46	46	100	4.64	239	5%
		4	0	46	46	100	4.06	452	9%
		5	0	46	46	100	5.62	265	5%

Analyte	MADL (µg/L)	Event	Exceedances of MADL[2]	Number of Detections[2]	Number of Samples[2]	Frequency of Detection	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Maximum Percent of MADL Detected (Maximum concentration/ MADL] (%)
Total Nitrogen	10000	1	0	17	46	37.0	< 0.1	0.22	0%
		2	0	1	46	2.2	< 0.1	0.12	0%
		3	0	4	46	8.7	< 0.1	0.5	0%
		4	0	13	46	28.3	< 0.1	0.17	0%
		5	0	9	46	19.6	< 0.1	0.37	0%
Pentachlorophenol	1	1	**8**	43	46	93.5	0.04	5.23	523%
		2	**14**	44	46	95.7	< 0.02	3.23	323%
		3	**8**	37	46	80.4	< 0.02	3.25	325%
		4	**6**	34	46	73.9	< 0.02	1.89	189%
		5	**7**	41	46	89.1	< 0.02	2.99	299%
Benzene	5	1	0	1	46	2.2	< 0.2	0.43	9%
		2	0	0	46	0	< 0.2	< 0.2	4%
		3	0	1	46	2.2	< 0.2	< 0.2	4%
		4	0	0	46	0	< 0.2	< 0.2	4%
		5	0	0	46	0	< 0.2	< 0.2	4%
Ethylbenzene	700	1	0	1	46	2.2	< 0.5	0.56	0%
		2	0	0	46	0	< 0.5	< 0.5	0%
		3	0	1	46	2.2	< 0.5	0.69	0%
		4	0	0	46	0	< 0.5	< 0.5	0%
		5	0	0	46	0	< 0.5	< 0.5	0%
Toluene	1000	1	0	26	46	56.5	< 0.5	13.6	1%
		2	0	8	46	17.4	< 0.5	3.2	0%
		3	0	5	46	10.9	< 0.5	2.61	0%
		4	0	7	46	15.2	< 0.5	1.19	0%
		5	0	11	46	23.9	< 0.5	3.92	0%
Xylenes	10000	1	0	1	46	2.2	< 1.5	3.49	0%
		2	0	0	46	0	< 1.5	< 1.5	0%
		3	0	1	46	2.2	< 1.5	3.83	0%
		4	0	0	46	0	< 1.5	< 1.5	0%
		5	0	0	46	0	< 1.5	< 1.5	0%
Benzo(a)pyrene	0.2	1	0	17	46	37.0	< 0.01	0.16	80%
		2	0	20	46	43.5	< 0.01	0.15	75%
		3	**1**	30	46	65.2	< 0.01	0.52	260%
		4	**3**	28	46	60.9	< 0.01	2.6	1300%
		5	**1**	25	46	54.3	< 0.01	0.34	170%

Analyte	MADL (µg/L)	Event	Exceedances of MADL[2]	Number of Detections[2]	Number of Samples[2]	Frequency of Detection	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Maximum Percent of MADL Detected (Maximum concentration/ MADL] (%)
Di(2-ethylhexyl) phthalate	6	1	**2**	37	46	80.4	0.53	8.1	135%
		2	**1**	35	46	76.1	< 0.5	14	233%
		3	**4**	45	46	97.8	< 0.5	18	300%
		4	**7**	46	46	100	0.65	65	1083%
		5	**3**	43	46	93.5	< 0.5	9.1	152%
Priority Pollutants									
2,4-D	70	1	0	17	46	37.0	< 0.1	3.22	5%
		2	0	1	46	2.2	< 0.02	< 0.08	0%
		3	0	0	46	0	< 0.02	< 0.08	0%
		4	0	4	46	8.7	< 0.02	1.48	2%
		5	0	11	46	23.9	< 0.02	1.13	2%

Notes:

[1] This table includes only those common or priority pollutants that were detected in one or more samples.

[2] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 6, Supplemental Panel 5 and the carry over locations. This table does not include the results of duplicate samples or laboratory reanalyses.

[3] "<" Indicates the laboratory reporting limit.

[4] Bold, shaded text indicate pollutant concentration exceeds the MADL.

Table 4-2 provides summary of non-detect priority pollutant stormwater monitoring data.

Table 4-2: Summary[1] of Non-Detect Priority Pollutant Screen Analyte Data - Year 6

Analyte	MADL (µg/L)	Event	MRL Exceeds MADL	Number of Non-Detections	Number of Samples	Minimum MRL (µg/L)	Maximum MRL (µg/L)
Priority Pollutant Screen[2]							
Dinoseb	7	1	0	46	46	0.2	0.8
		2	0	46	46	0.02	0.08
		3	0	46	46	0.02	0.08
		4	0	46	46	0.02	0.08
		5	0	46	46	0.02	0.08
Picloram	500	1	0	46	46	0.4	1.6
		2	0	46	46	0.07	0.28
		3	0	46	46	0.07	0.28
		4	0	46	46	0.07	0.28
		5	0	46	46	0.07	0.28
1,2,4-Trichlorobenzene	70	1	0	46	46	0.5	0.5
		2	0	46	46	0.5	0.5
		3	0	46	46	0.5	0.5
		4	0	46	46	0.5	0.5
		5	0	46	46	0.5	0.5
1,3-Dichlorobenzene	5.5	1	0	46	46	0.5	0.5
		2	0	46	46	0.5	0.5
		3	0	46	46	0.5	0.5
		4	0	46	46	0.5	0.5
		5	0	46	46	0.5	0.5
Carbon tetrachloride	5	1	0	46	46	0.2	0.2
		2	0	46	46	0.2	0.2
		3	0	46	46	0.2	0.2
		4	0	46	46	0.2	0.2
		5	0	46	46	0.2	0.2
Chlorobenzene	100	1	0	46	46	0.2	0.2
		2	0	46	46	0.2	0.2
		3	0	46	46	0.2	0.2
		4	0	46	46	0.2	0.2
		5	0	46	46	0.2	0.2
o-Dichlorobenzene[3]	600	1	0	46	46	0.5	0.5
		2	0	46	46	0.5	0.5
		3	0	46	46	0.5	0.5
		4	0	46	46	0.5	0.5
		5	0	46	46	0.5	0.5
p-Dichlorobenzene[4]	75	1	0	46	46	0.5	0.5
		2	0	46	46	0.5	0.5
		3	0	46	46	0.5	0.5
		4	0	46	46	0.5	0.5
		5	0	46	46	0.5	0.5

Notes:

[1] This table summarizes the results of the UIC stormwater samples for each event. It includes the results of Panel 1, Panel 6, Supplemental Panel 5, and the carry over locations. This table does not include the results of duplicate laboratory reanalyses.

[2] Table 3-3 provides a complete list of PPS analytes. PPS analytes are those detected by analytical methods used for the required common pollutant monitoring. Full PPS testing is required by the WPCF permit in Years 1, 4, and 9.

[3] o-Dichlorobenzene is also known as 1,2-dichlorobenzene.

[4] p-Dichlorobenzene is also known as 1,4-dichlorobenzene.

Table 4-1 provides a summary of common pollutants and PPS analytes detected in Year 6.

Table 4-3: Summary of Detected Ancillary Pollutants[1] - Year 6

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration (µg/L)
Ancillary Pollutants Detected by Required Analyses							
Dicamba	EPA 515.3	1	2	46	4	< 0.2[3]	1.84
		2	0	46	0	< 0.03	< 0.12
		3	0	46	0	< 0.03	< 0.12
		4	1	46	2	< 0.03	< 0.12
		5	1	46	2	< 0.03	0.129
1,2,4-Trimethylbenzene	EPA 8260	1	1	46	2	< 0.5	2.72
		2	0	46	0	< 0.5	< 0.5
		3	1	46	2	< 0.5	1.12
		4	0	46	0	< 0.5	< 0.5
		5	0	46	0	< 0.5	< 0.5
1,3,5-Trimethylbenzene	EPA 8260	1	1	46	2	< 0.5	0.76
		2	0	46	0	< 0.5	< 0.5
		3	0	46	0	< 0.5	< 0.5
		4	0	46	0	< 0.5	< 0.5
		5	0	46	0	< 0.5	< 0.5
2-Butanone	EPA 8260	1	0	46	0	< 5	< 5
		2	0	46	0	< 5	< 5
		3	1	46	2	< 5	138
		4	0	46	0	< 5	< 5
		5	1	46	2	< 5	36.5
4-Isopropyltoluene	EPA 8260	1	1	46	2	< 0.5	0.53
		2	1	46	2	< 0.5	9.26
		3	0	46	0	< 0.5	< 0.5
		4	0	46	0	< 0.5	< 0.5
		5	0	46	0	< 0.5	< 0.5
Acetone	EPA 8260	1	0	46	0	< 20	< 20
		2	1	46	2	< 20	36.6
		3	2	46	4	< 20	212
		4	0	46	0	< 20	< 20
		5	1	46	2	< 20	114
Acenaphthene	EPA 8270M-SIM	1	0	46	0	< 0.02	< 0.06
		2	0	46	0	< 0.02	< 0.02
		3	1	46	2	< 0.02	< 0.06
		4	2	46	4	< 0.02	0.2
		5	0	46	0	< 0.02	< 0.06
Acenaphthylene	EPA 8270M-SIM	1	5	46	11	< 0.02	0.089
		2	4	46	9	< 0.02	0.042
		3	19	46	41	< 0.02	0.12
		4	13	46	28	< 0.02	0.11
		5	7	46	15	< 0.02	< 0.06
Anthracene	EPA 8270M-SIM	1	4	46	9	< 0.02	0.062
		2	5	46	11	< 0.02	0.05
		3	13	46	28	< 0.02	0.084
		4	16	46	35	< 0.02	0.71
		5	5	46	11	< 0.02	0.066

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration (µg/L)
Benzo(a)anthracene	EPA 8270M-SIM	1	15	46	33	< 0.01	0.13
		2	16	46	35	< 0.01	0.13
		3	25	46	54	< 0.01	0.44
		4	21	46	46	< 0.01	2.7
		5	20	46	43	< 0.01	0.27
Benzo(b)fluoranthene	EPA 8270M-SIM	1	25	46	54	< 0.01	0.24
		2	31	46	67	< 0.01	0.22
		3	37	46	80	0.01	0.84
		4	35	46	76	< 0.01	3.9
		5	29	46	63	< 0.01	0.52
Benzo(ghi)perylene	EPA 8270M-SIM	1	30	46	65	< 0.01	0.29
		2	34	46	74	< 0.01	0.23
		3	40	46	87	< 0.01	0.63
		4	38	46	83	< 0.01	2.4
		5	33	46	72	< 0.01	0.37
Benzo(k)fluoranthene	EPA 8270M-SIM	1	8	46	17	< 0.01	0.079
		2	10	46	22	< 0.01	0.066
		3	19	46	41	< 0.01	0.29
		4	20	46	43	< 0.01	1.4
		5	19	46	41	< 0.01	0.17
Butyl benzyl phthalate	EPA 8270M-SIM	1	1	46	2	0.95	< 3
		2	3	46	7	< 0.5	1.2
		3	2	46	4	< 0.5	< 1.5
		4	3	46	7	< 0.5	2.8
		5	0	46	0	< 0.5	< 1.5
Chrysene	EPA 8270M-SIM	1	21	46	46	< 0.01	0.22
		2	25	46	54	< 0.01	0.18
		3	35	46	76	0.01	0.67
		4	33	46	72	< 0.01	2.9
		5	29	46	63	< 0.01	0.38
Di-n-butyl phthalate	EPA 8270M-SIM	1	1	46	2	0.52	< 3
		2	0	46	0	< 0.5	< 0.5
		3	1	46	2	< 0.5	< 1.5
		4	1	46	2	< 0.5	< 2.5
		5	1	46	2	< 0.5	2.7
Di-n-octyl phthalate	EPA 8270M-SIM	1	8	46	17	0.56	2
		2	10	46	22	< 0.5	1.4
		3	14	46	30	< 0.5	2.9
		4	13	46	28	< 0.5	14
		5	15	46	33	< 0.5	< 1.5
Dibenzo(a,h)anthracene	EPA 8270M-SIM	1	7	46	15	< 0.01	0.042
		2	9	46	20	< 0.01	0.12
		3	17	46	37	< 0.01	0.12
		4	18	46	39	< 0.01	0.54
		5	13	46	28	0.01	0.068
Diethyl phthalate	EPA 8270M-SIM	1	1	46	2	0.12	< 3
		2	0	46	0	< 0.5	< 0.5
		3	0	46	0	< 0.5	< 1.5
		4	1	46	2	< 0.5	< 2.5
		5	1	46	2	< 0.5	1.9

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration (µg/L)
Dimethyl phthalate	EPA 8270M-SIM	1	0	46	0	< 1	< 3
		2	3	46	7	< 0.5	1.6
		3	0	46	0	< 0.5	< 1.5
		4	0	46	0	< 0.5	< 2.5
		5	1	46	2	< 0.5	< 1.5
Fluoranthene	EPA 8270M-SIM	1	31	46	67	< 0.01	0.36
		2	39	46	85	< 0.01	0.38
		3	44	46	96	< 0.01	1.4
		4	44	46	96	0.01	7.1
		5	37	46	80	< 0.01	1
Fluorene	EPA 8270M-SIM	1	1	46	2	< 0.02	< 0.06
		2	3	46	7	< 0.02	0.025
		3	12	46	26	< 0.02	0.062
		4	14	46	30	< 0.02	0.24
		5	4	46	9	< 0.02	< 0.06
Indeno(1,2,3-cd)pyrene	EPA 8270M-SIM	1	19	46	41	< 0.01	0.13
		2	23	46	50	< 0.01	0.11
		3	32	46	70	< 0.01	0.48
		4	29	46	63	< 0.01	2
		5	25	46	54	< 0.01	0.28
Naphthalene	EPA 8270M-SIM	1	14	46	30	< 0.04	1.2
		2	20	46	43	< 0.04	0.15
		3	40	46	87	< 0.04	0.45
		4	19	46	41	< 0.04	0.24
		5	19	46	41	< 0.04	0.18
Phenanthrene	EPA 8270M-SIM	1	25	46	54	< 0.02	0.22
		2	34	46	74	< 0.02	0.2
		3	45	46	98	< 0.02	0.58
		4	40	46	87	< 0.02	3
		5	37	46	80	< 0.02	0.44
Pyrene	EPA 8270M-SIM	1	34	46	74	< 0.01	0.46
		2	39	46	85	< 0.01	0.44
		3	45	46	98	< 0.01	1.2
		4	44	46	96	< 0.01	5.4
		5	41	46	89	< 0.01	0.71

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event for Panel 1, Panel 6, Supplemental Panel 5, and the carry over locations. It does not include the results of duplicate samples or laboratory reanalyses.

