

FACT SHEET
And
CLASS V UNDERGROUND INJECTION CONTROL (UIC) WPCF PERMIT EVALUATION

Department of Environmental Quality
Northwest Region
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SOURCE CATEGORY: Stormwater

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COLLECTION SYSTEM CLASS: Municipal Stormwater and Incidental Non-Stormwater Fluids

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1.0 INTRODUCTION

The City of Portland (Permittee) has applied for an Individual Water Pollution Control Facilities Permit (WPCF) in accordance with Oregon Administrative Rules (OAR) 340-040-0035 to construct, operate, maintain and close Permittee-owned or operated (public) Class V Underground Injection Control UICs (UICs) for stormwater. This Fact Sheet and Evaluation Report provides an explanation of the permit and the basis for the Department's decisions in developing permit conditions.

1.1 Permit Overview

The overarching goal of the UIC WPCF permit is to protect the highest beneficial use of groundwater, while allowing underground injection of permitted fluids. By protecting the naturally high quality of groundwater, the public's health, safety and welfare, and the environment are protected during subsurface injection activities. The permit conditions are specifically designed to protect groundwater through managing and monitoring stormwater quality before it is discharged into the subsurface. The permit is intended to:

- Protect groundwater quality while continuing to manage stormwater disposal through UICs.
- Maintain aquifer recharge in urbanized areas in the context of watershed health.
- Maximize economies with other Permittee stormwater management programs, including the Permittee's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4), to the extent practicable.
- Encourage the use of effective best management practices (BMPs) that reduce or eliminate pollutants in stormwater before disposal into UICs.
- Demonstrate through a statistically valid discharge monitoring program and reporting requirements that the naturally high groundwater quality is maintained while meeting the goals of stormwater management and watershed health.
- Establish rigorous compliance and corrective action protocols, including time constraints, in the event that stormwater discharge quality does exceed the groundwater protection levels established in the permit.

The UIC WPCF permit issued to the Permittee is limited to public UICs. Privately-owned UICs within the jurisdiction of the Permittee are not covered under this permit.

A UIC for stormwater is any system designed to distribute or dispose of stormwater beneath ground surface. Under this definition, surface infiltration BMPs such as swales, ponds, porous pavers, and porous concrete are not UICs. Examples of UICs for stormwater are dry wells, soakage trenches, drill holes, infiltration gallery drains, French Drains, or other system or device that inject or distribute fluids in the subsurface. Not all French drains are UICs. If a French drain is designed to put water into the ground, in part or in whole, it is a UIC. If a French drain collects water from the subsurface and disposes the fluid into a system that eventually discharges to a surface water body or a surface infiltration basin, it is not a UIC.

All floor drains that discharge fluids to the subsurface either directly or through a UIC device are Class V UICs. Motor vehicle floor drains are strictly prohibited in Oregon by federal and state regulations.

1.1.1 UICs Requiring WPCF Permit

The purpose of the UIC regulations is to protect groundwater as a drinking water resource. Groundwater is presumed to be protected when rule authorization (RA) conditions (OAR 340-044-0018) are met. When RA conditions can not be met, then a permit to construct, operate or maintain UICs is required or the UICs must be closed. The UIC WPCF permit for Portland is designed to protect groundwater quality and allows Portland to construct, operate and maintain UICs.

Groundwater protection requirements (OAR 340-040-0020) are applied at the point of injection (POI) for UICs. The Department defines POI as the end-of-pipe (EOP) discharge point into a UIC after any pretreatment of the fluid.

Conditions that require a UIC WPCF permit include, but are not limited to:

- UICs within 500 feet of a private water supply well (domestic water well), irrigation well, or a public water supply well that does not have an Oregon Department of Human Services (DHS) two-year (2-yr) time of travel (TOT) delineation for a public water supply system and do not have adequate pretreatment of fluids discharged to the injection system to protect groundwater quality.
- UICs within the DHS delineated 2-yr TOT for a public water supply well and do not have adequate pretreatment of fluids to protect groundwater quality.
- Areas of high traffic volumes and patterns where a greater potential risk to groundwater quality may exist due to the higher level of traffic.
- UICs with insufficient vertical separation distance to groundwater.

The Department includes irrigation wells in the setback provisions because Oregon Water Resources Department (WRD), which oversees water well construction, does not require well conversion notification or have regulations to prevent irrigation wells from becoming drinking water supply wells. WRD regulations require irrigation wells to be constructed to the same standards as a water supply well. According to WRD, irrigation wells are often converted to public or private drinking water supply wells. If the Permittee has enforceable regulations to prohibit connection of a public or private drinking water system to an irrigation well, then the Department would not apply the setback requirement to irrigation wells.

It is the Permittee's responsibility to demonstrate fluids discharged to a public UIC meet permit requirements.

The Permittee must take corrective actions when UICs do not meet permit requirements.

The permit allows the Permittee to install, operate and maintain public UICs within 500 feet of a private water well, an irrigation well, a public water supply well without a 2-year TOT, and within the 2-year TOT for a public water supply well, provided the fluids discharged meet water quality discharge limits established in the permit. The Permittee must demonstrate through monitoring data that this condition is met.

The Permittee currently manages stormwater under its NPDES MS4 and Municipal Wastewater Treatment Plant (WWTP) permits. The Department intends that the UIC WPCF permit for stormwater work in concert to the extent possible with the NPDES MS4 and WWTP permits to effectively manage stormwater disposal in a watershed health context. Stormwater injected into the subsurface under this permit provides recharge to groundwater, which in turn may discharge to surface water bodies. Groundwater discharge to surface water is an important part of watershed health and maintenance of healthy streams.

1.1.2 Overview of Data and Information Utilized to Develop Permit Conditions.

Concepts and requirements implemented in this permit are based on the Department's analysis of the best available science and information the time of permit development regarding stormwater quality, groundwater quality and BMP effectiveness. The Department utilized local, regional, and national data related to stormwater quality, shallow lithology, and groundwater quality of the Portland Basin to develop permit conditions. Overall, pollutants present in Portland area stormwater have lower concentrations than those observed in regional and national data. A reason for lower pollutant concentrations may be the Permittee's active

stormwater management program that includes effective BMPs and UIC maintenance. Sections 3.0 and 4.0 provide a summary of the data and discussion of the data analysis. The Department determined that:

- The Permittee has developed effective pretreatment BMPs as part of the Permittee's NPDES MS4 permit. In most cases, pretreated stormwater discharged to UICs in the permitted area meet permit conditions. The Department considers BMP pretreatment of stormwater before discharge to a UIC as both practical and cost effective to protect the groundwater without groundwater monitoring. Portland sump and drywell specific discharge data tend to support BMP management and pretreatment before subsurface disposal as protective of groundwater quality;
- Published literature regarding shallow lithology in the Portland Basin indicates the coarse sand and gravel deposits have clayey silt coatings. The coatings likely provide additional adsorption and absorption treatment of stormwater derived pollutants within the unsaturated zone before the discharge reaches groundwater;
- Groundwater quality underlying the Portland Basin has been monitored since the mid-1970's. The Department maintained a monitoring network of private domestic water wells until the mid-1990's. The USGS has monitored groundwater quality in the mid- and late-1990's. The Permittee monitored groundwater quality at the USGS monitoring wells in 2003. Based on the Department's review of these data, there does not appear to be correlations between common stormwater pollutants and presence of these pollutants in groundwater to indicate injection activities have adversely impacted groundwater quality; and
- After more than sixty years of stormwater injection in the Portland area, stormwater and groundwater data do not indicate adverse impacts to groundwater quality resulting from subsurface stormwater disposal.

The permit requires the Permittee to minimize potential groundwater degradation and protect groundwater by implementing effective BMPs and meet permit conditions.

1.1.3 Permit Duration.

The permit is effective for ten (10) years from the date of issuance, unless the Department modifies, terminates, revokes or reissues the permit. The Permittee must renew the permit within the time frame established in the permit in order to continue operate UICs.

1.1.4 Permit Applicability.

The permit is applicable to all Permittee-owned or operated Class V UICs as identified in the permit.

1.2 Summary of Permit Conditions

The permit requires the Permittee to protect groundwater to its highest and best beneficial use while discharging stormwater below the ground surface. The permit allows the Permittee to inject fluids provided groundwater quality remains protected within permit-specific water quality limits.

To protect groundwater quality, the permit sets water quality limits and conditions prior to subsurface discharge as a prevention-based approach to groundwater protection. The Permittee must meet the four basic requirements listed below:

- Actively identify pollution sources.
- Prevent stormwater pollution from reaching groundwater.

- Operate UICs in a manner that maximizes stormwater quality.
- Ensure UICs have minimum pretreatment and separation from groundwater.

These requirements are accomplished through:

- A comprehensive system assessment to identify any public UICs that receive drainage from areas that may have higher pollutant loads;
- Robust source control and pollution prevention actions accepted by the Department as part of a comprehensive UIC Management Plan (UICMP). The UIC MP will include structural and non-structural BMPs to minimize pollutants entering stormwater;
- Structural or a combination of structural and other pretreatment requirements for UICs within 500 feet or the 2-yr time of travel of drinking water or irrigation wells;
- Establishment of numeric concentrations for stormwater quality prior to discharge into the ground. The Department establishes Maximum Allowable Discharge Limitations (MADLs) for stormwater quality for the most common stormwater pollutants. The MADLs are set at the State's numeric reference levels for groundwater (OAR 340-040-0020 Tables 1, 2 and 3), which are primarily the federal primary and secondary MCLs, except lead (Pb);
- Annual monitoring program to determine the quality of stormwater discharged;
- A pollutant screen in the 1st, 4th and 9th years of the permit for the presence of urban pollutants not included in the MADL pollutant list. Requires the Permittee to monitor for these less common urban pollutants when they are detected during a screening event;
- Maintain minimum separation distance between the bottom of the UIC and groundwater. A minimum of 10 ft. separation distance is required unless otherwise specified in the permit or in writing by the Department. The ability of the natural deposits to attenuate pollutants in the subsurface must be considered in establishing the separation distance; and
- Timely and decisive actions to address UICs that do not meet permit conditions or requirements, including:
 - Compliance response if the injection fluid exceeds the MADLs. The compliance response process requires the Permittee to aggressively pursue implementation of structural or non-structural BMPs to achieve the MADLs. BMPs will be defined in the Permittee's Department- accepted UIC Management Plan;
 - Corrective Action when compliance response actions after one consecutive wet season fails to bring stormwater concentrations into compliance with permit specified limits, or when a public UIC does not meet the minimum structural and pretreatment requirements established in the permit; and
 - Corrective actions as identified in a Department-accepted Corrective Action Plan. This plan will provide a menu of actions that may be implemented to ensure that groundwater is protected. These actions could include retrofit or decommissioning of the UIC, risk assessment, groundwater monitoring, or other actions approved by the Department. The CAP will also include design and decision making criteria that will direct implementation of solutions that support a watershed based approach to stormwater management when possible. The Permittee must complete corrective actions within three full Capital Improvement Project (CIP) Cycles from the date of discovery.

The Permittee has several bureaus, departments and commissions that may operate and/or maintain public UICs. This permit applies to all Permittee owned or operated UICs regardless of internal Permittee bureau jurisdictions. The Bureau of Environmental Services (BES) oversees stormwater management for the Permittee. BES is responsible for the implementation and compliance of other Permittee stormwater and wastewater discharge permits. Therefore, the Department recognizes BES as the Permittee's responsible bureau for all Permittee owned or operated public UICs. Any internal jurisdictional resolutions necessary to

meet permit conditions are the responsibility of the Permittee. A violation of a permit condition will result in Department enforcement action against the Permittee, not the individual bureau, department or commission.

