Annual Stormwater Discharge Monitoring Report

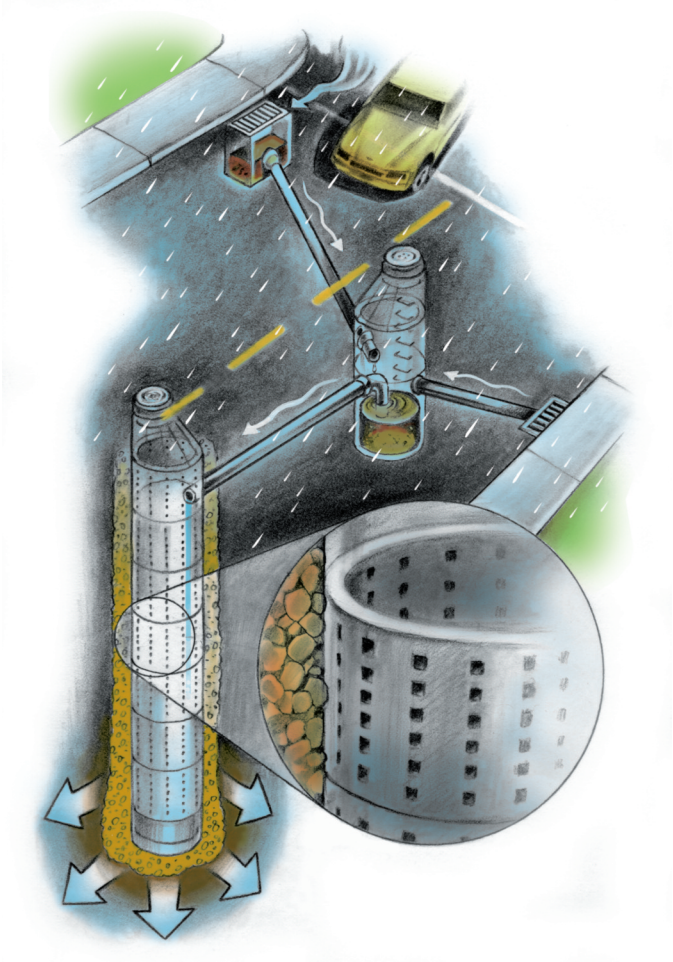
Year 8

October 1, 2012 – May 31, 2013

Water Pollution Control Facilities (WPCF) Permit

Class V Stormwater Underground Injection Control Systems

DEQ Permit Number 102830



November 1, 2013

Prepared by

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

City of Portland, Oregon

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

Permit Number: 102830

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Underground Injection Control Systems
System Monitoring

November 2013

Prepared By:
City of Portland, Bureau of Environmental Services

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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
COC	chain-of-custody
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
FDS	field data sheet
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/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
QAPP	Quality Assurance Project Plan
QC	quality control
ROW	right(s)-of-way
RPD	relative percent difference
SAP	Sampling and Analysis Plan

List of Acronyms (Continued)

SDMP	Stormwater Discharge Monitoring Plan
SOP	Standard Operating Procedures
SP	supplemental panel
TA	Test America
TPD	trips per day
TSS	total suspended solids
UIC	underground injection control
UICMP	UIC Management Plan
WPCF	Water Pollution Control Facility
WPCL	Water Pollution Control Laboratory

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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.

At the end of Year 7 monitoring and the beginning of Year 8, DEQ issued two permit modifications that impacted monitoring for the remainder of the permit term:

- Permit Modification (No. 3) dated April 19, 2012:
  - Reduced storm events from five to three
  - Reduced the frequency of monitoring stationary Panel 6
  - Moved BTEX from the common pollutant list to the priority pollutant screen (PPS)
- Permit Modification (No. 4) dated December 6, 2012:
  - Increased the original Maximum Allowable Discharge Limits (MADL) by a factor of 10 to create a modified MADL for some common pollutants [i.e., 10 µg/L for pentachlorophenol, 60 µg/L for di(2-ethylhexyl)phthalate (DEHP), 2 µg/L for benzo(a)pyrene, and 500 µg/L for total lead].

Year 8 Monitoring Program: The City's UIC monitoring program was implemented in accordance with the permit modifications listed above and the *Stormwater Discharge Monitoring Plan* (SDMP), Version 2 (City of Portland, December 2012). 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. Nineteen UIC locations were sampled in Year 8:

- Fifteen UIC locations selected to implement the required Year 8 monitoring (i.e., compliance monitoring) described in the SDMP Version 2. These UICs were previously sampled in Year 3 and are thus called Panel 3.
- Four UIC locations carried over from Year 7 monitoring because of exceedances of the original permit-defined MADL for pentachlorophenol, benzo(a)pyrene, or DEHP.

UIC monitoring locations were selected on the basis of two traffic flow categories at the time of the *Systemwide Assessment* (City of Portland, 2006c), <1,000 trips per day (TPD) and ≥1,000 TPD. Year 8 locations (i.e., Panel 3) included seven UIC locations in the <1,000 TPD category and eight locations in the ≥1,000 TPD category.

Year 8 Results: Three sampling events were completed, as required in the SDMP Version 2, between October 2012 and May 2013. 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. The collected Year 8 field and laboratory data met the SDMP data quality objectives. Testing of

priority pollutant screen (PPS) analytes is not required in permit Year 8; however, three PPS analytes (total nitrogen, 2,4-D, and picloram) are reported because the U.S. Environmental Protection Agency (EPA) test methods include them as part of the analysis of the common pollutants.

All nine common pollutants and three PPS analytes were detected in Year 8. Twenty-two ancillary pollutants (i.e., analytes derived from the analytical methods for common pollutants) were detected at generally low concentrations. The nine ancillary pollutants detected at the highest frequencies (>50%) during all individual sampling events are polycyclic aromatic hydrocarbons (PAHs). PAHs are expected in urban rights-of-way. Sources generally include fresh and used petroleum products associated with motor vehicle combustion, exhaust, and wear and tear; other sources include wood preservatives and cigarette filters.

Maximum Allowable Discharge Limit (MADL) Exceedances: Three common pollutants [pentachlorophenol, DEHP, and benzo(a)pyrene] were detected in five UICs at concentrations above their original MADLs. All samples of these pollutants exceeded their original MADLs during Event 1, when these MADLs were in effect. Concentrations of other common and PPS analytes were detected below both their original and modified MADLs. The City reported all MADL exceedances to DEQ, as required by the permit.

Annual Geometric Mean Concentrations: Four UIC locations had annual geometric mean concentrations that exceeded the original MADLs for pentachlorophenol and benzo(a)pyrene[2]. Three of these locations were carry-over UICs from Year 7. None of the UICs exceeded the modified MADLs of 10 µg/L for pentachlorophenol and 2 µg/L for benzo(a)pyrene.

Since 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, (using the original MADL as the trigger) geometric means were also calculated for DEHP (four UIC locations) and total lead (one UIC location). The annual geometric mean concentrations were well below both the original and modified MADLs for these pollutants. 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 regarding the potential differences in pollutant concentrations among permit years and traffic categories. In general, data are similar for each variable for Panel 3 in Years 3 and 8. For most of the evaluated pollutants, the concentration ranges were generally narrow, and geometric means were well below their original and modified MADLs (i.e., <50 percent). Pollutant concentrations appear to be slightly higher in the ≥1,000 TPD traffic category than in the <1,000 TPD category and are similar among sample panels.

[2] All four of the UIC locations exceeded the original MADL (1.0 µg/L) for pentachlorophenol, and one of the four UICs exceeded the original MADL (0.2 µg/L) for benzo(a)pyrene. The annual geometric means for UICs exceeding the original MADL ranged from 0.45 µg/L to 1.729 µg/L for pentachlorophenol, and were 0.045 µg/L and 0.22 µg/L for benzo(a)pyrene.

Year 7 Response Actions: No source investigations were initiated in Year 8. However, three locations in Year 7 had an annual geometric mean for a pollutant that exceeded an original MADL; source investigations for these were continued in Year 8. No annual geometric mean concentrations exceeded the modified MADL for any pollutant at these locations in Year 8.

Category 4 UICs: A total of seventeen locations have been identified as Category 4 UICs during years 1 through 7, based on sampling results compared to original MADLs. The corrective action for each of these UICs was a groundwater protectiveness demonstration. No new Category 4 UICs were identified in Year 8.

Additional Monitoring: Four UICs exceeded the original MADLs for at least one pollutant:

- Three UICs (P3_5, SP6_7, and SP6_10) exceeded for pentachlorophenol
- One UIC (SP6_10) exceeded for benzo(a)pyrene

In Year 8, however, no UIC locations had annual geometric mean concentrations that exceeded the modified MADL for a pollutant (which was the MADL in effect at the end of Year 8). Therefore, no UIC locations will be carried over into Year 9.

Permit compliance is demonstrated in this report by documenting that Year 8 sampling, analyses, data evaluation, and response actions were performed in accordance with the permit, SDMP Version 2 (December 2012), and *UIC Management Plan* (December 2006).

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Section 1

Introduction and Organization

1.1 Purpose

This *Annual Stormwater Discharge Monitoring Report* presents the results of the City of Portland's (City) eighth year of stormwater sampling, conducted between October 1, 2012 and May 31, 2013, 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 three sampling events in Year 8[3]
- Descriptive information for the UICs sampled (e.g., location, surrounding land use)
- Description of the individual storms constituting each sampling event
- Identification of maximum allowable discharge limit (MADL) concentration exceedances
- Identification and discussion of common and ancillary pollutants detected
- Discussion of Year 8 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

[3] Sampling three storm events is a change from the first seven years of stormwater discharge monitoring, when five storm events were sampled. On April 19, 2012, DEQ approved a major permit modification authorizing the City to reduce sampling to three storm events. Section 2.1.2 provides more information about this change.

water quality of the groundwater is adequate, and maintain the existing high quality of groundwater to support those 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 Version 2 (December 2012a), which was used to direct Year 8 sampling, consists of the *Sampling and Analysis Plan* (SAP) (and the *Quality Assurance Project Plan* (QAPP). 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 Version 2 was submitted to DEQ in January 2013. Much of the background information in this report is summarized from that document.

1.3 Permit Requirements and Monitoring Program Goals and Objectives

As designated in a July 2011 WPCF permit action letter from DEQ, the City must submit to DEQ by November 1 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 8 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 this monitoring report by:

- Identifying traffic or land use changes that would modify sampling protocols or the sampling network.
- Presenting programmatic activities and BMPs performed to prevent, minimize, and control pollutants.
- 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.
- Presenting corrective actions performed to correct UICs that have been identified as non-compliant.

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.[4] The goals are to:

- 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) and subsequent DEQ-approved permit modifications.
- 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.

[4] 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.

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.

Section 2

2 Monitoring Design and Locations

This section summarizes the UIC system monitoring design and presents the Year 8 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 8 design.

2.1.1 Sample Locations

UICs are sampled to perform long-term trend analysis, evaluate permit compliance during the 10-year permit term, and assess temporal and spatial trends in stormwater quality. The UIC sampling network consists of one stationary and five rotating panels for a total of six panels. The intent of the stationary panel is to assess for temporal trends in pollutant concentrations at the same UIC locations over time. The intent of the rotating panels is to assess for spatial trends in pollutant concentrations. The six panels consist of 15 UICs each, for a total of 90 unique UIC locations. UIC locations were identified using the GRTS survey design.

2.1.2 Frequency of Sampling and Major Permit Modification No. 3

The 2005 permit stipulated the following sampling schedule for the rotating and stationary panels:

- The stationary panel (i.e., Panel 6) consisting of 15 UIC locations was originally required to be sampled during five storm events annually for 10 years.
- The 75 rotating UIC locations (five panels consisting of 15 individual UICs each) were originally required to be sampled twice each over the 10-year permit term (i.e., once during the first five years and once during the second five years of the permit term) during five storm events annually.

The first six years of monitoring demonstrated that most analyte concentrations are generally well below MADLs and are protective of groundwater. In 2012, therefore, the City conducted a power analysis to evaluate the impact of reducing the frequency of sampling during annual monitoring. The model used in the analysis was specifically developed for probability surveys in environmental monitoring (Urquhart and Kincaid, 1999). The power analysis assessed whether a reduced monitoring frequency would change the trend detection power of the sampling design in light of the contributions to the overall variance by random effects associated with sampling locations, years, and location by year interactions. The analysis evaluated the effect of varying: (1) the frequency of sampling for Panel 6 and (2) the number of annual storm events.

The analysis showed that:

- Reducing the frequency of annual monitoring results in a loss of less than 5 percent of trend detection power over the 10- year permit duration.

- Sampling five events and sampling Panel 6 annually are not contributing much power to the overall trend detection ability of the design.

- Reducing sampling frequency from five storm events to three represents a loss of very little power; the last two storm events contribute little additional information.

- Most of the trend detection ability of the monitoring design is determined by the overall number of UICs monitored over the course of the permit term (90 UIC locations) and by the variability of the concentration of pollutants, both which are unchanged.

Based on the results of this power analysis, DEQ approved the City's Major Permit Modification Request No. 3 in April 2012, authorizing the City to discontinue stationary Panel 6 sampling in Years 8 and 9 and reduce the frequency of sampling from five storm events to three events annually. Detailed information about this analysis can be found in *Permit Modification Request No. 3, Attachment A*, dated January 10, 2012.

2.1.3 Sample Size

The sample size ("n") for the UIC monitoring locations was selected to be representative of the City's UIC system and is described in detail in the SDMP. 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, 2006b.) To limit the amount of uncertainty around the estimated proportion of exceedances, the confidence interval was set (in partnership with EPA) at a 90 percent confidence level and a half-width of 12 percent, as described in the SAP.

The proportion of UICs expected to exceed 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 initially selected to be representative of the City's UIC population.

In January 2012, all stormwater discharge monitoring data were used to evaluate the pilot study conclusion. Assigning weights to accurately represent the City's UIC population (e.g., the greater proportion of UICs with <1,000 TPD than UICs with >1,000 TPD, the proportion of UICs in commercial/industrial areas versus in other land use areas, etc.), the revised proportion of all City-owned UICs estimated to exceed the pentachlorophenol MADL is 10.6 percent, within a 95 percent confidence interval of 5.7-15.5 percent. This evaluation may be repeated at the conclusion of the first permit term; however, the conclusion is unlikely to change significantly, since all 90 compliance UIC locations designated for monitoring under the design have been sampled.

2.1.4 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 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 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 predominantly in residential areas, the sample design is considered to be conservative.

2.2 Year 8 Monitoring Locations and Characteristics

2.2.1 Overview

Nineteen UIC locations were sampled in Year 8:

- Fifteen rotating panel UIC locations (discussed in Section 2.2.2 below) were sampled to implement the required Year 8 compliance monitoring.
- Four UIC locations (P6_8, SP6_4, SP6_7, SP6_10[5]) were carried over from Year 7 monitoring because of annual geometric mean concentrations exceeding MADLs (see Section 2.2.4).

In accordance with the SAP, each selected UIC sampling location was inspected in August and September 2012, 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). Tables 2-2 and 2-3 summarize the characteristics of Year 8 UIC monitoring locations. Figure 2-2 shows Year 8 sampling locations, and Appendix A contains detailed maps of all Year 8 locations. The SAP describes the UIC sampling design in detail.

2.2.2 Rotating Panel (Panel 3)

Fifteen randomly selected UICs (Panel 3) were sampled from October 2012 to May 2013. Panel 3 was previously sampled in Year 3 of the permit. Panel 3 includes seven UICs with traffic counts <1,000 TPD and eight UICs with traffic counts ≥1,000 TPD.[6] UIC locations were sampled during three storm events, as discussed in Section 2.1.2.

2.2.3 Oversample Panel

As described in the SAP, an oversample panel of 85 alternate locations was generated to develop compliance sampling panels if needed. Unsuitable UICs are replaced by selecting the next location in a similar traffic categorization from the oversample panel list. No replacement locations were used for compliance monitoring Panel 3.

2.2.4 Carry-Over Locations from Previous-Year MADL Exceedances

Geometric mean stormwater concentrations are calculated for locations where an individual analyte is detected in at least one sampling event at a concentration ≥50 percent of the analyte's MADL. If the annual geometric mean concentration exceeds the MADL at a given UIC, and the UIC has not previously received a no further action letter from DEQ (from past exceedances), the UIC is sampled again (i.e., carried over to) the following year.

In Year 7, there were nine UIC locations with annual geometric mean concentrations that exceeded the MADL. Five of the nine UIC locations (P2_5, P2_13, P2_14, P6_1, and P6_14) exceeded the MADL for pentachlorophenol only, but had been identified as a

[5] SP6_7 and SP6_10 are supplemental panel (SP) UIC locations collected near commercial/industrial sites in the sixth year of supplemental panel monitoring.

[6] In Year 3, Panel 3 was noted as including seven UICs with traffic counts <1,000 TPD and eight UICs with traffic counts ≥1,000 TPD. However, the traffic count for UIC P3_12 has since been updated, from an estimated 459 TPD to 4,561 TPD. No physical UIC locations have changed.

Category 4 UIC for this constituent in a previous year and had received no further action letters from DEQ. Therefore, these five UICs were not resampled during Year 8. The remaining four UIC locations were carried over for sampling in Year 8 after exceeding MADLs for the following analytes:

- P6_8 and SP6_4 for di(2-ethylhexyl)phthalate (DEHP)
- SP6_7 for pentachlorophenol
- SP6_10 for benzo(a)pyrene

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Section

3

3 Monitoring Implementation

This section describes how key elements of the SDMP were implemented in Year 8. 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 8 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

Table 1 of the WPCF permit lists the common pollutants and the PPS analytes required to be sampled as part of the City's compliance monitoring. If information or data indicate that additional pollutants should be added to Table 1, UIC Program staff will notify DEQ as part of its annual reporting requirements. In Year 8, no additional pollutants were identified for monitoring.

3.2.1 Common Pollutants

The permit requires the common pollutants listed in Table 3-1 to be monitored annually. This list represents a change from Years 1 through 6 because the October 2011 Major Permit Modification No. 2 approved moving five common pollutants (benzene, toluene, ethylbenzene, and xylenes (BTEX) and nitrate-nitrogen) to the priority pollutant screen (PPS) analyte list (see following section). Common 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 8. 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 initially required the PPS analytes listed in Table 3-1 to be monitored for the first storm event in Years l, 4, and 9. However, as a result of the April 2012 Major Permit Modification No. 3 that allows the City to suspend Panel 6 monitoring in Years 8 and 9, PPS analytes will be monitored again in both compliance panels in Year 10 rather than Year 9.

PPS monitoring was not required in Year 8; however, the permit requires that analytes detected by any of the laboratory methods used in the stormwater monitoring program be reported. Section 4 reports those 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 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 8:

- 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.
- E. coli (Coliert QT), total organic carbon (SM 5310B), ammonia-nitrogen (EPA 350.1), nitrate-nitrogen (EPA 300.0), orthophosphate (EPA 365.1), total phosphorus (EPA 365.4), and hardness (SM 2340B) were measured at all UIC Panel 3 monitoring locations during each sampling event. These analyses were performed to meet MS4 permit monitoring requirements, and data are reported in Appendix D.
- Multi-Residue Pesticide Screens were conducted during Events 1 and 3 at all UIC Panel 3 monitoring locations. Samples were analyzed at Pacific Agricultural Laboratory (PAL) using a combination of EPA Methods 8081B, 8141B, 8270D, and 8321B. Data are reported in Table 4-2 and Appendix D.
- Dissolved copper, lead, zinc, and mercury were measured at all UIC monitoring locations during each sampling event. Samples were:
    - 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 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 ≥0.2 inch per storm
- Predicted rainfall duration of ≥6 hours
- Antecedent dry period of ≥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.

Precipitation data from the following 13 rain gages across Portland were averaged and used to characterize individual storms for Years 1 through 8:

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 Year 8 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 three Year 8 stormwater sampling events comprised several storms or sample collection periods. The dates of individual sample collection periods for each event were:

- Event 1: 10/30/12 and 10/31/12
- Event 2: 12/19/12, 12/20/12, and 2/22/13
- Event 3: 4/4/13, 4/19/13, 5/13/13, and 5/21/13

Tables 3-4 through 3-6 summarize hourly average precipitation records for each storm event. Figures 3-1 through 3-3 provide hydrographs for each storm event. This information was used to estimate the duration, intensity, and antecedent dry period[7] for each sample collection period in each storm event. Table 3-7 summarizes these storm characteristics for events 1 through 3. The *Data Usability Report* in Appendix B provides additional information about forecasted rainfall for individual storms in a storm event.

The first predicted storm during Year 8 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 and 3) were distributed across the monitoring season as storms occurred that met the target storm event criteria.

Table 3-8 summarizes long-term (30-year) and Years 1 through 8 precipitation and temperature records for the Portland area. (See Table 3-8 footnotes for specific data sources used to generate climatological data.) The permit-defined wet-season months are shaded. Figure 3-4 depicts precipitation totals for these time periods graphically. The long-term average (1971-2000) is 37.08 inches. Year 1 had approximately 5.69 inches more precipitation than the long-term average. Years 2 through 5 received less precipitation than the long-term average, ranging from 2.49 inches to 9.88 inches below the average. Years 6 through 8 again received rainfall above the average: approximately 13.62 inches, 0.78 inches, and 2.26 inches more, respectively.

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.

[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.

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 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:

Infiltration Volume (cubic feet) = AP x (1ft/12 inches) x IA x LE

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 3-9 summarizes the total estimated stormwater infiltration volumes calculated for the City-owned UIC system for Years 5 through 8. Infiltration volumes for Years 1, 2, 3, and 4 are available in the annual monitoring reports for those years.

The total volume of stormwater infiltration was estimated for June 1 through May 31 each year, using annual precipitation measurements from the following sources:

- Years 1 through 4: Portland International Airport
- Years 5 and 6: National Weather Service
- Years 7 and 8: The average of 13 rain gages in North, Northeast, and Southeast Portland

The actual precipitation totals for each year were:

- Year 1 (2005-2006) was 42.77 inches
- Year 2 (2006-2007) was 34.41 inches
- Year 3 (2007-2008) was 33.94 inches
- Year 4 (2008-2009) was 27.2 inches
- Year 5 (2009-2010) 34.59 inches
- Year 6 (2010-2011) 50.7 inches
- Year 7 (2011-2012) 37.86 inches
- Year 8 (2012-2013) 39.34 inches (Table 3-8)

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 732 UICs were identified and removed for the Year 8 calculation.

Based on these calculations, the City-owned UICs drain a total adjusted catchment area of approximately 608,188,000 square feet (13,960 acres), of which approximately 230,266,100 square feet (5,290 acres) are impervious. Using these values, approximately 38 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 76,200 square feet (1.7 acres), of which an average 38 percent or 28,800 square feet (0.70 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 31, 2006)
- 474 million cubic feet (3.5 billion gallons) in Year 2 (June 1, 2006, through May 31, 2007)
- 481 million cubic feet (3.6 billion gallons) in Year 3 (June 1, 2007, through May 31, 2008)
- 385 million cubic feet (2.9 billion gallons) in Year 4 (June 1, 2008, through May 31, 2009)
- 570 million cubic feet (4.2 billion gallons) in Year 5 (June 1, 2009, through May 31, 2010)
- 600 million cubic feet (4.5 billion gallons) in Year 6 (June 1, 2010 through May 31, 2011)
- 578 million cubic feet (4.3 billion gallons) in Year 7 (June 1, 2011 through May 31, 2012)
- 558 million cubic feet (4.2 billion gallons) in Year 8 (June 1, 2012 through May 31, 2013)

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 overestimate 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 was based on data collected at the Portland International Airport for years 1 through 4, National Weather Service for years 5 and 6, and an average of the 13 rain gages (listed in Section 3.3) for years 7 and 8. 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 produce more runoff, 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, such as areas with high density of evergreen trees, areas with significant tree cover over roads, and neighborhoods with no mature trees.
- Topography. (Flat areas generally will retain more water than steep slopes.)

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Section 4

4 Monitoring Results and Evaluation

This section presents the data collected, results, and evaluation during Year 8, in accordance with the permit and SDMP.

4.1 Monitoring Results

4.1.1 Common Pollutants

All nine common pollutants listed in Table 3-1 were detected during Year 8. 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 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.[8] Three common pollutants [pentachlorophenol, DEHP, and benzo(a)pyrene] were detected at concentrations above their MADLs in at least one sample during Event 1; these are discussed further in Section 4.2.