[2] Concentrations reported with a minimum and maximum concentration range of <x to <y may indicate all concentrations were below MRLs or may indicate a concentration is below the maximum MRL. See Appendix D, Table D-3, for actual values.

[3] "<" Indicates laboratory reporting limit.

Table 4-4: Summary of Total and Dissolved Metal Results - Year 6

Metal	MADL (µg/L)	Traffic Category (TPD)	Number of Samples	Number of Detections	Average[1] (µg/L)	Geometric Mean[1] (µg/L)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Ratio of Dissolved Average/Total Average
Common Pollutants									
Arsenic (total)	10	<1000	115	115	0.38	0.28	0.054	2.15	NA
	10	≥1000	115	115	0.44	0.33	0.046	2.48	
Cadmium (total)	5	<1000	115	24	0.11	0.11	< 0.1	0.466	NA
	5	≥1000	115	49	0.15	0.13	< 0.1	1	
Chromium (total)	100	<1000	115	89	1.00	0.78	< 0.4	7.36	NA
	100	≥1000	115	109	2.45	1.55	< 0.4	32.1	
Copper (total)	1300	<1000	115	115	5.64	4.67	1.08	33.9	
	1300	≥1000	115	115	12.22	8.58	1.15	108	<1000 39%
Copper (dissolved)	NA	<1000	115	115	2.21	1.80	0.374	8.9	≥1000 25%
	NA	≥1000	115	115	3.08	2.45	0.365	11.8	
Lead (total)	50	<1000	115	115	4.27	2.56	0.25	76.5	
	50	≥1000	115	115	9.52	5.08	0.26	148	<1000 5%
Lead (dissolved)	NA	<1000	115	60	0.22	0.15	< 0.1	1.64	≥1000 3%
	NA	≥1000	115	84	0.28	0.21	< 0.1	1.64	
Zinc (total)	5000	<1000	115	115	32.96	23.93	4.06	265	
	5000	≥1000	115	115	69.05	48.00	5.13	452	<1000 42%
Zinc (dissolved)	NA	<1000	115	115	13.90	10.83	1.7	50.6	≥1000 33%
	NA	≥1000	115	115	22.47	16.77	3.24	141	
Priority Pollutant Screen									
Mercury (dissolved)	NA	<1000	115	83	0.00	0.00	< 0.001	0.009	NA
	NA	≥1000	115	89	0.00	0.00	< 0.001	0.007	

Notes:

[1] All data were used in calculation of the mean and geometric mean. No outliers were omitted. Values reported at <MRL were included at 50% of the MRL for estimation of the mean and geometric mean. Duplicate sample results were not included.

Table 4-5: Summary of Total Suspended Solids (TSS) Results[1] - Year 6

		Total mg/L			
	Number of Samples	**Average**	**Geometric Mean**	**Minimum Concentration**	**Maximum Concentration**
<1,000 Trips per Day					
TSS	115	24.37	14.32	2	279
≥1,000 Trips per Day					
TSS	115	63.30	32.34	4	1100

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 6, Supplemental Panel 5, and the carry over locations. This table does not include the results of duplicate samples or laboratory reanalyses.

Table 4-6: Field Parameter Summary Statistics[1] - Year 6

Field Parameter	Units	Event	Number of Samples	Mean	Geometric Mean	Minimum	Maximum
Conductivity - specific	umhos/cm	1	46	33	28.2	10	100
		2	46	19.2	16.2	5	60
		3	46	16.8	14	5	60
		4	46	23	19.9	7	62
		5	46	20	17.2	5	52
pH	Units	1	46	6.5	6.5	5.4	7.2
		2	46	6.6	6.6	5.5	7.6
		3	46	6.6	6.6	5.9	7.3
		4	44	6.4	6.4	5.3	8.1
		5	46	6.5	6.4	5.6	9.1
Temperature	°C	1	46	13.2	12.7	7.9	17.9
		2	46	7.6	7.5	4.3	9.3
		3	46	6.2	5.6	2.9	11.7
		4	46	8.6	8.4	5.2	11.5
		5	46	10.6	10.5	7.2	13

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 6, Supplemental Panel 5, and the carry over locations. This table does not include the results of duplicate samples or laboratory reanalyses.

Table 4-7: Summary of UICs with Concentrations Exceeding 50 Percent of the MADL[1] - Year 6

Analyte	Location Code	Traffic Category (TPD)	MADL (µg/L)	Event Concentration (µg/L) 1	2	3	4	5
Benzo(a)pyrene	P1_10	≥1000	0.2	0.038	0.015	0.018	0.18	0.029
	P1_4	<1000		0.028	0.028	0.086	0.1	0.13
	P5_5	<1000		0.078	0.1	**0.52** [2]	**2.6**	**0.34**
	P6_1	≥1000		0.016	0.041	**0.2**	**0.89**	0.025
	P6_11	<1000		<0.01	0.14	0.021	<0.01	0.035
	P6_2	≥1000		<0.01	<0.01	0.094	**0.23**	0.036
	SP4_10	≥1000		0.017	0.052	0.061	0.13	0.059
	SP5_10	≥1000		0.16	0.15	0.12	0.16	0.19, 0.14[3]
	SP5_2	≥1000		0.03	0.02	0.038	0.18	0.06
	SP5_9	≥1000		0.086	0.059	0.12	0.038	0.025
Di(2-ethylhexyl) phthalate	P1_10	≥1000	6	5.1	2.5	3.1	**65**	**6.7**
	P1_12	≥1000		3.7	1.4	3.4	3.3	4.1
	P1_5	≥1000		1.6	1.1	3.3	1.8	1.8
	P1_7	≥1000		<1	1.5	1.6, 1.4	3.1, 3.3	1.9
	P5_5	<1000		1.1	<0.5	3.6	2.2	2.1
	P6_1	≥1000		3.5	2.7	**12**	**23**	3.2
	P6_10	≥1000		<1	1.6	4.1	3.1	3.8, 3.7
	P6_11	<1000		0.56	3.8	2.8	3.5	2.3
	P6_12	≥1000		1.2	2.2	1.8	4	3.2
	P6_14	≥1000		2.7	2.8	3.5	4.6	3
	P6_15	≥1000		0.89	1.5	2.3	5.2	<0.5
	P6_2	≥1000		<1	1.7	**18**	**28**	3.6
	P6_5	≥1000		3.1	3.3	**10**	**6.3**	2.6
	P6_7	<1000		0.89	2.6	3.5	3.1	2.3
	P6_8	<1000		1.3	2	5.1	5.1	**9.1**
	SP4_10	≥1000		3.7	4.4	4.3	**8.1**	3.9
	SP4_2	≥1000		3.1	5.5	4.9	4.3	3.4
	SP4_3	≥1000		0.8	0.87	2.7, 2.2	5.6	2.4, 2
	SP4_4	<1000		0.78	<0.5	1.3	4.7	1.3
	SP5_10	≥1000		**8.1**	**14**	4.5	**7.3**	4.8, 4.6
	SP5_2	≥1000		3.3	2	3.8	**11**	3.8
	SP5_3	<1000		1.8, 2	0.87	1.4	1.8	4.8
	SP5_7	≥1000		1.9	1.4, 1.2	1.6	3.9	2
	SP5_9	≥1000		**6.4**	5.2	**9.1**	5.9	**7.9**
Lead (total)	P6_1	≥1000	50	7.16	17.1	**54.5**	**148**	8.63
	P6_11	<1000		4.64	**76.5**	8.77	4.3	7.27
	P6_2	≥1000		1.5	3.36	39.8	**103**	9.15
	P6_5	≥1000		15.2	19.2	29.8	22.5	13.2
	SP5_2	≥1000		7.87	3.59	5.44	31.3	10.5

(cont.)

	P1_1	<1000		**1.27**	**1.55**	0.476	0.764	0.818
	P1_10	≥1000		**1.4**	**2.23**	**2.92**	**1.19**	**1.64**
	P1_5	≥1000		0.424	0.541	0.582	0.391	0.317
	P1_8	<1000		0.336	0.583, 0.571	0.365	0.234	0.413
	P5_15	≥1000		**1.21**	**3.23**	**3.25**	**1.63**	**2.73**
	P5_5	<1000		0.633	0.601	0.164	0.126	0.165
	P6_1	≥1000		**1.09**	**1.19**	0.754	0.982	**1.36**
	P6_12	≥1000		0.424	0.541	0.215	0.283	0.209
	P6_14	≥1000		0.789	**2.36**	0.701	0.634	0.568
	P6_15	≥1000		0.254	0.43	<0.02	0.547	0.346
	P6_2	≥1000		0.712	0.357	0.135	0.0463	0.245
	P6_3	≥1000		0.152, 0.0597	0.0249	0.0438, <0.04	<0.02	0.675
Pentachlorophenol	P6_4	<1000	1	0.245	0.377	0.685	0.42	0.452
	P6_7	<1000		0.814	**1.2**	**1.08**	0.455	0.856
	SP4_10	≥1000		**3.28**	**2.29**	**1.03**	**1.16**	**2.99**
	SP4_2	≥1000		**3.29**	**2.64**	**2.46**	**1.89**	**1.27**
	SP4_3	≥1000		0.465	**1.16**	0.407, 0.465	0.899	0.561, 0.49
	SP4_4	<1000		0.907	0.506	0.803	0.464	0.451
	SP5_10	≥1000		0.782	**1.53**	0.907	0.568	**1.78, 1.59**
	SP5_2	≥1000		**2.4**	**1.56**	**1.53**	**1.47**	**1**
	SP5_4	<1000		0.151, 0.148	0.132	0.0603	0.0431	0.989
	SP5_5	<1000		0.877	**1.98**	**1.28**	0.931	0.0291
	SP5_6	<1000		0.42	0.749	0.569	0.391	0.332, 0.35
	SP5_7	≥1000		0.599	**1.26, 1.33**	0.907	0.445	0.0863
	SP5_9	≥1000		**5.23**	**1.28**	**1.03**	**1.45**	**1.21**

Notes:

[1] This table summarizes those UIC locations where at least one concentration ≥ 50 percent of the MADL.

[2] Bolded numbers exceed the MADL.

[3] Duplicate samples reported as: sample concentration, duplicate concentration.

Table 4-8: Priority Pollutant Screen Analyte Action Levels

Annual Mean Concentration Action Level	Compliance Response Action
≤ 50 % MADL	No further action. Return to PPS sampling frequency specified in the permit.
> 50 % MADL, but < MADL	Continue monitoring UIC at frequency of 5 sampling events per wet season, or request permit modification to return to normal PPS sampling frequency specified in permit
≥ MADL	Implement compliance response in accordance with permit

Table 4-9: Year 6 Annual Mean Concentrations - Common Pollutants[1]

Analyte	MADL (µg/L)	Location Code	Traffic Category (TPD)	Number of Events	Event Concentration (µg/L) Average (µg/L)	Geometric Mean (µg/L)	Minimum[2] (µg/L)	Maximum (µg/L)
Benzo(a)pyrene	0.2	P1_10	≥1000	5	0.056	0.035	0.015	0.18
		P1_4	<1000	5	0.074	0.061	0.028	0.13
		P5_5	<1000	5	**0.728** [3]	**0.324**	0.078	**2.6**
		P6_1	≥1000	5	**0.234**	0.078	0.016	**0.89**
		P6_11	<1000	5	0.043	0.025	< 0.01	0.14
		P6_2	≥1000	5	0.076	0.038	< 0.01	**0.23**
		SP4_10	≥1000	5	0.064	0.053	0.017	0.13
		SP5_10	≥1000	5	0.156	0.154	0.12	0.19
		SP5_2	≥1000	5	0.066	0.048	0.02	0.18
		SP5_9	≥1000	5	0.066	0.057	0.025	0.12
Di(2-ethylhexyl) phthalate	6	P1_10	≥1000	5	**16.48**	**7.034**	2.5	**65**
		P1_12	≥1000	5	3.18	2.988	1.4	4.1
		P1_5	≥1000	5	1.92	1.799	1.1	3.3
		P1_7	≥1000	5	1.82	1.698	< 1	3.1
		P5_5	<1000	5	1.9	1.557	< 0.5	3.6
		P6_1	≥1000	5	**8.88**	**6.086**	2.7	**23**
		P6_10	≥1000	5	2.72	2.386	< 1	4.1
		P6_11	<1000	5	2.592	2.169	0.56	3.8
		P6_12	≥1000	5	2.48	2.274	1.2	4
		P6_14	≥1000	5	3.32	3.255	2.7	4.6
		P6_15	≥1000	5	2.078	1.515	< 0.5	5.2
		P6_2	≥1000	5	**10.46**	4.987	< 1	**28**
		P6_5	≥1000	5	5.06	4.414	2.6	**10**
		P6_7	<1000	5	2.478	2.251	0.89	3.5
		P6_8	<1000	5	4.52	3.613	1.3	**9.1**
		SP4_10	≥1000	5	4.88	4.666	3.7	**8.1**
		SP4_2	≥1000	5	4.24	4.144	3.1	5.5
		SP4_3	≥1000	5	2.474	1.908	0.8	5.6
		SP4_4	<1000	5	1.716	1.254	< 0.5	4.7
		SP5_10	≥1000	5	**7.74**	**7.087**	4.5	**14**
		SP5_2	≥1000	5	4.78	4.019	2	**11**
		SP5_3	<1000	5	2.134	1.801	0.87	4.8
		SP5_7	≥1000	5	2.16	2.015	1.4	3.9
		SP5_9	≥1000	5	**6.9**	**6.76**	5.2	**9.1**
Lead (total)	50	P6_1	≥1000	5	47.078	24.329	7.16	**148**
		P6_11	<1000	5	20.296	9.946	4.3	**76.5**
		P6_2	≥1000	5	31.362	11.358	1.5	**103**
		P6_5	≥1000	5	19.98	19.161	13.2	29.8
		SP5_2	≥1000	5	11.74	8.723	3.59	31.3

(cont.)