1.3 Portland UIC Program

The Permittee manages stormwater through surface water discharges and underground injection. Surface water injection is regulated under the Clean Water Act through the Permittee's National Pollutant Discharge and Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit. Underground injection of stormwater through UICs is regulated under the Safe Drinking Water Act and state UIC regulations. This UIC WPCF permit issued by the Department meets the federal SDWA and state UIC regulatory requirements. The Permittee has developed a Stormwater Management Manual (SWMM), which address stormwater control for private and public development. The SWMM is available at the following web site:

<http://www.portlandonline.com/bes/index.cfm?c=35122>.

The Permittee's SWMM is an enforceable City ordinance. It establishes a hierarchical protocol to manage stormwater disposal. The SWMM requires surface infiltration, unless site specific-conditions are such that underground injection is the only reasonable available alternative to stormwater disposal. The SWMM also requires new developments to retain stormwater disposal within the property boundary in order to reduce flows to the Permittee's stormwater systems. The hierarchy applies to all new developments on private and public lands within the Permittee's jurisdiction. Under the hierarchy, surface infiltration must be considered before discharge to a UIC is allowed. The hierarchical approach meets the condition of OAR 340-044-0012(2) and allows use of UICs when site specific constraints preclude the use of surface infiltration options.

On August 11, 1994, the EQC adopted the Amended Stipulation and Final Order (ASFO) for Portland that requires the Permittee to significantly reduce the frequency of overflows to waters of the State from its combined sewer overflow (CSO) system. The EQC accepted the Permittee's facility plan designed to meet the ASFO requirements. One of the four cornerstone projects of the ASFO is to use UICs to alleviate flows to the CSO. Because of the EQC Order, the Department does not consider the CSO as a reasonable alternative to underground injection of stormwater within the CSS boundary.

Outside the CSO boundary and east of the Willamette River, stormwater is primarily managed through underground injection. The Permittee has annexed a large portion of mid-Multnomah County and consequently inherited a large number of UICs. During the Permittee's efforts to install a sanitary sewer in the mid-county area, many of these inherited UICs were upgraded with modern pretreatment designs.

It should be noted that the mid-Multnomah County sanitary sewer project eliminated most cesspools and removed the daily discharge of approximately 25 million gallons of raw sewage to groundwater. Some pollutants from cesspool discharges, such as nitrate, still linger in the groundwater. For purposes of this permit, the Department considers these residual pollutant concentrations as background in groundwater within the mid-county and downgradient areas. The Department also considers the volume and low-nitrate quality of stormwater discharged from UICs as an environmental benefit that reduces existing groundwater nitrate concentrations.

1.3.1 Compliance Response and Corrective Actions.

The Permittee is required to take action to protect groundwater under the following conditions:

- When the annual mean concentration of a stormwater discharge quality limit is exceeded; and
- When a UIC is non-compliant with permit conditions.

Maximum allowable discharge limits (MADLs) for stormwater discharged to a UIC are established in Schedule A of the permit. Non-compliant UICs are defined in Schedules D and F of the permit. The permit further groups non-compliant UICs into four categories:

- Category 1: UICs known to be non-compliant upon date of permit issuance;
- Category 2: UICs discovered as non-compliant during the system-wide assessment;
- Category 3: UICs discovered as non-compliant after completion of the system-wide assessment; and
- Category 4: UICs that become non-compliant by failing to meet the annual mean MADL in Table 1 within one wet season after the exceedance or fails to satisfy any groundwater protection conditions of the permit.

The permit allows limited flexibility to comply with permit conditions. One area of flexibility is “compliance response action” to an exceedance of the annual mean concentration of a stormwater discharge quality limit. Compliance response actions are tied to the wet season cycle defined in the permit as October 1 through May 31. When an annual mean concentration of a pollutant exceeds the permit established limit, compliance must be met within the next full wet season. If it is not met within the next wet season, then corrective action must be undertaken. A discussion of compliance response action is provided in Section 7.5.

Corrective actions for non-compliant UICs, as defined in the permit, are tied to the Permittee’s CIP funding cycle, which begins on July 1 of each year. Using the CIP cycle allows time to design, fund corrective action projects, award contracts and implement corrective actions. Permit conditions require the Permittee to complete a corrective action within 3 CIP cycles. The permit also requires the Permittee to prioritize non-compliant UICs each year and implement corrective action according to the Department-approved prioritized list.

When conditions occur that require more than 3 CIP cycles to complete corrective actions, the permit establishes a process for time extensions. In each case, the extension request must be submitted in writing to the Department. The Department may consider time extensions as follow:

- An extension of one CIP cycle to complete a corrective action. If granted, the Department considers this a minor permit modification under the provisions of OAR 340-0-45-0055;
- An extension of more than one CIP cycle through a major permit modification request. A time extension granted under a major permit modification shall not exceed the original permit expiration date and requires public review and comment; and
- For a more regional corrective action, the Department may issue a Department Order that is separate from the permit. Public review and comment is required for a Department Order. The Permittee must demonstrate and justify to the Department that a regional corrective action can not be accomplished under a permit modification.

1.3.2 Benefits of Underground Injection of Stormwater.

Underground injection of stormwater has the beneficial effect of aquifer recharge. In urban areas where impervious surfaces have reduced natural recharge from rainfall infiltration, underground injection of stormwater becomes an important substitute for natural recharge and an integral part of watershed health. However, stormwater injection can potentially carry pollutants to the groundwater. The aquifers (unconfined and confined zones of groundwater) underlying the Permittee are considered underground source of drinking water (USDW) and are protected under state and federal law.

1.4 Regulatory Requirements.

Underground injection of fluids is regulated under Title 42 United States Code §300f *et seq.* of the federal Safe Drinking Water Act (SDWA), and Title 42 U.S.C. 6901 *et seq.* of the federal Resource Conservation and

Recovery Act (RCRA). The U.S. Environmental Protection Agency (EPA) regulates UICs under Title 40 Code of Federal Regulations (CFR) Parts 144 through 147. The SDWA also establishes maximum contaminant levels (MCLs) for pollutants in public drinking water supplies, including underground sources of drinking water in 40 CFR Parts 141 through 143. Analytical methods and monitoring requirements for drinking water are established in 40 CFR Part 136.

Under 40 CFR 144.12(a) prohibits injection that allows movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142 or may otherwise adversely affect the health of persons is prohibited. Further, any Class V UIC must be either authorized by rule or under a permit (40 CFR 144.24).

Oregon Revised Statutes (ORS) 468B.025 protect waters of the state from pollution. ORS 468B.050 requires a permit to discharge wastes into waters of the state. By statute, groundwater in Oregon is protected as waters of the state (ORS 468B.005(10)). Because stormwater carries pollutants that may adversely affect waters of the state, stormwater is considered a waste when discharged to a UIC. Under the provisions of ORS 468B.050, the Permittee applied on July 1, 2002 for a WPCF permit to discharge stormwater and other fluids to its UICs. In addition to the Oregon Revised Statutes, the Department regulates UICs under Oregon Administrative Rules (OAR) 340-044.

ORS 468B.048 (f) allows the Environmental Quality Commission (EQC) to set establishes water quality standards. The EQC has established water quality standards for groundwater in OAR 340-040. For new permitted facilities, the groundwater quality standard for permit compliance is the natural background water quality (OAR 340-040-0030(3)(b)). The Department can establish groundwater compliance limits up to the federal MCLs under the provisions of OAR 340-040-0030(4). Under the provisions of OAR 340-040-0030, the WPCF permit for the Permittee's UICs represent a new facility that must comply with the background groundwater quality requirement or have Department established concentration limit variances.

The UIC WPCF permit issued to the Permittee meets the federal and state regulatory requirements, as discusses above, that protect federally defined "underground sources of drinking water" and state defined "waters of the state"

1.5 Permit Structure.

The Class V UIC WPCF permit is subdivided into the five schedules listed below. Each schedule provides specific permit conditions.

- Schedule A - Discharge Limitations and Stormwater Management.
- Schedule B - Monitoring and Reporting Requirements.
- Schedule C - Compliance Conditions and Schedules.
- Schedule D - Special Conditions.
- Schedule F - General Conditions.

Schedule E is not applicable to this permit. Therefore, it is not included in the permit or discussed in this evaluation report.

The Department's intent and expectations of the Permittee for each applicable schedule are presented in the subsequent sections of this evaluation report.

2.0 OVERVIEW OF THE CITY OF PORTLAND UIC SYSTEM

The Permittee primarily use UICs in areas where storm sewer systems are unavailable. UICs are also used within the CSO boundary as part of an agreement with the Department. Stormwater discharges to the Permittee's storm sewer system or CSO are regulated under the Department issued NPDES MS4 permit. Distribution and density of the Permittee's stormwater UICs are illustrated in Figure 1.

Stormwater injection has occurred throughout Portland for approximately 60 years, primarily on private property and in areas located in mid-Multnomah County. More than 50 percent of the Permittee's UICs have been constructed since 1994 as part of the Permittee's program to reduce overflows from the Combine Sewer Overflow (CSO) system, or were included as part of the Permittee's annexation of mid-Multnomah County.

At present, the Department has registered a total of 9,904 Permittee owned or operated UICs. Approximately 8,500 of these UICs are actively used for stormwater discharge to the subsurface. The remaining UICs are considered inactive. Closure status of the inactive UICs is uncertain. The Department expects the permittee to address the closure status of the inactive UICs during its system-wide assessment.

2.1 System Assessment.

The Permittee conducted an initial UIC system assessment in preparation for submitting its UIC WPCF permit application. This assessment is provided in its UIC Report (City of Portland, 2002) which was submitted to the