4.1.2 Priority Pollutant Screen Analytes

The PPS analytes listed in Table 3-1 were derived from the analytical methods for common pollutants (2,4-D, dinoseb, and picloram) or collected as part of National Discharge Pollutant Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit monitoring (alachlor, atrazine, carbofuran, chlordane, lindane, and nitrate-nitrogen) during Year 8. Consistent with the NPDES permit, MS4 analytes were sampled during events 1 and 3 only. PPS pollutants total nitrogen, 2,4-D and picloram were detected during laboratory

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

- **B**: Data Usability Report (QA/QC results, copies of all field and data forms)
- **C**: Year 8 Field Audit Report
- **D**: Year 8 Pollutant Summary Tables (for field parameters, common pollutants, and PPS pollutants)
- **E**: Year 8 Analytical Laboratory Reports (includes data flags)
- **F**: Year 8 Stormwater Discharge Monitoring Database (on CD) (analytical data and key UIC location characteristics)

[8] Permit Modification No. 4 (dated December 6, 2012) increased MADLs for four constituents by one order of magnitude. The new MADLs are: pentachlorophenol 10 µg/L, DEHP 60 µg/L, benzo(a)pyrene 2µg/L, and lead 500 µg/L. The original MADLs were used to determine individual MADL exceedances only in Event 1. The new MADLs were used to determine individual MADLs exceedances in Events 2 and 3, which occurred after the permit modification approval, and to determine annual geometric mean MADL exceedances.

analysis for common pollutants in Year 8. 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 concentrations, and the maximum percent of the MADL detected (i.e., maximum concentration/MADL *x* 100). Table 4-2 summarizes the PPS analytes that were analyzed but not detected, including the number of samples analyzed and the range of MRLs.

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 8, 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-two ancillary pollutants were analyzed for three sampling events. All 22 ancillary pollutants were detected in Year 8. Three of these pollutants were detected at maximum frequencies of below 10 percent. Ten 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 is 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 8. 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. There are no MADLs for dissolved metals, but dissolved metals results are well below their respective total metal MADLs. The ratios of dissolved to total metal concentrations for the ≥1,000 TPD traffic category were 8 percent for lead, 44 percent for zinc, and 45 percent for copper. Concentration ratios for the <1,000 TPD traffic category were 8 percent for lead, 43 percent for zinc, and 46 percent for copper. The ratio of dissolved to total metal concentrations is equal in

the two traffic categories for lead. For zinc, it is slightly higher for the high traffic category. For dissolved copper, it is slightly 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 three sampling events. For UICs with <1,000 TPD, TSS concentrations ranged from less than 3 milligrams per liter (mg/L) to 130 mg/L. For UICs with ≥1,000 TPD, TSS concentrations ranged from 3 mg/L to 160 mg/L. The geometric mean TSS concentration for UICs with <1,000 TPD was 20.9 mg/L, and the geometric mean TSS concentration for UICs with ≥1,000 TPD was 17.4 mg/L.

Field Parameters. Field data were collected to help interpret 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 5.4 to 10.3 in stormwater discharge during Year 8. The mean pH readings for individual events ranged from 6.5 to 6.9.
- **Conductivity**. Conductivity measurements ranged from 6 to 98 micromhos per centimeter (µmhos/cm) in stormwater discharge during Year 8. The mean conductivity readings for individual sampling events ranged from 24.5to 53.6 µmhos/cm.
- **Temperature**. Temperature measurements ranged from 4.4 to 20.4^{o} C in stormwater discharge during Year 8. The mean temperature measurements for individual sampling events ranged from 5.6 to 15.6^{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 compares the individual detected concentrations to MADL values for common pollutants. Samples collected in Event 1 (before approval of Permit Modification No. 4) are compared to the original MADLs in the WPCF permit (i.e., original MADL), and samples collected

MADLs

Original MADL:

- Required by the 2005 WPCF Permit
- Used for all compliance monitoring through Year 8, Event 1

Modified MADL:

- Permit Modification No. 4 replaced four MADL concentrations
- Used for compliance monitoring for four pollutants starting with Year 8, Event 2
- Used for annual mean MADL comparison for four pollutants starting with Year 8

after Permit Modification No. 4 was approved are compared to the new MADLs (i.e., modified MADLs). Three common pollutants [benzo(a)pyrene, DEHP, and pentachlorophenol] were detected in Year 8 at concentrations above their original MADLs in at least one sample. Lead exceeded 50 percent of the MADL, but did not exceed the MADL of 50 µg/L. The following UIC locations exceeded an individual MADL:

Benzo(a)pyrene	SP6_10		
DEHP	P6_8		
Pentachlorophenol	P3_3	P3_5	SP6_7

Benzo(a)pyrene. One Year 8 UIC sample location exceeded the original 0.2 µg/L MADL for benzo(a)pyrene and was categorized as < 1000 TPD. The exceedance was 0.21 µg/L, slightly above the original MADL. No UIC locations exceeded the modified 2 µg/L MADL.

DEHP. One Year 8 UIC sample location exceeded the original 6.0 µg/L MADL for DEHP and was categorized as ≤1,000 TPD. The exceedance was 9.8 µg/L. No UIC locations exceeded the modified 60 µg/L MADL.

Pentachlorophenol. Three Year 8 UIC sample locations exceeded the original 1.0 µg/L MADL for pentachlorophenol. Of these, two UICs were categorized as ≥1,000 TPD, and one was UIC categorized as <1,000 TPD. The exceedances ranged from 1.3 µg/L to 1.9 µg/L. No UIC locations exceeded the modified 10 µg/L MADL.

As required by the permit, the City reports any observed MADL exceedances from each individual sampling event to DEQ in a timely manner - within 7 days following the receipt of validated analytical data. Exceedances in Event 1 were reported to DEQ in MADL Exceedance Notification Year 8 – Event 1, letter dated January 15, 2013.

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:

- **Benzo(a)pyrene**. Incomplete combustion of organic material (e.g., fuel from vehicles, wood- and oil-burning furnaces, and incinerators). It is also a component of coal tar, tobacco smoke, charbroiled food.
- **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.

- **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.

4.2.2 Priority Pollutant Screen Analytes

Total nitrogen, 2,4-D and picloram were the only PPS analytes detected during routine laboratory analysis for common pollutants in Year 8. No PPS analytes were detected at concentrations exceeding their MADLs. Table 4-1 presents the maximum percent of the MADLs 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 end-of-pipe (EOP) discharge point after any pretreatment best management practices (BMPs) or structural controls. The annual mean concentration is calculated using the geometric mean of the three 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 for 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 is calculated for pollutants detected in at least one sampling event or individual sampling location at a concentration >50 percent of their MADLs. Table 4-7 presents these pollutants and their individual event concentrations. The annual geometric mean concentration cannot exceed the MADL for analytes detected at concentrations <50 percent of the MADL. The annual geometric mean concentrations were calculated and compared to the modified MADLs (i.e., the MADLs in effect at the end of Year 8) for the following four pollutants:

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

Table 4-9 presents the annual geometric mean concentrations for these pollutants. Table 4-9 also presents pollutant MADLs; the arithmetic mean; 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 an inappropriate measure of central tendency (DEQ, 2005b).

4.3.2 Common Pollutants

Annual geometric mean concentrations were less than both the original and modified MADLs for the following common pollutants:

- **DEHP**. The annual geometric mean concentration was calculated for four locations where the concentration was ≥50 percent of the original 6.0 µg/L MADL for DEHP. The annual geometric means for these locations ranged from 3.575 to 5.482 µg/L. All locations had geometric means below the original MADL for DEHP.
- **Total Lead.** The annual geometric mean concentration for total lead was calculated for one UIC location where the concentration was ≥50 percent of the original 50.0 µg/L MADL in Event 1. The annual geometric mean for this location was 15.3 µg/L, below the original MADL for lead.

Annual geometric mean concentrations exceeded the original MADL but not the modified MADL, for the following pollutants:

- **Benzo(a)pyrene**. The annual geometric mean concentration for benzo(a)pyrene was calculated for two UIC locations where the concentration was ≥50 percent of the original 0.2 µg/L MADL. The annual geometric mean concentrations for these locations were 0.045 µg/L (P6_8) and 0.221 µg/L (SP6_10). The annual geometric mean concentration for SP6_10 exceeded the original MADL, but not the modified MADL.
- **Pentachlorophenol**. The annual geometric mean concentration for pentachlorophenol was calculated for six UIC locations where the concentration was ≥50 percent of the original MADL (1.0 µg/L) in at least one sampling event. The annual geometric mean for all locations ranged from 0.45 µg/L to 1.729 µg/L. The geometric mean concentration for three UIC locations (P3_5, SP6_7, and SP6_10) exceeded the original MADL, but not

the modified MADL. The annual geometric means for these three locations ranged from 1.133 to 1.729 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 8 Results

This section evaluates Year 8 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.

4.4.1 Year 8 Concentration Data by Traffic Category

Box plots were prepared using Year 8 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 six pollutants: benzo(a)pyrene, DEHP, pentachlorophenol, total arsenic, total chromium, and total lead.

The following general observations are made regarding this information:

- Pentachlorophenol, lead, arsenic, and DEHP generally appear to be symmetric on a log scale. However, benzo(a)pyrene and total chromium appear to be truncated by the non-detect values.
- The ≥1,000 TPD traffic category has a slightly higher median concentration than the <1,000 TPD category for total chromium, DEHP, total lead, and pentachlorophenol. Total arsenic and benzo(a)pyrene had slightly higher concentrations in the <1000 TPD category.
- The 75th percentile of the distributions of the evaluated pollutants are all less than their respective MADLs. No measurement exceeded 50 percent of the MADLs approved in Permit Modification No. 4.

4.4.2 Individual UIC Location Concentration Data by Sampling Event

Dot plots were prepared for total arsenic (Figure 4-3), benzo(a)pyrene (Figure 4-4), DEHP (Figure 4-5), total lead (Figure 4-6), pentachlorophenol (Figure 4-7), and total chromium (Figure 4-8).

These plots depict the pollutant concentration for each UIC sampling location in Year 8 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; all are below the MADLs approved in Permit Modification No. 4.
- Concentrations at most individual UIC locations are within a narrow concentration range.
- There is less of a noticeable difference between traffic categories than in previous years.
- Many of the highest concentrations are the result of carry-over sites from Year 7.

4.4.3 Year 8 Concentration Data by Sampling Event

Box plots showing the concentrations by sampling event were prepared using Year 8 stormwater discharge data, including non-detect values. Figure 4-9 presents box plots for six pollutants: benzo(a)pyrene, DEHP, pentachlorphenol, total arsenic, total chromium, and total lead.

Box plots were generated using data from 19 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:

- There is no consistent relationship between concentration and event.
- In general, the distribution of concentrations from event to event is very similar.

Section 5

5 Preliminary Trend Analysis

5.1 General

This section presents stormwater discharge monitoring data from Panel 3 for Years 3 and 8, using statistical and graphical methods to identify potential differences or similarities between permit years and traffic categories. Since Panel 3 was the only panel monitored this year, new trend information is available only for it. Complete Year 3 results are presented in the Year 3 annual stormwater discharge monitoring report (City of Portland, 2008a).

Box plots were prepared to present the results of selected analytes for Years 3 and 8. 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 in this or previous years. Plots were generated using data from the third and eighth 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 to compare stormwater discharge concentrations of selected analytes by permit year. Figure 5-1 presents the plot comparisons for pentachlorophenol, total lead, benzo(a)pyrene, DEHP, total chromium, and total arsenic. The following observations are made regarding Figure 5-1:

- Concentration ranges and distributions are very similar between the two permit years in which Panel 3 locations were sampled (Year 3 and Year 8).
- All annual geometric mean concentrations of the evaluated compounds are <50 percent of their respective MADLs for both years.
- Trends in these pollutant concentrations are mostly down or flat. Lead and chromium appear to have distinctly downward trends, while the others are flat. A change in detection limit in DEHP gives the appearance that concentrations have declined, even though they have not changed much between the two monitoring years.

5.3 Traffic Categories

Plots were prepared for Panel 3 to compare the concentrations of selected analytes by traffic category (<1,000 TPD and ≥1,000 TPD) for Years 3 and 8. Figure 5-2 presents the box plots for pentachlorophenol, total lead, benzo(a)pyrene, DEHP, total chromium, and total arsenic by traffic category. The following observations are made regarding Figure 5-2:

- Patterns for both traffic categories have similar concentration ranges for both permit years.
- Distributions of total arsenic, total lead, total chromium, and pentachlorophenol are symmetric, with the geometric mean roughly equal to the median. Distributions of DEHP and benzo(a)pyrene are somewhat skewed by the truncation at the detection limit, but otherwise appear symmetric when the concentrations are further from the detection limit. Both of these patterns are consistent with a lognormal model that has been truncated at the detection limit (i.e., data are skewed by the non-detect values).
- All 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, though the difference is quite small.

Summary: Box plots were prepared to identify potential differences in pollutant concentrations between permit years and traffic categories. In general, data are similar for each variable for Panel 3 in Years 3 and 8. 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 slightly higher in the ≥1,000 TPD traffic category than in the <1,000 TPD category and similar among sample panels.

Section 6

6 Response Actions

This section summarizes the actions taken during Year 8 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 Source Investigations

Source investigations may be conducted when new data are inconsistent with previous results or observations. No new source investigations were initiated in response to Year 8 monitoring results. In accordance with the Final Stormwater Discharge Monitoring Plan Version 2 (2012), however, sampling locations P6_8, SP6_4, and SP6_10 were each sampled again in Year 8 because the annual geometric mean exceeded a MADL for at least one pollutant in Year 7. During Year 8 Event 1 sampling, P6_8 exceeded DEHP and SP6_4 exceeded benzo(a)pyrene; however, no violations were observed during follow-up site investigations. Because the City's fate and transport modeling demonstrated that UICs with pollutant levels commonly found in Portland's stormwater are protective of groundwater, DEQ issued Permit Modification No. 4 (dated December 6, 2012) prior to Event 2 sampling. The permit modification increased the MADLs one order of magnitude for pentachlorophenol, benzo(a)pyrene, DEHP, and lead. No exceedances were identified for these locations during Events 2 and 3; consequently, no subsequent annual geometric means exceeded a MADL. No additional source investigations were required.

Another source investigation was initiated at P2_3 in Year 7 because of individual MADL exceedances (i.e., not annual geometric mean exceedances) for three pollutants in Event 1. This location was not required to be monitored again in Year 8 because annual geometric means did not exceed the MADL for any pollutant in Year 7; however, the site continued to be visually monitored in Year 8. No specific issues or violations were observed during follow-up site investigations performed during Year 8.

6.2 UIC System Cleaning

As a result of observations during pre-sampling inspections or during stormwater event sampling, the City's UIC Program requested that selected UICs be cleaned by City Bureau of Maintenance crews or by the City's response contractor(s). 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 (revised in 2012).

Tables 2-2 and 2-3 identify recent cleaning and/or maintenance activities conducted at Year 8 UIC sampling locations. Cleaning was requested for UICs with records showing that they had not been cleaned in four years or more.

6.3 Investigation of Other Factors

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, additional analysis may be considered (e.g., detailed trend analysis, correlations, or logistic regression). If conducted and appropriate, such evaluation and analyses will be included in the annual UICMP 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)
- Compare data groups to determine if they are statistically different (i.e., concentrations between traffic categories)

Section 7

7 Data Management and Validation

This section summarizes the types of information managed and maintained during Year 8 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 2012-2013 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 Year 8, 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) and field data sheets (FDS). WPCL and Test America (TA) COCs are included with the analytical laboratory data packages (Appendix E).

7.1.2 Laboratory Data

The BES Laboratory Information Management System (LIMS) functions as the WPCL database for data storage, sample tracking, and reporting. In November 2010, 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 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. 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 8 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 8 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 include 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., are systematically filed as they are 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 8 without change. The QAPP provides additional information on DQOs.

Field and laboratory data collected during Year 8 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

This section notes any deviations from field procedures outlined in the SAP. 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 3 UIC locations were already scouted prior to Year 3, they were included in Year 8 pre-sampling investigations to ensure that sample locations were still accessible and suitable for sampling. The SAP describes the factors used in this evaluation.

Sample Stratification. UIC monitoring locations are stratified by traffic category (>1,000 or <1,000 TPD). More accurate GIS transportation system metadata in 2006 resulted in the change of traffic categories for two Panel 1 UICs from >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 >1,000 TPD category. Year 7 included Panel 2, which included 14 UIC sampling locations in the <1,000 TPD and 16 locations in the >1,000 TPD category. As discussed in Section 2.2.2, in Year 3, Panel 3 was noted as including seven UICs with traffic counts <1,000 TPD and eight UICs with traffic counts >1,000 TPD. However, the traffic count for UIC P3_12 has since been updated, from an estimated 459 TPD to 4,561 TPD. No physical UIC locations have changed.

Precipitation Events. Three sampling events were completed successfully between October 2012 and May 2013. Table 3-7 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 2012-2013 wet season. Several samples needed to be collected from surcharged UICs; however, this is not generally believed to affect sample quality.

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 8 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 8 analytical data were determined to meet the identified DQOs and to be of acceptable quality. All planned data were collected and analyzed, and all permit-required data were considered usable. Year 8 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 8 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 was 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 BES Investigation and Monitoring Services (IMS) staff. Selected samples were flagged by the WPCL QA Coordinator, using 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. Final lab reports were then generated and provided to the IMS Monitoring Coordinator. The data were released to the UIC program for use following preliminary data usability and field QC sample data review for each event by IMS.

Table 7-2 summarizes all noteworthy laboratory QC issues identified during the 2012-2013 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.

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.

[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

7.4.1 Deviations, Nonconformance, and Occurrences

No deviations, nonconformance, or occurrences were noted during the 2012-2013 wet season.

7.4.1 Field Corrective Actions

A field corrective action is initiated if problems associated with field measurements or field sampling equipment are observed. No corrective action was taken during the 2012-2013 wet season.

7.4.1 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 2012-2013 wet season.

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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

ATSDR 2002. *Toxicological Profile for Di(2-ethylhexyl)phthalate (DEHP).* Agency for Toxic Substances and Disease Registry. September 2002. http://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=684&tid=65

Brown and Caldwell. 1997. *Surface Stormwater Facilities Maintenance Management Manual.* Prepared for City of Portland Bureau of Environmental Services. April 1997.

City of Portland, Bureau of Environmental Services. 2005. *WPCL Quality Manual.* Revision 6. April 2005.

City of Portland, Bureau of Environmental Services. 2006a. *Stormwater Discharge Monitoring Plan* [consists of *Sampling and Analysis Plan* and *Quality Assurance Project Plan*]. February 2006. Version: 1.

City of Portland, Bureau of Environmental Services. 2006b. *Annual Stormwater Discharge Monitoring Report – Year 1 – October 2005 – May 2006*. July 2006.

City of Portland, Bureau of Environmental Services. 2006c. *Systemwide Assessment.* July 2006.

City of Portland, Bureau of Environmental Services. 2008a. *Annual Stormwater Discharge Monitoring Report – Year 3 – October 2007 – May 2008*. July 2008.

City of Portland, Bureau of Environmental Services. 2012a. *Stormwater Discharge Monitoring Plan* [consists of *Sampling and Analysis Plan* and *Quality Assurance Project Plan*]. December 2012. Version 2.

City of Portland, Bureau of Environmental Services. 2012b. *Annual Stormwater Discharge Monitoring Report – Year 7 – October 2011 – May 2012*. July 2012.

City of Portland, Bureau of Environmental Services. 2012c. Permit Modification Request No. 3, Attachment A. Submitted to DEQ January 10, 2012.

City of Portland, Bureau of Environmental Services. 2012d. Permit Modification Request No. 4. Submitted to DEQ December 6, 2012.

DEQ. 2005a. Water Pollution Control Facilities Permit for Class V Stormwater Underground Injection Control Systems, Permit No. 102830. June 1, 2005.

DEQ. 2005b. *Permit Evaluation Report*. June 1, 2005.

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. 40 p. http://pubs.usgs.cov/sir/2008/5059

Snyder, D.T., D.S. Morgan, and T.S. McGrath. 1994. Estimation of groundwater recharge from precipitation, runoff into drywells, and on-site waste disposal systems in the Portland Basin, Oregon and Washington. Water Resources Investigations Report WRIR 92-4010. http://or.water.usgs.gov/pubs_dir/orrpts.html5HDR6

Stevens, D.L., Jr., and A.R. Olsen. 2004. Spatially-balanced sampling of natural resources. *Journal of the American Statistical Association*. 99: 262-278.

Urquhart, N. S. & T.M. Kincaid. 1999. 'Designs for Detecting Trend from Repeated Surveys of Ecological Resources', Journal of Agricultural, Biological, and Environmental Statistics 4(4), 404-414.

USGS. 2008. Estimated Depth to Groundwater and Configuration of the Water Table in the Portland, Oregon Area: Scientific Investigations Report. 2008-5059.

2012-13 (Year 8) UIC Monitoring
Panel 3 - Site 2
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Investigations & Monitoring Services
Bureau of Environmental Services

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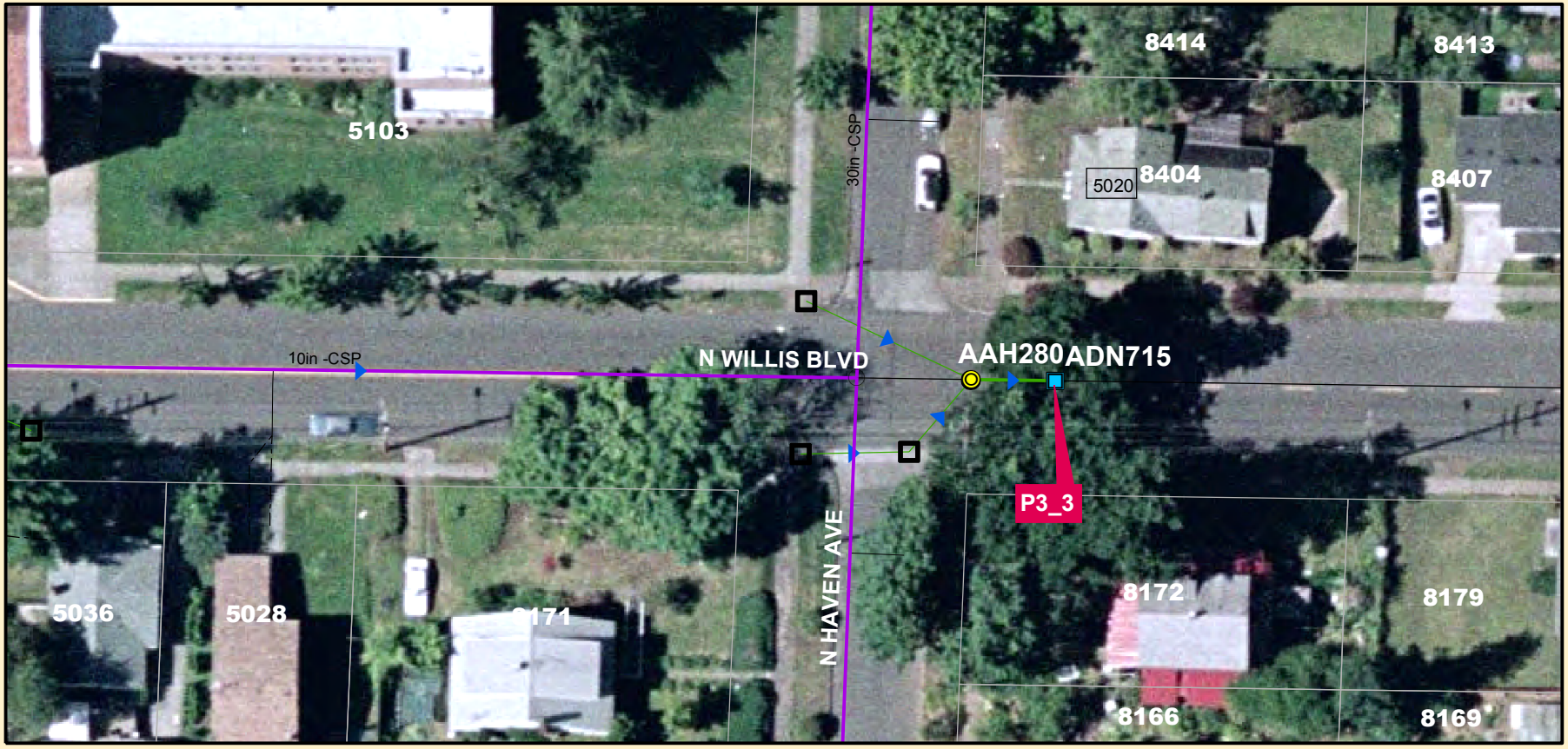

2012-13 (Year 8) UIC Monitoring
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Investigations & Monitoring Services
Bureau of Environmental Services