Analyte	MADL (µg/L)	Location Code	Traffic Category (TPD)	Number of Events	Event Concentration (µg/L)			
					Average (µg/L)	Geometric Mean (µg/L)	Minimum[2] (µg/L)	Maximum (µg/L)
Pentachlorophenol	1	P1_1	<1000	5	0.976	0.898	0.476	**1.55**
		P1_10	≥1000	5	**1.876**	**1.778**	**1.19**	**2.92**
		P1_5	≥1000	5	0.451	0.44	0.317	0.582
		P1_8	<1000	5	0.386	0.37	0.234	0.583
		P5_15	≥1000	5	**2.41**	**2.241**	**1.21**	**3.25**
		P5_5	<1000	5	0.338	0.265	0.126	0.633
		P6_1	≥1000	5	**1.075**	**1.055**	0.754	**1.36**
		P6_12	≥1000	5	0.334	0.311	0.209	0.541
		P6_14	≥1000	5	**1.01**	0.86	0.568	**2.36**
		P6_15	≥1000	5	0.319	0.211	< 0.02	0.547
		P6_2	≥1000	5	0.299	0.208	0.0463	0.712
		P6_3	≥1000	5	0.165	0.061	< 0.02	0.675
		P6_4	<1000	5	0.436	0.413	0.245	0.685
		P6_7	<1000	5	0.881	0.837	0.455	**1.2**
		SP4_10	≥1000	5	**2.15**	**1.931**	**1.03**	**3.28**
		SP4_2	≥1000	5	**2.31**	**2.198**	**1.27**	**3.29**
		SP4_3	≥1000	5	0.698	0.644	0.407	**1.16**
		SP4_4	<1000	5	0.626	0.599	0.451	0.907
		SP5_10	≥1000	5	**1.113**	**1.019**	0.568	**1.78**
		SP5_2	≥1000	5	**1.592**	**1.531**	**1**	**2.4**
		SP5_4	<1000	5	0.275	0.139	0.0431	0.989
		SP5_5	<1000	5	**1.019**	0.57	0.0291	**1.98**
		SP5_6	<1000	5	0.492	0.471	0.332	0.749
		SP5_7	≥1000	5	0.659	0.483	0.0863	**1.26**
		SP5_9	≥1000	5	**2.04**	**1.646**	**1.03**	**5.23**

Notes:

[1] Table includes only those UIC monitoring locations where the concentration was ≥ 50 percent of the MADL in at least one sample.

[2] Minimum concentrations may be either MRL or MDL values (i.e., < symbol not shown).

[3] Bold, shaded text indicates pollutant concentration geometric mean exceeds the MADL.

Table 7-1: Overall Data Quality Objectives

Compound Class	Precision	Accuracy	Completeness
Volatile Organic Compounds (VOCs)	± 25%	Per method/per analyte	95%
Polynuclear Aromatic Hydrocarbons (PAHs)	± 50%	Per method/per analyte	95%
Semivolatile Organic Compounds (SVOCs)	± 50%	Per method/per analyte	95%
Herbicides/Pesticides	± 30%	± 30%	95%
Total Metals	± 20%	± 25%	95%
Conventionals	± 20%	± 25%	95%

Table 7-2: Laboratory QC Issues for Permit Year 6
UIC WPCF Permit Monitoring

Event	Method	Issue	Affected Samples	Cause	Comments, Actions Taken	Usability
1	8270M-SIM	MS/MSD recoveries for several analytes from four analytical batches outside acceptance limits.	Various	Matrix effects	RPDs generally acceptable, no other QC issues, no action taken.	Usable
	8270M-SIM	Benzo(a)pyrene field duplicate RPD failed <0.01/0.035 ug/l (111%)	SP5_3	Non-homogenous samples, low concentrations	Values < 5x MRL, no action taken	Usable
	8260	Toluene detected in 10/24/2010 trip blank at 0.56 ug/l (< MRL)	P1_3, P6_13	Lab or field contamination	P1_3 (0.58), and P6_13 (2.84); P1_3 value < 5x blank concentration and qualified with "JB" for estimated due to blank contamination	Usable with qualifiers
	8260	Dibromofluoromethane recovery slightly high for sample P1_5	P1_5	Matrix effects	Associated analytes not detected, no other QC issues, no action taken.	Usable
	515.3	For batch 10K0427, Acifluorfen (172%, 174%), Bentazon (145%, 147%), and Picloram (138%, 146%) MS/MSD recoveries above acceptance limits.	None	Matrix effects	RPDs acceptable, no other QC issues, no action taken.	Usable
	515.3	For batch 10K0429, Acifluorfen (158%, 160%, 157%, 174%) MS1/MS2/MSD1/MSD2, Bentazon (132%, 138%) MS1/MSD2, and Picloram (139%) MSD2 recoveries above acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected (except for Picloram slightly above the MDL in one sample), no other QC issues, no action taken	Usable
	515.3	For batch 10K0466, Bentazon (142%, 142%) and Picloram (152%, 160%) MS1/MSD1 recoveries above acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken	Usable
	515.3	For batch 10K0889, Bentazon (137%, 138%, 132%) MS1/MS2/MSD1 results above acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken	Usable
	8270D	DCBP recoveries (170%, 157%, 157%, 170%) above acceptance limits.	SP5_4, P6_15, SP5_2, P6_10	Analytical difficulties	Associated analytes detected, no other QC issues, no action taken.	Usable
	8321B	Diuron field duplicate RPD failed <0.03/0.43 (173.9%)	P6_8	Non-homogenous samples, low concentrations	Detects qualified with "JH" for estimated, probable high bias; non-detects qualified with "UJ" for reporting limit may be inaccurate or imprecise.	Usable with qualifiers
2	200.8	Arsenic laboratory duplicate RPDs failed 0.1187/0.1050 (12%), 0.1187/0.0942 (23%)	None	Non-homogenous samples, low concentrations	RSD acceptable, no action taken	Usable
	8270M-SIM	Benzo(k)fluoranthene (27%) MSD recovery outside acceptance limits for batch B10L141.	P1_4, P5_5, P6_4, P6_8, SP4_10	Matrix effects	MS recovery and RPD acceptable, no other QC issues, no action taken.	Usable
	8270M-SIM	Acenaphthylene LCS (117%) and MS/MSD recoveries (117%/121%) for batch B10L452 outside acceptance limits	P1_3, P1_9, P1_10, P1_12, P6_3, P6_15, SP5_5, SP5_8, SP5_9, SP5_10	Matrix effects	MS/MSD RPD acceptable. Detects qualified with "JH" estimated, probable high bias.	Usable with qualifiers
	8260	Dibromofluoromethane recoveries slightly high for 11 samples, November 17, 2010	various	Analytical difficulties	All results or associated analytes ND, no action taken.	Usable
	515.3	For batch 10L0355, Bentazon (145%) LCS recovery and MS1/MS2/MSD1/MSD2 (149%, 138%, 151%, 143%) results outside acceptance limits.	None	Analytical difficulties, matrix effects	Analyte not detected, RPDs acceptable, no other QC issues, no action taken.	Usable
	515.3	For batch 10K0883, Bentazon (134%, 137%) MS/MSD results outside acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no action taken	Usable
	515.3	For batch 10L0705, Bentazon (161%, 158%) MS/MSD results outside acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no action taken	Usable
	515.3	For batch 11A0140, Acifluorfen (134%) MSD2, 2,4-DB (42.6%) MS2, and Pentachlorophenol (69.8%, 69.9%) MS1/MSD1 recoveries outside acceptance limits. 2,4-DB RPD failed.	None	Matrix effects	Acifluorfen and pentachlorophenol RPDs acceptable, 2,4-DB not detected, no other QC issues, no action taken.	Usable

Table 7-2: Laboratory QC Issues for Permit Year 6
UIC WPCF Permit Monitoring

Event	Method	Issue	Affected Samples	Cause	Comments, Actions Taken	Usability
3	200.8	Zinc detected in equipment and field decontamination blanks at 0.689 and 0.595 ug/l	None	Field contamination	Blank concentrations slightly above MRL and < 5x sample concentrations, no action taken	Usable
	8270M-SIM	Di(2-ethylhexyl)phthalate detected in laboratory method blank at 0.64 ug/l (< MRL)	P1_4, P1_8, P1_11, P1_12, P1_5, P6_8, P6_15, SP4_4, SP5_2, SP5_4, P1_6, P6_4, and FDBLANK	Lab contamination	P1_4, P1_8, P1_11, P1_12, P1_5, P6_8, P6_15, SP4_4, SP5_2, SP5_4 sample values qualified with “JB” for estimated, sample concentration < 10x blank concentration. P1_6, P6_4, and FDBLANK qualified with “UB” for estimated, blank concentration exceeds sample concentration.	Usable with qualifiers
	8270M-SIM	Di(2-ethylhexyl)phthalate detected in field decontamination blank at 0.60 ug/l (< MRL) for batch B11C002	FDBLANK	Lab contamination	Analyte also detected in laboratory method blank, field blank concentration qualified with “UB” for method blank concentration exceeds sample concentration	Usable with qualifiers
	8270M-SIM	Fluoranthene-d10 recovery (131%) for batch B11B234 method blank failed.	None	Analytical difficulties	No analytes detected, no other QC issues, no action taken.	Usable
	8270M-SIM	Bis(2-ethylhexyl)phthalate LCS (117%) recovery for batch B11B234 outside acceptance limits	P1_1, P1_13, P1_13 DUP, P1_14, P5_5, P6_1, P6_5, P6_12, P6_14, SP4_2, SP4_3, SP_3 DUP, SP4_10, SP5_7, SP5_10	Analytical difficulties	Detects qualified with “JH” estimated, probable high bias.	Usable with qualifiers
	515.3	For batch 11B0679, Bentazon (144%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no other QC issues, no action taken.	Usable
	515.3	For batch 11A0649, Bentazon (169%, 159%) MS1/MSD1 results outside acceptance limits.	None	Matrix effects	RPD acceptable, analytes not detected, no action taken	Usable
	515.3	For batch 11A0484, Bentazon (137%, 136%) MS/MSD results outside acceptance limits.	None	Matrix effects	RPD acceptable, analytes not detected, no action taken	Usable
	515.3	For batch 11B0069, Bentazon (143%, 149%, 138%, 146%) MS1/MS2/MSD1/MSD2 and Pentachlorophenol (66.2%, 67.4%) MS2/MSD2 recoveries outside acceptance limits.	None	Matrix effects	RPDs acceptable, Bentazon not detected, no other QC issues, no action taken.	Usable
	515.3	For batch 11C0093, Bentazon (139%, 139%) MS/MSD results outside acceptance limits.	None	Matrix effects	RPD acceptable, analytes not detected, no action taken	Usable
	515.3	Pentachlorophenol field duplicate RPD failed 0.0463/0.0637 (32%)	P1_7	Non-homogenous samples, low concentrations	Values < 5x MRL, no action taken	Usable
3/4*	515.3	For batch 11C0328, Bentazon (159%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no other QC issues, no action taken.	Usable
	515.3	For batch 11C0328, Acifluorfen (145%, 150%) MS2/MSD2, Bentazon (159%, 162%, 136%, 166%) MS1/MS2/MSD1/MSD2, 2,4-DB (58.1%) MS2, 3,5-Dichlorobenzoic acid (131%) MSD2, Pentachlorophenol (52.1%) MSD1, Picloram (139%, 157%, 160%) MS1/MS2/MSD2 recoveries outside acceptance limits. 2,4-DB RPD failed.	None	Matrix effects	All other RPDs acceptable, no analytes detected other than pentachlorophenol, no other QC issues, no action taken.	Usable
4	200.8	Arsenic, lead and zinc field duplicate RPDs failed 1.31/0.31 (120%), 0.965/2.75 (96%), 7.4/15 (68%)	P1_15	Non-homogenous samples	RPDs also failed for TSS and pentachlorophenol, sample results qualified with "J" for estimated	Usable with qualifiers
	8270M-SIM	Matrix interference affected the internal standard response for sample P1_10 for Benzo(a)anthracene, Chyrsene, Pyrene, Butyl benzyl phthalate, Di-n-octyl phthalate, and Bis(2-ethylhexyl) phthalate.	P1_10	Matrix effects	Results for Benzo(a)anthracene, Chyrsene, Pyrene, Butyl benzyl phthalate, Di-n-octyl phthalate, and Bis(2-ethylhexyl) phthalate were qualified with “J” for estimated.	Usable with qualifiers
	515.3	For batch 11C0374, Bentazon (139%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no other QC issues, no action taken.	Usable