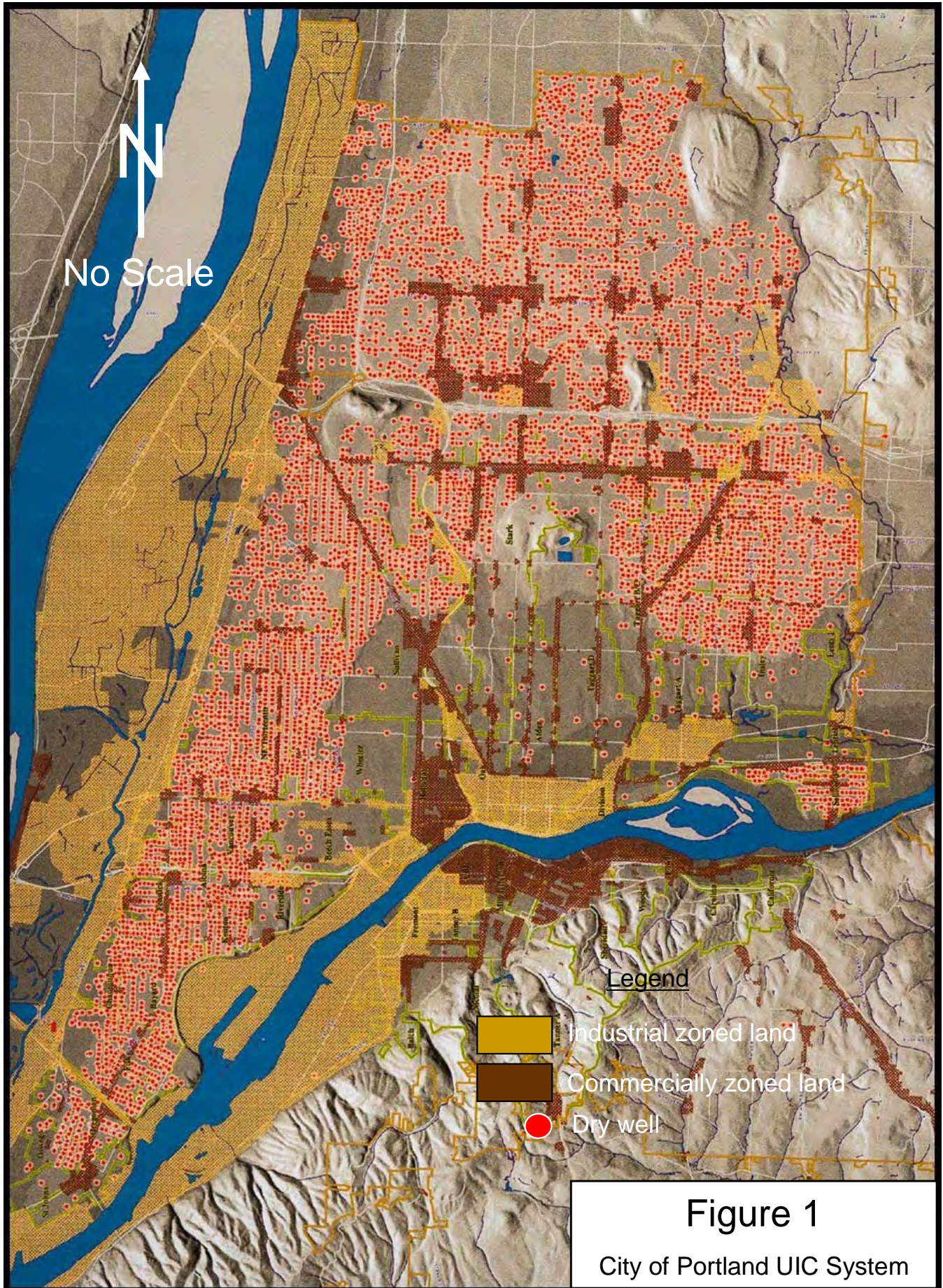
Department on March 15, 2002. The UIC Report identifies 9,255 UICs at the time of WPCF permit application submittal in July 2002. The Permittee considers 6,460 of the UICs as meeting the Rule Authorization (RA) conditions as defined in OAR 340-044-0018. According to the UIC Report (City of Portland, 2002), the remaining UICs need further investigation but probably meet RA conditions. The Department concurs that additional assessment is needed. However, the Department considers an unspecified number of UICs do not meet RA conditions. UICs that do not meet RA conditions must be decommissioned or under a WPCF permit. Therefore, further assessment of the Permittee's UIC system is necessary. The Department has established a permit condition to refine the System-wide assessment. The Department expects the Permittee to build upon its work reported in the UIC Report. System-wide assessment requirements are established in Schedule D of the permit.

2.2 UIC Construction.

The Permittee improved its design, pretreatment and construction requirements for UICs in 1994. Therefore, UICs may be grouped as pre- and post-1994 for type of construction. In addition, the Permittee incorporated existing UICs during its annexation of mid-Multnomah County. These annexed UICs were constructed similar to the Permittee's pre-1994 UICs. Approximately two-thirds of the Permittee's UICs have sediment manholes that pretreat the stormwater prior to discharge into the UIC. Pre-1994 constructed UICs, including annexed systems, are more likely to lack sediment manholes or other structural pretreatment controls. Since 1994, the Permittee has undertaken a program to upgrade these UICs with structural pretreatment BMPs.

In Portland, the most common types of UICs are:

- A drywell, usually 4 feet wide and 30 feet deep; and
- A soakage trench.



A drywell typically has perforated concrete rings that allow stormwater to seep into the subsurface. Typical construction details for dry wells and other types of UICs are provided in the Permittee's SWMM. The Permittee's UIC Report describes the construction depths of UICs as follows:

- No UIC exceeds a depth of 40 feet below ground surface (bgs);
-
- The average depth for newer UICs (post 1994) is 30 feet bgs; and
- The average depth of UICs older than 1994 is 18 feet bgs.

2.3 Separation Distance.

Unsaturated sediments in the vadose (unsaturated) zone function as part of the water quality treatment system. These unsaturated sediments attenuate pollutants which may still be present in stormwater after pretreatment at the surface has been applied. To assure that the vadose zone functions as intended as part of the treatment system, a vertical separation distance sufficient to remove the pollutants must be maintained in the unsaturated zone between the bottom of the UIC and groundwater. For fecal and *e. coli* bacteria removal, the permit establishes minimum separation distances, which are based on the depth of the UIC and the ability of the unsaturated sediments to remove the bacteria. Natural attenuation of other pollutants in stormwater may require a larger separation distance than is needed for bacteria removal.

The Department expects the Permittee to address vertical separation from groundwater and horizontal separation from drinking water and irrigation wells in the System-wide Assessment. The Permittee estimated depth to groundwater (Figure 2) as part of its UIC Report (City of Portland, 2002). The distance between the bottom of the UIC and the estimated depth to groundwater represents the vertical separation distance. The estimates were derived from data obtained as part of the Permittee's Portland wellfield studies and Portland Basin aquifer studies by the U.S. Geological Survey (USGS). The USGS, in a cooperative study with the Permittee and other local governments, is updating these estimates. The Department intends to apply the current depth to groundwater estimates until the USGS study is completed. At that time the USGS study shall supersede the March 15, 2002 estimates for depth to groundwater. Upon completion of the USGS study and based on the study results, the Permittee will be evaluating those UICs that may have insufficient vertical separation distance to groundwater and take appropriate corrective actions in accordance with permit conditions.

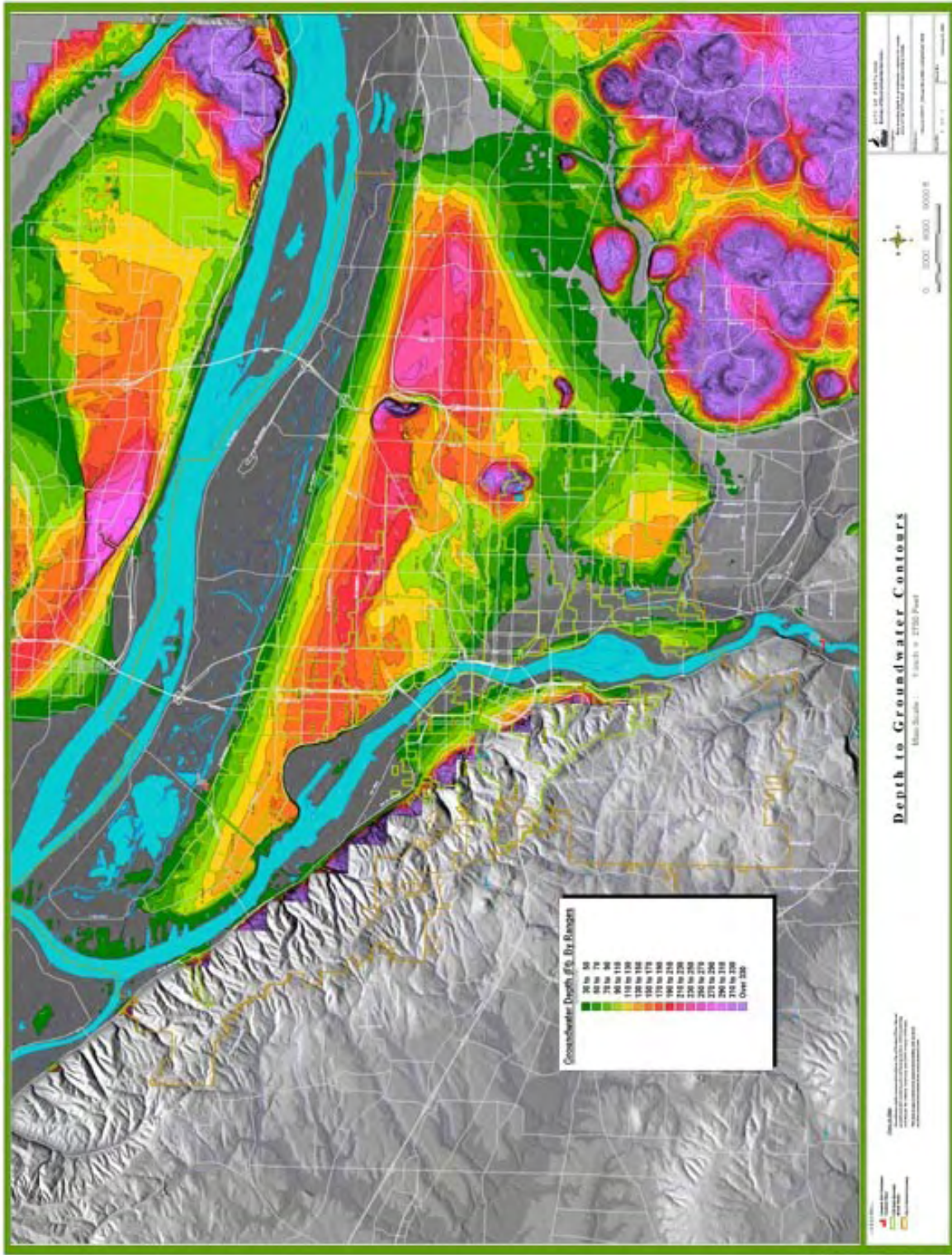
Horizontal separation is the distance between a UIC and a drinking water or irrigation well. UICs within 500 feet of a domestic well, an irrigation well or a public water system well that does not have a 2-year time-of-travel (TOT) determination must be decommissioned or under a permit. Although the permit allows UICs inside the minimum horizontal separation setbacks from water supply wells, the UICs are non-compliant with permit conditions until the Permittee demonstrates that the stormwater quality discharged into the UICs meet annual mean MADL concentrations.

The Permittee estimates the number of UICs with insufficient horizontal separation distance between less than 15 to more than 50 UICs. The permit requires the Permittee to identify all UICs with insufficient horizontal setback, demonstrate these UICs comply with the stormwater discharge quality limits established in the permit, and take appropriate corrective action if they do not meet the water quality limits established in the permit.

The Permittee is actively identifying UICs that have insufficient horizontal and vertical separation distances.

2.4 Stormwater Discharge Quality.

As of March 2002, approximately 6,600 (72 percent) of the UICs are within residential, park and open space areas (City of Portland, 2002). Most of the UICs are located within the right-of-way of residential streets, residential feeder streets, and streets representing mixed uses. Review of stormwater quality data from multiple



Source: City of Portland, Bureau of Environmental Services

Figure 2
Estimated Depth to Groundwater

sources, indicates most pollutant concentrations in stormwater that discharge to residential UICs meet the water quality limits specified in the permit (Department of Environmental Quality LASAR Database; Woodward-Clyde Consultants, 1997; City of Portland, 2004; GeoSyntec, 2004; and Pitt, et. al., 2004). These data and reports indicate that pollutant concentrations in stormwater tend to increase with an increase in traffic volume.

Portland Department of Transportation (PDOT) classifies its road infrastructure by traffic volume and patterns. Residential streets have traffic volumes less than 1,000 vehicle trips per day. Other land uses, except parks and open space would generally have traffic volumes greater than 1,000 vehicle trips per day. Based on PDOT information, the Department developed Table A that illustrates the relationship between traffic volume with land use and likelihood of risk to groundwater quality. The Department used Table A to develop the requirements in Schedule B of the permit for the stormwater discharge monitoring.