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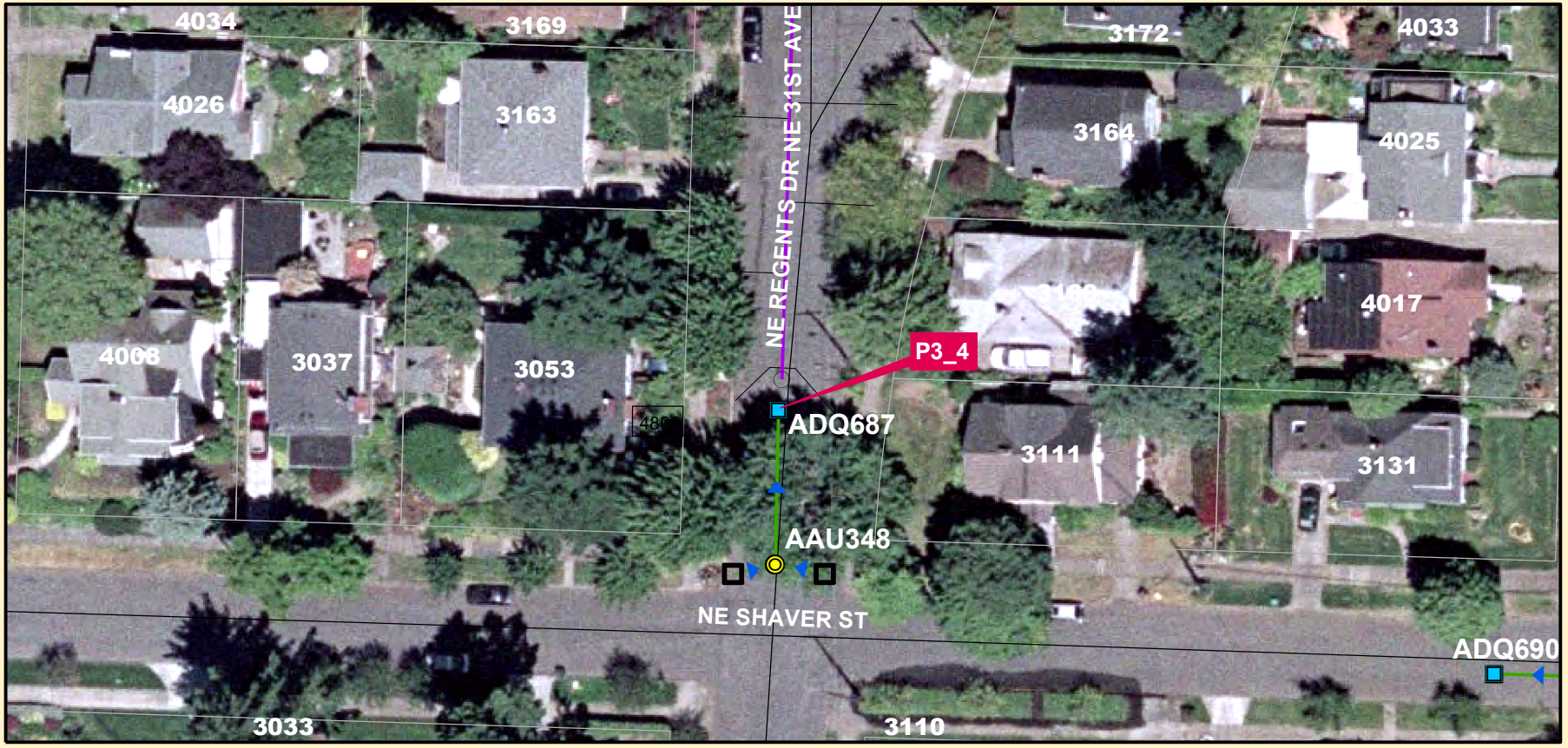

2012-13 (Year 8) UIC Monitoring
Panel 3 - Site 4
3150 NE Regents Dr - ADQ687

Investigations & Monitoring Services
Bureau of Environmental Services

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2012-13 (Year 8) UIC Monitoring
Panel 3 - Site 5
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Investigations & Monitoring Services
Bureau of Environmental Services

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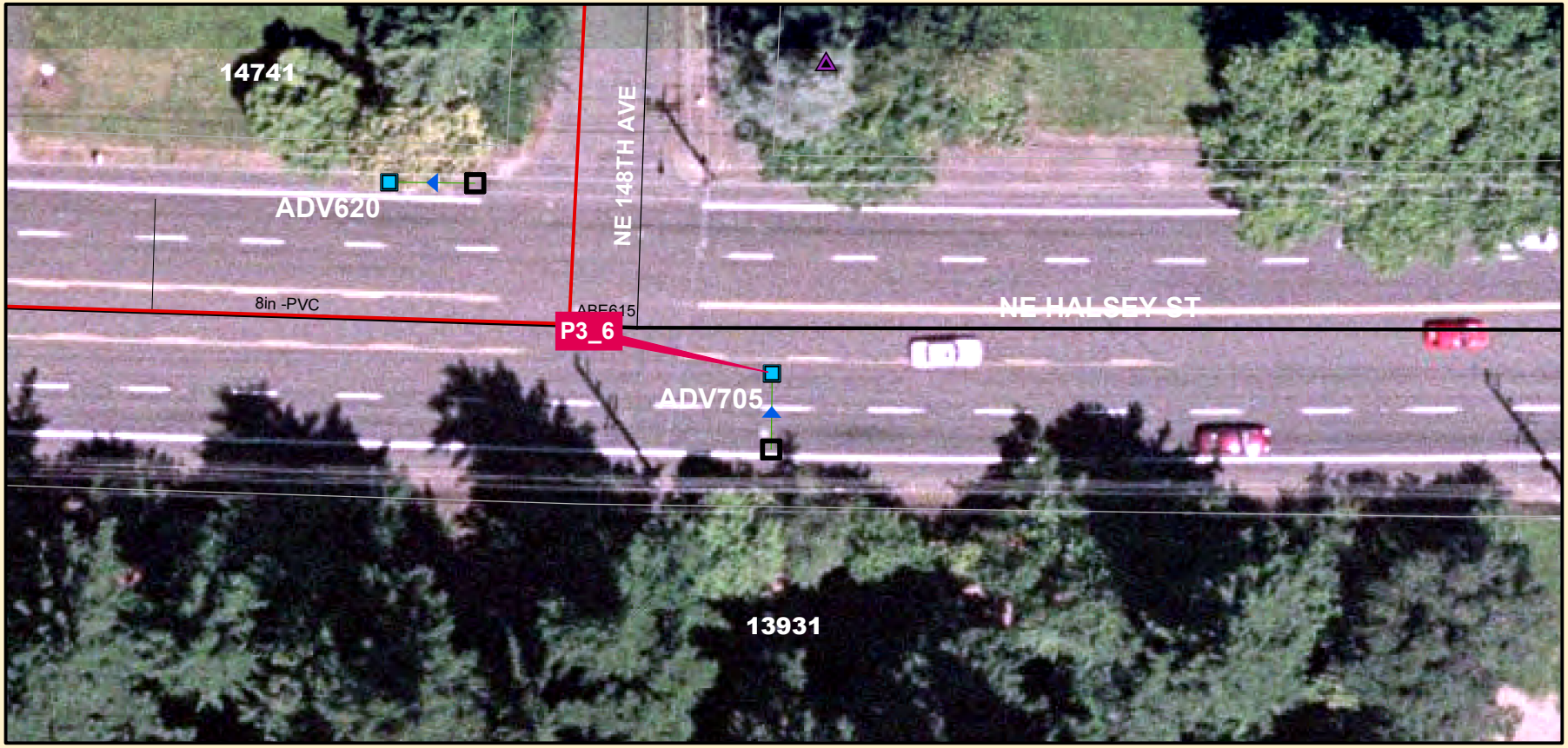

2012-13 (Year 8) UIC Monitoring
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Investigations & Monitoring Services
Bureau of Environmental Services

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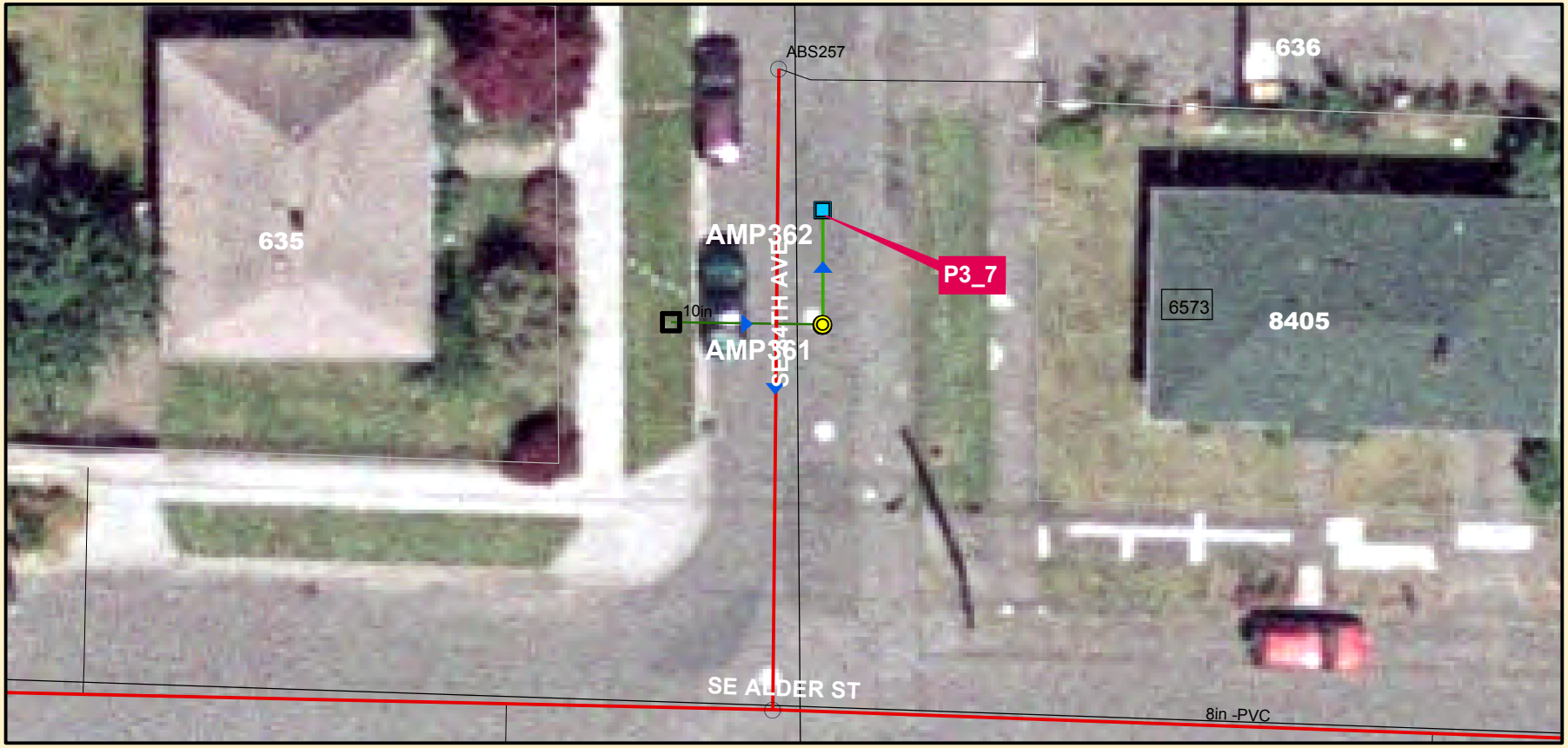

2012-13 (Year 8) UIC Monitoring
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Investigations & Monitoring Services
Bureau of Environmental Services

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2012-13 (Year 8) UIC Monitoring
Panel 3 - Site 8
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Investigations & Monitoring Services
Bureau of Environmental Services

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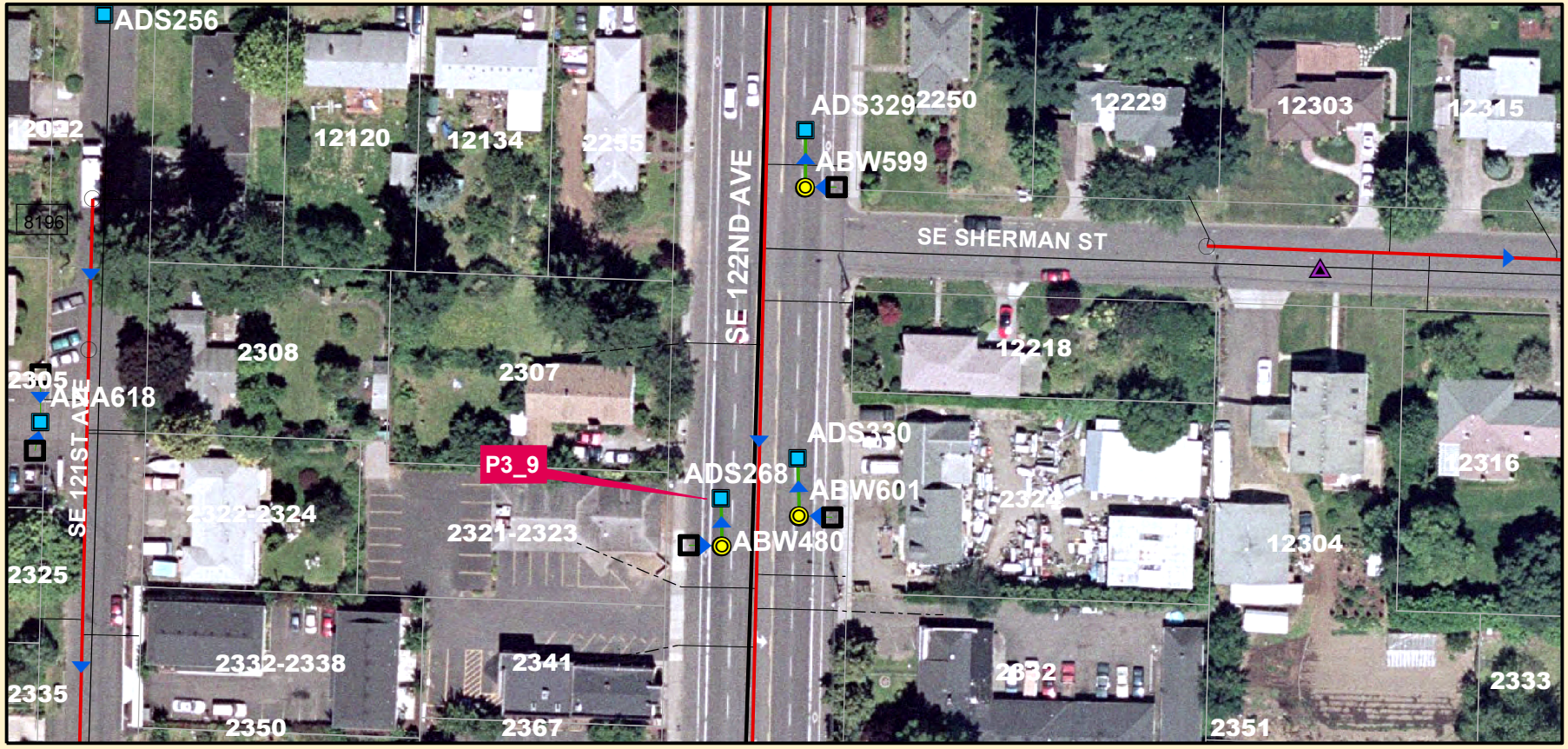

2012-13 (Year 8) UIC Monitoring
Panel 3 - Site 9
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Investigations & Monitoring Services
Bureau of Environmental Services

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2012-13 (Year 8) UIC Monitoring
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Investigations & Monitoring Services
Bureau of Environmental Services

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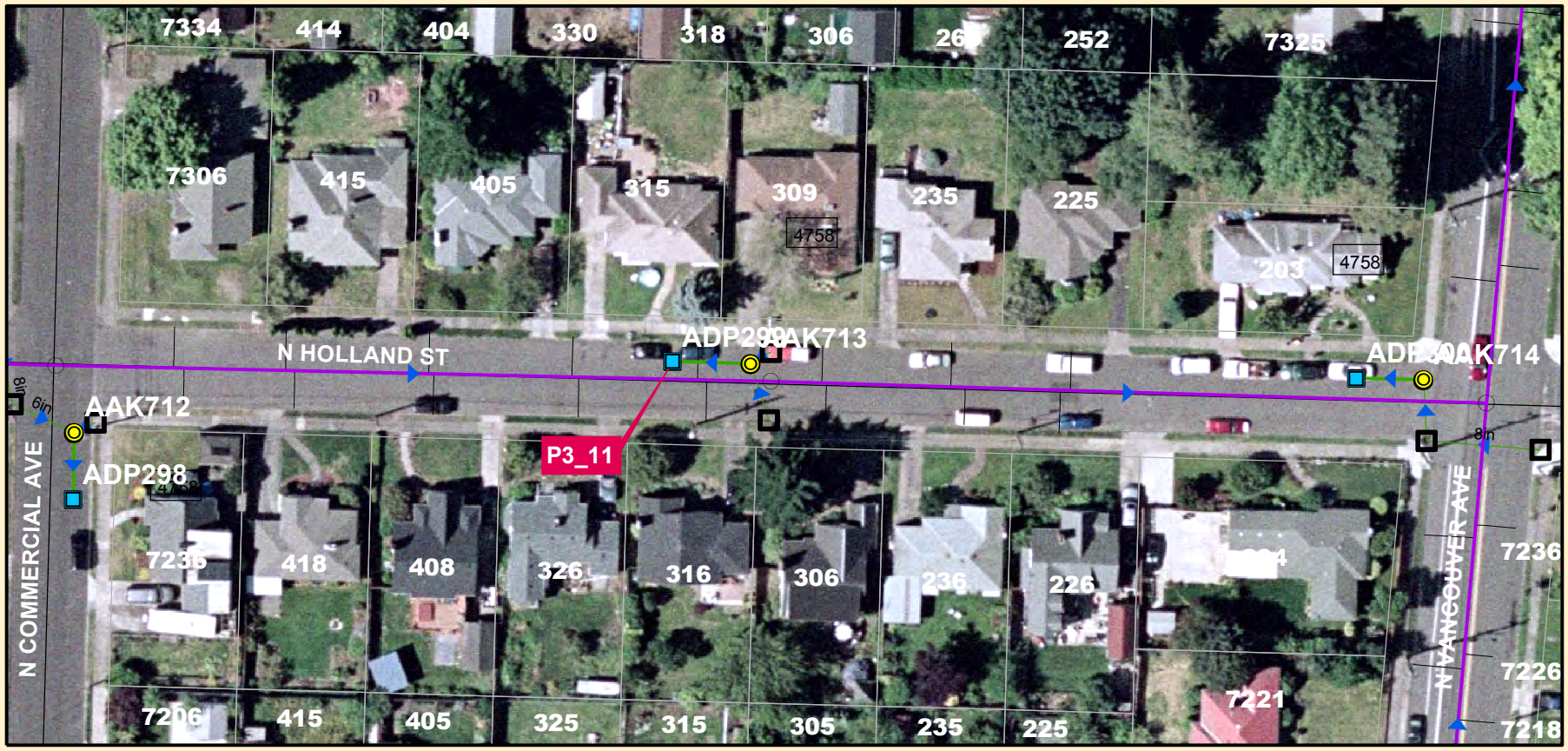

2012-13 (Year 8) UIC Monitoring
Panel 3 - Site 11
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Investigations & Monitoring Services
Bureau of Environmental Services

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2012-13 (Year 8) UIC Monitoring
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Bureau of Environmental Services

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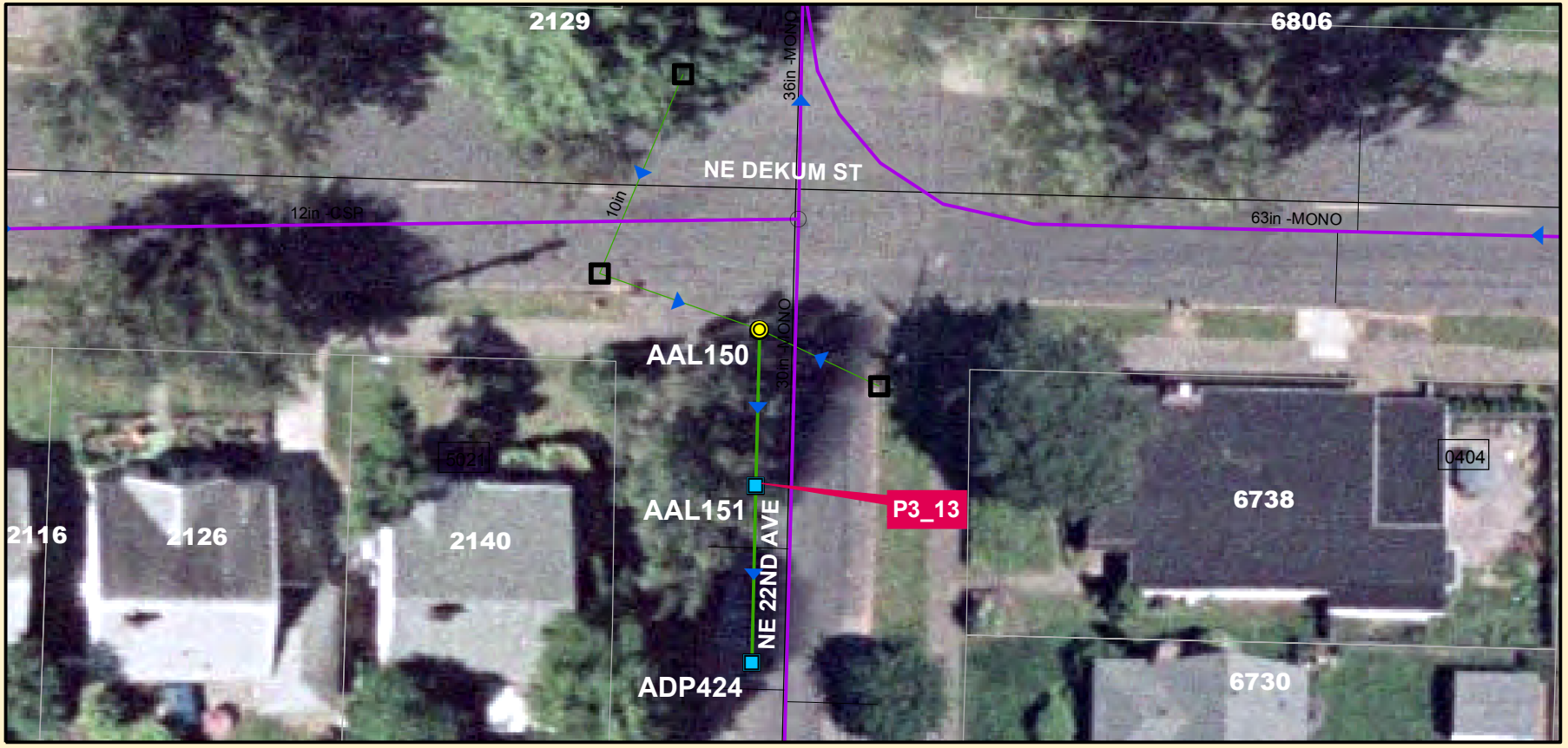

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Bureau of Environmental Services