Table 7-2: Laboratory QC Issues for Permit Year 6
UIC WPCF Permit Monitoring

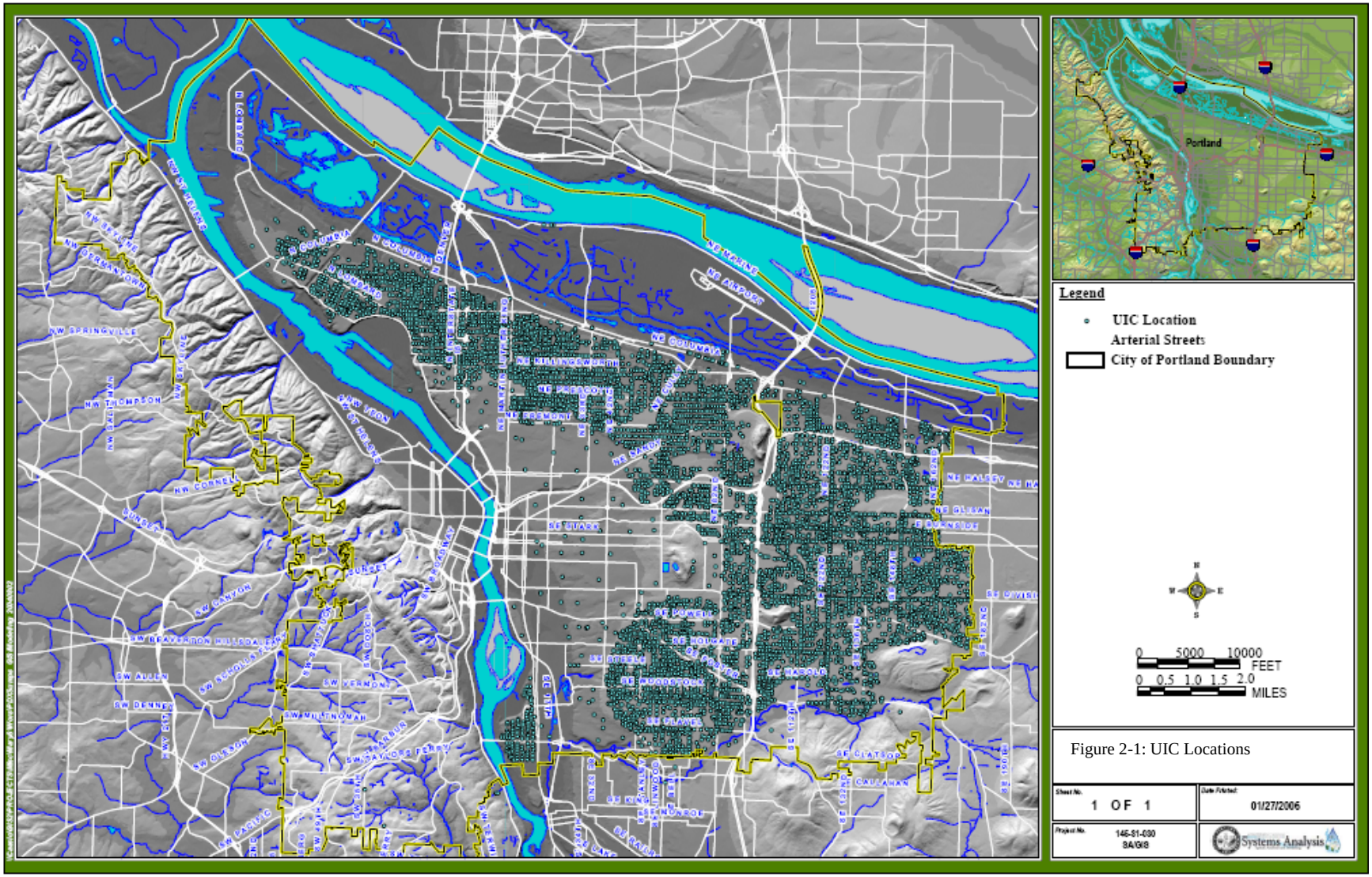
Event	Method	Issue	Affected Samples	Cause	Comments, Actions Taken	Usability
4 (cont.)	515.3	For batch 11C0747, Bentazon (134%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no other QC issues, no action taken.	Usable
	515.3	For batch 11D0141, Bentazon (136%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no other QC issues, no action taken.	Usable
	515.3	For batch 11C0374, Bentazon (143%, 136%) MS/MSD, Dinoseb (68.7%) MSD, Pentachlorophenol (65.4%, 221%) MS/MSD, 2,4,5-TP (63.6%) MSD recoveries outside acceptance limits. Pentachlorophenol RPD failed.	None	Matrix effects	All other RPDs acceptable, no analytes detected other than pentachlorophenol, no other QC issues, no action taken.	Usable
	515.3	For batch 11C0744, Acifluorfen (58.6%, 52.5%) MS1/MSD1, Dinoseb (66.9%) MSD1, Pentachlorophenol (59.4%, 55.2%) MS1/MSD1, 2,4,5-TP (67.3%) MSD1 recoveries outside acceptance limits.	None	Matrix effects	RPDs acceptable, no analytes detected other than pentachlorophenol, no other QC issues, no action taken.	Usable
	515.3	For batch 11C0747, Acifluorfen (135%, 137%) and Bentazon (160%, 162%) MS/MSD results outside acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no action taken.	Usable
	515.3	For batch 11C0799, Acifluorfen (69.1%, 145%, 69.8%, 151%) MS1/MS2/MSD1/MSD2, Bentazon (145%, 181%, 143%, 187%) MS1/MS2/MSD1/MSD2, 2,4-D (132%, 135%) MS2/MSD2, Pentachlorophenol (53.9%, 58.2%) MS1/MSD1, Picloram (133%, 134%) MS2/MSD2, 2,4,5-TP (69.0%) MS1 recoveries outside acceptance limits.	None	Matrix effects	RPDs acceptable, no analytes detected other than pentachlorophenol, no other QC issues, no action taken.	Usable
	515.3	For batch 11D0141, Acifluorfen (138%, 141%, 140%, 138%) and Bentazon (168%, 162%, 162%, 170%) MS1/MS2/MSD1/MSD2 results outside acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no action taken.	Usable
	515.3	Pentachlorophenol field duplicate RPD failed < 0.02/0.0888 (130%)	P1_15	Non-homogenous samples, low concentrations	Values < 5x MRL, no action taken	Usable
4/5*	515.3	For batch 10C0583, Pentachlorophenol (65.8%, 64.4%, 62.1%, 64.8%) MS1/MS2/MSD1/MSD2 results outside acceptance limits.		Matrix effects	RPDs acceptable, no other QC issues, no action taken.	Usable
5	200.8	Copper and dissolved copper detected in field decontamination blanks at 0.547 and 0.221 ug/l	None	Field contamination	Blank concentrations < 5x sample concentrations, no action taken [note some concentrations were < 5x the blank concentration; however, these samples were collected the same day as the Event 4 field blank (Event 4 and 5 overlapped) which was non-detect for total and dissolved copper]	Usable
	200.8	Lead laboratory duplicate RPD failed 29.4/16.8 (55%)	None	Non-homogenous samples	Duplicate source sample from different project, no other QC issues, no action taken	Usable
	515.3	Dicamba detected in laboratory method blank at 0.0596 ug/l	None	Field contamination	Analyte not detected in associated samples, no action taken	Usable
	515.3	For batch 11D0101, Bentazon (135%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no action taken.	Usable
	515.3	For batch 11D0506, Bentazon (131%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no action taken.	Usable
	515.3	For batch 11D0733, Bentazon (136%) LCS recovery outside acceptance limits (calibration verification recovery also outside acceptance limits).	None	Analytical difficulties	Analyte not detected, no action taken.	Usable
	515.3	For batch 11D0101, Bentazon (145%, 138%) MS/MSD recoveries above acceptance limits (calibration verification recovery also outside acceptance limits).	None	Matrix effects	RPD acceptable, analyte not detected, no action taken.	Usable

Table 7-2: Laboratory QC Issues for Permit Year 6
UIC WPCF Permit Monitoring

Event	Method	Issue	Affected Samples	Cause	Comments, Actions Taken	Usability
5 (cont.)	515.3	For batch 11D0506, Acifluorfen (161%, 144%) MS/MSD, Bentazon (171%, 158%) MS/MSD, 2,4-D (136%) MS, 2,4,-DB (151%, 139%) MS/MSD, Pentachlorophenol (60.5%) MSD, Picloram (138%) MS recoveries outside acceptance limits.	None	Matrix effects	RPDs acceptable, no analytes detected other than 2,4-D and pentachlorophenol, no other QC issues, no action taken.	Usable
	515.3	For batch 11D0733, Bentazon (165%, 165%) MS2/MSD2 results outside acceptance limits.	None	Matrix effects	RPD acceptable, analyte not detected, no action taken.	Usable
	515.3	For batch 11E0162, Acifluorfen (150%, 146%), Bentazon (161%, 161%), 2,4-DB (138%, 136%), and Picloram (134%, 135%), MS/MSD results outside acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
	515.3	For batch 11E0460, Acifluorfen (131%, 135%), Bentazon (192%, 186%), 2,4-D (188%, 179%), 2,4,-DB (151%, 153%), 3,5-Dichlorobenzoic acid (144%, 141%), Dichlorprop (140%, 135%) Picloram (162%, 156%) MS/MSD recoveries outside acceptance limits.	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
	515.3	2,4-D field duplicate RPDs failed < 0.02/0.115 (140%), 0.143/< 0.02 (150%)	SP5_6, SP5_10	Non-homogenous samples, low concentrations	Detects qualified with “JH” for estimated, probable high bias; non-detects qualified with “UJ” for reporting limit may be inaccurate or imprecise	Usable with qualifiers

Notes: * = Some samples from separate Events analyzed as part of the same analytical batches by TA
Batch numbers are included in Laboratory Reports presented in Appendix E of the*Annual Stormwater Discharge Monitoring Report – Year 6*, July 2011.
DUP = field duplicate
MRL = method reporting limit
MS/MSD = matrix spike/matrix spike duplicate
ND = not detected
QC = quality control
RPD = relative percent difference
RSD = relative standard deviation