The Permittee summarized stormwater quality data for the periods of 1991 through 1996 (City of Portland, 2002). These data were collected and analyzed by Woodward-Clyde Consultants (1997) for Oregon Association of Clean Water Agencies (ACWA). In addition, the Permittee reviewed national stormwater discharge quality data and pollutants commonly found in stormwater. The ACWA data, which includes sample sites in Portland, indicate median concentrations for common pollutants in stormwater runoff meet the federal MCLs. Subsequent to the 2002 UIC report, the Permittee further evaluated UIC performance at 15 UICs within various land uses in the Permittee that correspond with Table A. ACWA also conducted a stormwater discharge quality study on BMP performance.

In general, these data indicate stormwater quality in residential areas (<1,000 vehicle trips per day) generally have lower concentrations of the pollutants listed in Schedule A of the permit. The data also indicates higher concentrations of some pollutants such as total lead in areas with higher traffic volumes (>1,000 vehicle trips per day). The summaries of these studies are discussed in Section 4.0.

<p style="text-align: center;">TABLE A Sampling Design Plan Stratification</p>		
Vehicle Trips per Day	Corresponding Land Use	Likelihood of Risk to Groundwater Quality
<1,000	Residential Street; Small Parking Lot	Low to Moderate
>1,000	Residential Feeder Streets; Commercially Zoned Areas; Transportation Corridors; Industrial Areas	Moderate to High

3.0 GEOLOGIC AND HYDROGEOLOGIC OVERVIEW

3.1 Regional Geologic Overview

Most of Portland lies within the northwest-trending Portland Basin which approximately 20 miles wide and 45 miles long. Sedimentary deposits within the Portland Basin have a maximum thickness of 1,600 feet (Golder, 1993).

The sedimentary deposits range in age from upper Eocene to Holocene. As described in the UIC Report (City of Portland, 2002), the oldest (Eocene to middle Oligocene) undifferentiated sedimentary rocks generally are not exposed in the Portland metropolitan, including the Skamania Volcanics. Overlying these deposits are

deposits of the Columbia River Basalt Group (middle Miocene), Rhododendron Formation (middle to late Miocene), the Sandy River Mudstone and Troutdale Formations (late Miocene to late Pliocene). Overlying these deposits are the Boring Lava and Volcanic Rocks of the High Cascade Range (late Pliocene to Pleistocene). Late Pleistocene and Holocene deposits cap these older sedimentary and volcanic rocks. The late

Pleistocene deposits are a complex assortment of generally unconsolidated sand, gravel, clay flood deposits and terrace deposits and mudflows and volcanic debris flows. The sand, gravel silt clay and terrace deposits represent Bretz flood deposits. These late Pleistocene deposits are highly eroded, incised and redeposited (Hartford and McFarland, 1989). Holocene in age alluvial deposits of sand, silt and clay with subordinate amounts of gravel cap the sequence of sedimentary rocks.

The coarse sand and gravel deposits underlying the Portland Basin commonly have clayey silt coatings (Trimble, 1963).

3.2 Hydrogeologic Overview

The geology and hydrogeology of the Portland basin has been described by several authors (Trimble, 1963; Willis, 1977 and 1978; Hoffsetter, 1984; Hartford and McFarland, 1989; Swanson, et. al, 1993). Brief lithologic and hydrogeologic descriptions of the sediments underlying the Portland Basin are provided in Figure 2 and Table B. In general, the hydrogeologic units as described by Hartford and McFarland (1989) are from oldest to youngest in age and depositional sequence: (1) Sand and Gravel Aquifer, (2) Confining Unit 1, (3) Troutdale Sandstone Aquifer, (4) Confining Unit 2, (5) Unconsolidated Gravel/Troutdale Gravel Aquifer, (6) Columbia River Sand Aquifer; (7) Blue Lake Aquifer, and (8) Overbank Deposits. Figure 4 (adapted from Golder, 1993) provides a schematic cross-section that depicts the relationship of these aquifers within the Portland Basin.

Table B correlates the hydrogeologic units described by Hartford and McFarland with previously identified hydrogeologic units (Willis, 1977, 1978 and Hoffsetter, 1984). It also provides a brief description of the aquifer units. Trimble (1963) describes the unconsolidated sediments as coarse sand, gravels and boulders that commonly are clay coated. Trimble's unconsolidated deposits are the unconsolidated gravel/Troutdale gravel aquifer described by Hartford and McFarland (1989) and the unconsolidated sedimentary aquifer described by Swanson, et. al, 1993). In Figure 4, Golder (1993) grouped Hartford and McFarland's (1989) Unconsolidated gravel/Troutdale Gravel aquifer, Columbia River sand aquifer and Blue Lake sand aquifer into a single Unconsolidated Sedimentary Aquifer.

Trimble (1963) describes the unconsolidated sedimentary aquifer of Swanson (1993) as lacustrine deposits that include the Bretz flood deposits (catastrophic flood deposits in Figure 3) and upper Troutdale gravels, with clasts that range in size from pebbles to large boulders. These clasts commonly are clay coated. Hartford and McFarland (1989) and Swanson, et. al. (1993) identify these deposits as consolidated to weakly consolidated intercalated beds and lenses of bouldery gravel, sandy gravel, and sandy silt with a matrix of generally fine to coarse sand with silt. Groundwater at greatest risk from UIC discharge to the subsurface are the Unconsolidated Gravel/Troutdale Gravel, Columbia River Sand, Blue Lake Aquifer as described by Hartford and McFarland (1989) or the Unconsolidated Sedimentary aquifer of Golder (1993).

TABLE B
Portland Basin Hydrogeologic Units
(Source: Hartford and McFarland, 1989)

System	Series	Willis: 1977, 1978	Hofsetter: 1984	Hartford & McFarland: 1989	Unit Description
Quaternary	Pleistocene	Unnamed clays and sandy silt	Recent floodplain deposits	Overbank deposits	Thickness greatest near modern Columbia River shoreline and thins to zero form east to west; Thins to west. Unsaturated sandy silt and fine-grained alluvial material of overbank deposits.
		Blue Lake aquifer	Blue Lake aquifer	Blue Lake gravel aquifer	60 to 220 feet thick; Ancestral Columbia River channel fill deposits; Primarily boulder-cobble- and gravel-sized clasts in minor matrix of clayey to sandy silt; 80-95 % gravel and 5-20 % matrix. Becomes more silty with depth.
		Columbia River sands	Columbia River sands	Columbia River sand aquifer	>300 feet thick; Ancestral Columbia River channel fill; Fine-grained commonly quartz-rich basaltic sand; traces of silt, siltstone and sandstone, coarse sand and gravel; bottom 20 to 40 feet consists of coarse sand and gravel with minor boulders.
		Troutdale gravel aquifer	Parkrose gravel aquifer	Unconsolidated gravel/Troutdale gravel aquifer	0 to 580 feet thick; Consists mainly of pebbly to cobbly conglomerate with silty sand matrix; Clasts commonly clay coated; Matrix consists of sand, silt and clay.
Tertiary	Pliocene	unnamed aquitard	Parkrose aquitard	Confining unit 1	0 to 150 feet thick, averaging 100 feet; Closed basin lacustrine deposit consisting of sand, silt and clay are predominant lithologies; Black vitric sand/sandstone occurs in 5-15 feet thick beds; Clay occurs at bottom of unit.
		Troutdale sandstone aquifer	Troutdale sandstone aquifer	Troutdale sandstone aquifer	Averages 100 feet in thickness; Sand, sandstone and conglomerate; Consists of 2 distinct hydrogeologic sub units, Upper sand and sandstone and lower cemented, quartzite-bearing basalt conglomerate; Basaltic glass and clay at top of upper unit
		Unnamed aquitard	Parkrose aquitard	Confining unit 2	0 to 100 feet thick; leaky confining unit; Consists of clay with minor silt and thin lenses of fine- to medium-grained basaltic sand; Claystone occurs near bottom of unit; Interpreted as lacustrine beds deposited in closed basin.
		Sandy River Mudstone aquifer	Rose City aquifer Lower Rose City aquifer	Sand and gravel aquifer	Maximum thickness >560 feet; Divided into 2 units, coarse-grained upper unit and fine-grained lower unit; Upper unit most productive aquifer as drinking water source; Units comprised of predominantly sand, silt, gravel and clay beds; Sand and gravel at top of unit; Predominant source of drinking water from Portland