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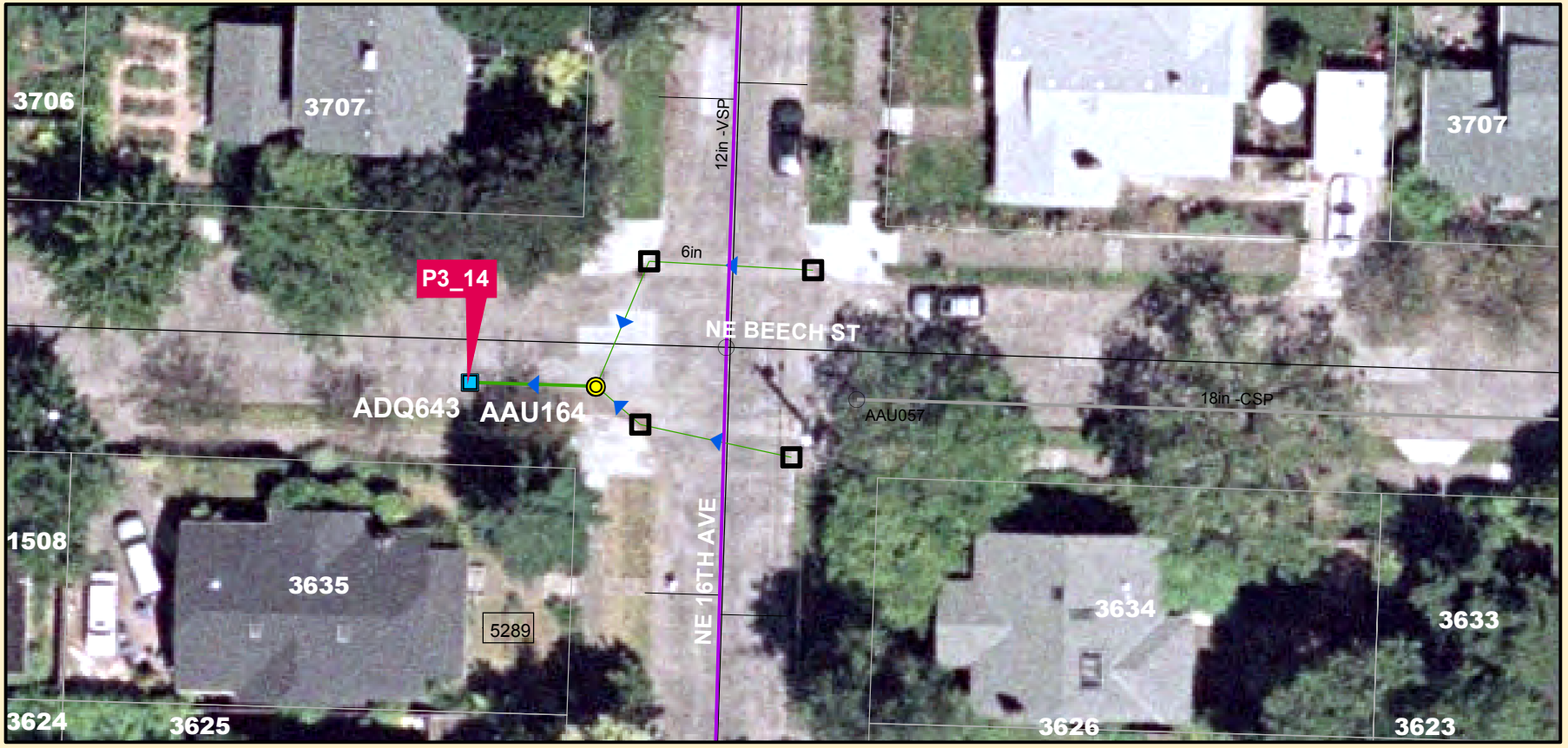

2012-13 (Year 8) UIC Monitoring
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Investigations & Monitoring Services
Bureau of Environmental Services

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2012-13 (Year 8) UIC Monitoring
Panel 3 - Site 15
8003 SE 11th Ave - ADU050

Investigations & Monitoring Services
Bureau of Environmental Services

Source: ESRI Data & Maps CD
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2012-13 (Year 8) UIC Monitoring
Panel 6 - Site 8
10064 SE Woodstock Blvd - ADV169

Investigations & Monitoring Services
Bureau of Environmental Services

Source: ESRI Data & Maps CD
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2012-13 (Year 8) UIC Monitoring

Supplemental Panel 6 - Site 10

321 SE 80th Ave

ADV724

Investigations & Monitoring Services
Bureau of Environmental Services

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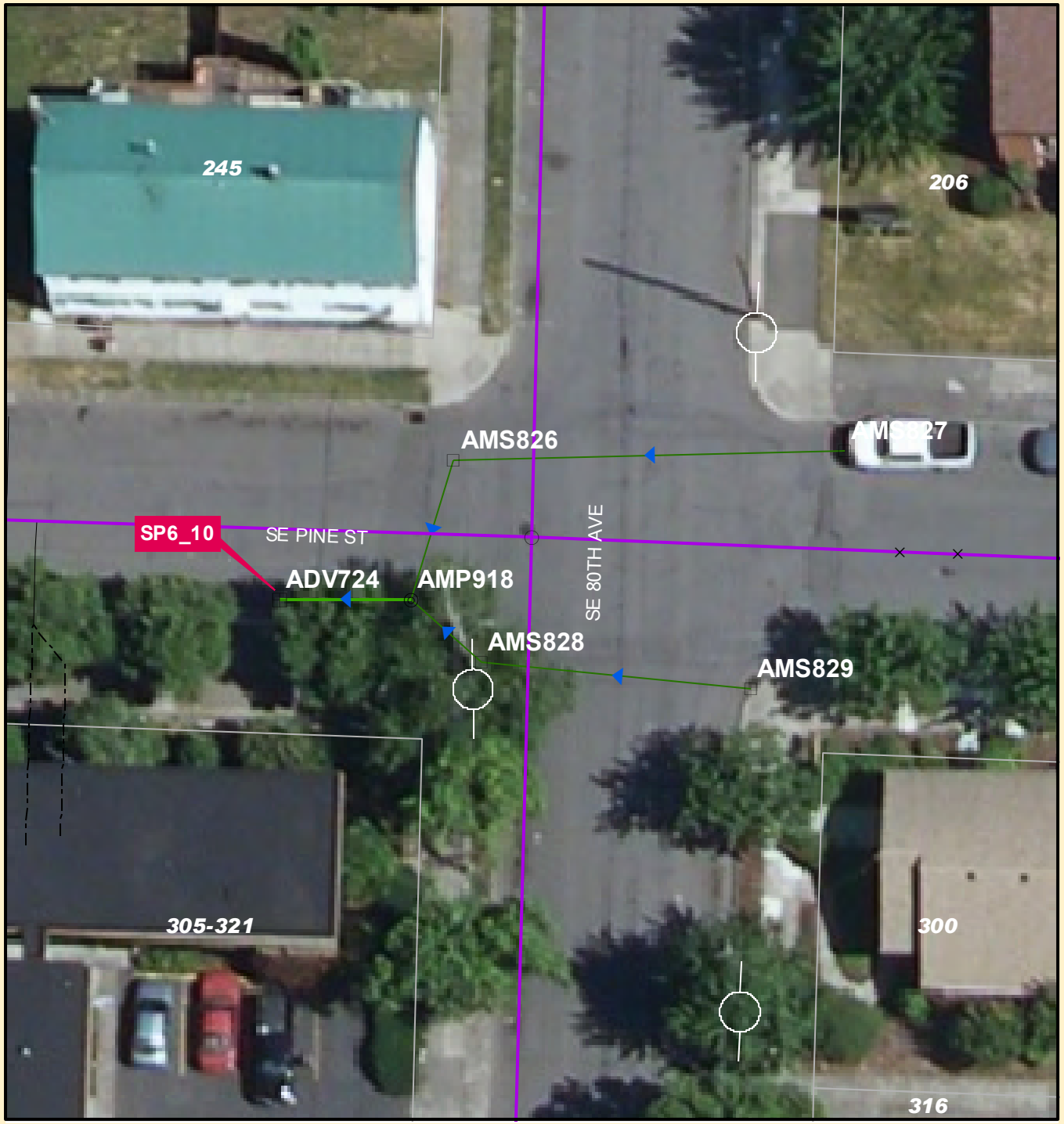

2012-13 (Year 8) UIC Monitoring

Supplemental Panel 6 - Site 4

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Investigations & Monitoring Services
Bureau of Environmental Services

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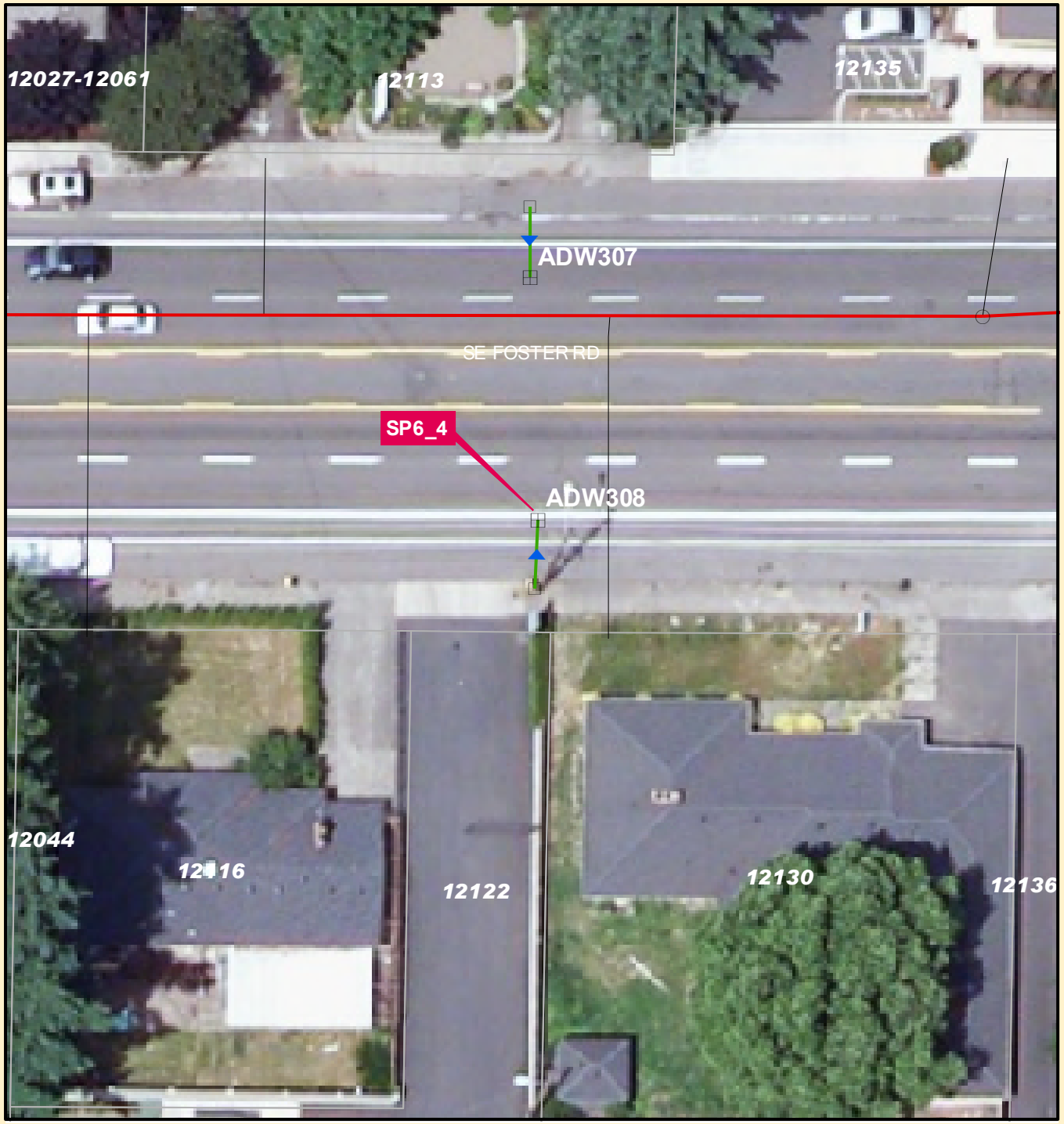

2012-13 (Year 8) UIC Monitoring

Oversample Panel - Site 37

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ADN343

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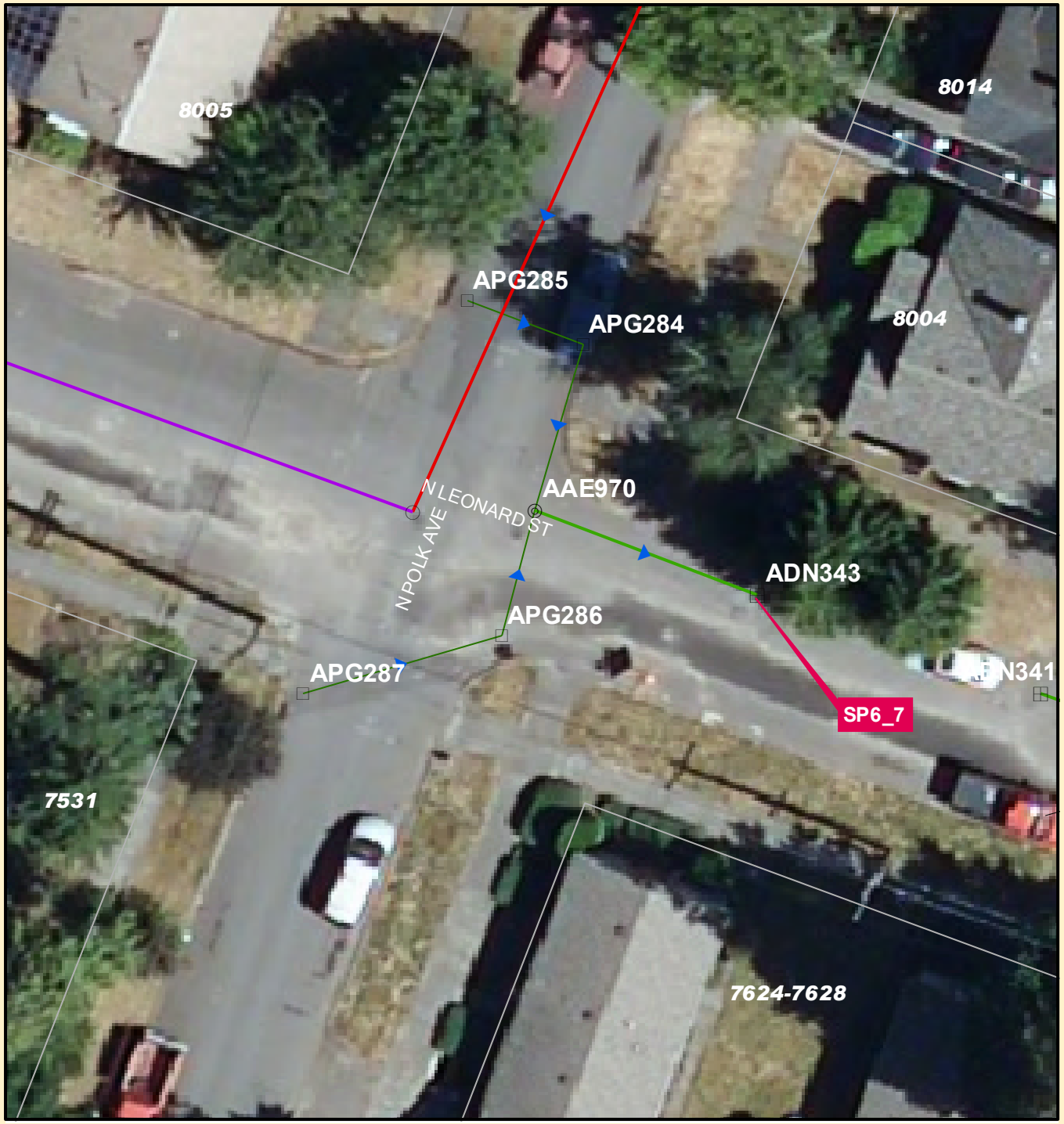


Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

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 3-8 Figures 3-1 through 3-4 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 8 Panel 3 Table 2-3 - Year 7 Carry-over
(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 8 Panel 3 Table 2-3 - Year 7 Carry-over
(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 8 Panel 3 Table 2-3 - Year 7 Carry-over 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 8 Panel 3 Table 2-3 - Year 7 Carry-over
(10) The estimated total volume of recharge to the aquifer by public UICs.	Section 3 Table 3-9
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

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

(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, 6 and 7
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 and 5-2
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.	Sections 4 and 6
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 10th[3] 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

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

i. If 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 Table 4-9
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.	
k. In the event the Permittee undertakes groundwater monitoring, the Permittee must provide the following:	Not applicable for Year 8. Groundwater monitoring was not performed in Year 8.
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	

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

viii. If applicable, a discussion of any Department-approved groundwater corrective actions, including, but not limited to:	Not applicable for Year 8. Need for groundwater Corrective Action was not identified in Year 8.
(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 Version 2 (Dec. 2012)[4] Section 2
b. Ensure the results of the system-wide assessment, required under Schedule D.8, are incorporated into the SDMP as appropriate;	SDMP Version 2 (Dec. 2012)
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
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;	Section 3.2
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 Version 2 (Dec. 2012)
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.	Section 4.2.1

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].

[3] The Priority Pollutant Screen was changed from Year 9 to Year 10 per Permit Modification No. 3 (April 19, 2012).

[4] Permit Modification No. 3, April 19, 2012

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 Lot
≥ 1,000	Residential Feeder Streets; Commercially Zoned Areas; Transportation Corridors; Industrial Areas

Table 2-2: UIC Location Information - Rotating Panel, Year 8, Panel 3

Location Code	Approximate Address[a]	Estimated Trips per Day (TPD)[g]	Traffic Category[g] (TPD)	Predominant Land Use[b]	DEQ UIC ID	BES ID[c]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance[d]	Distance to Nearest Well (ft)[e]	Within Two-year Time of Travel from Public Drinking Water Well?	Date of Last Maintenance	Maintenance Performed	Sediment Level (ft)[f]
P3_1	2810 N BUFFALO ST	5,988	> 1000	SFR	10102 - 2657	ADP171	45.57	-122.69	30	Sed MH	75	6755	No	2012	15967420 CLEAN SUMP & SED	1
P3_2	11759 SE TAYLOR ST	140	< 1000	SFR	10102 - 7653	ADT035	45.51	-122.54	30	Sed MH	94	2882	No	2010	15967420 CLEAN SUMP & SED	3.5
P3_3	4940 N WILLIS BLVD	3,828	> 1000	SFR	10102 - 2373	ADN715	45.58	-122.71	20	Sed MH	70	4880	No	2012	15967420 CLEAN SUMP & SED	3
P3_4	3150 NE REGENTS DR	1,199	> 1000	SFR	10102 - 3683	ADQ687	45.55	-122.63	32.6	Sed MH	181	4791	No	2012	15967420 CLEAN SUMP & SED	3
P3_5	5518 N CAMPBELL AVE	5,155	> 1000	COM	10102 - 4422	ADP547	45.56	-122.68	31.2	Sed MH	87	8519	No	2012	15967420 CLEAN SUMP & SED	2.5
P3_6	14800 NE HALSEY ST	16,483	> 1000	POS	10102 - 8445	ADV705	45.53	-122.51	20	No Pretreatment	114	1860	No	2011	15967420 CLEAN SUMP & SED	0
P3_7	635 SE 84TH AVE	1,230	> 1000	MFR	10102 - 112	AMP362	45.51	-122.57	24.6	Sed MH	134	3829	No	2009	15967420 CLEAN SUMP & SED	3
P3_8	4320 SE 101ST AVE	394	< 1000	SFR	10102 - 6271	ADT366	45.49	-122.55	31	Sed MH	48	2867	No	2012	15967420 CLEAN SUMP & SED	3.5
P3_9	2321 SE 122ND AVE	22,938	> 1000	COM	10102 - 7444	ADS268	45.5	-122.53	21	Sed MH	66	609	No	2012	15967420 CLEAN SUMP & SED	1.8
P3_10	6310 SE FRANKLIN ST	391	< 1000	SFR	10102 - 6944	ADU095	45.49	-122.59	30	Sed MH	102	4700	No	2012	15967420 CLEAN SUMP & SED	4
P3_11	315 N HOLLAND ST	291	< 1000	SFR	10102 - 2568	ADP299	45.57	-122.66	30	Sed MH	63	2153	No	2012	15967420 CLEAN SUMP & SED	3
P3_12	7346 SE 46TH AVE	459	< 1000	SFR	10102 - 5149	ADT782	45.46	-122.61	26.2	Sed MH	77	2666	No	2013	15967420 CLEAN SUMP & SED	0
P3_13	6738 NE 22ND AVE	3651	> 1000	SFR	10102 - 2687	AAL151	45.57	-122.64	25.2	Sed MH	61	3074	No	2012	15967420 CLEAN SUMP & SED	3
P3_14	1600 NE BEECH ST	412	< 1000	SFR	10102 - 3708	ADQ643	45.54	-122.64	35.5	Sed MH	103	5476	No	2009	15967420 CLEAN SUMP & SED	2.1
P3_15	8003 SE 11TH AVE	735	< 1000	SFR	10102 - 4962	ADU050	45.46	-122.65	30.5	Sed MH	43	1653	No	2010	15967420 CLEAN SUMP & SED	3

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

c BES number is obtained from the BES Hansen database.

d 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).

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

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

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

Table 2-3: UIC Summary Information - Carry-over Sites from Year 7 for Year 8

Location Code	Approximate Address[a]	Estimated Trips per Day (TPD)[g]	Traffic Category (TPD)[g]	Predominant Land Use[b]	DEQ UIC ID	BES ID[c]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance[d]	Distance to Nearest Well (ft)[e]	Within Two-year Time of Travel from Public Drinking Water Well?	Date of Last Maintenance	Maintenance Performed	Sediment Level (ft)[f]
P6_8	10064 SE WOODSTOCK BLVD	795	< 1000	IND	10102 - 5448	ADV169	45.47	-122.56	25.75	Sed MH	5	2710	No	2012	15967420 CLEAN SUMP & SED	10
SP6_10	7940 SE PINE ST	908	< 1000	COM	10102 - 7995	ADV724	45.52	-122.58	30.4	Sed MH	133	4884	No	2013	15967420 CLEAN SUMP & SED	8.8
SP6_4	12130 SE FOSTER RD	24953	> 1000	COM	10102 - 5276	ADW308	45.47	-122.53	19.5	No Pretreatment	30	783	No	2010	15967420 CLEAN SUMP & SED	9.5
SP6_7	7624 N LEONARD ST	441	< 1000	SFR	10102 - 2044	ADN343	45.58	-122.74	31.1	Sed MH	64	4141	No	2012	15967420 CLEAN SUMP & SED	1

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

c BES number is obtained from the BES Hansen database.

d 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).

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

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

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

Table 3-1: UIC Stormwater Analytes

Common Pollutants	**Pentachlorophenol**[1] **Di(2-ethylhexyl)phthalate**[2] **Benzo(a)pyrene**	**Arsenic (Total)** **Cadmium (Total)** **Chromium (Total)** **Copper (Total)** **Lead (Total)** **Zinc (Total)**	
Priority Pollutant Screen	Antimony (Total) Barium (Total) Beryllium (Total) Cyanide (Total) Mercury (inorganic) Selenium Thallium Benzene[3] Toluene[3] Ethylbenzene[3] Xylenes[3,6]	**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 **Nitrate-nitrogen**[3]

Notes:

[1] Bold text indicates that the analyte was analyzed during Year 8 as a WPCF or MS4 permit analyte.

[2] Di(2-ethylhexyl)phthalate is also known as bis(2-ethylhexyl)phthalate or DEHP.

[3] BTEX (Benzene, Toluene, Ethylbenzene, and Xylenes) and nitrate-nitrogen were moved from common pollutants to priority pollutant screen pollutants in Year 7 as a result of the major permit modification dated October 4, 2011.

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

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

[6] Xylenes is equal to o-xylene + m,p-xylene.

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

Analyte	Analytical Laboratory	Method	Method Detection Limit	Method Reporting Limit	MADL
Pentachlorophenol	TA[1]	EPA 515.4[2]	0.010 µg/L [3]	0.04 µg/L	10 µg/L [4]
Di(2-ethylhexyl) phthalate	WPCL[5]	EPA 8270-SIM[6]	0.5 µg/L [3]	1.0 µg/L [3]	60 µg/L [4]
Benzo(a)pyrene	WPCL	EPA 8270-SIM[6]	0.01 µg/L	0.01 µg/L	2 µg/L [4]
Total Arsenic	WPCL	EPA 200.8[7]	0.00134 µg/L	0.045 µg/L	10 µg/L
Total Cadmium	WPCL	EPA 200.8[7]	0.00078 µg/L	0.1 µg/L	5 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	500 µg/L [4]
Total Zinc	WPCL	EPA 200.8[7]	0.00424 µg/L	0.5 µg/L	5000 µg/L

Notes:

[1] TA indicates Test America. (North Creek Analytical, identified in the SDMP, was acquired by Test America in early 2006.) Through PY7, analysis was performed at TA in Beaverton, Oregon by EPA Method 515.3. For PY8, analysis was performed at TA in Irvine, California by EPA Method 515.4.

[2] 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.

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

[4] MADL revised in Major Permit Modification No. 4 dated December 6, 2012.

[5] WPCL indicates BES Water Pollution Control Laboratory.

[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.