Figure 2-1: City of Portland UIC Locations



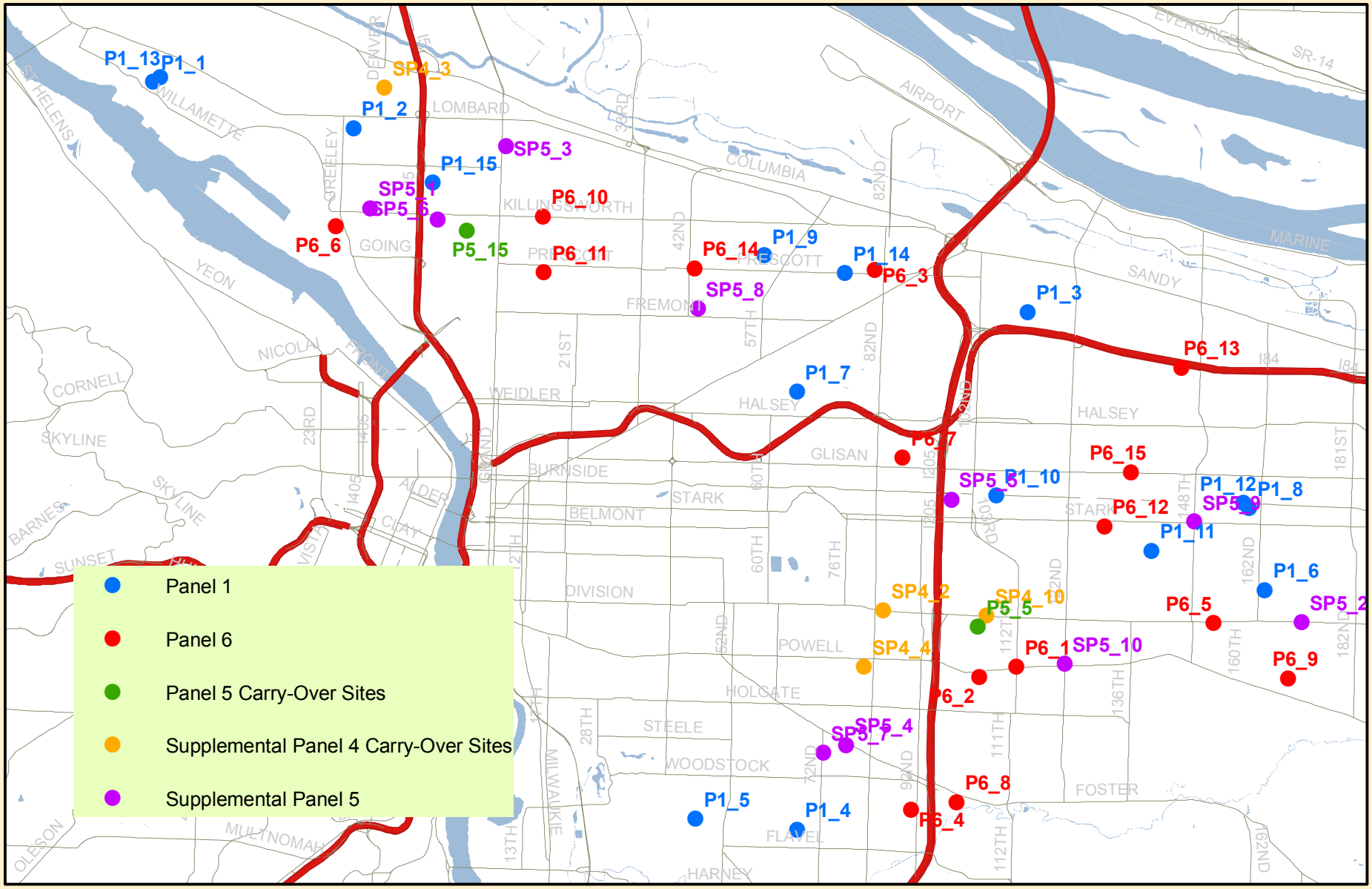


Figure 2-2
2010-11 (Year 6) UIC Monitoring Locations

Investigations & Monitoring Services
Bureau of Environmental Services

Source: ESRI Data & Maps CD
Created in ArcGIS 9.3.1 using ArcMap

Figure 3-1: Year 6 Event 1 Rain Gage Data

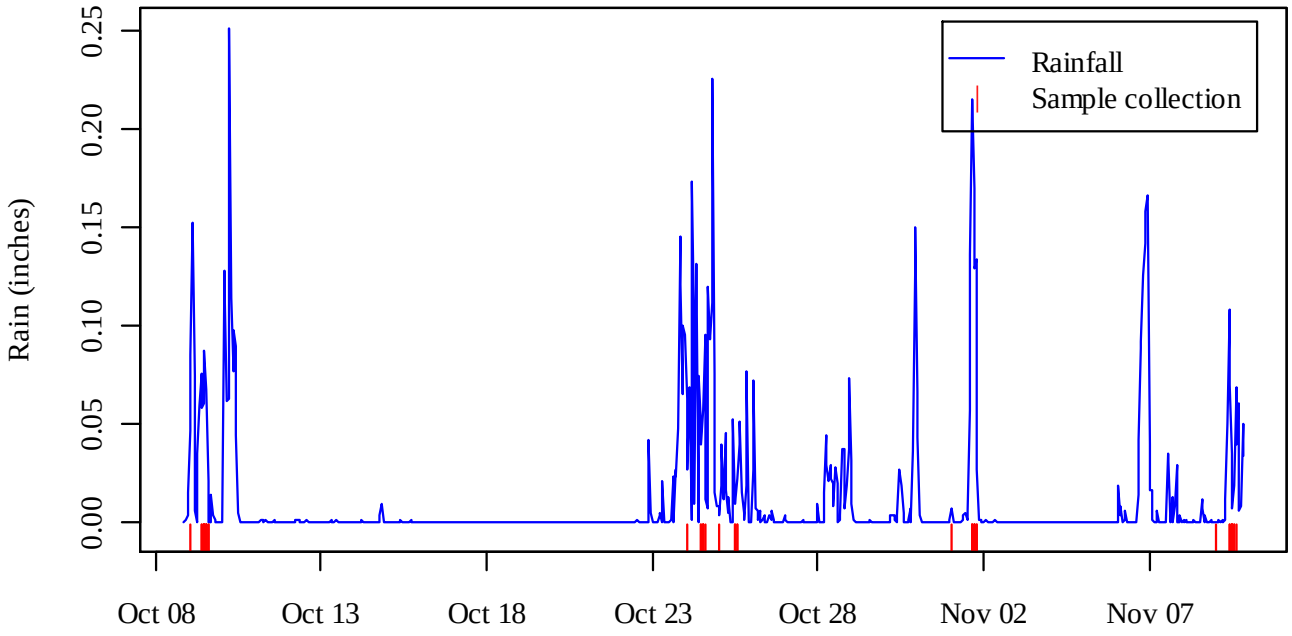


Figure 3-2: Year 6 Event 2 Rain Gage Data

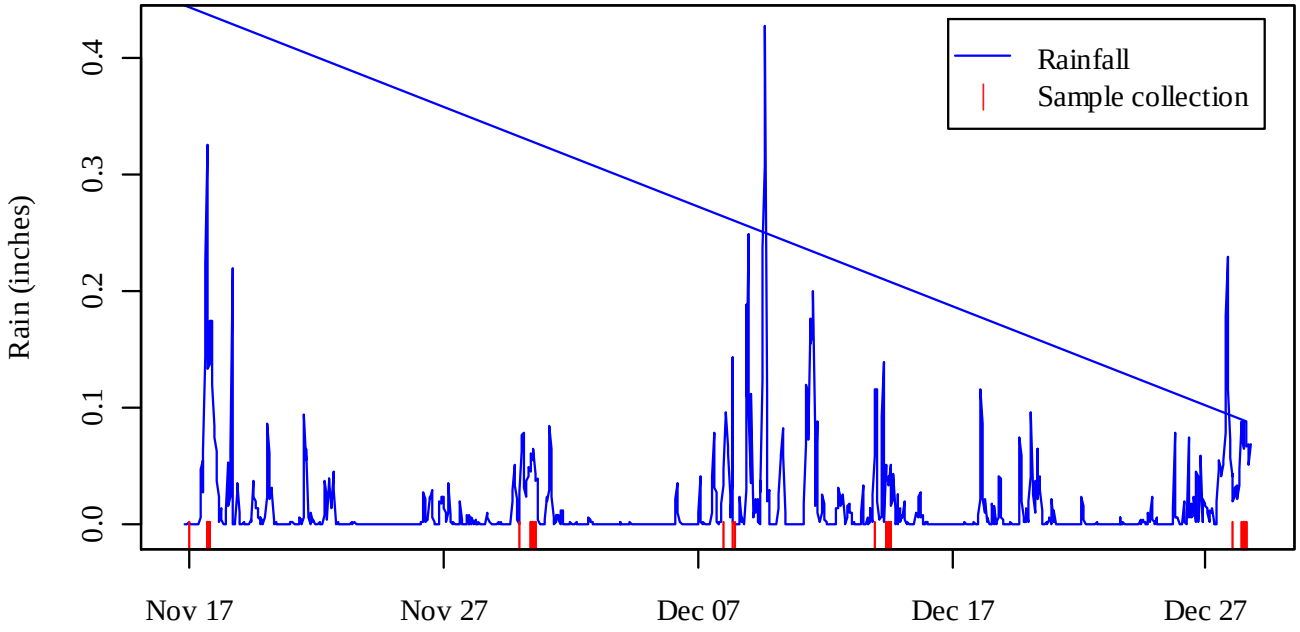


Figure 3-3: Year 6 Event 3 Rain Gage Data

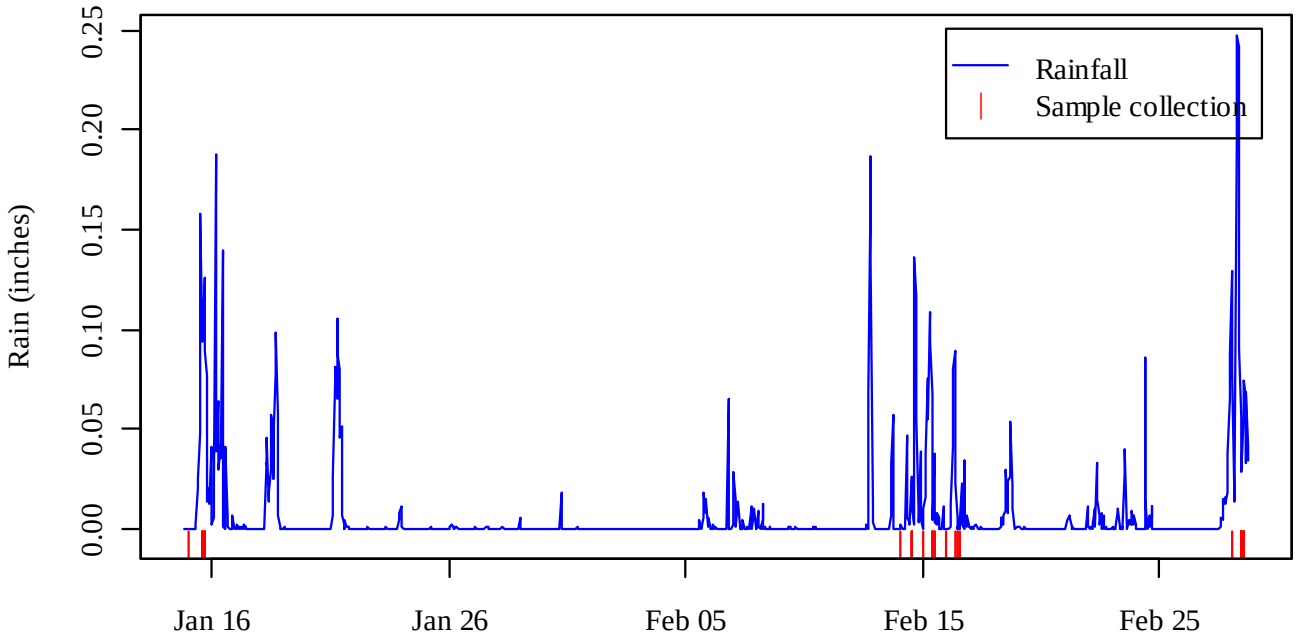


Figure 3-4: Year 6 Event 4 Rain Gage Data

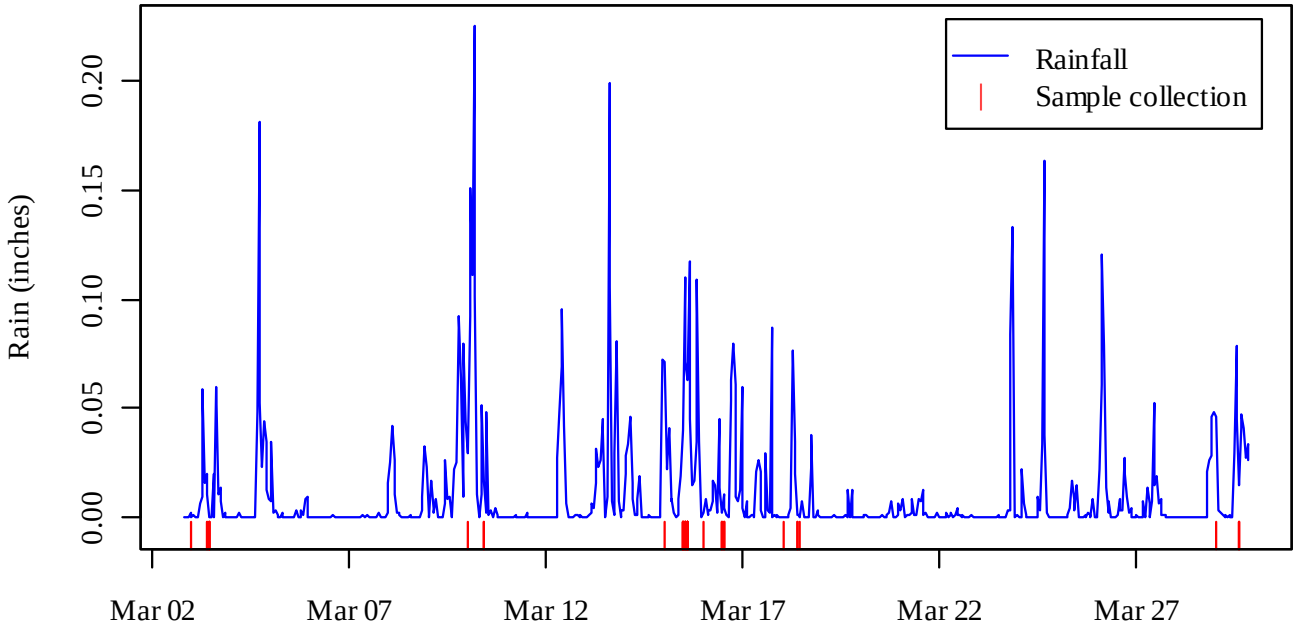


Figure 3-5: Year 6 Event 5 Rain Gage Data

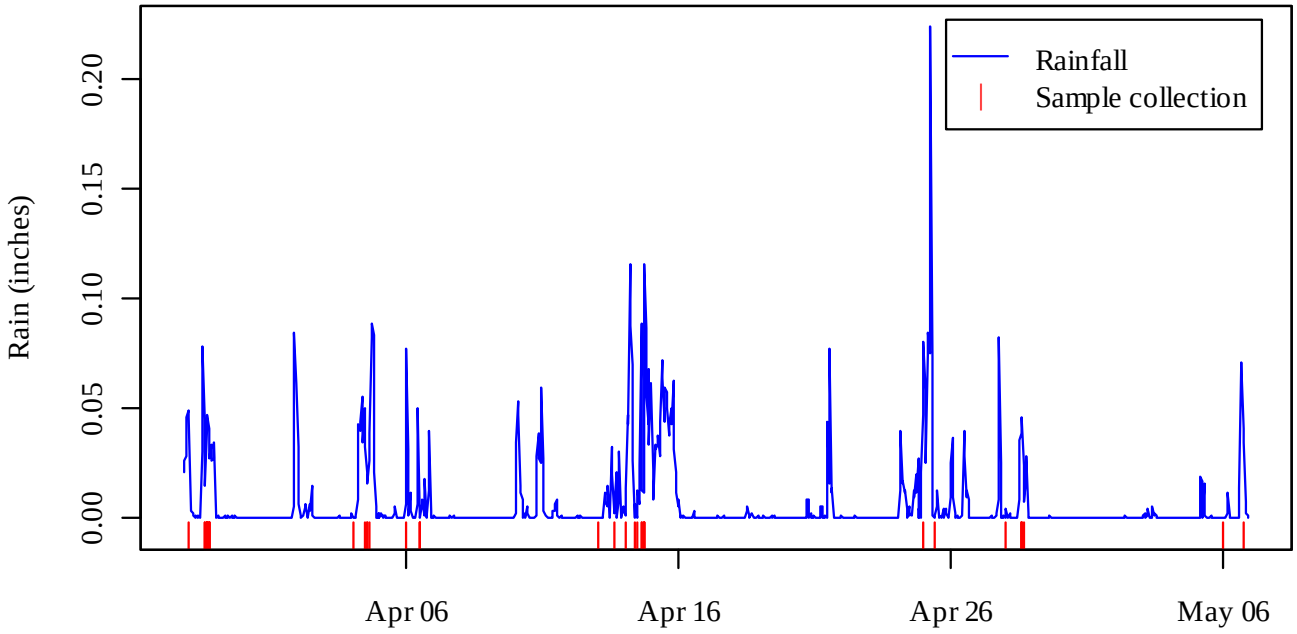
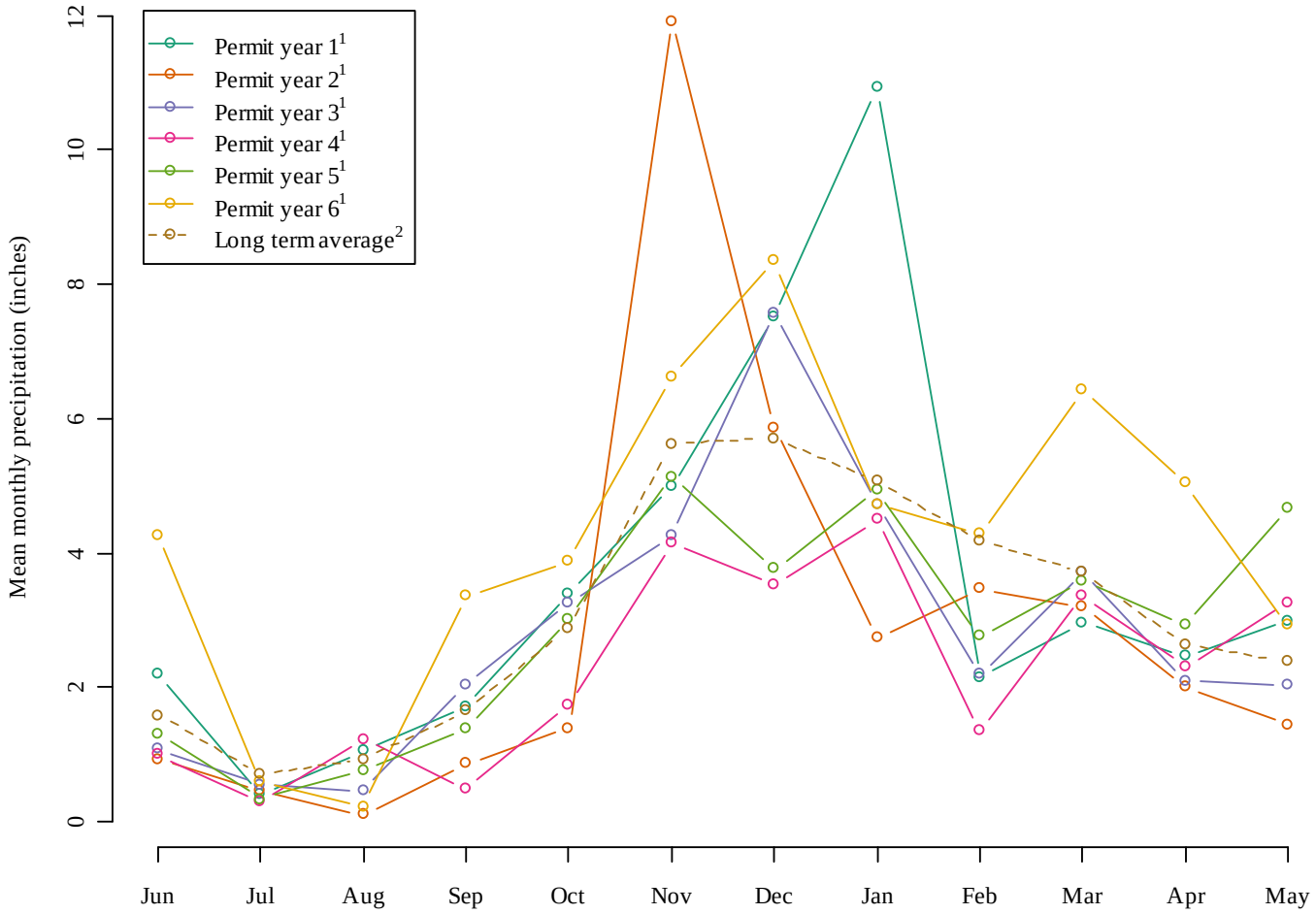