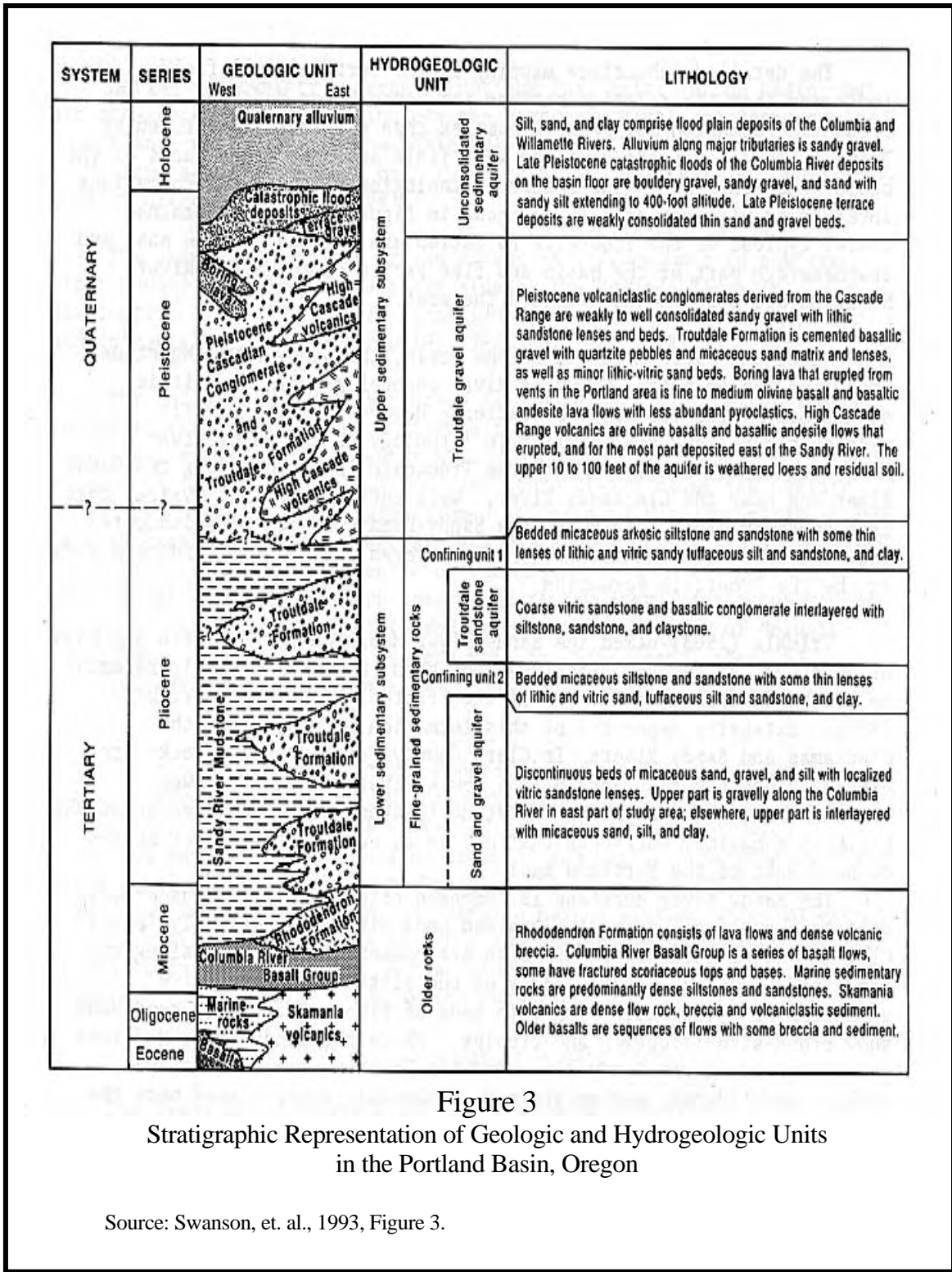
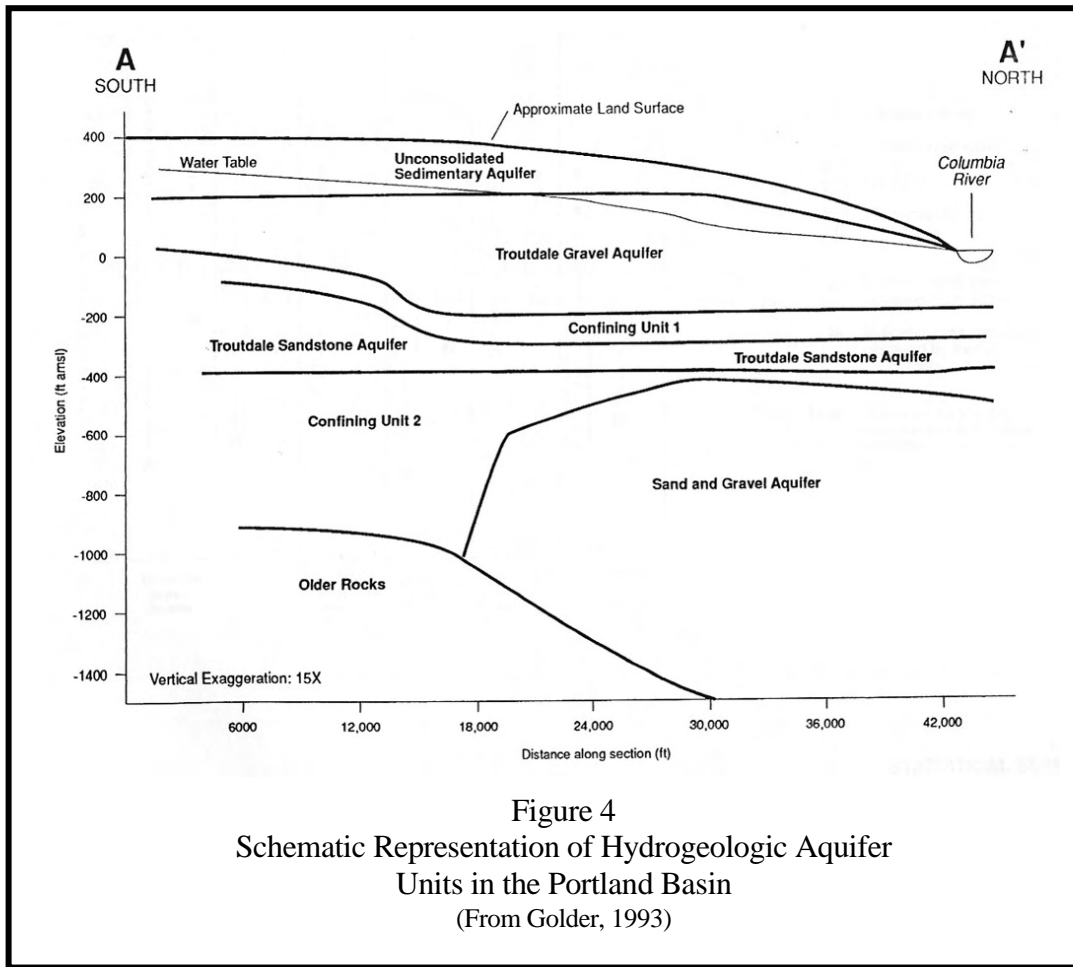


Figure 3
Stratigraphic Representation of Geologic and Hydrogeologic Units
in the Portland Basin, Oregon

Source: Swanson, et. al., 1993, Figure 3.



4.0 WATER QUALITY COMPLIANCE LIMITS

4.1 Stormwater Quality Discharge Limits

In preparation of developing water quality limits for stormwater discharged to UICs, the Department reviewed multiple sources of data and literature to identify what pollutants are contained in stormwater runoff in urban areas. The Department evaluated the pollutants and developed 2 categories of pollutants, (1) common pollutants, which should be monitored throughout a wet season, and (2) less common pollutants, which should be monitored periodically but a lower frequency than the common pollutants. The two categories are represented in Table 1 of the permit as Common Pollutants and Priority Pollutant Screen pollutants. The following subsections of this evaluation report discusses the development of the two categories and how the compliance concentration limits were developed.

4.1.1 Common Pollutants

Stormwater runoff in urban areas inherently carries pollutants. Pitt (1996) identifies urban pollutants carried in stormwater and potential sources for the pollutants (Table C). The Department has reviewed the pollutants

listed in Table C, compared the list with the pollutants identified in OAR 340-044-0018(3)(b, e, and f), and determined a subset of common pollutants as most applicable to the urban setting within the Permittee's

This subset of pollutants is presented as Table 1 in the permit. The pollutants identified in Table 1 of the permit are based on existing stormwater discharge quality monitoring data from the national, state and local scale, including data collected by the Permittee. Because of the generally common occurrence of these pollutants, they may pose an elevated risk to groundwater quality through subsurface injection. In developing Table 1 of the permit, the Department acquired and analyzed data from several sources, including but not limited to:

- The Permittee's 2003 data for monitoring the performance of sediment manholes and drywells during storm events.
- US Geological Survey (USGS) and Permittee data on groundwater quality from monitoring wells within the Permittee.
- Stormwater data collected between 1990 and 1996 as part of the Oregon Association of Clean Water Agencies (ACWA) study and analysis of urban runoff water quality data.
- Data from the 2003-2003 ACWA study of BMP effectiveness for UICs.
- Data submitted as part of annual reporting requirements under Rule Authorization from private and public facilities.
- Data from the Permittee regarding the characterization of sludge collected from sediment manholes and other stormwater infrastructure.
- Summary of data from the National Stormwater Quality Database on urban stormwater pollutants.
- Groundwater and stormwater quality data collected by the Department since the mid-1980's.

The Department compared the data and list with the pollutants listed in OAR 340-044-0018. Based on the presence and prevalence of each pollutant, the Department ranked the pollutants as common or less common. Table 1 in the permit, reflects the results of this ranking. The less common pollutants identified as Priority Pollutant Screen pollutants in Table 1 of the permit are discussed in Sections 4.1.2, below. It should be noted that all pollutants listed in Pitts (1996) table, except for phosphorous and bacteria, are present in Table 1 of the permit.

Pentachlorophenol (penta) and Di(2-ethylhexyl)Phthalate (phthalate) are listed as common pollutants in Table 1 of the permit. These contaminants were found present in stormwater runoff at several existing UIC locations. Concentrations of these contaminants in stormwater was near or at the federal Maximum Contaminant Level (MCL) for drinking water. Sources of these pollutants are unknown at present. Therefore, the Department included penta and phthalate as Common Pollutants in Table 1 of the permit until the Permittee can demonstrate that the presence and concentration of these pollutants do not pose a risk to groundwater quality.

4.1.2 Priority Pollutant Screen (PPS) Pollutants

Less likely to be present in stormwater runoff are pollutants listed under Priority Pollutant Screen (PPS) in Table 1 of the permit. The PPS were derived from the Department's review of the following sources:

- 40 CFR part 141, Subpart G, "National Revised Maximum Contaminant Levels and Maximum Residual Disinfectant Levels";
- A review of the pollutants listed by Pitt (1996);
- A review of the National Drinking Water Standards (NDWS) contaminants (EPA 816-F-01-007, March 2001); and
- The potential likelihood of the presence of usage of the pollutants within the Permittee.

TABLE C
Common and Potential National Urban Stormwater Pollutants

HEAVY METALS	POTENTIAL SOURCE(S)
Cadmium (Cd)	Motor vehicles
Chromium (Cr)	Landscape areas, roof runoff, motor vehicles
Copper (Cu)	Roof runoff, pesticide, motor vehicle
Lead (Pb)	Tires, tire weights, landscape areas
Nickel (Ni)	Motor vehicles, landscape areas
Zinc (Zn)	Roof runoff, fungicide, motor vehicles, landscape areas
ORGANIC COMPOUNDS	
Polycyclic aromatic hydrocarbons (PAHS)	
Benzo(a)anthracene	Gasoline, wood preservatives, motor oil
Benzo(b)fluoranthene	Gasoline, motor oil
Benzo(k)fluoranthene	Gasoline, asphalt (bitumen), motor oil
Benzo(a)pyrene	Gasoline, asphalt, motor oils
Fluoranthene	Gasoline, motor oils, wood preservatives, asphalt
Naphthalene	Gasoline, insecticides, asphalt
Pyrene	Gasoline, motor oils, asphalt, wood preservatives
Pesticides/Herbicides	
Chlordane	Insecticides
Glyphosate	Herbicide
Bis(2-chloroisopropyl)	Insecticide
Bis(2-chloroethyl)	Ether pesticides, fumigants, paints, solvents
1,3-Dichlorobenzene	Insecticide
NUTIRENTS	
Nitrate (as nitrogen)	Fertilizers, landscape areas
Phosphorous	Fertilizers, landscape areas
BACTERIA	
Fecal coliform	Animal waste
E. Coli	Animal waste

Source: Pitt, et. al., 1996.

In addition to a review of the resources listed above, the Department:

- Considered the list of organic compounds listed in 40 CFR Part 141, Subpart G;
- Compared the list to the USGS monitoring well data for the presence of those contaminants in groundwater;
- Reviewed its ambient groundwater monitoring database for detections of pesticide organic compounds in groundwater;
- Reviewed stormwater and groundwater data provided by the Permittee for the presence of pollutants listed in 40 CFR Part 141, Subpart G and the NDWS contaminants; and
- Considered the likelihood of usage of the listed pesticides with respect to stormwater runoff to a Permittee owned or operated UIC.

Based on the Department's review of the USGS groundwater data and its own database, the Department reached the following conclusions:

- Pollutants unlikely to be present in urban stormwater runoff include most chlorinated organic compounds used in industrial processes, by products of drinking water disinfection, and pesticides not readily available or commonly used by urban consumers;
- Those pollutants that the data indicated were not present in groundwater may be eliminated from the PPS pollutant list; and
- Those pollutants in which there was a lack of data, or the reviews indicated a likelihood of being present in stormwater runoff should remain on the PPS list.

The intent of the PPS pollutant sampling is to verify these less common pollutants are not present in stormwater discharged to public UICs. The Department determined the appropriate interval to conduct PPS sampling is the 1st, 4th and 9th years of the permit for the following reasons:

- The 1st year sampling establishes the initial sampling to determine the likely presence of the listed priority pollutants.
- The 4th year sampling event provides data and allows time for a mid-permit duration sampling correction, if necessary.
- The 9th year sampling event provides data immediately prior to permit renewal.