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 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 µg/L
Total Selenium	WPCL	EPA 200.8[2]	0.0127 µg/L	0.5 µg/L	50 µg/L
Total Thallium	WPCL	EPA 200.8[2]	0.00099 µg/L	0.1 µg/L	2 µg/L
Total (inorganic) Mercury	WPCL	WPCL SOP M-10.02[3]	0.0009 µg/L	0.002 µg/L [4]	2 µg/L
Total Cyanide	WPCL	SM 4500-CN-E[3]	0.002 [4] mg/L	0.01 mg/L	0.2 mg/L
Alachlor	TA[5]	EPA 8270C	0.01 µg/L	0.5 µg/L	2 µg/L
	PAL[6]	EPA 8081B	NR	0.3 µg/L	2 µg/L
Atrazine	TA	EPA 8270C	0.2 µg/L	0.5 µg/L	3 µg/L
	PAL	EPA 8270D	NR	0.3 µg/L	2 µg/L
Benzene	WPCL	EPA 8260B	0.04 µg/L [4]	0.2 µg/L	5 µg/L
Carbofuran	TA	EPA 531.1[3]	0.026 µg/L	0.9 µg/L	40 µg/L
	PAL	EPA 8321B	NR	0.12 µg/L	2 µg/L
Carbon Tetrachloride	WPCL	EPA 8260B	0.05 µg/L [4]	0.2 µg/L	5 µg/L
Chlordane (tech)	TA	EPA 8081	0.5 µg/L	1.0 µg/L	2 µg/L
	PAL	EPA 8081B	NR	0.6 µg/L	2 µg/L
Chlorobenzene	WPCL	EPA 8260B	0.05 µg/L [4]	0.2 µg/L	100 µg/L
2,4-D[7]	TA	EPA 515.4	0.06 µg/L [4]	0.1 µg/L	70 µg/L
Dalapon	TA	EPA 552.2	0.36 µg/L [4]	1.0 µg/L	200 µg/L
o-Dichlorobenzene	WPCL	EPA 8260B	0.06 µg/L [4]	0.5 µg/L	600 µg/L
p-Dichlorobenzene	WPCL	EPA 8260B	0.06 µg/L [4]	0.5 µg/L	75 µg/L
1,3-Dichlorobenzene	WPCL	EPA 8260B	0.04 µg/L [4]	0.5 µg/L	5.5 µg/L
Bis(2-chloroisopropyl) ether	TA	EPA 8270C	0.1 µg/L	0.5 µg/L	0.80 µg/L
Bis(2-chloroethyl) ether	TA	EPA 8270C	0.1 µg/L	0.5 µg/L [8]	0.30 µg/L
Dinoseb[7]	TA	EPA 515.4	0.1 µg/L [4]	0.2 µg/L [4]	7 µg/L
Diquat	TA	EPA 549.2	0.37 µg/L	0.4 µg/L	20 µg/L
Endothall	TA	EPA 548.1	2.0 µg/L	9.0 µg/L	100 µg/L
Ethylbenzene	WPCL	EPA 8260B	0.05 µg/L [4]	0.5 µg/L	700 µg/L
Glyphosate	TA	EPA 547	1.2 µg/L	6.0 µg/L	700 µg/L
Lindane	TA	EPA 8081	0.05 µg/L	0.1 µg/L	0.2 µg/L
	PAL	EPA 8081B	NR	0.12 µg/L	2 µg/L
Picloram[7]	TA	EPA 515.4	0.05 µg/L [4]	0.1 µg/L [4]	500 µg/L
Toluene	WPCL	EPA 8260B	0.04 µg/L [4]	0.5 µg/L	1,000 µg/L
1,2,4-Trichlorobenzene	WPCL	EPA 8260B	0.04 µg/L [4]	0.5 µg/L [4]	70 µg/L
Xylenes	WPCL	EPA 8260B	0.12 µg/L [4]	1.0 µg/L	10,000 µg/L

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

Analyte	Analytical Laboratory	Method	Method Detection Limit	Method Reporting Limit	MADL
Nitrate-Nitrogen[9]	WPCL	EPA 300.0[4]	0.0041 mg/L	0.1 mg/L	10 mg/L

Notes:

NR = Not Reported

[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 8 Data Usability Report in Appendix B.

[4] Method and/or limits changed from QAPP, see PY 8 Data Usability Report in Appendix B.

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

[6] PAL indicates Pacific Agricultural Laboratory. Analytes were reported as part of Multi-Residue Pesticide Screen to meet City of Portland NPDES MS4 permit pesticide monitoring requirements. Multi-Residue Pesticide Screen was conducted on Panel 3 sites only.

[7] Indicates PPS pollutants analyzed during Year 8 as part of routine common pollutant testing and reporting.

[8] Current TA MRL exceeds MADL. Laboratory capabilities will be reviewed prior to Year 10 PPS monitoring to ensure that MRLs are at or below MADLs. The MRL/MDL reflects TA reporting limits based on current MDL study. MRLs/MDLs will be revisited prior to Year 10 PPS monitoring, and lab capabilities will be reviewed to ensure that project data quality objectives are met.

[9] Indicates PPS pollutant analyzed during Year 8 for NPDES MS4 permit monitoring on Panel 3 sites only.

Table 3-4: City of Portland HYDRA Rain Gage[1] Data, Year 8, Event 1

	Hours																							
Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2012-10-26										0.01		0.01													0.03
2012-10-27								0.04	0.06	0.06	0.04	0.04	0.03	0.02	0.13	0.01	0.02	0.01		0.06	0.07	0.01			0.60
2012-10-28							0.05	0.01				0.01	0.04	0.14	0.18	0.11	0.04	0.05	0.05	0.04	0.02	0.02	0.01	0.03	0.79
2012-10-29	0.01	0.09	0.06	0.08	0.01	0.01																	0.05	0.12	0.44
2012-10-30	0.02			0.01		0.02		0.02	0.04	0.09	0.09	0.1	0.05	0.04	0.01	0.01						0.02	0.01		0.54
2012-10-31						0.01	0.01		0.02	0.03	0.02	0.04	0.03	0.02	0.01	0.02							0.03	0.02	0.29

Notes:

[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 8, Event 2

	Hours																							
Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2012-12-15										0.04	0.05	0.03	0.02	0.04	0.03	0.1	0.02	0.01							0.34
2012-12-16					0.01	0.01	0.04	0.01	0.01	0.04	0.02	0.02	0.02	0.05	0.05	0.04	0.02	0.12	0.14	0.19		0.03	0.05	0.03	0.92
2012-12-17		0.02	0.02	0.01	0.05	0.07	0.05	0.04	0.02		0.02			0.03										0.01	0.36
2012-12-18				0.04	0.03	0.02	0.01		0.02	0.01	0.02	0.01						0.02							0.18
2012-12-19			0.02					0.03	0.04	0.02	0.03		0.01		0.01			0.01	0.1	0.06	0.07	0.03	0.06	0.04	0.55
2012-12-20	0.07	0.12	0.08	0.07	0.08	0.1	0.1	0.11	0.11	0.11	0.06	0.05	0.07	0.04											1.17
2012-12-21					0.01			0.04											0.01	0.02					0.09
2012-12-22				0.01	0.05	0.05	0.01	0.01										0.01							0.16
2012-12-23						0.01		0.01	0.01	0.01	0.01	0.04	0.05	0.04	0.07	0.07	0.07	0.07					0.02	0.02	0.51
2012-12-24	0.01			0.01																					0.02
2012-12-25				0.08	0.09	0.06	0.04	0.02	0.05	0.1	0.09	0.09	0.03	0.07	0.07	0.01		0.01				0.01	0.04	0.04	0.92
2012-12-26	0.03	0.03	0.01		0.01		0.01	0.01			0.01	0.01	0.01		0.01										0.15
2012-12-27																									
2012-12-28																									
2012-12-29																									0.01
2012-12-30																									
2012-12-31																									
2013-01-01																									0.01
2013-01-02																									
2013-01-03																									
2013-01-04				0.02	0.01	0.01	0.01	0.01																	0.06
2013-01-05																							0.01	0.01	0.03
2013-01-06																				0.01	0.05	0.07	0.05	0.07	0.26
2013-01-07	0.09	0.02				0.01	0.03					0.01													0.16
2013-01-08					0.03	0.03	0.03	0.02	0.03																0.14
2013-01-09							0.03	0.03	0.05	0.05	0.01	0.02	0.01												0.22
2013-01-10							0.01	0.06	0.02								0.01				0.02				0.14
2013-01-11																									0.01
2013-01-12																									
2013-01-13																									
2013-01-14																				0.01		0.01	0.01	0.01	0.05
2013-01-15																									0.02
2013-01-16																									
2013-01-17																									
2013-01-18																									
2013-01-19																									
2013-01-20																									0.01

	Hours																							
Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2013-01-21																									
2013-01-22																									
2013-01-23													0.03	0.05	0.05	0.08	0.04								0.26
2013-01-24																		0.02	0.12	0.02	0.04	0.04	0.02	0.02	0.29
2013-01-25	0.02	0.04		0.03	0.05	0.01	0.01		0.01	0.01	0.02														0.21
2013-01-26			0.02	0.01	0.01						0.01														0.06
2013-01-27												0.01	0.01	0.02	0.02	0.04	0.02	0.01		0.02	0.02	0.01			0.19
2013-01-28					0.01	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.02	0.02	0.02	0.04	0.03	0.03	0.03	0.08	0.08	0.08	0.06	0.03	0.75
2013-01-29	0.01	0.03	0.03	0.04	0.03	0.04	0.05	0.02	0.06	0.04	0.02					0.01									0.4
2013-01-30				0.02	0.04	0.03	0.03	0.01	0.01	0.02														0.01	0.19
2013-01-31																									
2013-02-01																									
2013-02-02																									0.01
2013-02-03																									
2013-02-04																									
2013-02-05						0.03	0.01						0.04				0.02	0.01					0.01		0.12
2013-02-06																	0.01						0.04	0.03	0.08
2013-02-07	0.02																	0.01	0.01						0.05
2013-02-08																									
2013-02-09																									
2013-02-10																									
2013-02-11																									0.01
2013-02-12																									
2013-02-13										0.02	0.01														0.03
2013-02-14																									
2013-02-15																									
2013-02-16													0.01	0.01	0.03										0.06
2013-02-17																									
2013-02-18																									0.01
2013-02-19	0.01	0.02		0.02	0.03	0.01																			0.1
2013-02-20																0.04	0.01	0.01	0.01						0.07
2013-02-21												0.02	0.01												0.04
2013-02-22										0.04	0.09	0.14	0.1	0.12	0.02	0.06							0.02		0.6

Notes:

[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 8, Event 3

	Hours																							
Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2013-03-31																									
2013-04-01																									
2013-04-02																									
2013-04-03																									
2013-04-04										0.02	0.02	0.04	0.06	0.02	0.02		0.01								0.22
2013-04-05																0.02	0.04	0.02	0.02	0.05	0.01	0.05	0.02	0.02	0.26
2013-04-06	0.02	0.07	0.05				0.02	0.03										0.04	0.09	0.06	0.06	0.06	0.08	0.06	0.66
2013-04-07	0.06	0.01	0.01	0.04	0.03						0.01	0.02			0.02				0.02						0.23
2013-04-08															0.01										0.04
2013-04-09																									
2013-04-10										0.03	0.02		0.1	0.03											0.18
2013-04-11																									
2013-04-12																			0.03				0.01	0.03	0.07
2013-04-13				0.05	0.02																				0.07
2013-04-14						0.05	0.05	0.02				0.02	0.01				0.01	0.02							0.19
2013-04-15																			0.02	0.01	0.02			0.01	0.07
2013-04-16	0.02																								0.03
2013-04-17																					0.01				0.01
2013-04-18																						0.01	0.03		0.05
2013-04-19	0.01	0.04	0.06	0.05	0.02		0.07	0.05	0.01					0.01											0.33
2013-04-20					0.01																				0.02
2013-04-21																			0.01	0.02					0.03
2013-04-22																									0.01
2013-04-23																									
2013-04-24																									
2013-04-25																									
2013-04-26																									
2013-04-27																									
2013-04-28																									
2013-04-29				0.02	0.1																				0.12
2013-04-30													0.01												0.01
2013-05-01																									
2013-05-02																									
2013-05-03																									

	Hours																							
Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
2013-05-04																									
2013-05-05																									
2013-05-06																									
2013-05-07																									
2013-05-08																									
2013-05-09																									
2013-05-10																									
2013-05-11																									
2013-05-12																		0.01	0.05	0.06	0.01	0.02		0.01	0.16
2013-05-13														0.02		0.01		0.01							0.05
2013-05-14																									
2013-05-15											0.01	0.01													0.03
2013-05-16						0.01	0.02		0.01	0.02				0.06				0.02	0.01						0.17
2013-05-17																		0.01	0.02	0.02					0.06
2013-05-18								0.01	0.02	0.01					0.03	0.03	0.05	0.06	0.01						0.22
2013-05-19																									
2013-05-20																									
2013-05-21				0.02	0.01								0.06	0.14	0.06	0.07	0.04	0.03	0.02						0.46

Notes:

[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: UIC Permit Year 8 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[2] (inches per hour)
1	10/30/2012	0.56 - 0.78+	0.54	7	0.46	9	0.01 - 0.10
	10/31/2012	0.59 - 1.02+	0.29	16	0.24	11	0.00 - 0.04
2	12/19/2012	0.74 - 0.92+	0.83	23	0.14	8	0.01 - 0.04
	12/20/2012	0.71 - 0.88	1.17	1 (29[4])	1.56	21	0.01 - 0.12
	2/22/2013	0.82 - 1.08+	0.6	42	0.58	7	0.02 - 0.14
3	4/4/2013	0.17 - 0.32+	0.22	> 72	0.22	8	0.00 - 0.06
	4/19/2013	0.24 - 0.42+	0.33	3 (> 72[4])	0.37	12	0.00 - 0.07
	5/13/2013	0.28 - 0.41+	0.05	18	0.05	5	0.00 - 0.02
	5/21/2013	0.25 - 0.37+	0.46	> 72	0.43	7	0.02 - 0.14

Notes:

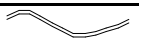
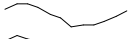
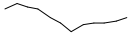
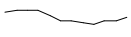
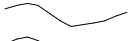
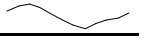
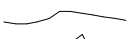
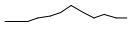
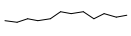
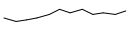
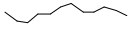
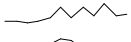
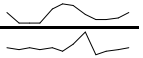
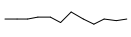
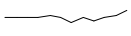
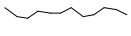
[1] Predicted rainfall from Extended Range Forecasting, Inc. daily reports

[2] Rainfall intensity and totals are the average of 13 rain gauges (see Section 3.0, Year 7 Data Usability Report presented in Appendix B).

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

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

Table 3-8: Climate Data Summary for Years 1-8 and Long-term Average.

		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Year	
Temperature[3]	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	40.0	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	45.0	46.6	48.2	51.0	55.0	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	
	Year 7	61.7	66.7	69.9	67.4	55.5	44.9	39.1	40.8	43.4	45.0	53.0	58.0	61.2	
	Year 8	61.2	68.0	71.1	66.1	56.0	48.7	42.8	37.8	44.4	48.7	52.4	59.7	54.7	
Precipitation[3]	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	27.20	
	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	50.70	
	Year 7	0.73	0.96	0.17	0.62	2.14	6.57	2.51	6.82	2.83	7.89	3.25	3.37	37.86	
	Year 8	4.10	0.21	0.00	0.04	6.14	8.23	7.56	3.49	1.26	1.46	2.19	4.75	39.43	
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	
	Year 7	-0.86	0.24	-0.76	-1.03	-0.74	0.95	-3.20	1.75	-1.35	4.18	0.61	0.99	0.78	
	Year 8	2.51	-0.51	-0.93	-1.61	3.26	2.61	1.85	-1.58	-2.92	-2.25	-0.45	2.37	2.35	

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" and red lines are long term averages.

Table 3-9: 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 Total Impervious Area Drainage[f] (ft^2)	Adjusted Sum of Total UIC Catchment Area[f] (acre)	Adjusted Sum of Total Impervious Area Drainage[f] (acre)	Year 5 Annual Infiltration Volume[g,h,i] (ft^3)	Year 6 Annual Infiltration Volume[g,i,n] (ft^3)	Year 7 Annual Infiltration Volume[g,h,i] (ft^3)	Year 8 Annual Infiltration Volume[g,h,i,m] (ft^3)
City Operated	9,263	693,813,000	260,041,300	16,000	6,000	608,188,000	229,389,500	13,960	5,270	567,949,300	597,655,200	575,729,400	556,491,300
Water	8	- [d]	102,400	- [d]	2.4	- [d]	102,400	- [d]	2.4	253,500	266,800	257,000	248,400
UC[j]	51	- [d]	1,137,900	- [d]	26.1	- [d]	774,200	- [d]	18	1,916,900	2,017,100	1,943,100	1,878,200
Others[k]	244	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]	- [d]
Sum	9,566	693,813,000	261,281,600	16,000	6,028	608,188,000	230,266,100	13,960	5,290	570,119,700	599,939,100	577,929,500	558,617,900
Average per UIC[e]	-	92,600	34,700	2.1	0.8	-	-	-	-	-	-	-	-
Adjusted Average per UIC[f]	-	-	-	-	-	76,200	28,800	1.70	0.7	71,300	75,000	72,300	69,900

Notes:

[a] The volume of stormwater infiltrated estimated to discharge into the City's UICs 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 year given the current conditions (e.g., total UICs, total UIC catchment, and total impervious area).

[b] Approximately 544 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, 732 BES UICs were not included in the 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 UIC catchment areas and impervious area outlier values appeared anomalous (> +2 standard deviations). These values were also changed to average values:92,600 and 34,700 square feet, respectively.

[g] Infiltration Volume = Annual Precipitation (inches) * 1ft/12in *Imprevious 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's Ownership other than BES: Bureau of General Services (BGS), Portland Fire Bureau (FIRE), Portland Parks (PARKS), Water Bureau (WTR).

[m] Year 1, 2, 3 and 4 Annual Infiltration Volumes are available in *Annual Stormwater Discharge Monitoring Reports - Years 1, 2, 3, and 4.*

Table 4-1: Frequency of Detected[1] Common and Priority Pollutant Screen Analytes[2] - Year 8

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	19	19	100	0.067	1.15	12%
		2	0	19	19	100	0.072	0.964	10%
		3	0	19	19	100	0.12	2.2	22%
Cadmium (total)	5	1	0	2	19	11	< 0.1 [3]	0.36	7%
		2	0	2	19	11	< 0.1	0.212	4%
		3	0	5	19	26	< 0.1	0.342	7%
Chromium (total)	100	1	0	16	19	84	< 0.4	3.92	4%
		2	0	18	19	95	< 0.4	3.05	3%
		3	0	18	19	95	< 0.4	5.96	6%
Copper (total)	1300	1	0	19	19	100	1.46	19.8	2%
		2	0	19	19	100	1.41	23.7	2%
		3	0	19	19	100	3.28	43.8	3%
Lead (total)	50 [4]	1	0	19	19	100	0.506	37.5	75%
	500	2	0	19	19	100	0.694	16	3%
	500	3	0	19	19	100	1.27	29	6%
Zinc (total)	5000	1	0	19	19	100	8.79	230	5%
		2	0	19	19	100	8.24	76.8	2%
		3	0	19	19	100	12.5	138	3%
Benzo(a)pyrene	0.2	1	**1** [5]	8	19	42	< 0.01	0.21	105%
	2	2	0	12	19	63	< 0.01	0.16	8%
	2	3	0	8	19	42	< 0.01	0.32	16%
Di(2-ethylhexyl) phthalate	6	1	**1**	15	19	79	< 0.5	9.8	163%
	60	2	0	18	19	95	< 0.5	4.5	8%
	60	3	0	15	19	79	< 0.5	5.1	9%
Pentachlorophenol	1	1	**3**	18	19	95	< 0.0099	1.9	190%
	10	2	0	19	19	100	0.048	2.9	29%
	10	3	0	19	19	100	0.07	1.3	13%

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] (%)
Priority Pollutants									
Total Nitrogen	10000	1	0	1	15	7	< 0.1	0.14	0%
		2	0	4	15	27	< 0.014	0.12	0%
		3	0	8	15	53	< 0.1	0.4	0%
2,4-D	70	1	0	2	19	11	< 0.059	0.71	1%
		2	0	0	19	0	< 0.059	< 0.06	0%
		3	0	2	19	11	< 0.06	2.3	3%
Picloram	500	1	0	0	19	0	< 0.05	< 0.1	0%
		2	0	0	19	0	< 0.05	< 0.05	0%
		3	0	6	19	32	< 0.05	0.57	0%

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 3 and the four carry-over UIC locations. This table does not include the results of duplicate samples or laboratory reanalyses.

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

[4] MADLs were increased after Event 1 per Permit Modification #4,dated December 6, 2012.

[5] 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[2] Priority Pollutant Screen Analyte Data - Year 8

Analyte	MADL (µg/L)	Event[3]	MRL Exceeds MADL	Number of Non-Detections	Number of Samples	Minimum MRL (µg/L)	Maximum MRL (µg/L)
Priority Pollutant Screen[4]							
Alachlor	2	1	0	15	15	0.3	0.3
		3	0	11	11	0.3	0.3
Atrazine	3	1	0	15	15	0.3	0.3
		3	0	11	11	0.3	0.3
Carbofuran	40	1	0	15	15	0.12	0.12
		3	0	11	11	0.12	0.12
Dinoseb	7	1	0	19	19	0.05	0.2
		2	0	19	19	0.099	0.1
		3	0	19	19	0.099	0.1
Gamma-BHC(Lindane)	0.2	3	0	11	11	0.12	0.12
		1	0	15	15	0.12	0.12

Notes:

[1] This table summarizes the results of the UIC stormwater samples for each event. It includes the results of Panel 3 and the four carry-over locations. This table does not include the results of duplicate laboratory reanalyses.

[2] Table 4-1 provides a summary of common pollutants and PPS analytes detected in Year 8.

[3] Municipal Separate Storm Sewer System (MS4) analytes were sampled during two storm events, consistent with the City's National Pollutant Discharge Elimination System (NPDES) permit.

[4] 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 10 (Permit modification #3 in 2012 changed PPS testing from Year 9 to Year 10).