Figure 3-6: Regional Precipitation Data



1) Data source: Local Climatological Data - Portland Oregon.
From http://www.weather.gov/climate/index.php?wfo=pqr
2) Data source: Portland International Airport. Period 1971 - 2000.
From NOWData - NOAA Online Weather Data at http://nowdata.rcc-acis.org/PQR/pubACIS results

Figure 4-1: Definition of a Box Plot

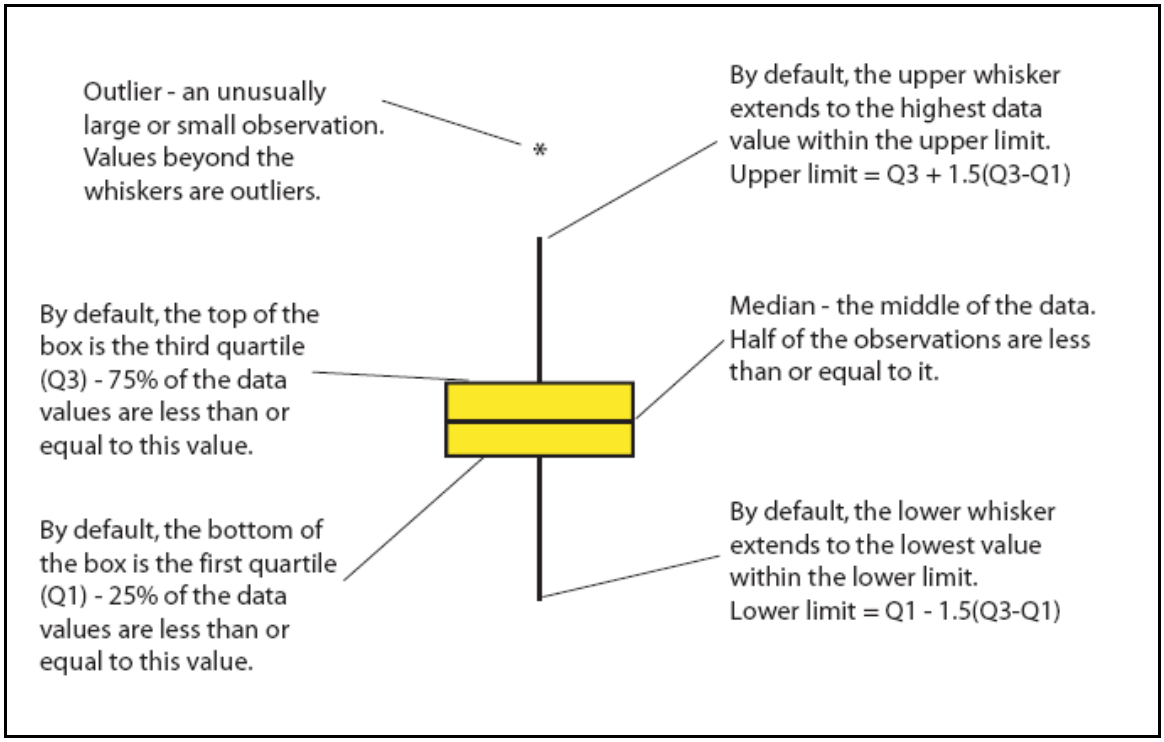
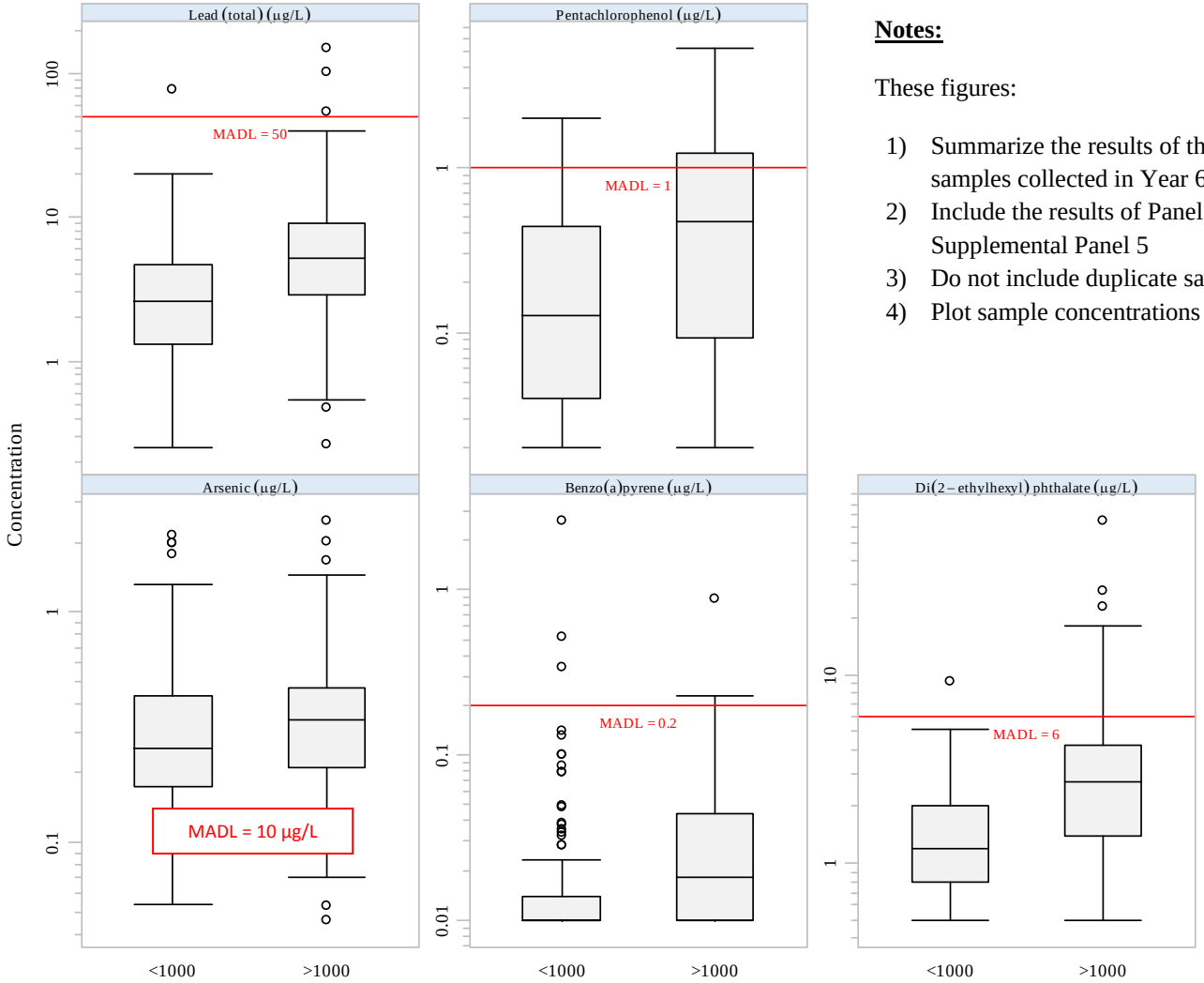


Figure note:
From Minitab®, version 14, 2006

Figure 4-2: Year 6 Pollutant Concentrations by Traffic Category



Notes:

These figures:

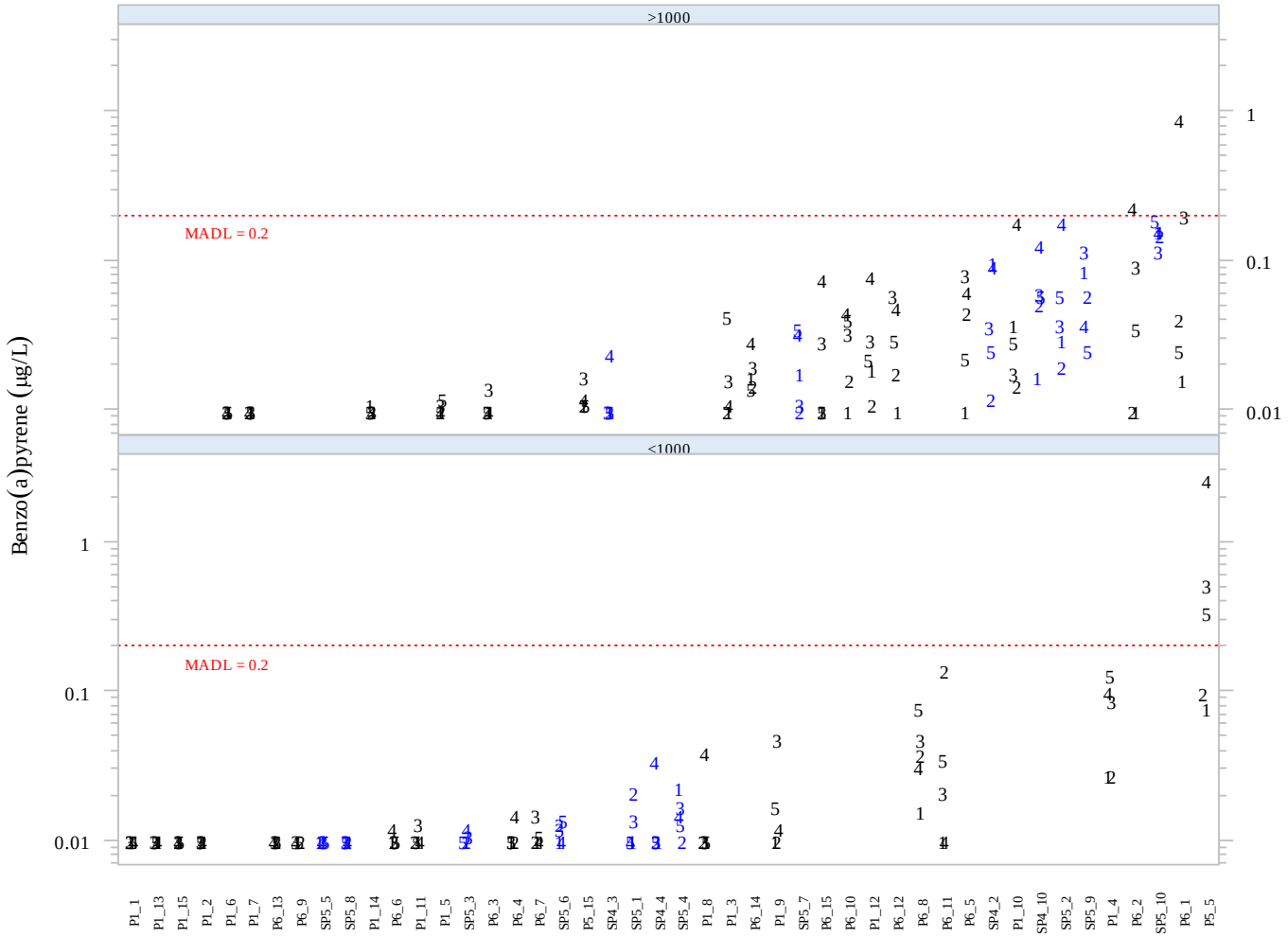
1) Summarize the results of the original UIC stormwater samples collected in Year 6
2) Include the results of Panel 1, Panel 6, and Supplemental Panel 5
3) Do not include duplicate sampling results
4) Plot sample concentrations <MRL at the MRL