4.2 Groundwater Quality Limits

The goal of the permit is to protect groundwater quality for its highest beneficial use while allowing discharge of stormwater into the subsurface through UICs. The permit is specifically designed such that groundwater quality monitoring is not required as long as the Permittee meets the stormwater discharge limits established in the permit. These limits are designed to be protective of groundwater quality. However, the Permittee may need to undertake groundwater monitoring as part of either compliance response or corrective actions to demonstrate groundwater is protected. The Department does not intend the Permittee to undertake groundwater monitoring if the Permittee meets the requirements and discharge limits established in Schedule A and Table 1.

The State's groundwater regulations require meeting background water quality conditions. The regulations also provide a process that allows contaminant concentrations in groundwater up to the federal MCLs as a concentration limit variance (CLV) for permitted facilities. Groundwater compliance concentration in Table 1 of the permit, other than "background," represents CLVs for those pollutants. With the exception of lead (Pb), the CLVs are the federal MCLs for drinking water sources. All other groundwater compliance limits are the background concentrations.

The Permittee may obtain the required data and petition the Department to establish other CLVs beyond those listed in Table 1 of the permit. The CLV process and conditions are clearly defined in OAR 340-040-0030(4). Any CLV request submitted to the Department is subject to the Department's public review and comment requirements.

In the event the Permittee undertakes groundwater monitoring for a UIC where a corrective action is required, the Permittee must comply with the groundwater monitoring requirements of OAR 340-040-0030(2), including establishing up- and downgradient monitoring wells. Background groundwater quality must be determined at the time of groundwater monitoring and be based on the pollutants concentration at the upgradient monitoring well, provided the upgradient well is not adversely impacted by discharge from the UIC of concern.

If the pollutant concentration in the upgradient monitoring well is greater than the downgradient (compliance) monitoring well, groundwater has not been adversely impacted by the injection activity. If the downgradient and upgradient monitoring wells have the same pollutant concentration, and the upgradient well has not been influenced by underground injection activities from other public UICs, groundwater has not been adversely impacted. If a pollutant concentration in the downgradient monitoring well is greater than the upgradient monitoring well, then groundwater has been adversely impacted. The Department presumes the adverse impact is the result of public UIC discharges unless the Permittee demonstrates to the Department's satisfaction that the pollutant of concern is from a source other than a public UIC. Exceeding the background groundwater quality at the downgradient (compliance) monitoring well is a permit violation.

All groundwater monitoring must be conducted in accordance with the Department accepted Groundwater Monitoring Plan.

4.3 Discussion of Stormwater Quality Discharge Limits

Stormwater discharge is permitted at levels that ensure groundwater quality remains protected during stormwater disposal activities. The Department has established Maximum Allowable Discharge Limits (MADLs), for stormwater discharge into UICs. The Department considers the MADLs protective of groundwater quality for the following reasons:

- These MADL numeric limits are based on several factors, including the capacity or natural attenuation in the unsaturated zone. The numeric limits in Table 1 of the permit establish acceptable levels of stormwater quality that protect groundwater quality and take into account natural attenuation within the unsaturated zone;
- Surface infiltration BMPs, in and by themselves, are not UICs and are not covered under this permit. Groundwater is the endpoint from surface infiltration or UIC discharge. In surface infiltration, pollution load reduction occurs in the upper 6 to 12 inches of the native soil or manufactured media of the surface infiltration BMP. Natural biological processes to treat infiltrating stormwater diminish with depth. The oxic (aerobic) zone where the natural biological processes occur generally does not occur below a depth of 5 to 10 feet below ground surface. Subsurface emplacement of fluid from a UIC typically occurs below the oxic zone. As a result, infiltrating stormwater injected at depths greater than 5 to 10 feet below ground surface by-pass the zone where much of the natural attenuation of pollutants occurs. Below a depth of 10 feet, natural attenuation becomes dependent on the physical and chemical properties of the sediments to remove or bind the pollutants. The diminished natural attenuation capacity of sediments below the oxic zone increases the risk of groundwater quality degradation from injection activity. OAR 340-040-0030 requires groundwater protection from permitted sources. Because the active biological zone is by-passed and the natural attenuation capacity of the unsaturated zone is reduced with depth, numeric limits are established in the permit at groundwater quality protective levels and concentration reduction oriented pretreatment is required.
- Because of a lack of data for most pollutants listed in Table 1 of the permit, the MADLs are set at the federal primary drinking water Maximum Contaminant Level (MCL). The degree of natural attenuation is dependent on several factors including local geology, separation distance to groundwater, land use and area drained by the UIC. The minimum MADL is the federal MCL or other health-based numeric standard if there is no MCL. The intent of meeting MADLs is that stormwater quality, through a combination of pretreatment BMPs and natural attenuation within the unsaturated zone, meet the groundwater quality protection requirements of OAR 340-040-0030(2).

Through OAR 340-045-0055, the Permittee may request an increase of any MADL concentration listed in Table 1 of the permit. As part of any request to modify the concentration established in Table 1 of the permit, the Permittee must present scientifically valid data and analyses that demonstrate an increase in the MADL concentration does not adversely affect groundwater quality for its beneficial uses as defined in OAR 340-040-0020. Under the provisions of OAR 340-045-0055, any proposed increase of a permit established

concentration limit is a major permit modification. Public review and comment on any proposed increase in a permit-established limit requires public review and comment prior to Department action on the request.

The permit requires the annual mean MADL concentration be met at end-of-pipe (EOP) discharge point after any pretreatment BMPs or structural controls into a UIC. For stormwater, adaptive management decisions are usually based on annual median concentrations of pollutants. Because groundwater is the endpoint of UIC discharges and is an underground source of drinking water, the Department requires using the annual mean concentration as a more protective compliance limit. The annual mean can be conservatively biased toward higher pollutant concentrations by outlier data points. Because of outlier data and stormwater data usually does not conform to a normal distribution, using an arithmetic mean may be inappropriate. The results are likely to be unduly biased. To keep a level of conservatism, yet not unduly bias the annual mean concentration from outlier data points, the department considers applying either a log-normal or geometric mean calculations to determine the annual mean concentration as appropriate methodology.

The Permittee's UIC Report (City of Portland, March 2002) indicates a significant number of the Permittee's UIC may qualify as Authorized by Rule, or Rule Authorized (RA), in accordance with OAR 340-044-0018. UICs that meet the requirements for RA are presumed to protect groundwater. Owners or operators of 50 or more UICs must monitor the stormwater discharged to UICs. OAR 340-044-0018 (3)(b) identifies the following pollutants as the minimum to monitor in order to demonstrate groundwater protection:

- Benzene, Toluene, Ethyl Benzene, Xylenes (BTEX)
- Benzo(a)pyrene (PAH)
- Unfiltered total lead (Pb), Chromium (Cr), and Cadmium (Cd)
- Total nitrogen
- Fecal coliform bacteria

When a permit is required, the Permittee must not violate any primary federal drinking water standard under the SDWA or other human-health based standard in groundwater, and must comply with the State's groundwater protection rules of OAR 340-040. The groundwater protection rules establish groundwater concentration limits for permitted facilities. The provisions of OAR 340-040 are applied groundwater. The permit meets the requirements established under OAR 340-040-0020 and OAR 340-040-0030. In accordance with the State's groundwater protection regulations, the Department expanded the list of pollutants that the permittee must assess in stormwater discharged into UICs. At a minimum, the Department considers the application of the water quality requirements under OAR 340-044-0035 must be met at groundwater.

4.3.1 Phosphorous Monitoring Exclusion

The Department concluded that the inclusion of total phosphorous as a common pollutant or a priority pollutant is not warranted based on the following:

- Pitt (1996) identifies phosphorous as a common pollutant in urban stormwater (Table A). In Portland specific and more regionally within the Portland Basin, the naturally occurring levels of total phosphorous are on the order of 0.14 mg/L with occasional deviations to a maximum concentration of 0.37 mg/l based on Total Maximum Daily Load (TMDL) studies for the Willamette River, Tualatin River and the Columbia Slough, and Department and USGS groundwater data. A review of total phosphorous in stormwater runoff within the Permittee indicates an average median concentration of 0.36 mg/l with a maximum median of 0.79 mg/l and a minimum median of 0.16 mg/l. It is commonly known that phosphorous has a high affinity to bind with soil. Given the low levels of total phosphorous in stormwater runoff, it is very unlikely that total phosphorous would reach groundwater at levels that exceed the naturally occurring background concentrations.
- Total Phosphorous is not listed as a primary or secondary MCL under the federal SDWA.
- Total Phosphorous is not listed in the numeric reference tables in OAR 340-040-0020.

- Total phosphorous does not pose an endangerment to human health. Neither the EPA Region 9 Preliminary Remediation Goals (PRGs).
- The Columbia Slough is phosphorous limited. Naturally occurring levels of total phosphorous were taken into consideration to determine phosphorous loading. Because infiltration of stormwater with total phosphorous is unlikely to cause an increase in the naturally background concentrations for total phosphorous, discharge of stormwater to a UIC should not adversely impact the TMDL phosphorous-limited Colombia Slough.

4.3.2 Bacteria Monitoring Exclusion

The Department concluded that bacteria (fecal coliform and *e. coli*) in stormwater discharge to a UIC in the Permittee does not pose an endangerment to groundwater quality, provided minimum separation distances established in the permit are maintained. The following discussion provides the basis for this decision:

- Under the Authorization by Rule provisions of the State's UIC regulations (OAR 340-044-0018(3)(b, d, f), an owner or operator of a UIC must monitor for the presence of fecal coliform and *e. coli*. This requirement is more restrictive than Authorization by Permit (OAR 340-044-0035) because compliance under authorization by rule presumes groundwater is protected. However, monitoring requirements and pollutants are not specified under Authorization by Permit (OAR 340-044-0035). OAR 340-044-0035 explicitly calls for compliance with the groundwater protection rules of OAR 340-040. Under OAR 340-040, the Department has latitude to establish permit-specific monitoring parameters and groundwater compliance concentration limits.
- The decision to exempt bacteria monitoring is based on data existing that demonstrates no presence of bacteria in groundwater when cesspools discharged approximately 25 million gallons of raw sewage a day into the aquifer. It should be noted that cesspools have essentially been eliminated when the Permittee installed sanitary sewers in the affected areas. Prior to completion of the mid-Multnomah County sewer project in the late-1990's, approximately 25 million gallons of raw sewage was disposed daily from cesspools into the rapidly draining soils of the subsurface. The point of injection for most of the cesspools was greater than 10 feet below ground surface. The Department monitored groundwater quality in mid-Multnomah County to evaluate the potential impacts of the sewage effluent from cesspools on groundwater quality. The Department's data shows elevated levels of nitrate in groundwater. Bacteria, including total coliform, fecal coliform and *e. coli*, were not detected in groundwater. The absence of bacteria indicates it is removed mechanically within the unsaturated zone before the cesspool effluent reached groundwater or dies off before it reaches groundwater. A sanitary sewer system has subsequently been installed in the mid-county area because of the nitrate as nitrogen concentration impact on ground and surface water quality.
- Anecdotally, the Department, in cooperation with the US Geological Survey and Deschutes County, has been evaluating the performance of innovative on-site septic system technologies in La Pine, Oregon. These on-site systems discharge in very rapidly draining soils. Groundwater monitoring wells were installed for each system to intersect the upper 5 feet of the shallow water table. Groundwater within the study area is typically less than 15 feet below ground surface and often less than 10 feet below ground surface. The monitoring well for each on-site system was located between 5 and 10 feet from the drainfield on the down gradient side. Most on-site systems, including the monitoring wells, were monitored for a minimum of three years under normal year-round occupancy conditions. The monitoring was conducted on a monthly to bi-monthly frequency. The on-site system effluent discharge impact to groundwater was readily observed by increases in chloride and nitrogen concentrations in the groundwater over the baseline water quality conditions. However, the presence of fecal or *e. coli* bacteria was not detected in the groundwater collected from the drainfield monitoring wells at any of the sites although bacteria were detected in effluent discharged into the drainfields. The Department determined that the bacteria were attenuated either through soil bacteria digestion or mechanical filtration within the unsaturated zone.