Table 4-3: Summary of Detected Ancillary Pollutants[1] - Year 8

Analyte	Method	Event	Number of Detections	Number of Samples[1]	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration (µg/L)
Ancillary Pollutants Detected by Required Analyses							
2,4-DB	515.4	1	0	19	0	< 0.5 [3]	< 2
		2	0	19	0	< 0.5	< 0.5
		3	1	19	5	< 0.5	1.2
Dicamba	515.4	1	0	19	0	< 0.05	< 1.5
		2	0	19	0	< 0.05	< 0.05
		3	7	19	37	< 0.05	0.35
Dichlorprop	515.4	1	1	19	5	< 0.2	< 1
		2	0	19	0	< 0.69	< 0.7
		3	2	19	11	< 0.69	1.2
Acenaphthylene	EPA 8270M-SIM	1	4	19	21	< 0.02	0.056
		2	4	19	21	< 0.02	0.038
		3	3	19	16	< 0.02	0.057
Anthracene	EPA 8270M-SIM	1	4	19	21	< 0.02	0.071
		2	5	19	26	< 0.02	0.055
		3	2	19	11	< 0.02	0.057
Benzo(a)anthracene	EPA 8270M-SIM	1	7	19	37	< 0.01	0.18
		2	11	19	58	< 0.01	0.15
		3	8	19	42	< 0.01	0.23
Benzo(b)fluoranthene	EPA 8270M-SIM	1	10	19	53	< 0.01	0.32
		2	14	19	74	< 0.01	0.23
		3	11	19	58	< 0.01	0.51
Benzo(ghi)perylene	EPA 8270M-SIM	1	15	19	79	< 0.01	0.23
		2	17	19	89	< 0.01	0.17
		3	14	19	74	< 0.01	0.35
Benzo(k)fluoranthene	EPA 8270M-SIM	1	5	19	26	< 0.01	0.1
		2	8	19	42	< 0.01	0.063
		3	8	19	42	< 0.01	0.17
Butyl benzyl phthalate	EPA 8270M-SIM	1	1	19	5	< 0.5	1.4
		2	0	19	0	< 0.5	< 0.5
		3	0	19	0	< 0.5	< 0.5
Chrysene	EPA 8270M-SIM	1	10	19	53	< 0.01	0.28
		2	14	19	74	< 0.01	0.18
		3	10	19	53	< 0.01	0.45
Di-n-butyl phthalate	EPA 8270M-SIM	1	2	19	11	< 0.5	1.5
		2	1	19	5	< 0.5	1.1
		3	1	19	5	< 0.5	0.57
Di-n-octyl phthalate	EPA 8270M-SIM	1	3	19	16	< 0.5	0.94
		2	2	19	11	< 0.5	0.79
		3	3	19	16	< 0.5	0.57
Dibenzo(a,h)anthracene	EPA 8270M-SIM	1	4	19	21	< 0.01	0.046
		2	7	19	37	< 0.01	0.034
		3	4	19	21	< 0.01	0.076

Analyte	Method	Event	Number of Detections	Number of Samples[1]	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration (µg/L)
Diethyl phthalate	EPA 8270M-SIM	1	1	19	5	< 0.5	0.58
		2	0	19	0	< 0.5	< 0.5
		3	1	19	5	< 0.5	0.51
Dimethyl phthalate	EPA 8270M-SIM	1	0	19	0	< 0.5	< 0.5
		2	0	19	0	< 0.5	< 0.5
		3	2	19	11	< 0.5	1.2
Fluoranthene	EPA 8270M-SIM	1	17	19	89	0.01	0.53
		2	19	19	100	0.011	0.37
		3	15	19	79	< 0.01	0.73
Fluorene	EPA 8270M-SIM	1	4	19	21	< 0.02	0.062
		2	3	19	16	< 0.02	0.037
		3	3	19	16	< 0.02	0.054
Indeno(1,2,3-cd)pyrene	EPA 8270M-SIM	1	8	19	42	< 0.01	0.18
		2	13	19	68	< 0.01	0.12
		3	11	19	58	< 0.01	0.3
Naphthalene	EPA 8270M-SIM	1	14	19	74	< 0.04	0.24
		2	10	19	53	< 0.04	0.066
		3	8	19	42	< 0.04	0.056
Phenanthrene	EPA 8270M-SIM	1	18	19	95	< 0.02	0.25
		2	18	19	95	0.02	0.15
		3	13	19	68	< 0.02	0.31
Pyrene	EPA 8270M-SIM	1	18	19	95	< 0.01	0.44
		2	19	19	100	0.014	0.34
		3	16	19	84	< 0.01	0.61

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event for Panel 3 and the four carry-over UIC 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 8

Metal	MADL[1] (µg/L)	Traffic Category (TPD)	Number of Samples	Number of Detections	Average[2] (µg/L)	Geometric Mean[2] (µg/L)	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Ratio of Dissolved Average/Total Average
Common Pollutants									
Arsenic (total)	10	<1000	30	90	0.52	0.42	0.145	1.42	NA
	10	≥1000	27	110	0.44	0.32	0.067	2.2	
Cadmium (total)	5	<1000	30	18	0.12	0.11	< 0.1	0.36	NA
	5	≥1000	27	50	0.12	0.11	< 0.1	0.342	
Chromium (total)	100	<1000	30	59	1.17	0.94	< 0.4	3.92	NA
	100	≥1000	27	103	1.27	0.99	< 0.4	5.96	
Copper (total)	1300	<1000	30	90	6.94	5.56	1.46	28.5	
	1300	≥1000	27	110	9.57	7.17	1.41	43.8	<1000 46%
Copper (dissolved)	NA	<1000	30	90	3.19	2.21	0.37	20.4	≥1000 45%
	NA	≥1000	27	110	4.31	3.01	0.511	22.6	
Lead (total)	50 [1]	<1000	30	90	5.97	3.34	0.506	37.5	
	50	≥1000	27	110	5.77	3.84	0.605	29	<1000 8%
Lead (dissolved)	NA	<1000	30	53	0.48	0.23	< 0.1	2.94	≥1000 8%
	NA	≥1000	27	87	0.46	0.31	< 0.1	1.52	
Zinc (total)	5000	<1000	30	90	39.07	27.62	8.79	230	
	5000	≥1000	27	110	38.59	31.33	8.24	138	<1000 43%
Zinc (dissolved)	NA	<1000	30	90	16.72	10.84	1.04	75.3	≥1000 44%
	NA	≥1000	27	110	17.02	14.67	3.7	44	
Priority Pollutant Screen									
Mercury (dissolved)	NA	<1000	30	69	0.00	0.00	< 0.001	0.0106	NA
	NA	≥1000	27	78	0.00	0.00	< 0.001	0.0152	

Notes:

[1] The MADL concentration for lead was increased after Event 1.

[2] 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 8

		Total mg/L			
	Number of Samples	**Average**	**Geometric Mean**	**Minimum Concentration**	**Maximum Concentration**
<1,000 Trips per Day					
TSS	30	33	20.9	3	130
≥1,000 Trips per Day					
TSS	27	26.8	17.4	3	160

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 3 and the four 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 8

Field Parameter	Units	Event	Number of Samples	Mean	Geometric Mean	Minimum	Maximum
Conductivity - specific	µmhos/cm	1	19	25.1	20.5	8	80
		2	19	24.5	19.4	6	72
		3	19	53.6	46.8	11	98
pH	Units	1	19	6.5	6.5	5.4	7
		2	19	6.9	6.9	6.1	10.3
		3	19	6.5	6.5	5.9	7.4
Temperature	˚C	1	19	15.6	15.6	14.7	16.4
		2	19	5.6	5.4	4.4	8
		3	19	12.9	12.6	9.9	20.4

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 3 and the four 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 8

Analyte	Location Code	Traffic Category (TPD)	MADL (µg/L)	Event Concentration (µg/L) 1	2	3
Benzo(a)pyrene	P6_8	<1000	0.2	0.12		
	P6_8	<1000	2		0.041	0.018
	SP6_10	<1000	0.2	**0.21** [2]		
	SP6_10	<1000	2		0.16	0.32
Di(2-ethylhexyl) phthalate	P3_7	≥1000	6	3.5		
	P3_7	≥1000	60		4.5	2.9
	P3_9	≥1000	6	5.3		
	P3_9	≥1000	60		3.1	5.1
	P6_8	<1000	6	**9.8**		
	P6_8	<1000	60		4.1	4.1
	SP6_4	≥1000	6	4.6		
	SP6_4	≥1000	60		4.1	3.6
Lead (total)	P6_8	<1000	50	37.5		
	P6_8	<1000	500		4.82	19.9
Pentachlorophenol	P3_15	<1000	1	0.69		
	P3_15	<1000	10		0.44	0.3
	P3_3	≥1000	1	**1.3**		
	P3_3	≥1000	10		0.54	0.39
	P3_5	≥1000	1	**1.9**		
	P3_5	≥1000	10		2.5	0.89
	P3_9	≥1000	1	0.59		
	P3_9	≥1000	10		0.79	0.34
	SP6_10	<1000	1	0.8		
	SP6_10	<1000	10		1.4	1.3
	SP6_7	<1000	1	**1.8**		
	SP6_7	<1000	10		2.9	0.99

Notes:

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

[2] Bolded numbers exceed the MADL.

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 3 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 8 Annual Mean Concentrations - Common Pollutants[1]

Analyte	MADL (µg/L)[2]	Location Code	Traffic Category (TPD)	Number of Events	Event Concentration (µg/L)			
					Average (µg/L)	Geometric Mean (µg/L)	Minimum[3] (µg/L)	Maximum (µg/L)
Benzo(a)pyrene	2	P6_8	<1000	3	0.06	0.045	0.018	0.12
		SP6_10	<1000	3	0.23	0.221	0.16	0.32
Di(2-ethylhexyl) phthalate	60	P3_7	≥1000	3	3.63	3.575	2.9	4.5
		P3_9	≥1000	3	4.5	4.376	3.1	5.3
		P6_8	<1000	3	6	5.482	4.1	9.8
		SP6_4	≥1000	3	4.1	4.08	3.6	4.6
Lead (total)	500	P6_8	<1000	3	20.74	15.322	4.82	37.5
Pentachlorophenol	10	P3_15	<1000	3	0.48	0.45	0.3	0.69
		P3_3	≥1000	3	0.74	0.649	0.39	1.3
		P3_5	≥1000	3	1.76	1.617	0.89	2.5
		P3_9	≥1000	3	0.57	0.541	0.34	0.79
		SP6_10	<1000	3	1.17	1.133	0.8	1.4
		SP6_7	<1000	3	1.9	1.729	0.99	2.9

Notes:

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

[2] MADL reflects DEQ-approved concentration as of Major Permit Modification No.4 dated December 6, 2012.

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

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 8
UIC WPCF Permit Monitoring

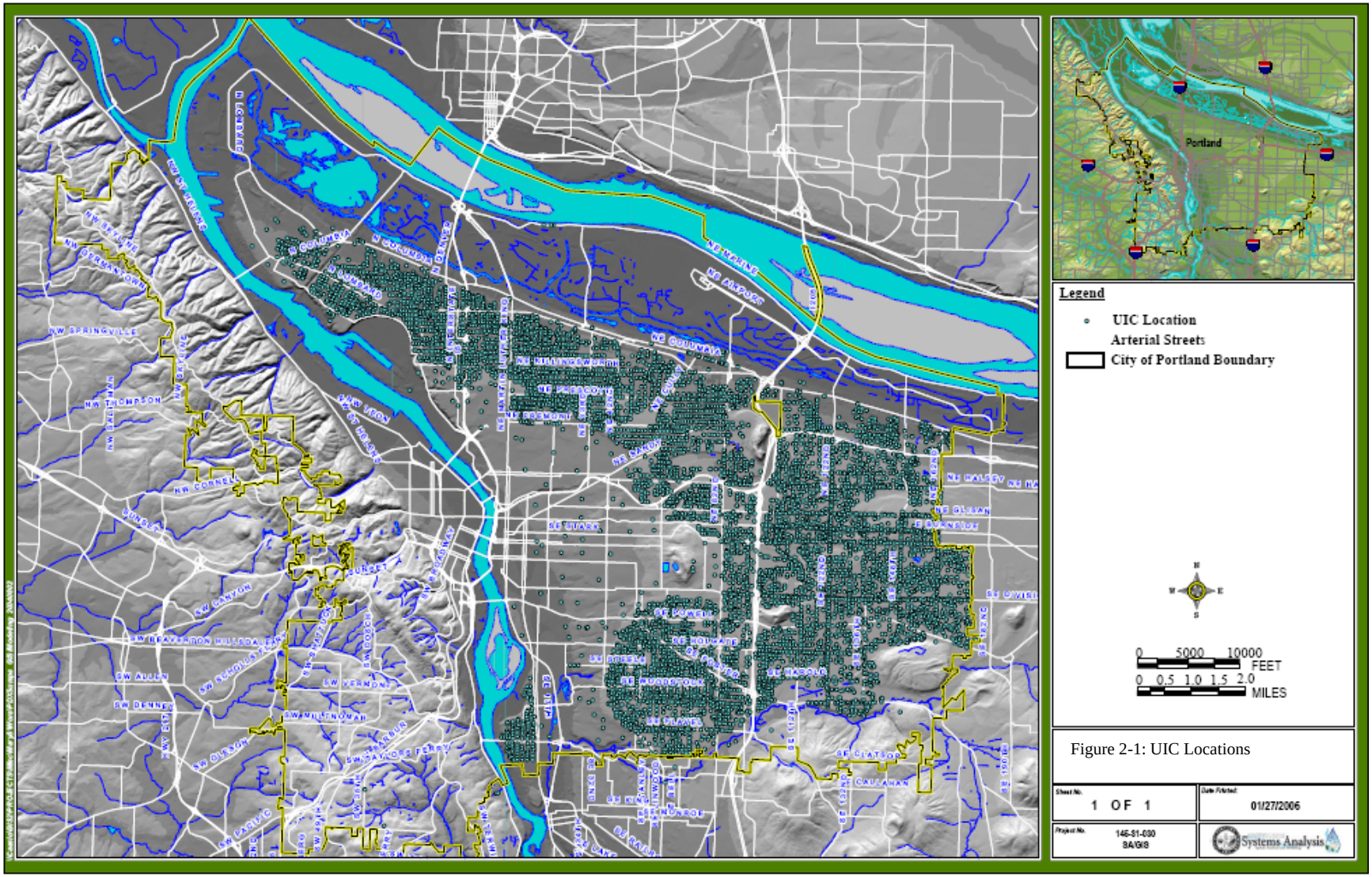
Event	Method	Issue	Affected Samples	Cause	Comments, Actions Taken	Usability
1	365.1	Orthophosphate field duplicate RPD failed 0.24/0.31 ug/l (25.5%)	P3_1, P3_1 DUP	Non-homogenous samples, low concentrations	Sample results < 5x MRL, no action taken.	Usable
	SM 2540D	Total Suspended Solids field duplicate RPD failed 3/< 2 mg/l (> 40%)	P3_6, P3_6 DUP	Non-homogenous samples, low concentrations	Sample results < 5x MRL, no action taken.	Usable
	515.4	2,4-D (135%), 2,4-DB (43%, 63%), 3,5-Dichlorobenzoic acid (140%, 147%), Bentazon (131%, 133%), and 3,5-Dichlorobenzoic acid (135%, 135%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable except for 2,4-DB (37%) and Bentazon (29%), analytes not detected, no other QC issues, no action taken.	Usable
	515.4	2,4-Dichlorophenylacetic acid surrogate recovery slightly low (50%)	P6_8	Matrix effects	Most analytes not detected, pentachlorophenol not detected though it is usually detected at this location. Pentachlorophenol result qualified with "UJ" for reporting limit may be inaccurate or imprecise.	Usable with qualifiers
	515.4	Pentachlorophenol field duplicate RPD failed 0.41/0.3 ug/l (31%)	P3_6, P3_6 DUP	Non-homogenous samples, low concentrations	Sample results qualified with "J" for estimated.	Usable with qualifiers
	Modified 8081B, 8141B, 8270D, and 8321B	For batch 2110502, Diazinon (127%, 137%, 132%) MS/MSD/MSD2 recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
2	365.1	For batch B13B338, Ortho-phosphate MS recovery (71%) outside acceptance limits	None	Matrix effects	No other QC issues, sample results consistent with seasonal variation in previous data, no action taken.	Usable
	SM 5310B	Total Organic Carbon field duplicate RPD failed 1.77/1.36 mg/l (26.2%)	P3_6, P3_6 DUP	Non-homogenous samples, low concentrations	Sample results < 5x MRL, no action taken.	Usable
	SM 2540D	Total Suspended Solids field duplicate RPD failed 10/8 mg/l (> 40%)	P3_6, P3_6 DUP	Non-homogenous samples, low concentrations	Sample results < 5x MRL, no action taken.	Usable
	515.4	2,4-Dichlorophenylacetic acid surrogate recovery high (182%)	None	Matrix effects	See MS/MSD results below.	Usable
	515.4	For batch 75215, Acifluorfen (134%), 2,4,5-TP (61%, 57%), 2,4-D (61%, 60%), 2,4-DB (0%, 0%), 3,5-Dichlorobenzoic acid (41%, 47%), Dichlorprop (52%, 55%), Dinoseb (66%, 58%), and Pentachlorphenol (25%, 24%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, MSD surrogate recovery high. Source sample from different project, no action taken.	Usable
	515.4	For batch 89597, Acifluorfen (154%, 153%) and 2,4,5-TP (134%, 146%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
3	200.8	Lead field duplicate RPD failed 2.46/3.2 mg/l (26%)	P3_3, P3_3 DUP	Non-homogenous samples, low concentrations	Sample results qualified with "J" for estimated.	Usable
	SM 5310B	Total Organic Carbon field duplicate RPD failed 7.57/14.9 mg/l (65.2%)	P3_3, P3_3 DUP	Non-homogenous samples, low concentrations	Sample results < 5x MRL, no action taken.	Usable
	515.4	For batch 98408, Dichlorprop (132%) and Pentachlorophenol (60%, 48%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
	515.4	For batch 100404, Acifluorfen (138%, 139%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
	515.4	For batch 107011, 2,4-DB (65%, 66%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
	515.4	For batch 108267, Pentachlorophenol (65%, 65%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
	Modified 8081B, 8141B, 8270D, and 8321B	For batch 3042041, Atrazine (101%), Ethofumesate (113%, 115%) and Parathion methyl (132%, 124%) LCS/LCSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable
	Modified 8081B, 8141B, 8270D, and 8321B	For batch 3042041, Parathion Methyl (137%, 134%) MS/MSD recoveries outside acceptance limits	None	Matrix effects	RPDs acceptable, analytes not detected, no other QC issues, no action taken.	Usable

Table 7-2: Laboratory QC Issues for Permit Year 8
UIC WPCF Permit Monitoring

Event	Method	Issue	Affected Samples	Cause	Comments, Actions Taken	Usability
	8321B	DCPAA surrogate recovery slightly high (117%)	Field Decon Blank	Analytical difficulties	Analytes not detected, no other QC issues, no action taken.	Usable

Notes: * = Some samples from separate Events analyzed as part of the same analytical batches
Batch numbers are included in Laboratory Reports presented in Appendix E of the *Annual Stormwater Discharge Monitoring Report – Year 8*, October 2013.
DUP = field duplicate
MRL = Method Reporting Limit
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference

Figure 2-1: City of Portland UIC Locations



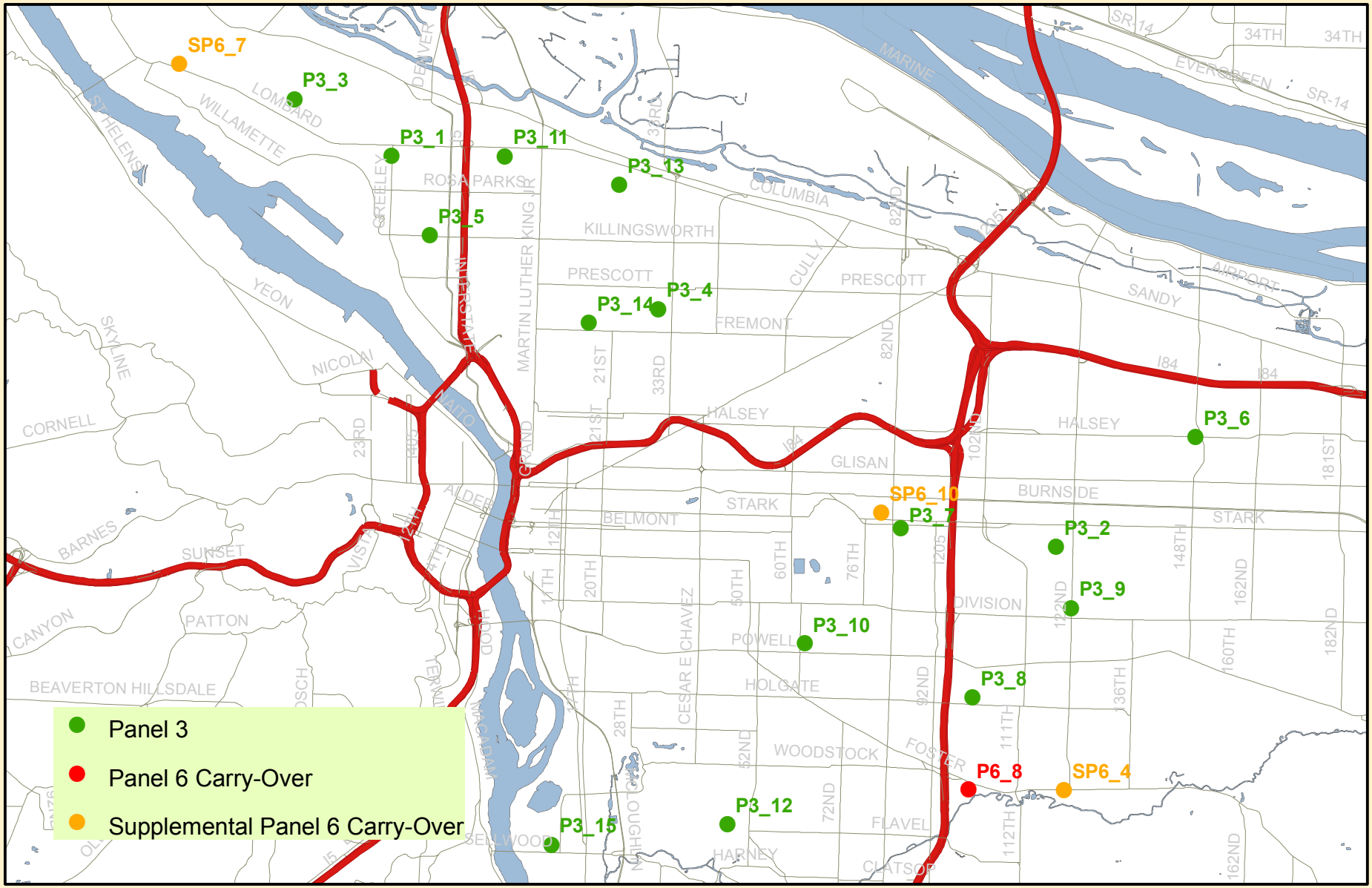


FIGURE 2-2
2012-13 (Year 8) UIC Monitoring Locations

Investigations & Monitoring Services
Bureau of Environmental Services

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

Figure 3-1: Year 8 Event 1 Rain Gage Data

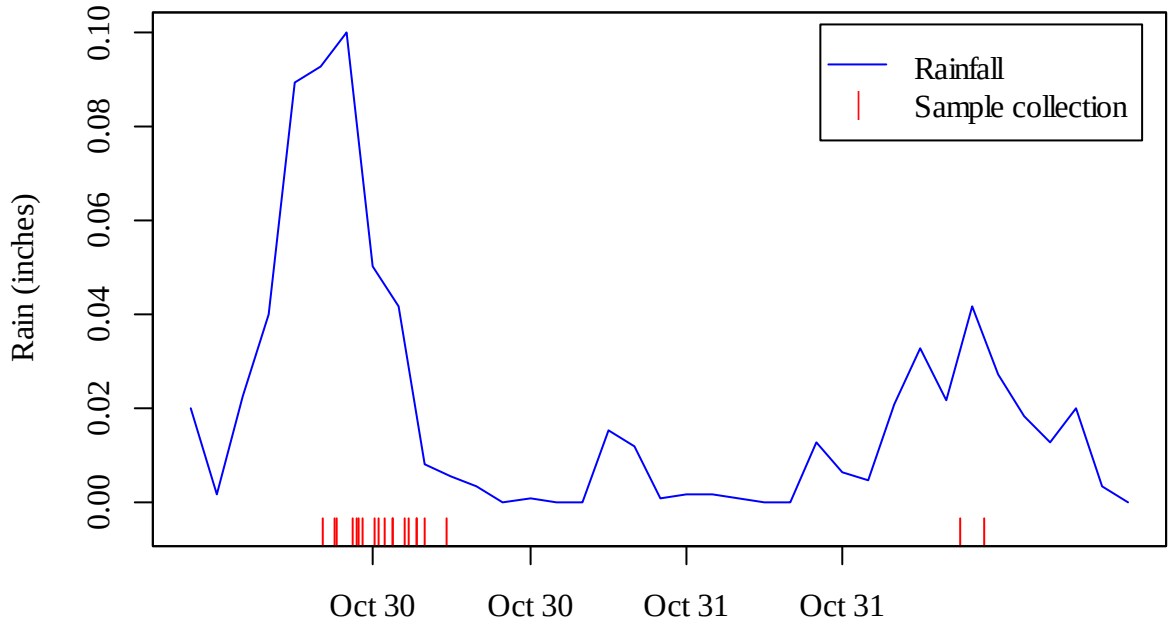


Figure 3-2: Year 8 Event 2 Rain Gage Data

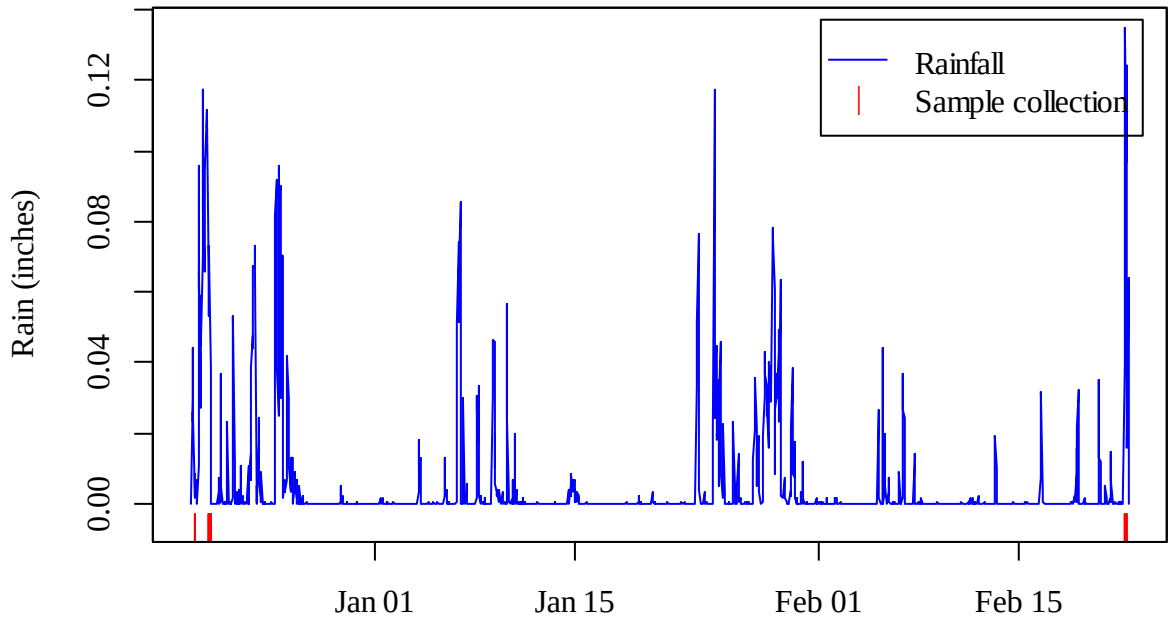


Figure 3-3: Year 8 Event 3 Rain Gage Data

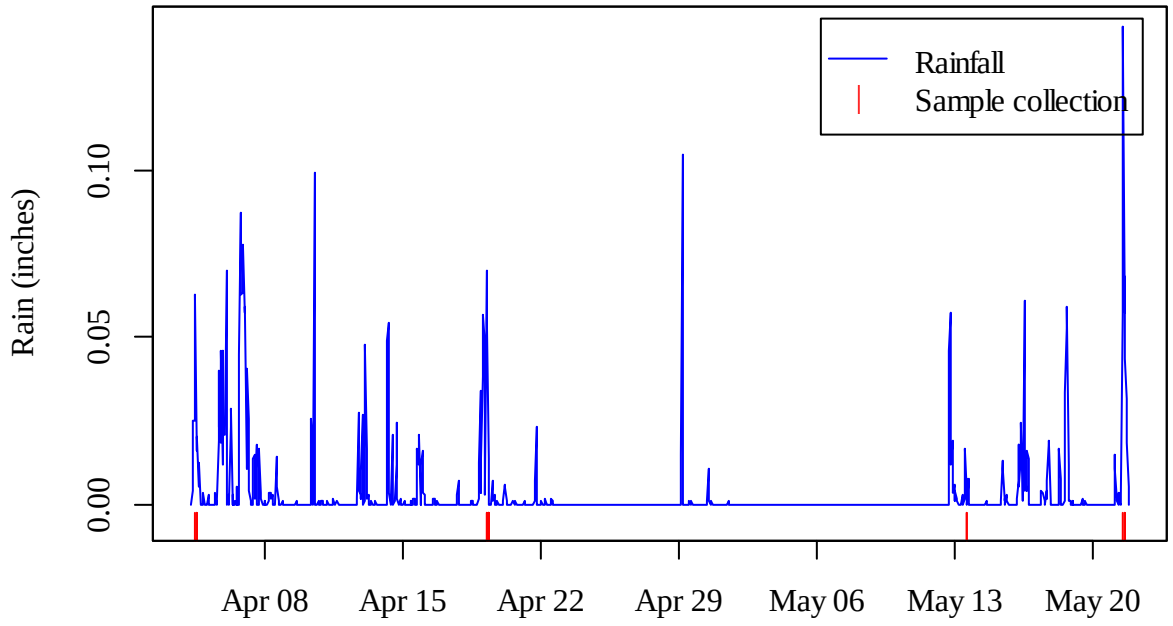
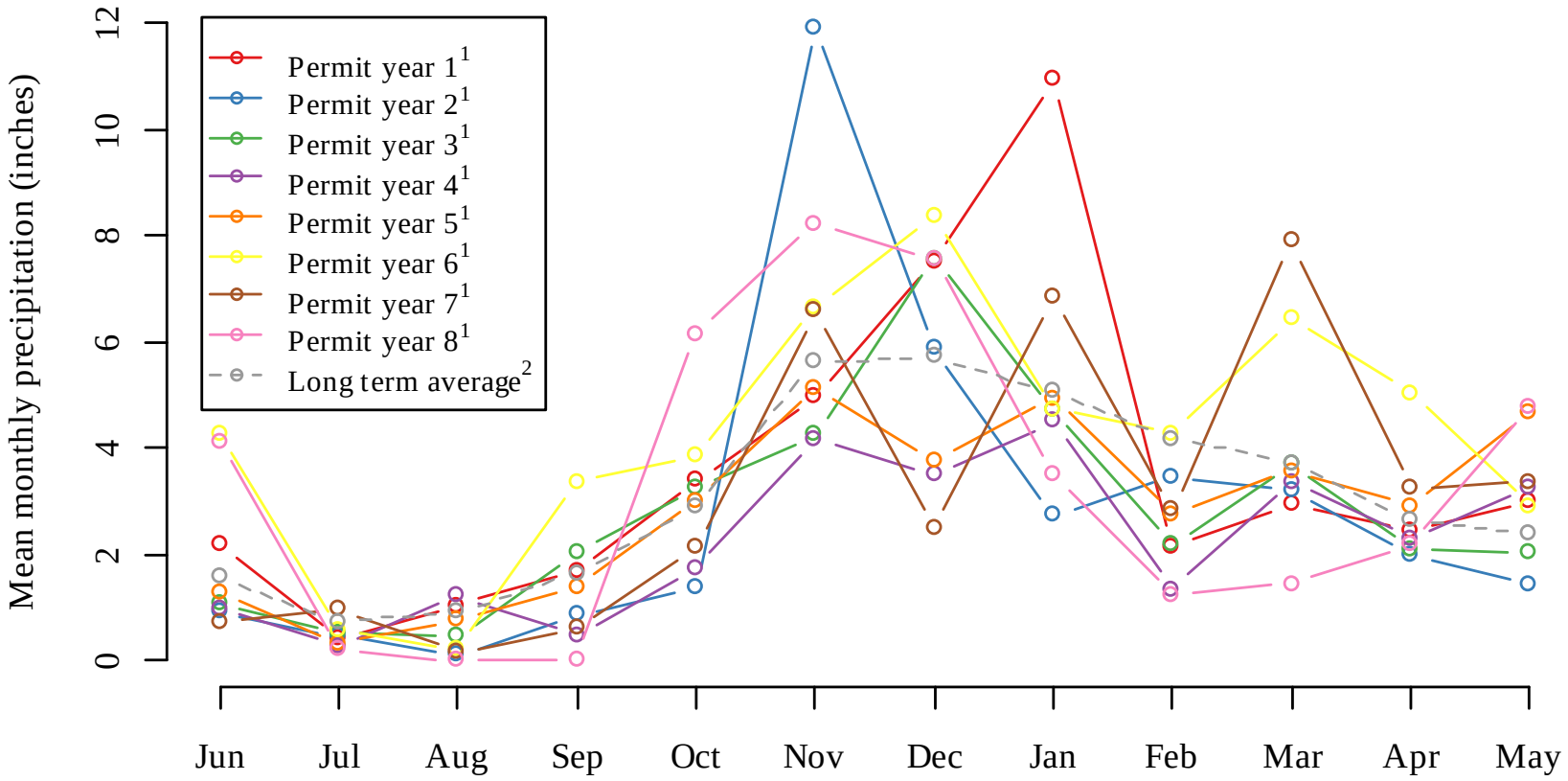


Figure 3-4: Regional Precipitation Data



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

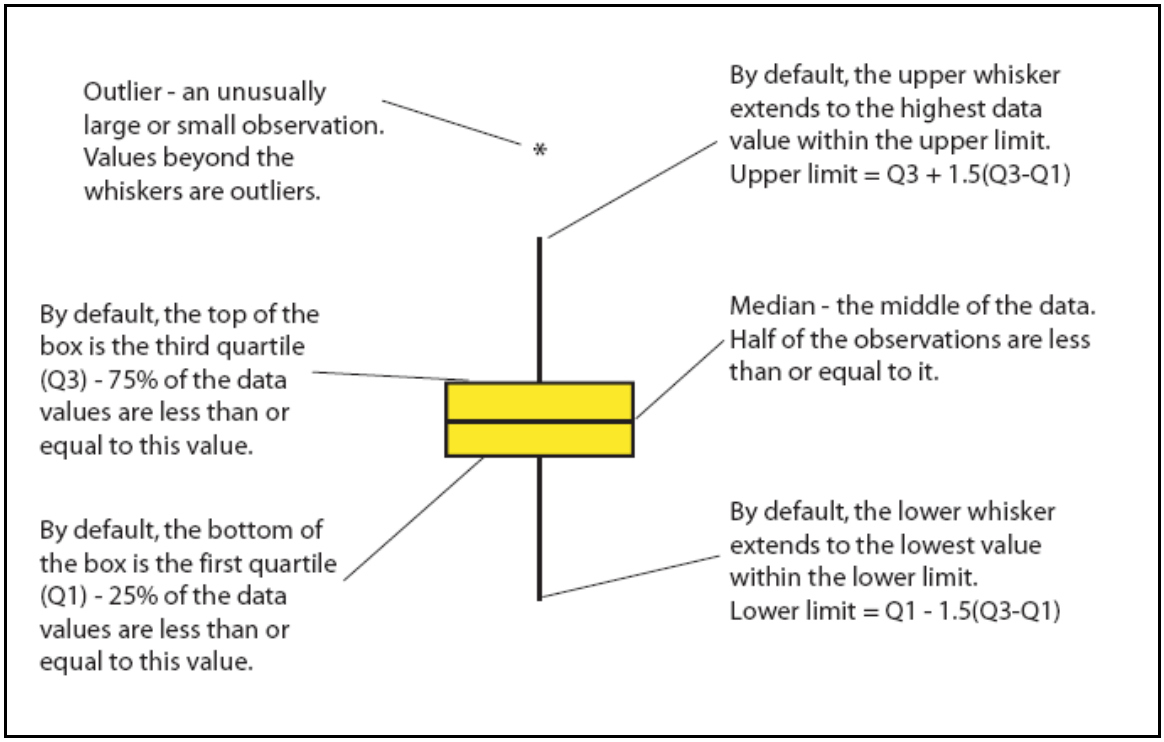
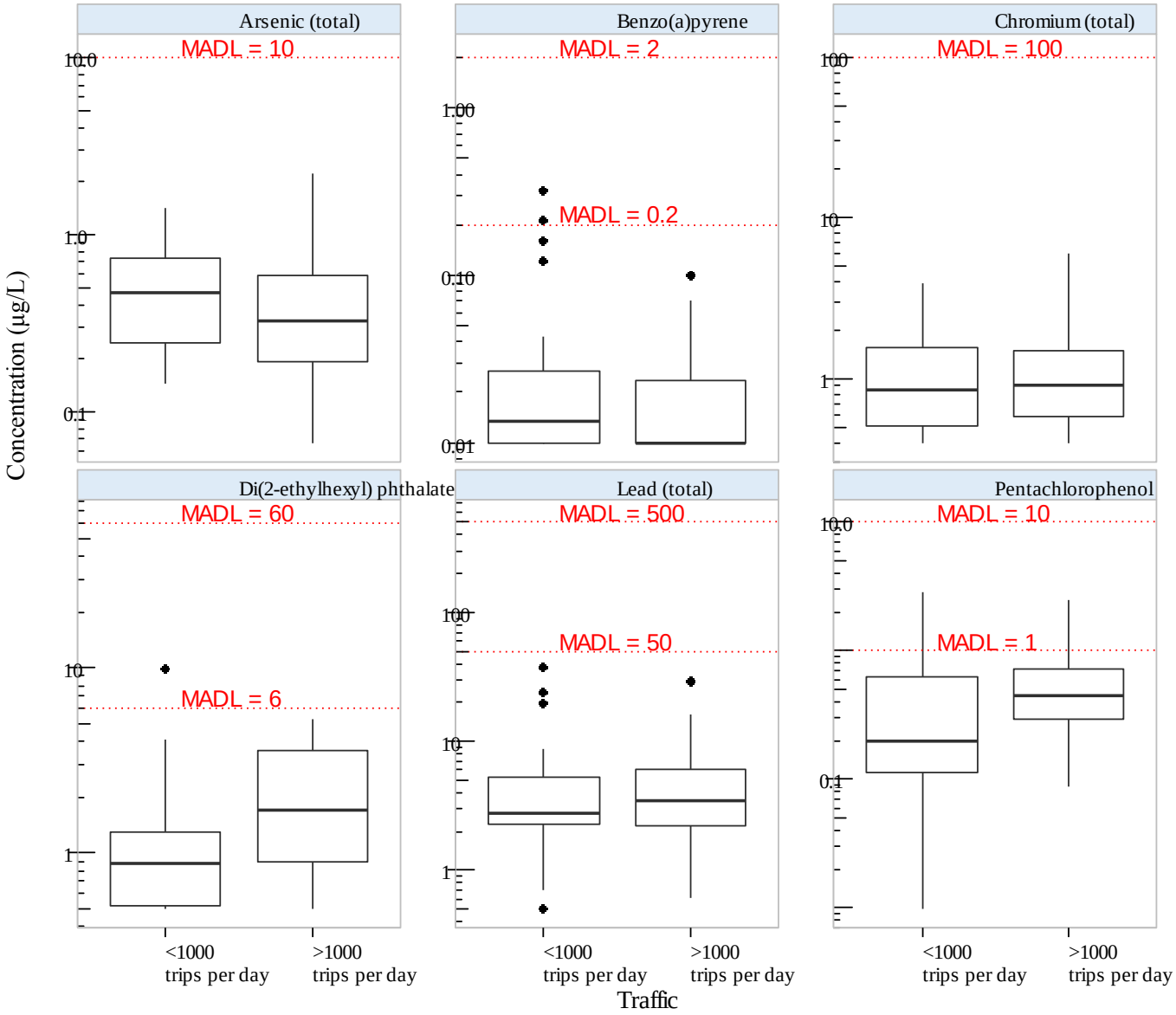


Figure note:
From Minitab®, version 14, 2006

Figure 4-2: Year 8 Pollutant Concentrations by Traffic Category

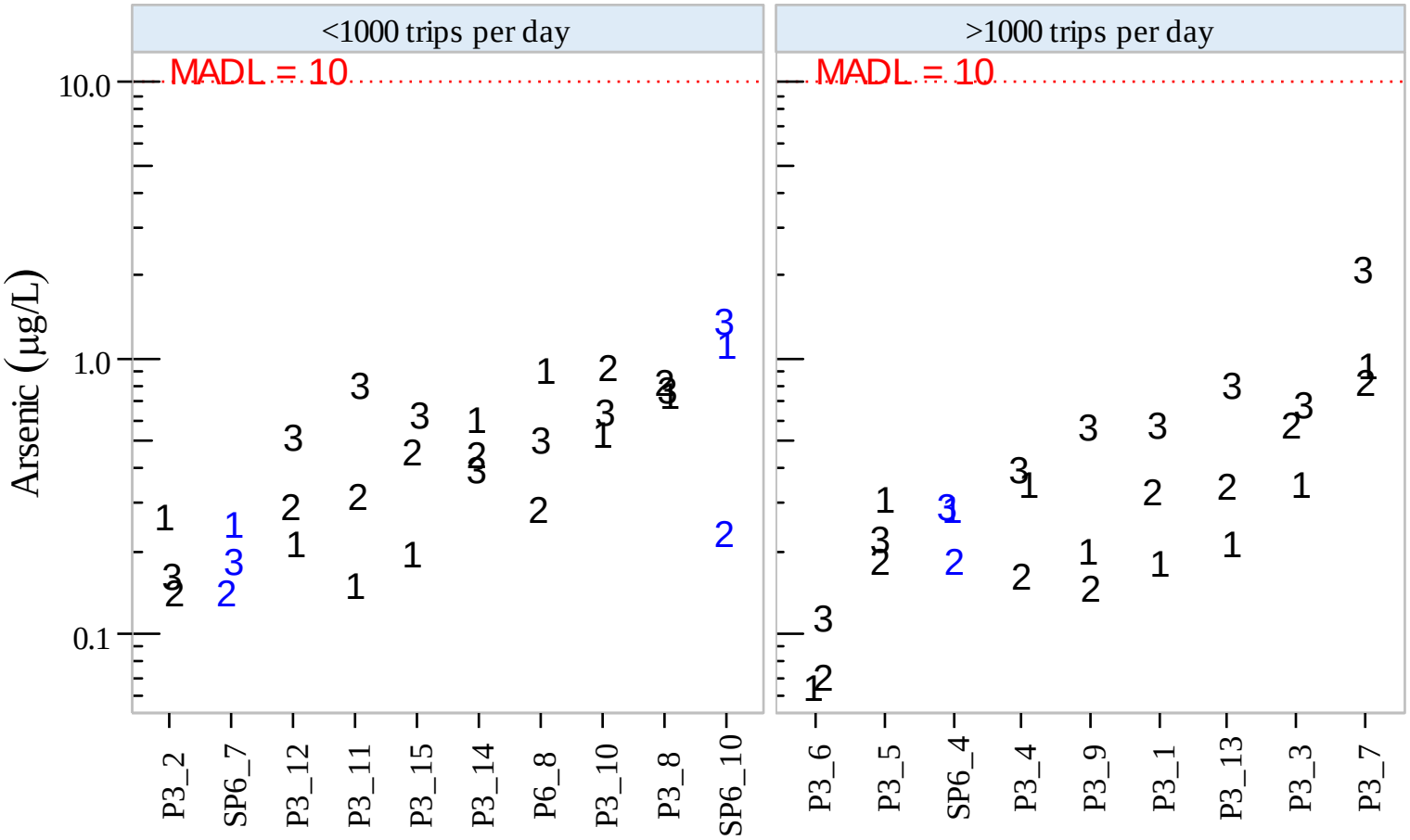


Notes:

These figures:

1) Summarize the results of the original UIC stormwater samples collected in Year 8
2) Include the results of Panel 3 and the four carry-over locations
3) Do not include duplicate sampling results
4) Plot sample concentrations <MRL at the MRL

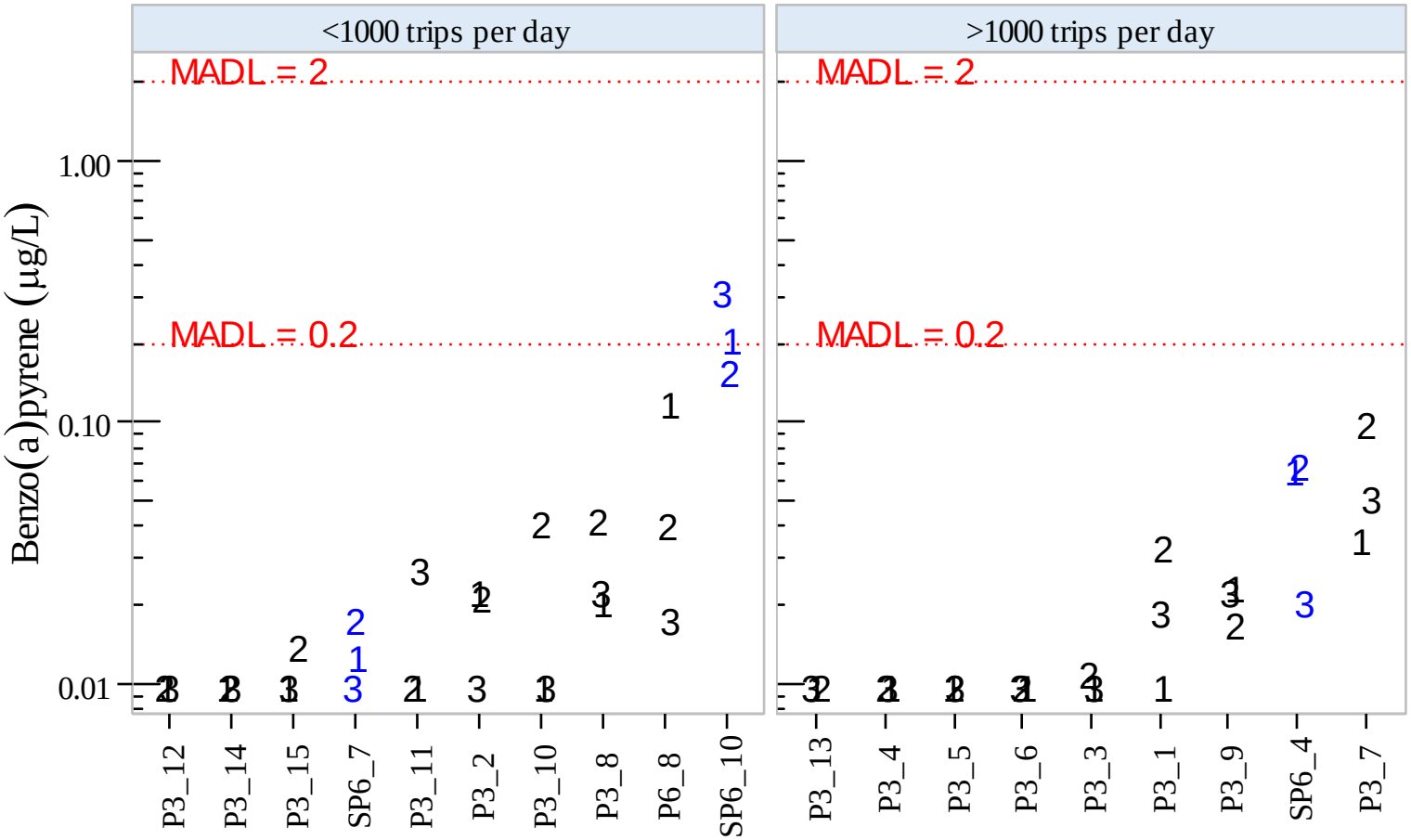
Figure 4-3: Year 8 Arsenic Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3) indicates Year 8 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 carry-over UIC monitoring locations.

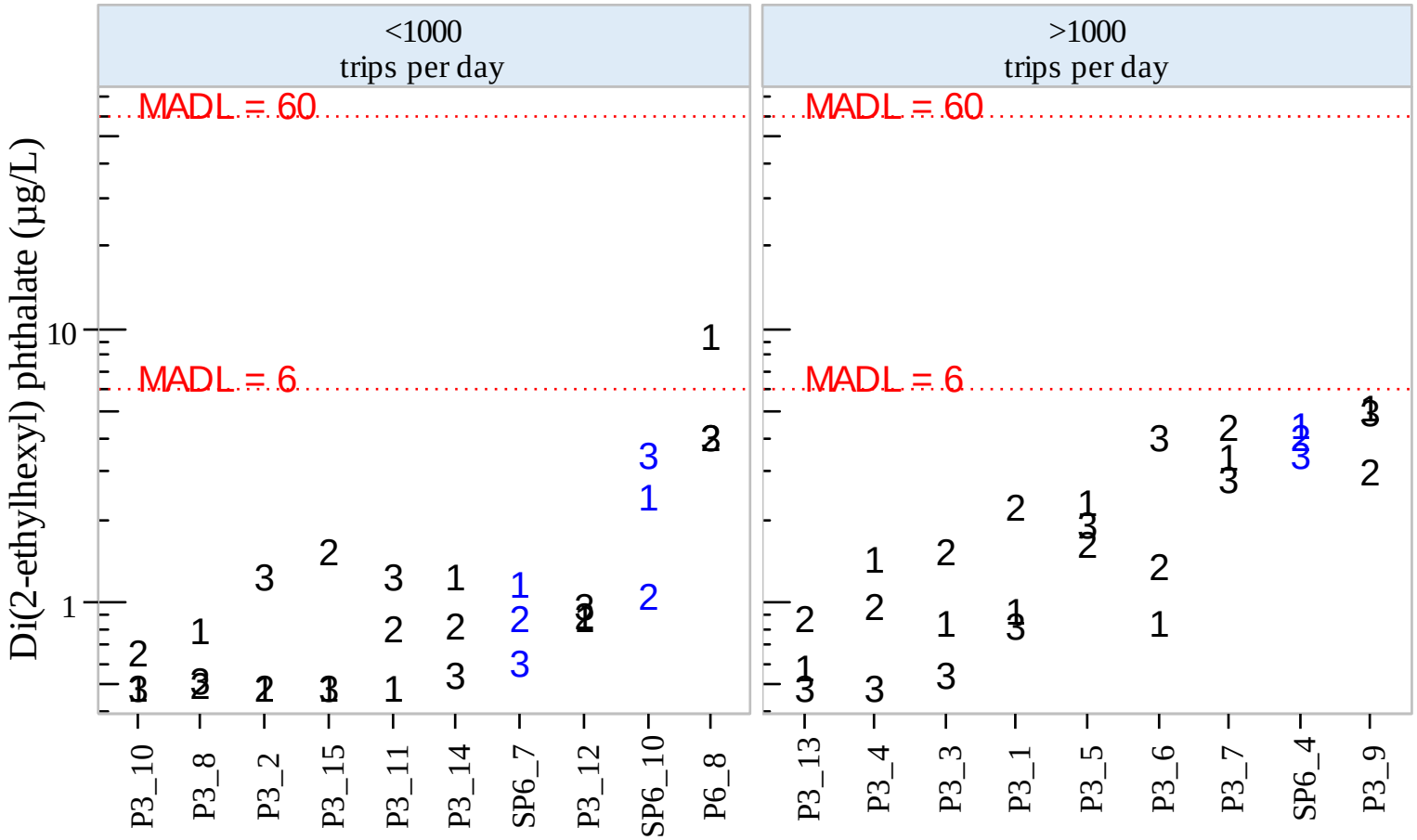
Figure 4-4: Year 8 Benzo(a)pyrene Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3) indicates Year 8 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
MADL concentration was increased after Event 1.
Data shown in blue are carry-over UIC monitoring locations.