Figure 4-3: Year 6 Arsenic Concentrations by Sampling Event and Traffic Category

Notes:

#(1, 2, 3, 4, 5) indicates Year 6 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

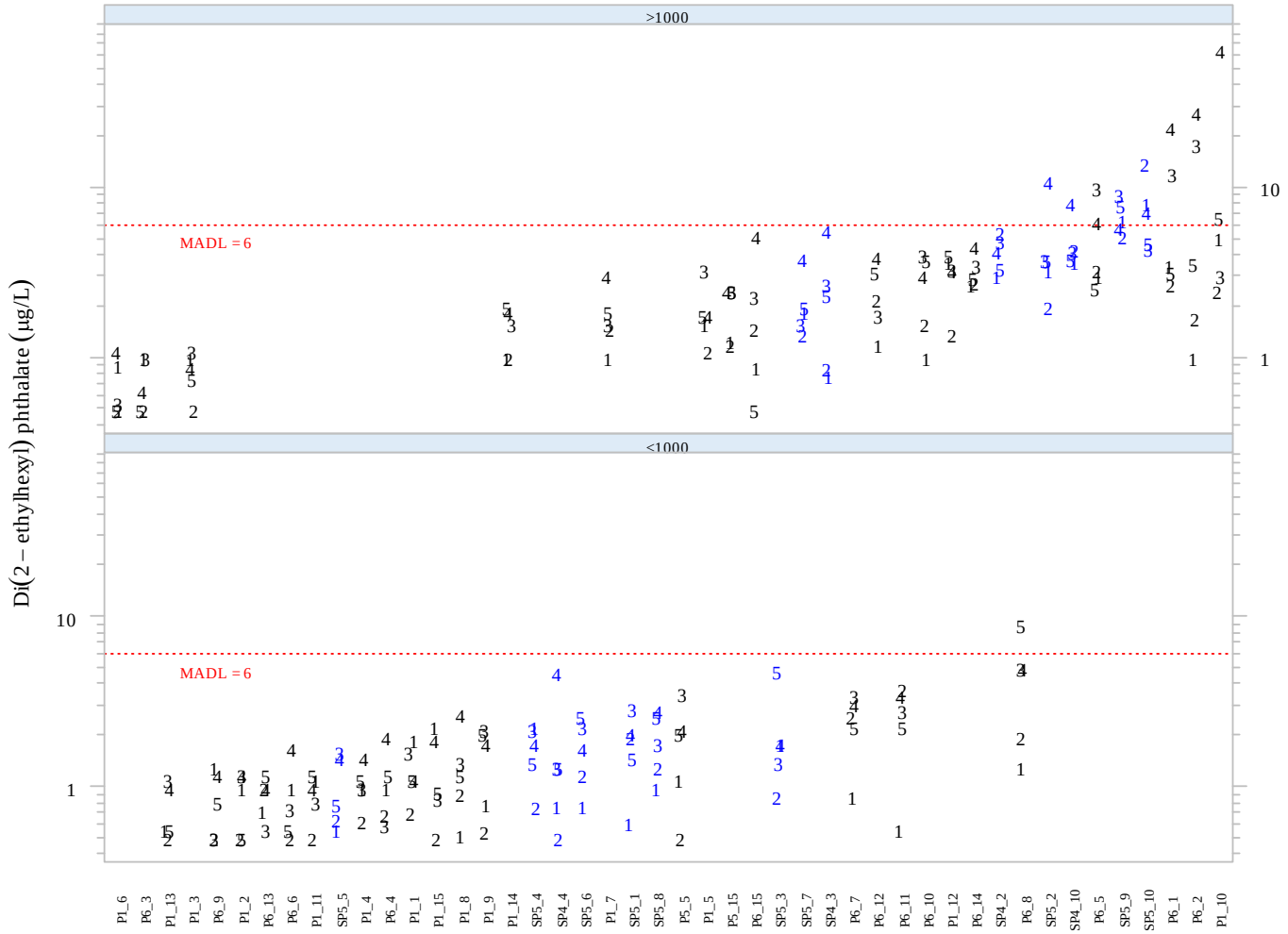
Figure 4-4: Year 6 Benzo(a)pyrene Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3, 4, 5) indicates Year 6 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

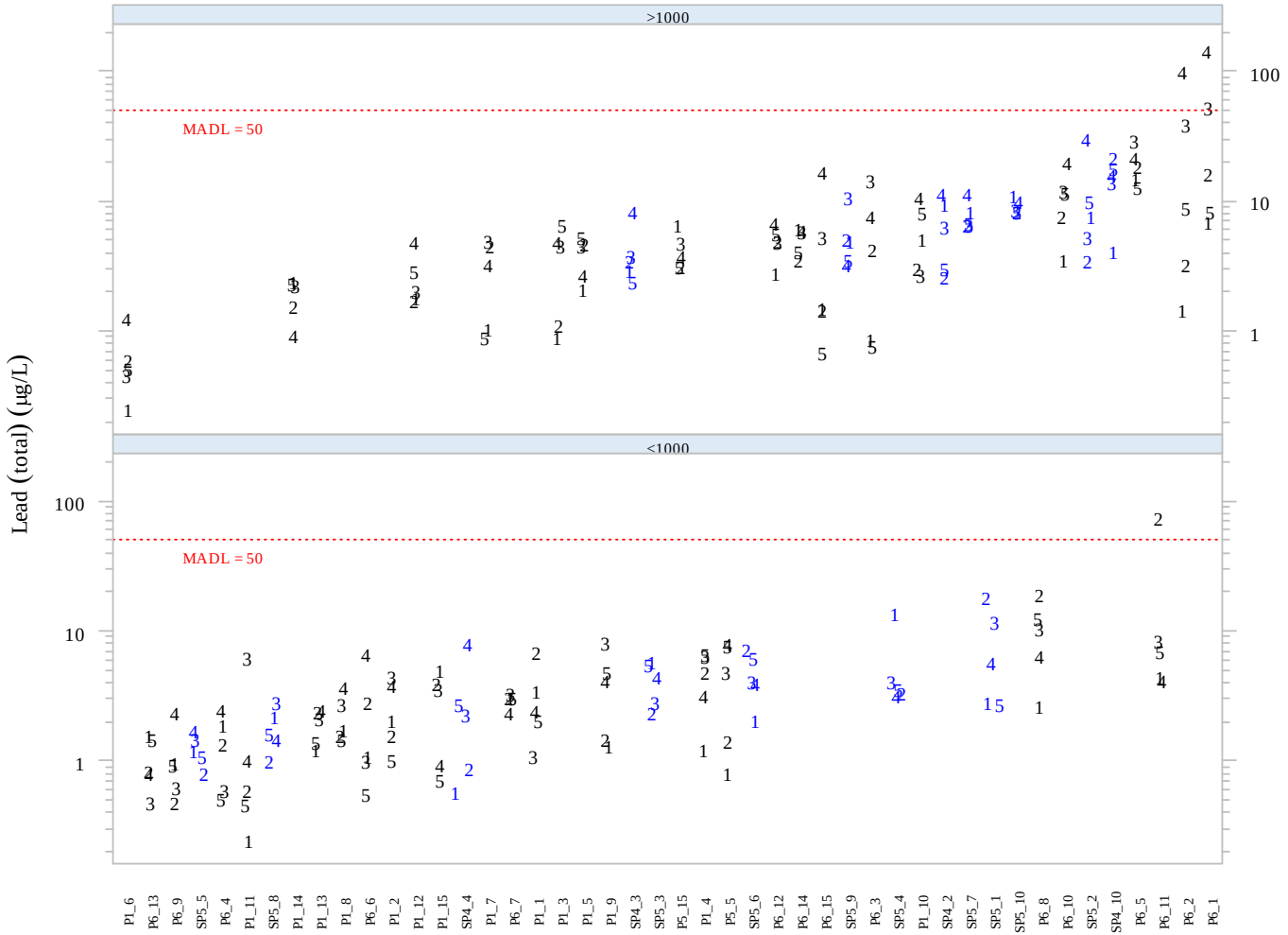
Figure 4-5: Year 6 Di(2-ethylhexyl)phthalate Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3, 4, 5) indicates Year 6 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

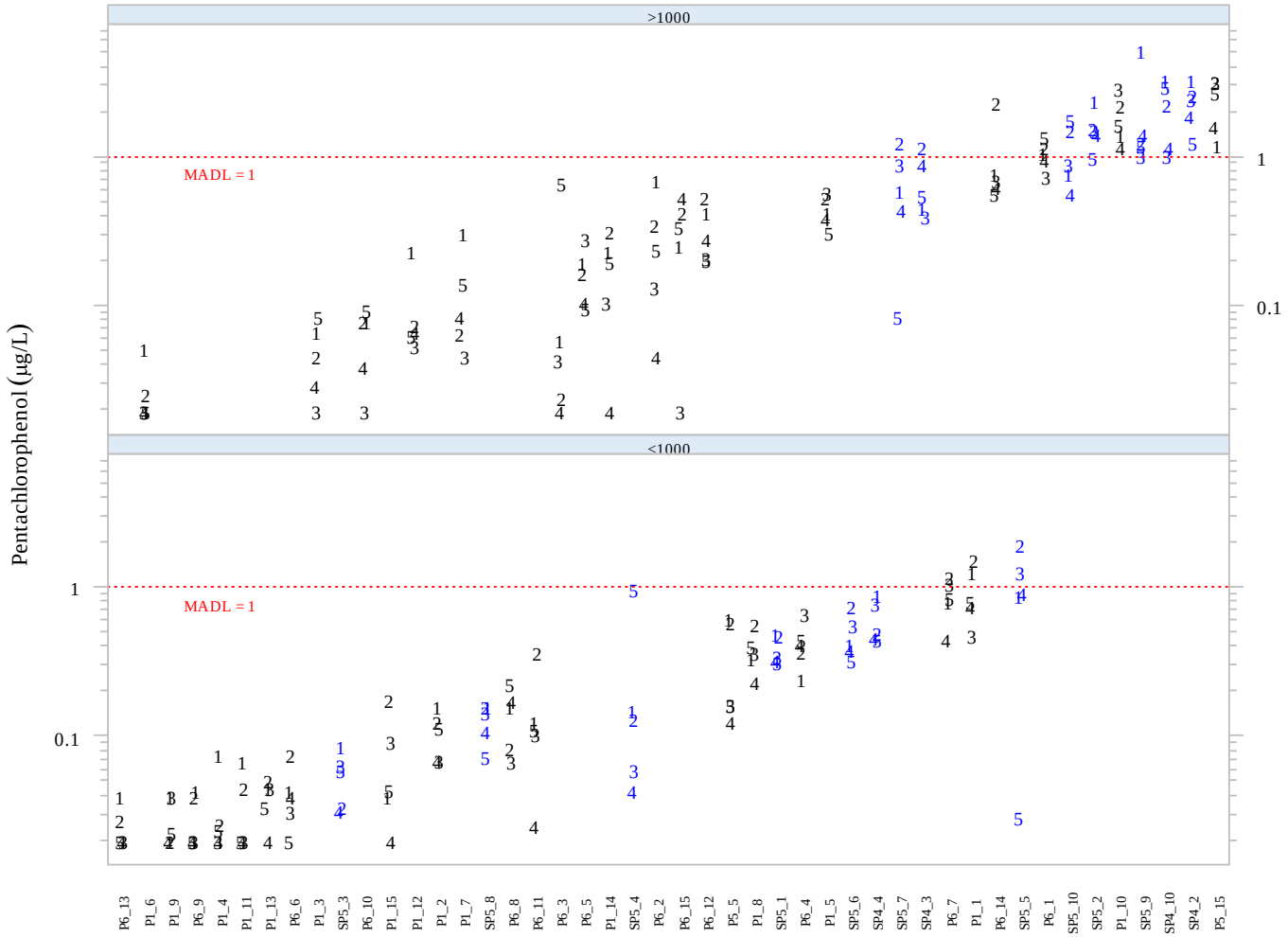
Figure 4-6: Year 6 Lead Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3, 4, 5) indicates Year 6 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

Figure 4-7: Year 6 Pentachlorophenol Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3, 4, 5) indicates Year 6 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