- Bacteria removal or attenuation occurs naturally in the shallow unsaturated zone from bacteria die-off, soil bacteria digestion and mechanical filtration by the soil. Soil bacteria digestion typically occurs within the shallow oxic portion of the unsaturated zone. The oxic portion usually extends no more than 10 feet below ground surface. Mechanical filtration becomes the dominant process for bacteria removal at depths greater than 10 feet below ground surface.

Therefore, the Department has determined based on these data and observations of on-site septic system performance to establish a minimum separation distance from the bottom of the UIC to the top of the aquifer instead of requiring bacteria monitoring. The minimum separation distances are established in the permit in Schedule F.5 and summarized below:

- For UICs with a maximum depth for injection of 5 feet below ground surface, the minimum separation distance is 5 feet.
- For UICs with a maximum depth for injection greater than 5 feet below ground surface, the minimum separation distance is 10 feet.

These minimum separation distances for bacterial removal are dependent upon the physical soil properties between the bottom of a UIC and the seasonally high groundwater. The permit establishes minimum separation distance for the biologically or mechanically remove fecal coliform and E. Coli bacteria in the unsaturated zone, prior to entering groundwater. Greater separation distances may be required for other pollutants or due to site specific conditions.

4.3.3 Establishing MADLs.

The intent of the federal and state UIC regulations is to protect underground sources of drinking water (federal) and groundwaters for their highest and best beneficial uses (state). Stormwater treatment is most effective prior to underground injection. The Permittee, as part of its stormwater management program to restore and enhance watershed health, implements a variety of effective BMPs that reduce pollutants in stormwater. These BMPs range from nonstructural controls (e.g. street sweeping) and structural controls (e.g. sediment manholes, filters, infiltration swales, etc.) to institutional controls (e.g. Stormwater Management Manual, Operations and Maintenance of its stormwater systems, employee and public education). BMP effectiveness studies conducted by the Permittee and Oregon Association of Clean Water Agencies (ACWA) show that sediment manholes are effective structural treatment BMPs employed by the Permittee before discharge to UICs.

To demonstrate groundwater protection without installing groundwater monitoring wells throughout the geographic area of the permit (a cost prohibitive means of monitoring), the Department has:

- Establishes discharge compliance limits at the end-of-pipe discharge into the drywell;
- Requires the Permittee to have an aggressive statistically valid sampling design plan representative of its UICs;
- Requires monitoring a minimum of 5 storm events during a wet season for pollutants that commonly are detected in stormwater within urban areas; and
- Requires sampling for the presence of less common pollutants that may or may not be present in stormwater at least 3 times during the permit duration.

The Department has established Maximum Allowable Discharge Limits (MADLs) for the common and less common pollutants in stormwater within the Permittee. The Department considers the MADLs protective of groundwater quality in that they met regulatory requirements for drinking water or can be demonstrated the established concentration does not pose a likely adverse impact to groundwater quality. By meeting the annual mean MADL concentration, the Permittee effectively demonstrates its discharge of stormwater to Class V UIC injections systems is protective of the groundwater in accordance with OAR 340-040-0020. The Department considers the annual mean MADL concentration representative of a pollutants potential loading to groundwater

over an entire wet season. In establishing the MADL concentration, the Department factored in the ability of the natural unsaturated soils to further remove pollutants before stormwater injectate reaches the shallow groundwater.

Table 1 of the permit establishes discharge limits to the UICs and groundwater compliance limit. Discharge limits to the UICs for common pollutants listed in Table 1 the permit are the MADLs, which are presently based on the federal MCLs for the pollutants unless otherwise specified. Groundwater compliance is based on the requirements of OAR 340-040-0030(3)(b), which requires concentration be established at background water quality levels unless Department-accepted concentration limit variances (CLVs) have been granted.

The MADLs in Table 1 of the permit reflect the numeric reference levels in Tables 1, 2 and 3 of OAR 340-020-0020, with the exception of arsenic (As), Benzo(a)pyrene, pentachlorophenol (penta), and di(2-ethylhexyl)phthalate (phthalate). The numeric reference levels applied in the permit are consistent with the federal MCLs, except lead (Pb) and As. The current MCLs for Pb and As are 15 and 10 µg/L, respectively. The Department applied the numeric reference level for Pb as the MADL. The As MADL is based on the current SDWA MCL. The Pb MADL is 50 µg/L. Justification for applying Pb at a concentration greater than the federal MCL is provided under Section 4.3.5. The decision to apply the federal MCL for As instead of the Department's numeric reference level is provided under Section 4.3.6.

Benzo(a)pyrene, penta and phthalate are not included in parameters listed in OAR 340-040-0020. Benzo(a)pyrene is a pollutant of concern under OAR 340-044-0018 and listed in the SDWA MCLs with one of the lowest concentration limits (0.2 µg/L). Penta and phthalate were detected in several samples as part of the Permittee's 2003 sampling study of BMP performance for underground injection controls. Penta and phthalates are both listed under EPA Region PRGs establishing human-health based standards. They are also listed as primary drinking water pollutants in SDWA. Penta and phthalate are not listed in the numeric reference tables of OAR 340-040-0020. The federal SDWA MCLs are based on human-health exposure limits. Therefore, the Department applied the federal MCLs current at the time of permit as the MADL concentration. For penta and phthalate, the MADLs are 1.0 and 6.0 µg/L, respectively.

Compliance with the MADLs listed in Table 1 of the permit is based on the annual mean concentration for the wet season in which the samples were collected. The Department defines a wet season as October 1 through May 31. Generally, stormwater quality is measured on median concentrations to reduce variability common to stormwater sampling. The Department decided that an annual mean concentration, which is usually greater than the median, would be more protective of groundwater quality. In making this decision, the Department recognizes that the annual mean may be skewed by a single storm event result or incidents beyond the Permittee's control that may occur between sampling events and affect the sampling result. In determining the annual mean concentration, an outlier data point that significantly skews the annual mean may be deleted from the annual mean calculation. The Permittee must report the outlier data and justify why the data point was not included in the calculation.

The annual mean concentration must be computed on a minimum of 5 storm event data points, unless conditions occur beyond the Permittee's control to monitor 5 storm events. The permit specifies the conditions that the Department will accept as beyond the Permittee's control. Outlier data points are not a valid reason for having less than 5 data points to base the annual mean MADL calculation, unless the outlier occurs during the last sampling storm event of the wet season. An exceedance of the annual mean concentration triggers a compliance response action. The Department does not consider the exceedance of the annual mean concentration as a permit violation. However, any failure to take a compliance response or corrective action is a permit violation. In order to ensure the Department is aware of any outlier data points that exceed the MADL during a single storm event that may have the potential to adversely impact groundwater quality, the Permittee is required to notify the Department if laboratory analyses of samples from a UIC indicates that a MADL has been exceeded in any sampling event.

4.3.4 Changes to the MADLs.

The permit allows the Permittee to request an increase of the MADL for each pollutant. Any request to increase a permit established MADL must address the following:

- Any increase in the permit established MADL must be based on sound science; and
- The Permittee must demonstrate, with data and human-health based criteria, that the proposed increase does not endanger the existing natural groundwater quality, which currently meets human-health based criteria in the EPA Region 9 PRGs.

Under OAR 340-045-0055, any increase in a MADL represents a major permit modification because the increase represents a lower initial protective level. As required by OAR 340-045-0055, the Department, after receiving the request, will post the request and the Department's analysis of the Permittee's request to increase a MADL on the Department's permit notices website for a 35-day public comment period. Upon closure of public comment period, and depending on comments received, the Department may approve, deny or amend the request, or the Department may request additional information based on public testimony.

4.3.5 Establishing Lead (Pb) MADL.

In the State's groundwater protection rules (Table 1 of OAR 340-040-0020), the state numeric reference level for Pb is 50 µg/L. However, the current federal MCL for Pb in drinking water is 15 µg/L. Both the state numeric reference level and federal MCL are applied at groundwater. For discharge into a UIC, a pollutant concentration may exceed the federal MCL, provided the elevated pollutant concentration meets the groundwater compliance limits established in the permit, which are protective for drinking water and human health. The Department evaluated the potential effects of a Pb MADL greater than the federal MCL at the EOP discharge point into a UIC. The following discussion outlines the Department's determination to establish the Pb MADL at the numeric reference level for Pb in Table 1 of OAR 340-040-0020, which is 50 µg/L. It is the Department's decision that:

- A Pb MADL of 50 µg/L discharged at the EOP discharge point does not adversely impact groundwater quality for its beneficial uses; and
- Meets the groundwater compliance limits established in the permit.

The Department considered the following factors in reaching its decision:

- Existing stormwater BMP controls and management
- Existing groundwater quality from 12 USGS monitoring wells in areas that receive injected stormwater
- Attenuation and filtration by the natural soils within the unsaturated zone
- Dilution effects in groundwater

4.3.5.1 Effects of BMP Controls and Management upon Lead Concentrations.

National, regional and Portland specific stormwater discharge quality data indicates Pb concentrations tend to vary by land use (i.e. traffic volume and patterns). High traffic volume and patterns typically occur in commercial and industrial zoned areas, including mixed use areas, where traffic volume exceeds 1,000 trips per day. Residential areas are considered low traffic volume areas, i.e. ≤1,000 trips per day. The median concentration of Pb by land use from various studies is summarized in Table D. The mean concentrations of Pb at the EOP are included in the table for the Portland sumps and drywells sampled. The groundwater compliance limit for Pb is 15 µg/L (federal MCL for Pb). General shallow aquifer background concentrations for Pb is usually less than the analytical method detection limit, e.g. not detected. The general groundwater background concentration is derived from groundwater analyses of multiple samples collected from 12 USGS

shallow aquifer monitoring wells and the Department’s data from several shallow drinking water wells in the Portland Basin sampled over a number of years between the 1980’s and early 1990’s.

A review of the data summarized in Table D clearly shows overall effectiveness of the Permittee’s stormwater management combined with the pretreatment capabilities of sediment manholes. The median and mean concentrations for Pb from the Portland sump and drywell data are an order of magnitude lower than regional or national results. Further, regional and national results indicate the median concentration for Pb is near or slightly above the federal MCL of 15 µg/L. However, the reported maximum d Pb concentrations are above the federal MCL for Pb, but well below the MADL for Pb for residential land uses (<1,000 vehicle trips permit day).

Land Use	David Evans & Associates (1992)	EPA NURP (1983)	ACWA (1997)		National Stormwater Quality Database 2004	Portland Sump & Drywell Data (2004) ⁽⁴⁾		FHWA (1990)	Santa Clara (1996)
			Total	Dissolved		Median	Mean		
Residential									
Maximum ⁽¹⁾	0.021		0.018	0.0019		0.022			
All Sites	0.017	0.144	0.01	0.0013	0.012	0.003	0.005		0.037
Commercial									
Maximum	0.141		0.063	0.0048		0.048			
All Sites	0.06	0.0104	0.026	0.0025	0.018	0.012	0.014		
Mixed									
Maximum	0.064		0.049	0.0017					
All Sites		0.0114	0.01	0.0015 ⁽²⁾					
Industrial									
Maximum	0.044		0.05	0.0019		0.053			
All Sites	0.04	0.0104	0.021	0.0018	0.025	0.013	0.017		0.121
Transportation									
Maximum	0.042		0.064	0.0025		0.048		0.400 ⁽⁵⁾	
All Sites			0.043	0.002	0.025 ⁽⁵⁾	0.016	0.017	0.054 ⁽⁶⁾	0.053

⁽¹⁾ Maximum concentration recorded at an individual sample station.
⁽²⁾ Median estimated by DEQ.
⁽³⁾ National Stormwater Quality Database for freeways.
⁽⁴⁾ Preliminary data provided by City of Portland, Bureau of Environmental Services.
⁽⁵⁾ From ACWA, 1997.
⁽⁶⁾ From David Evans and Associates, 1992.