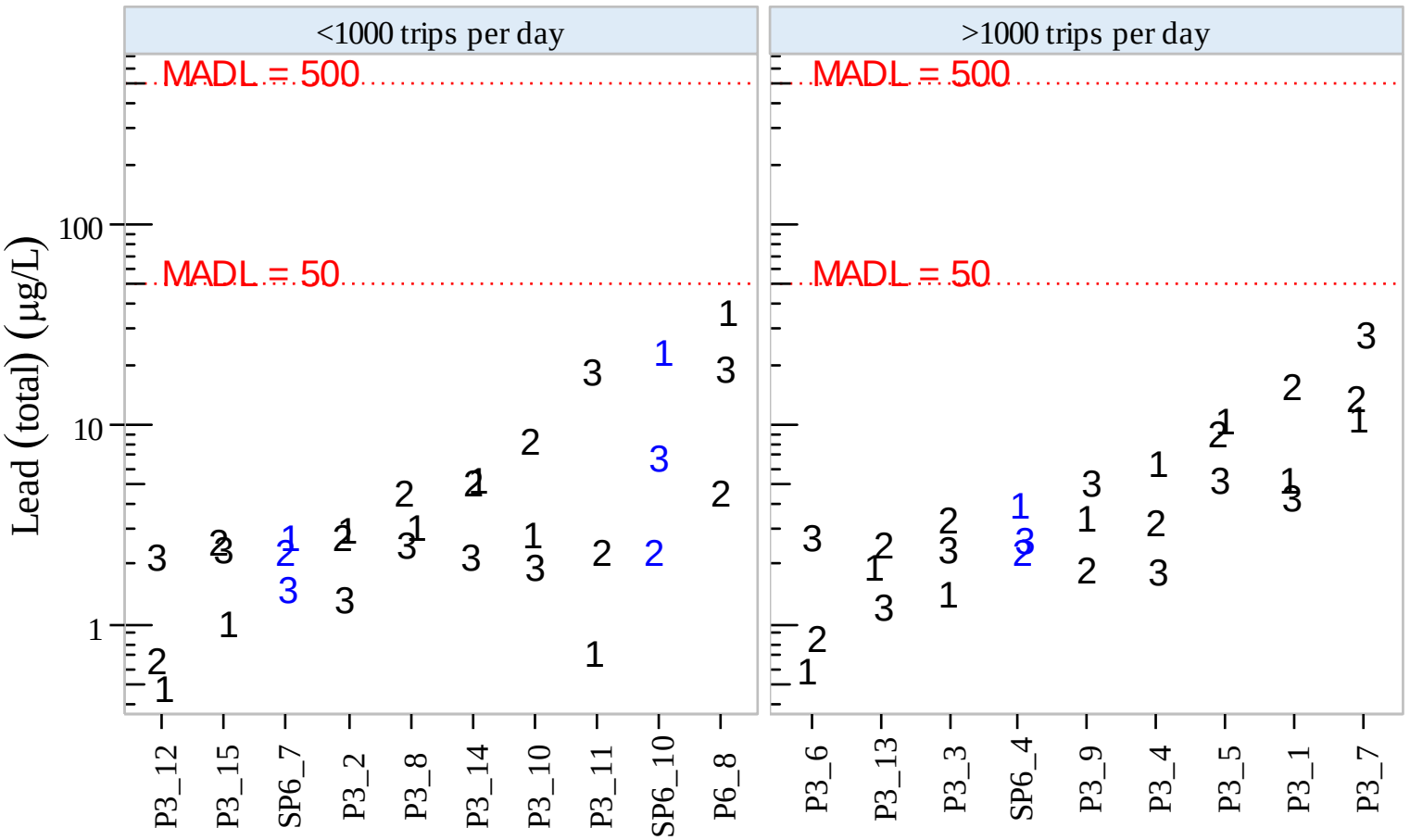
Figure 4-5: Year 8 Di(2-ethylhexyl)phthalate Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3) indicates Year 8 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
MADL concentration was increased after Event 1.
Data shown in blue are carry-over UIC monitoring locations.

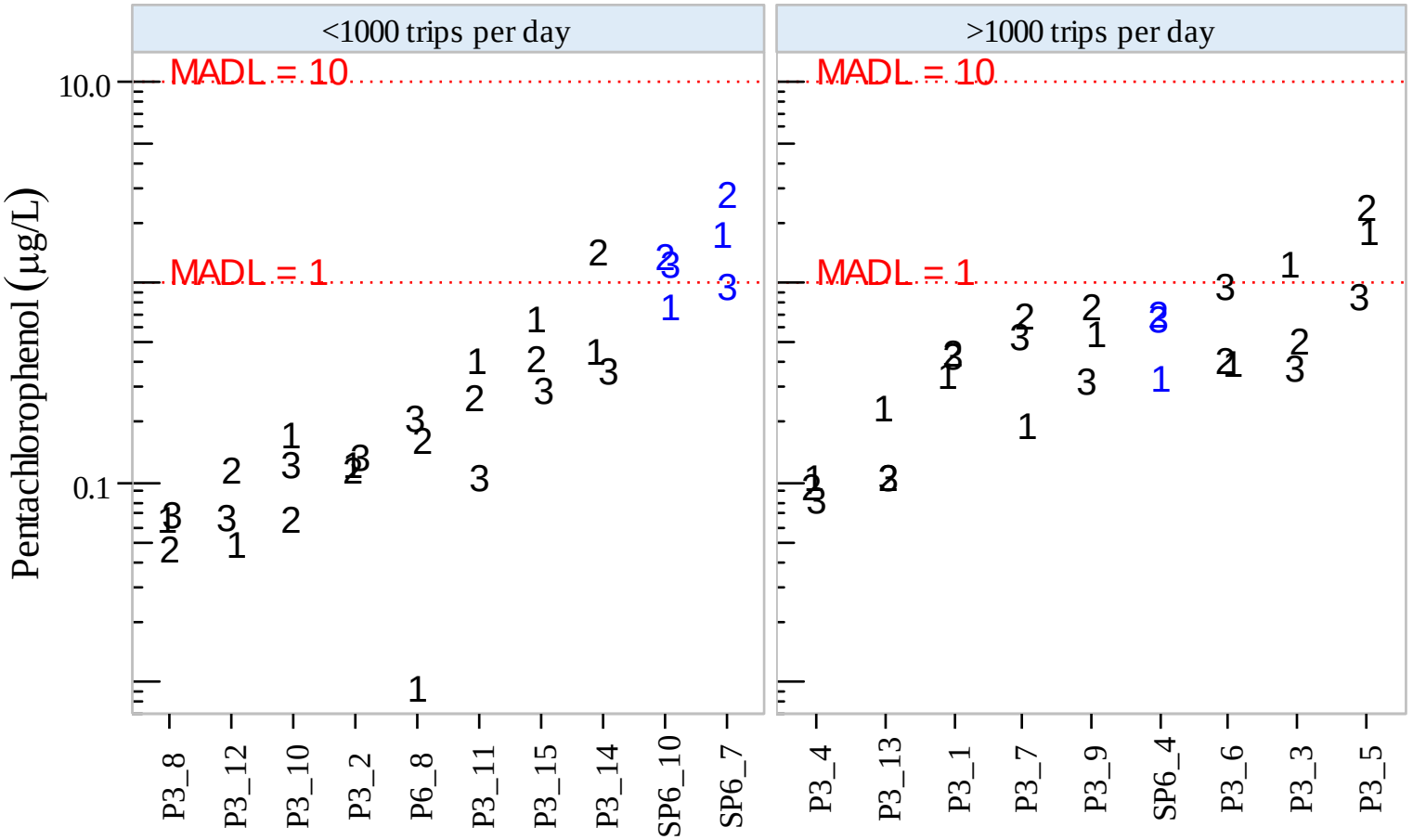
Figure 4-6: Year 8 Total Lead Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3) indicates Year 8 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
MADL concentration was increased after Event 1.
Data shown in blue are carry-over UIC monitoring locations.

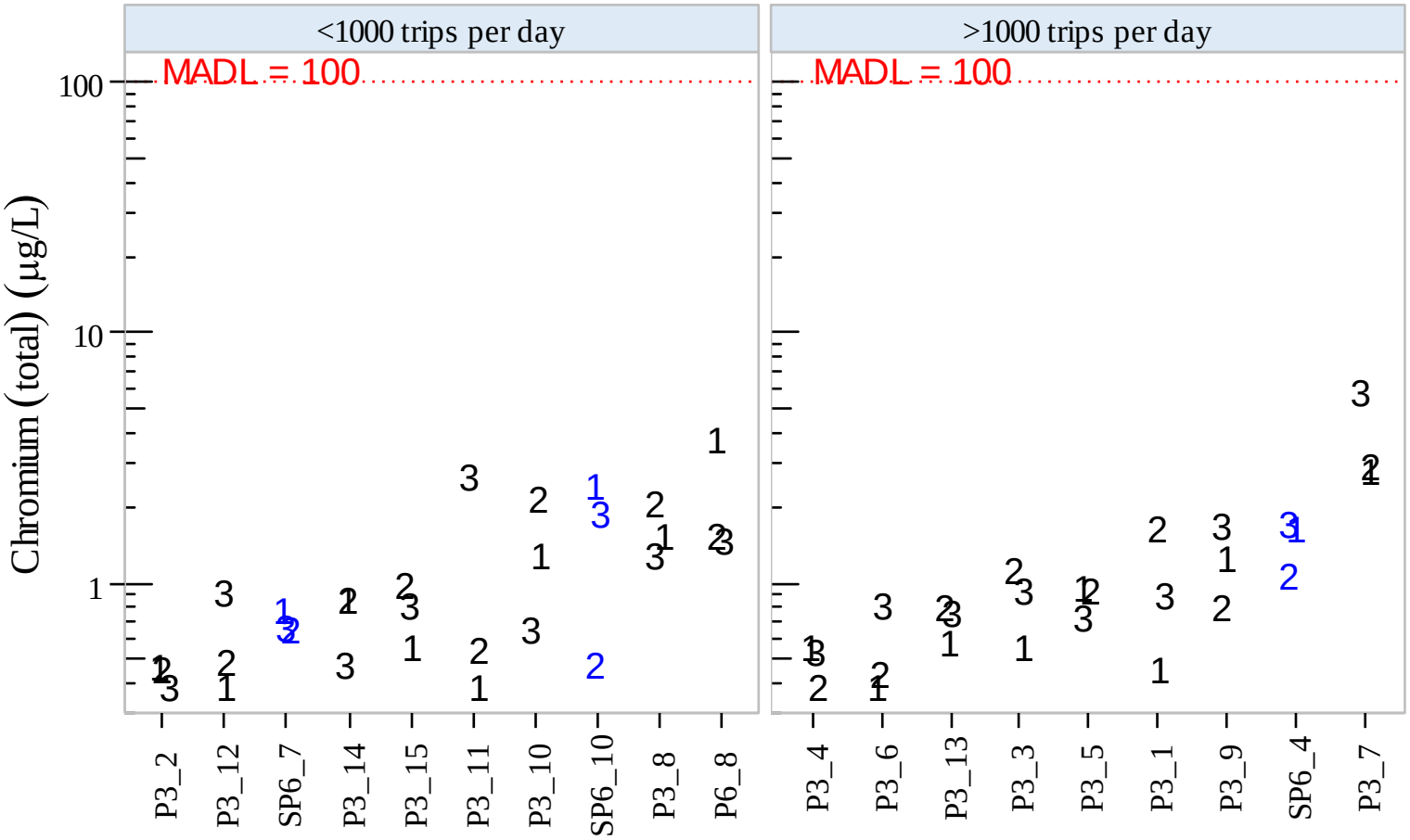
Figure 4-7: Year 8 Pentachlorophenol Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3) indicates Year 8 sampling event number.
<1000, ≥1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
MADL concentration was increased after Event 1.
Data shown in blue are carry-over UIC monitoring locations.

Figure 4-8: Year 8 Chromium Concentrations by Sampling Event and Traffic Category



Notes:

#(1, 2, 3) indicates Year 8 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 carry-over UIC monitoring locations.

Figure 4-9: Year 8 Pollutant Concentrations by Sampling Event

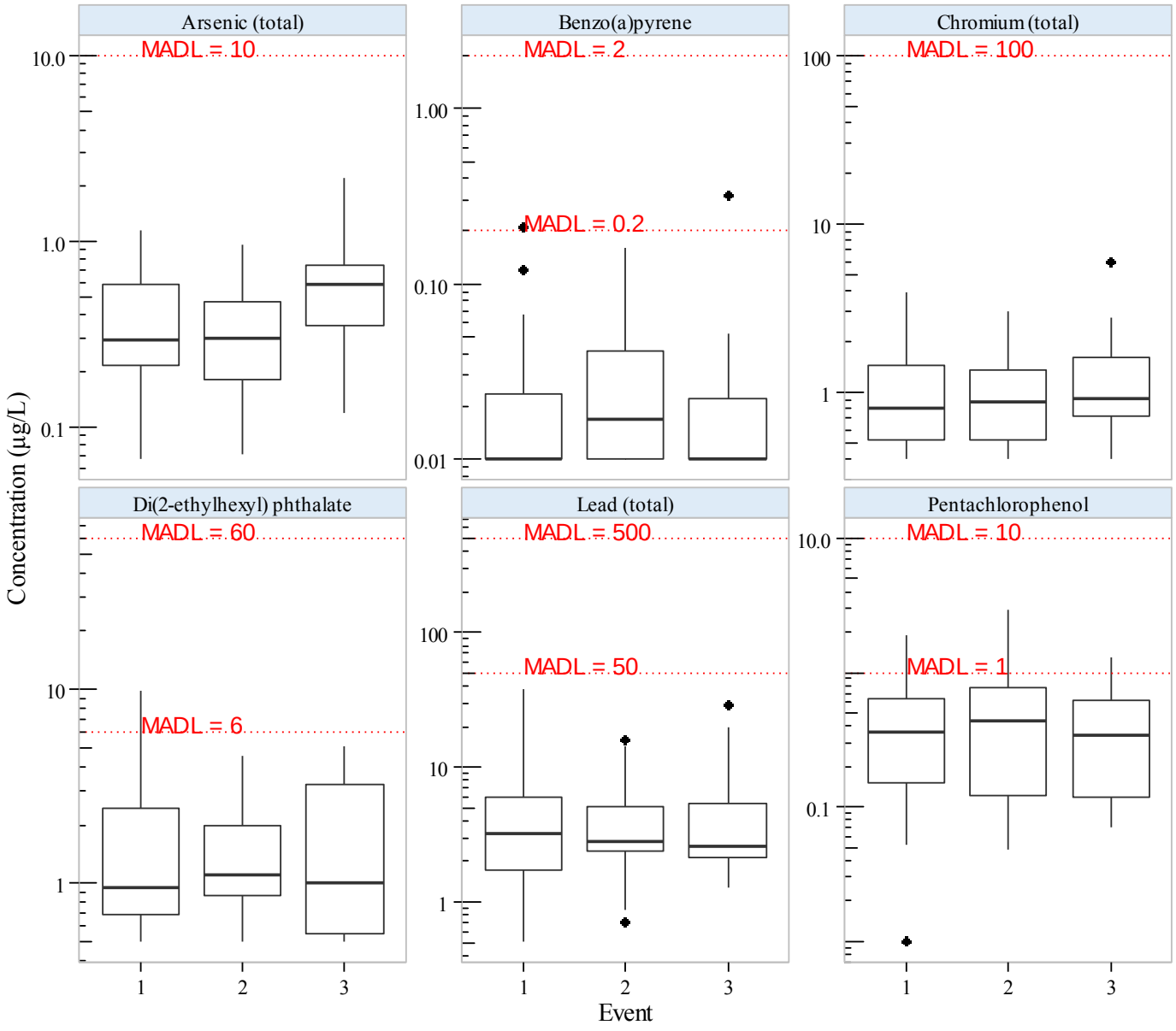
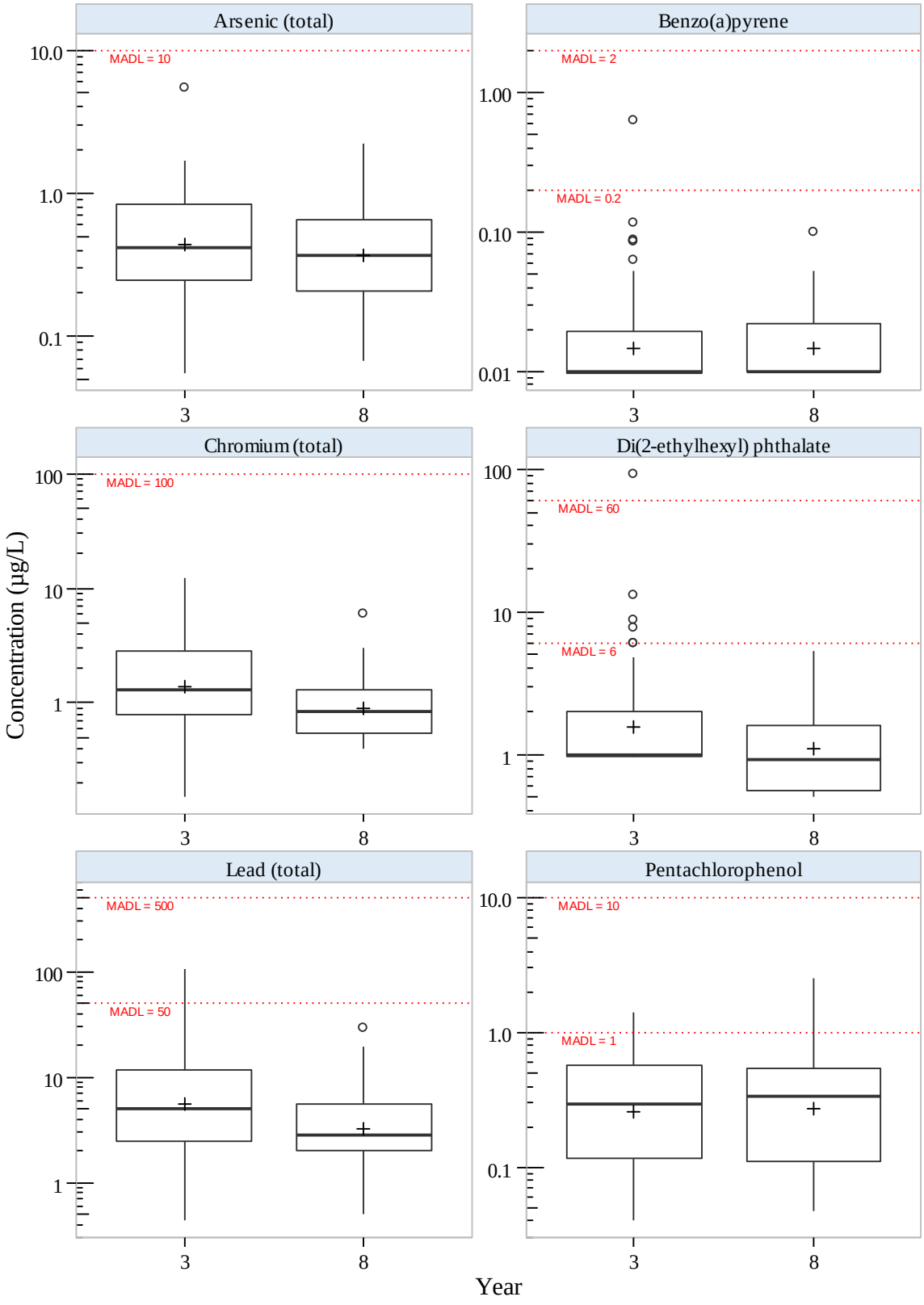
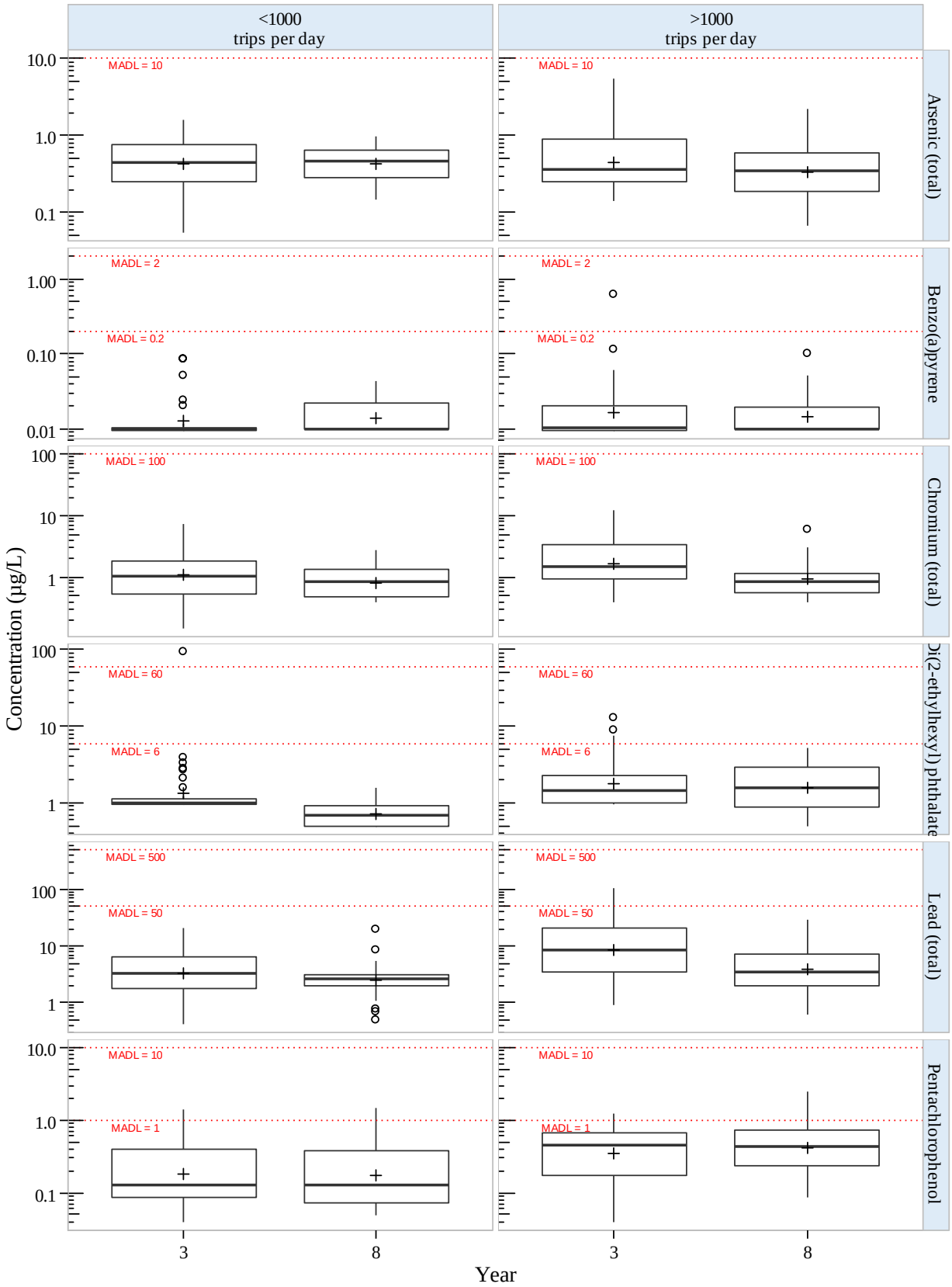


Figure 5-1: Comparison of Pollutant Concentrations by Year: Panel 3



+ Indicates geometric mean

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



+ Indicates geometric mean

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