Figure 4-8: Year 6 Pollutant Concentrations by Sampling Event

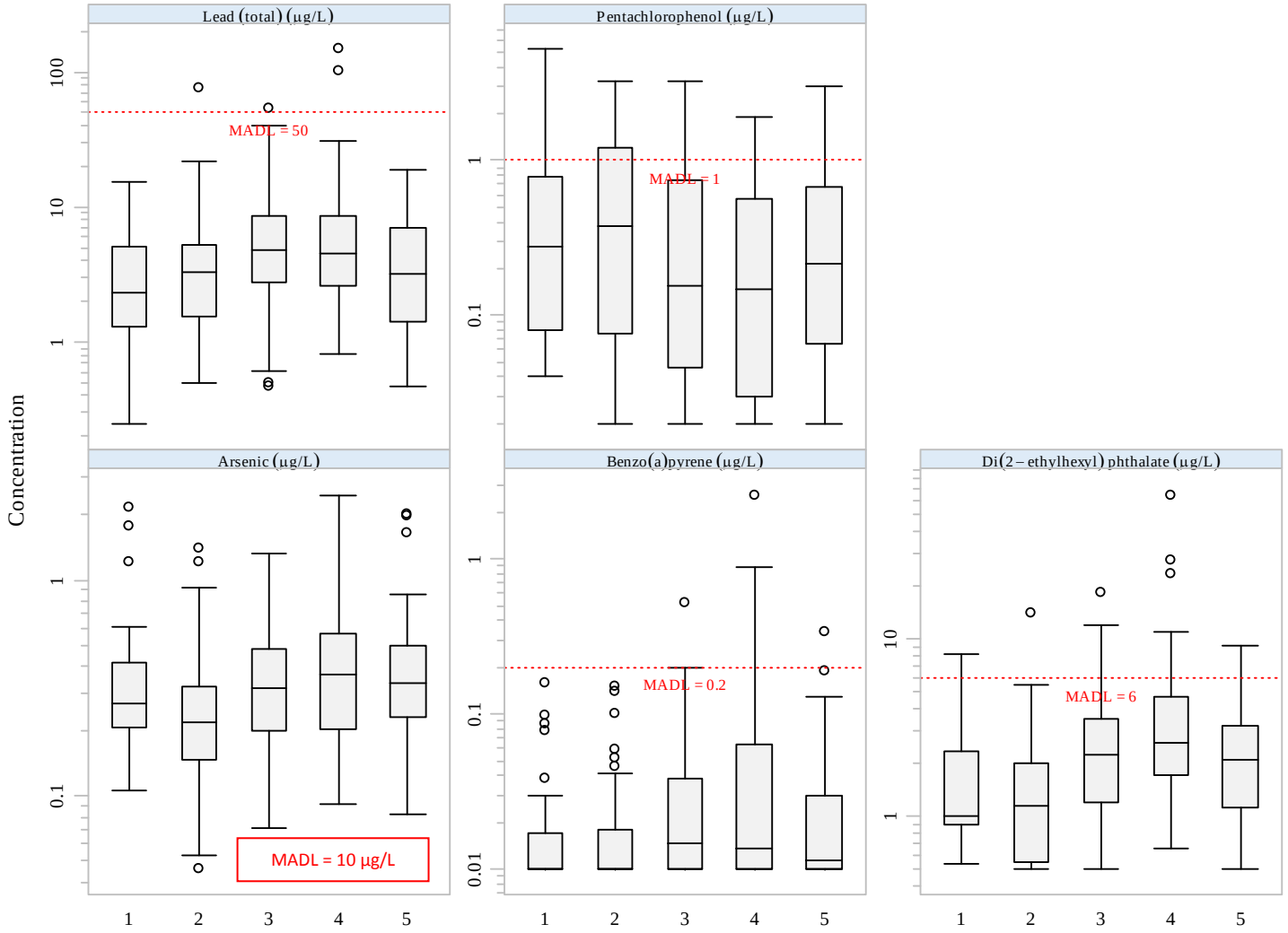
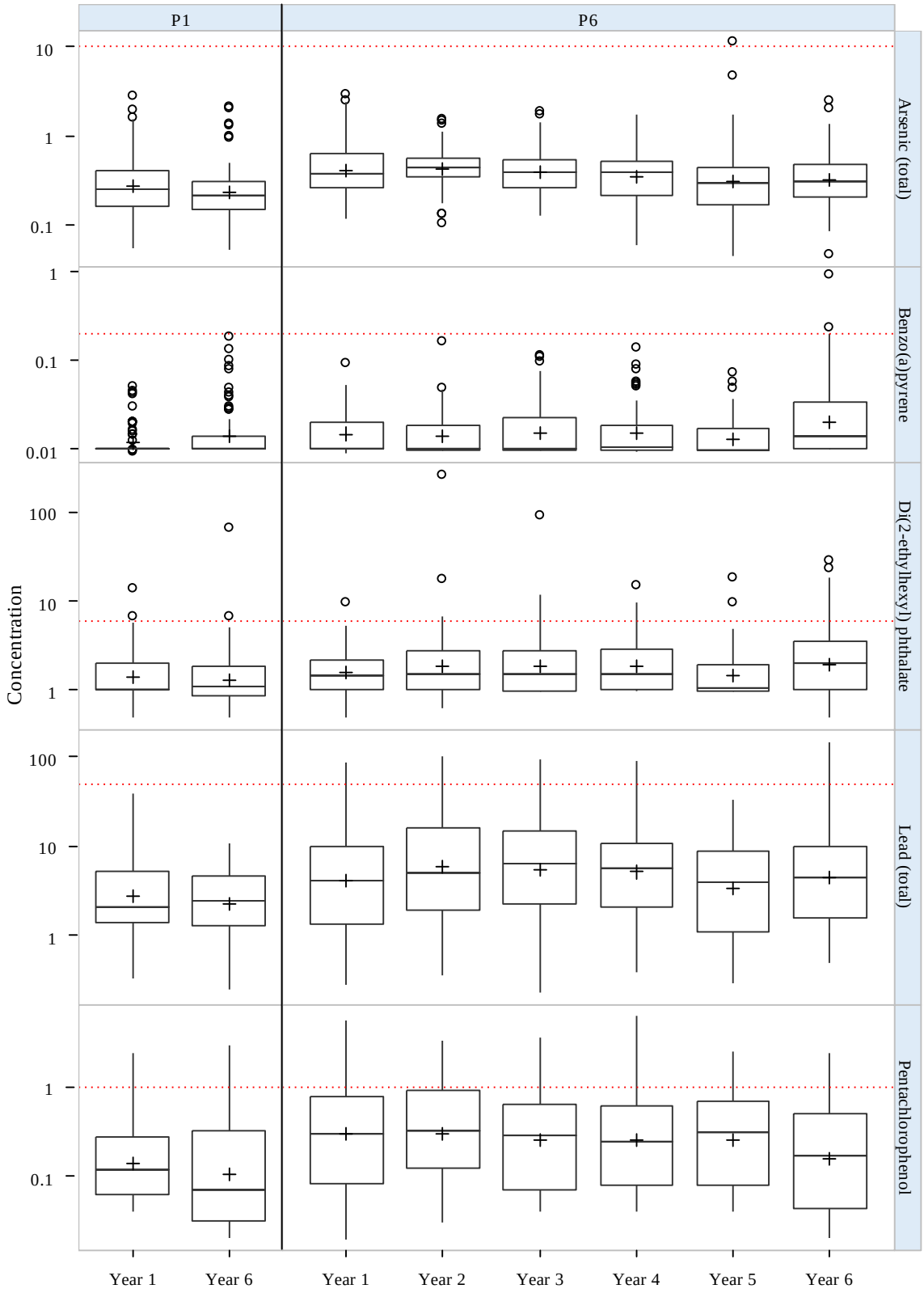
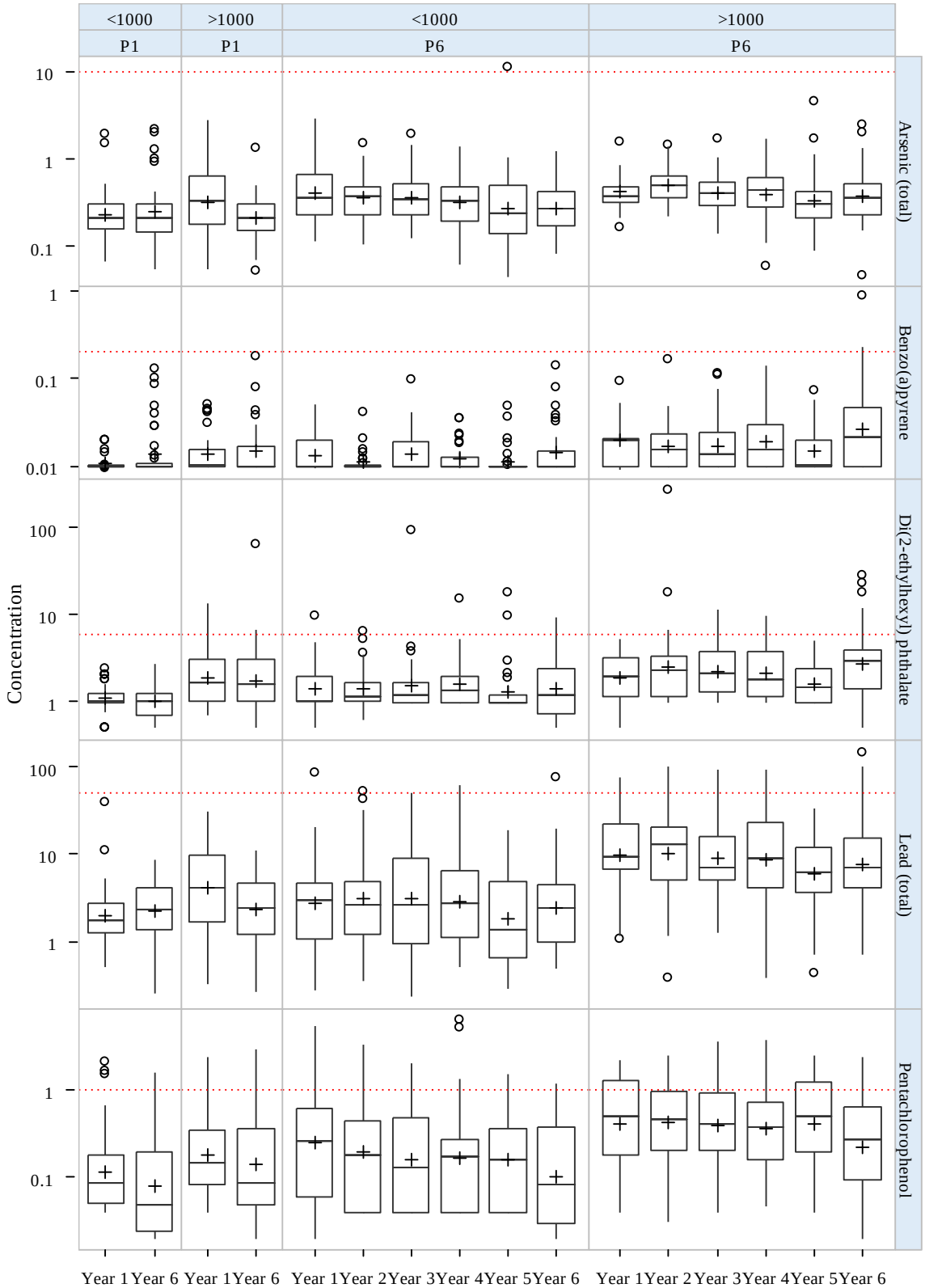


Figure 5-1: Comparison of Pollutant Concentrations for Years 1-6: Panel 6



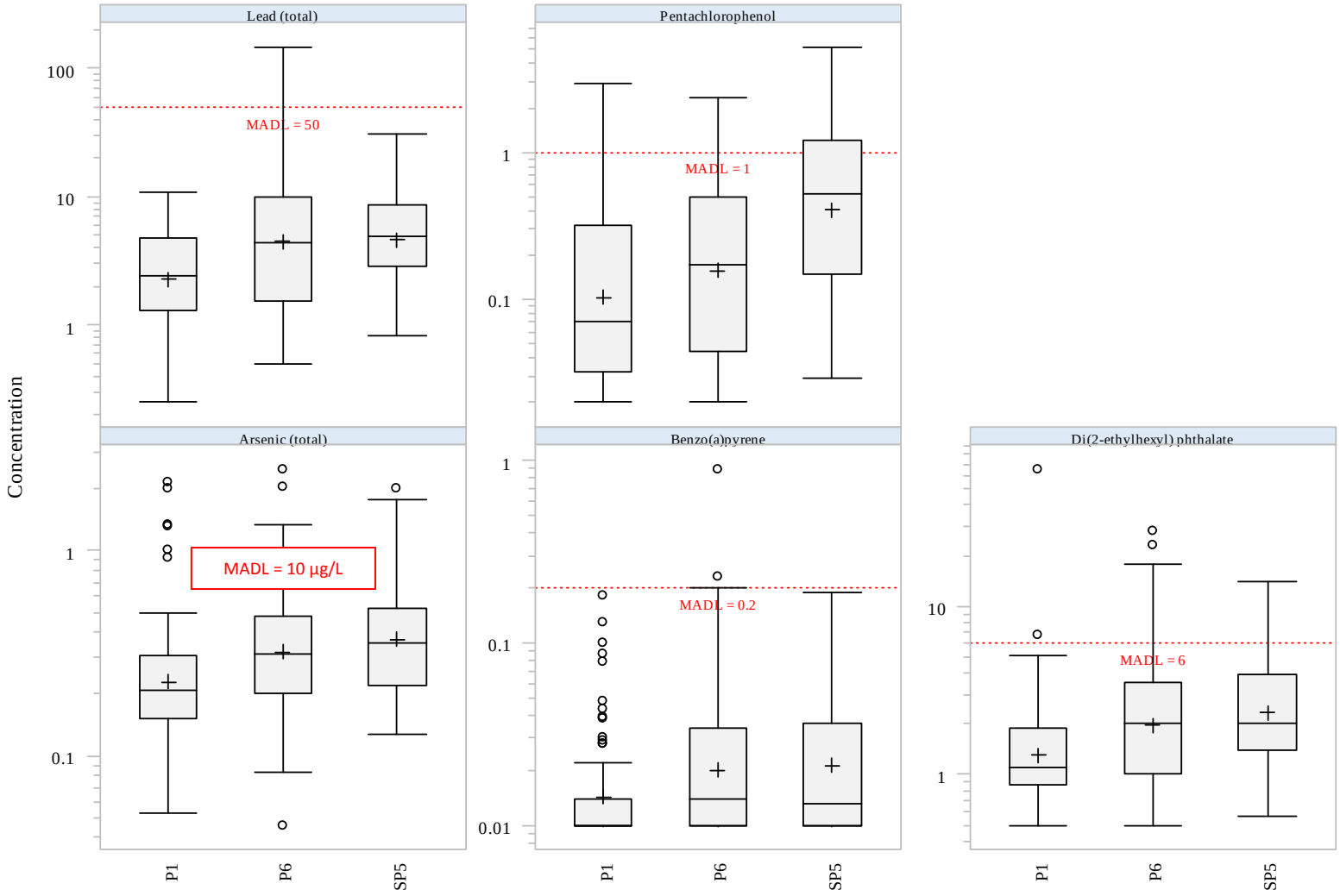
+ Indicates geometric mean

Figure 5-2: Comparison of Pollutant Concentrations by Year and Traffic Category



+ Indicates geometric mean

Figure 5-3: Comparison of Pollutant Concentrations by Sample Panel



+ Indicates geometric mean