

## Appendix C

### Year 1 (2015 Permit), Stormwater Discharge Monitoring Data Shallow Groundwater UICs

This report presents the stormwater discharge monitoring data collected in Year 1 (July 1, 2015 – June 30, 2016) of the City of Portland’s (City) 2015 Water Pollution Control Facilities (WPCF) Permit No. 102830 for Class V Stormwater Underground Injection Control Systems (UICs). Year 1 (2015 Permit) sampling was performed in accordance with the City’s 2015 Stormwater Discharge Monitoring Plan (SDMP). This report is divided into the following sections detailing the locations sampled and the final results from the laboratory analysis:

1. Introduction
2. Sampling design
  - Year 1 Monitoring Locations
  - Chemical Analysis
3. Results, Exceedances, and Response Actions
4. Analytical Data Validation

As required in Schedule B.5 of the 2015 Permit, a spreadsheet of all data provided in the analytical laboratory reports is included as Table 2. A CD of the datasheets and Microsoft Access database is also included.

#### **Introduction**

The City has prepared this report to be included as part of the UIC Management Plan (UICMP) annual report in compliance with Schedule B.5 its 2015 WPCF Permit.<sup>1</sup> The Oregon Department of Environmental Quality (DEQ) issued the City’s second WPCF Permit Number 102830 in June 2015, which approved the City’s required March 24, 2015, SDMP. The SDMP describes the stormwater monitoring strategy that the City will use throughout its second WPCF Permit term (June 2015 to May 2025) to evaluate stormwater discharges from public rights-of-way to City-owned UICs in areas of shallow groundwater.<sup>2</sup> Monitoring is conducted to demonstrate that the City’s UIC Program protects beneficial uses of groundwater, meets WPCF Permit requirements, and satisfies requirements of the federal Safe Drinking Water Act and state UIC and groundwater regulations.

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<sup>1</sup> The full name of the permit is the Water Pollution Facilities Permit for Class V Stormwater Underground Injection Control Systems.

<sup>2</sup> Areas of shallow groundwater refer to locations where UICs have < 5 feet of vertical separation distance between the bottom of the UIC and the seasonal high groundwater level. Seasonal high groundwater is discussed in Snyder’s USGS Report 2008-5059, *Estimated Depth to Ground Water and Configuration of the Water Table in the Portland, Oregon, Area* (2008), <http://pubs.usgs.gov/sir/2008/5059/>.

## **Sampling Design**

To comply with the monitoring requirements of the 2015 Permit, the City implements a program to sample stormwater entering the City's UIC system from a subset of UICs located in areas of shallow groundwater and compare stormwater data to permit Action Levels.

There are approximately 120 UICs located in areas of shallow groundwater. Over the length of the 2015 Permit, a sample of 75 UICs will be selected from the list of UICs located in shallow groundwater. The 75 UICs will be broken up into five panels of 15 UICs each. Over the course of the 10-year permit, each panel will be sampled twice to achieve monitoring objectives in the SDMP. With a sample size of 75, approximately 61% of the UICs located in shallow groundwater will be sampled at the end of the 10-year period. A finite population correction<sup>3</sup> will reduce the width of confidence intervals associated with this design by almost 50% in comparison to a sample size of 75 UICs selected from a population of 10,000. This design therefore has the equivalent power of a much larger sample from the entire UIC population.

A Generalized Random Tessellation Stratified (GRTS) survey design<sup>4</sup> will be used to select the 75 locations from the list of UICs in areas of shallow groundwater. A GRTS design will result in a random sample that is spatially balanced (i.e., a sample with a spatial distribution that is similar to the spatial distribution of the population).

The GRTS design also allows for simplifying the implementation of a sample design when some UICs are not suitable for sampling. A GRTS sample draw is an ordered list of sample locations that can be evaluated for sampling sequentially. The first 75 UICs on the list that are suitable for sampling are used as the sample, with sequential blocks of 15 UICs making up each of the five panels. For the purpose of choosing 75 UICs to sample, the entire population of UICs located in shallow groundwater areas was placed into random order using the R package *spsurvey*<sup>5</sup>.

### **Year 1 Monitoring Locations**

Year 1 (2015 Permit) monitoring locations are 15 shallow groundwater sites developed in accordance with the SDMP (Table 1, Figure 1, and Figure 2, attached). On October 14, 2015, the City submitted a letter that listed these first 15 sites to DEQ. This letter explains why, based on pre-sampling field inspections, five sites (SG-003, SG-006, SG-009, SG-013, and SG014) were removed and replaced in accordance with 2015 Sampling and Analysis Plan (SAP) procedures. During monitoring, it was determined that site SG-018 was not functioning appropriately and

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<sup>3</sup> When sampling more than approximately 5% of a finite population, a finite population correction is applied to the standard error of parameter estimates (e.g., annual trends, means, or population percentiles). This correction can significantly increase the precision of parameter estimates when a large proportion of the population is sampled ([http://en.wikipedia.org/wiki/Standard\\_error#Correction\\_for\\_finite\\_population](http://en.wikipedia.org/wiki/Standard_error#Correction_for_finite_population)).

<sup>4</sup> Stevens, D.L., Jr., and A.R. Olsen. 2004. "Spatially-balanced sampling of natural resources." *Journal of the American Statistical Association*. 99: 262-278. In collaboration with EPA, the City utilized the GRTS design to select its UIC stormwater monitoring program locations sampled for 2005 Permit compliance.

<sup>5</sup> Kincaid, T. M. and A.R. Olsen. 2013. *spsurvey: Spatial Survey Design and Analysis*. R package version 2.6. (<http://www.epa.gov/nheerl/arm/>).

would require maintenance before the locations could be sampled<sup>6</sup>. As described in the SAP, the next appropriate site from the ordered list (SG-021) was selected for monitoring. See Table 1 and Figure 2 for site specific information.

### **Chemical Analysis**

As identified in Table 1 of the 2015 Permit, six pollutants are required to be sampled and analyzed for each monitoring location (Benzo[a]pyrene, Pentachlorophenol, Di(2-ethylhexyl)phthalate, Total Lead, Total Zinc, and Total Copper). The list of pollutants and sampling and analytical methods can be found in the SDMP. Monitoring results are summarized below.

### **Results, Exceedances, and Response Actions**

The analytical results from the 15 shallow groundwater monitoring locations are attached in Table 2. All laboratory data sheets are included on CD included with report. Review of the data indicated no Table 1 Action Levels were exceeded, and thus no response actions were required. Collected data were also consistent with UIC monitoring that was conducted in the first WPCF Permit term.

### **Analytical Data Validation**

Analytical results were reviewed to ensure that the data quality objectives defined in the Quality Assurance Project Plan were achieved, and they were determined to be acceptable and usable. A data usability report is attached.

#### Attachments:

- Table 1 - Year 1 (2015 Permit) UIC Monitoring Location Information
- Table 2 - Year 1 (2015 Permit) Monitoring Results
- Figures 1 and 2 - Year 1 (2015 Permit) UIC Monitoring Location Site Maps
- Data Usability Report
- CD containing lab data sheets and Microsoft Excel database

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<sup>6</sup> SG-018 has since been cleaned and will be evaluated again during wet weather to determine if it can be used in Year 3.