As indicated in Table D, regional and national median Pb concentrations for commercial, industrial, transportation (freeway and arterial roads) and mixed (residential/commercial/industrial) land uses (>1,000 vehicle trips permit day) are near or slightly above the federal MCLs and below the MADL established in the permit. Maximum concentrations do exceed the MADL concentration. The maximum concentrations would be equivalent to outlier data points for single storm events and representative of the variability of results that occurs in stormwater monitoring. The Department requires the Permittee to report these individual storm event maximum concentrations. As previously stated, median concentrations are used as the standard practice for monitoring stormwater quality runoff quality. The median is more reflective of the overall quality of stormwater runoff. It is less responsive to the visibilities that occur in individual storm event monitoring.

Table E summarizes preliminary data collected by the Permittee from UICs representative of traffic volumes and patterns through the permitted area. The median and mean Pb concentrations are well below the Pb

MADL established in the permit. However, the median and mean Pb concentrations do exceed the federal MCL for Pb at the discharge point into the UIC. Again, residential (lower traffic) areas consistently show Pb is well within the limits for drinking water and the MADL established in the permit. The summary of median and mean Pb concentrations for the highest traffic areas (transportation and industrial land uses), show post-treatment concentration as slightly higher than the pretreatment concentration. These higher discharge concentrations may be related to a number of factors including storm intensity, timing of the sample collection relative to the storm event duration, the amount of sediment in the sediment manhole prior to the storm event (e.g. effect of maintenance frequency), and potentially other factors not yet fully understood. The factors that affect the BMP pretreatment performance or effectiveness will be evaluated as part of the permit’s requirement for BMP effectiveness testing and monitoring. Overall, the median and mean Pb concentrations for the high traffic volume areas may be above the MCL at the POI, they are below the MADL established in the permit and below the groundwater. In addition, the overall structural sediment manhole pretreatment BMP is expected to perform best when it is used in combination with other non-structural BMPs.

TABLE E					
SUMMARY OF SEDIMENT MANHOLE BMP PRETREATMENT FOR TOTAL RECOVERABLE ARSENIC (ug/L)					
Data Source: City of Portland Preliminary Monitoring Results, 2004					
Land Use	Traffic Volume (TPD)	Median		Mean	
		SedMH	Drywell	SedMH	Dry well
Residential	<1,000	0.340	0.330	0.403	0.417
Commercial	>1,000	0.625	0.570	0.971	0.591
Industrial		0.675	0.755	1.403	1.204
Transportation		0.550	0.710	0.587	0.681
Data source: City of Portland (2003) sump and drywell BMP effectiveness study preliminary data.					

4.3.5.2 Natural Attenuation and Filtration.

The unconfined water table (groundwater) in the unconsolidated sedimentary aquifer sediments is at greatest risk to adverse impacts from stormwater-carried pollutants discharged into UICs. This risk is naturally reduced by the general ability of soil and sediment in the unsaturated zone to attenuate and filter pollutants carried in stormwater. The ability of soil and sediments to attenuate pollutants can be derived through comparing groundwater quality data to pollutant concentration in the stormwater and understanding the physical characteristics of the natural sediments.

As illustrated in Figure 5, the unsaturated near surface soil and deeper sediments become an integral part of stormwater treatment before the discharged fluids reaches groundwater. The near surface soils tend to have the greatest natural attenuation capacity, which decreases with depth and type of sediment. As an example, standard on-site septic systems use the soil horizon as part of the treatment system for fecal and *e. coli* bacteria removal. Figure 5 illustrates the relationship between soil and sediment to attenuate pollutants. Most natural attenuation occurs in the soil horizon, usually less than 5 to 6 feet below ground surface. The soil horizon tends to be more aerobic and biologically active, have higher carbon content and is fine-grained. These factors are favorable to natural attenuation. The sand and gravel deposits (generally below 5 to 6 feet) underlying the soil horizon, become anaerobic and less biologically active, tend to have a lower carbon content and is more coarse-grained. These conditions are less favorable to natural attenuation although attenuation does occur to a lesser extent within the unsaturated sand and gravel.

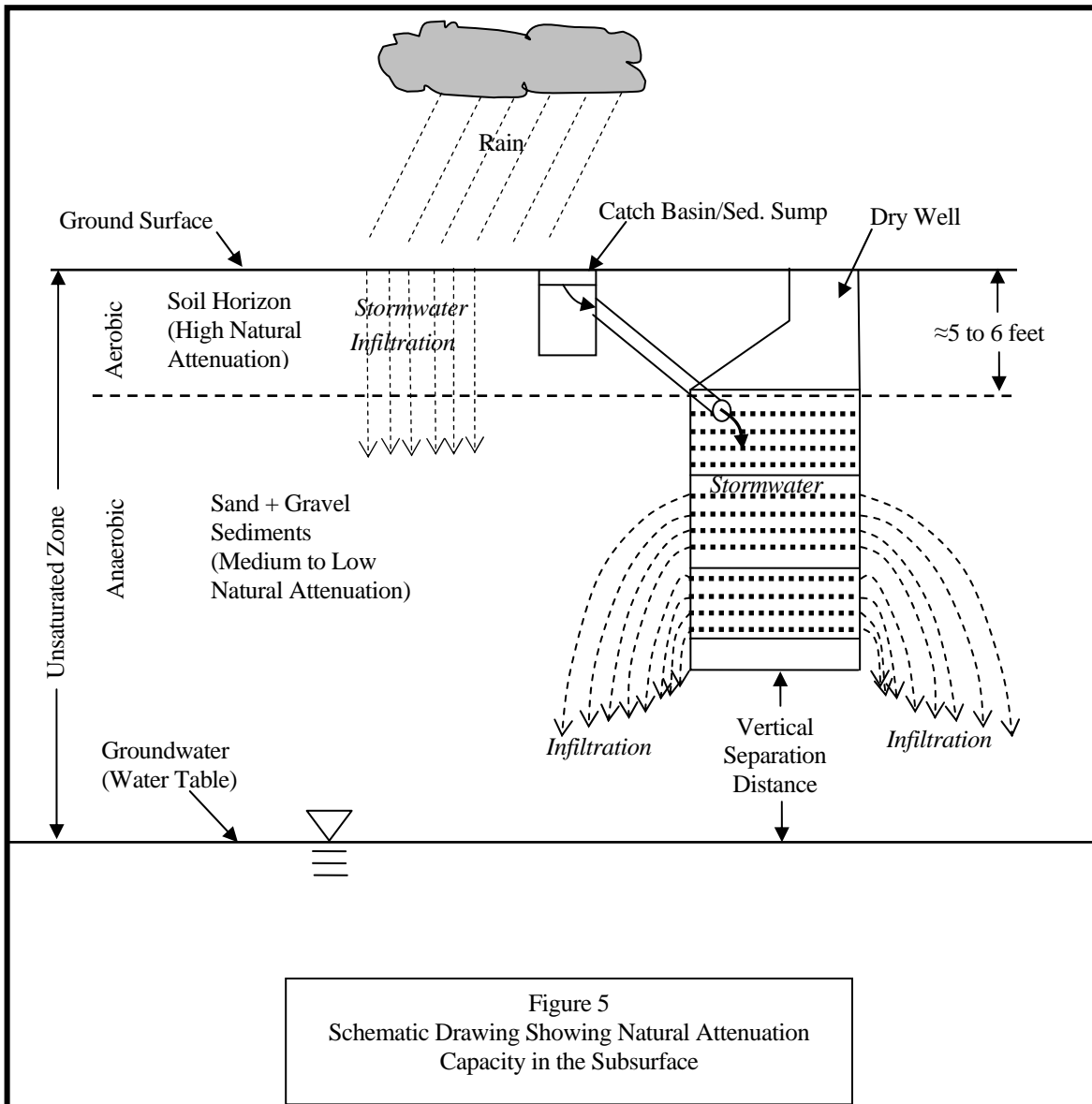


Figure 5 illustrates surface infiltration BMPs are more effective to remove pollutants as these BMPs take advantage of the soil horizon where the greatest natural attenuation occurs. UICs discharge stormwater into the unsaturated zone below the soil horizon. Stormwater pollutants are attenuated in the sand and gravel underlying the soil horizon, but to a lesser extent. Therefore a greater thickness of sediment (sand and gravel) is needed to achieve the attenuation capacity of the soil horizon. Recognizing these differences, the permit establishes minimum vertical separation distances between the bottom of the UIC and groundwater to remove bacteria from stormwater in the subsurface. A greater vertical separation distance may be necessary to remove other pollutants in stormwater.

As evidence for natural attenuation of stormwater pollutants in the unsaturated zone, groundwater quality data do not indicate long-term adverse impacts to groundwater from private and public UIC discharges, which have been used to manage stormwater the permitted area since the early 1960's. The Department reviewed stormwater quality data from multiple sources and reviewed literature on the physical and geologic

characteristics of sediments underlying the Portland Basin to ascertain the general ability of the unsaturated sediments to naturally attenuate and filter pollutants in storm water. Groundwater quality underlying the Portland Basin has been monitored since the mid-1970's. The Department maintained a monitoring network of private domestic water wells until the mid-1990's. The USGS has monitored groundwater quality in the mid- and late-1990's (Hinkle, 2004). The Permittee also sampled the USGS wells in 2003 (City of Portland, 2004).

The Department specifically evaluated total and dissolved metals in stormwater and compared the concentrations with observed concentrations for these metals in groundwater. The mean concentrations of total and dissolved metals commonly found in stormwater in urban Portland are summarized in Table F. These concentrations represent the common metals expected in the discharge fluids to a UIC without any structural pretreatment controls. These data were collected between 1991 and 1996 as part of a regional NPDES MS4 study commissioned by Oregon Association of Clean Water Agencies (ACWA) to evaluate stormwater discharge quality by type of land use (Woodward Clyde Consultants, 1997). As expected, the total metals concentration exceeds the concentration of the dissolved metals in the stormwater runoff.

Table G provides a summary of groundwater quality data for metals and other common stormwater pollutants observed at the USGS monitoring wells. The concentrations of metals in Table G are for dissolved metals. The USGS (Hinkle, 2004) and Permittee (City of Portland, 2004) analyzed only the dissolved component of metals. The Department during its mid-Multnomah County groundwater quality monitoring, analyzed dissolved and total metals in groundwater. The Department's data indicates the dissolved and total metals concentrations are nearly the same (Table H). Most of the groundwater data is from areas that receive UIC discharge of stormwater.

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<p align="center">Table F Summary of Total Recoverable Metals in Stormwater Discharge (1991-1996) City of Portland (Data Source: Woodward Clyde Consultants, 1997)</p>								
Metal	Total ug/L				Dissolved ug/L			
	Mean Concentration	Maximum Concentration	# samples	D.L (ug/L)	Mean Concentration	Maximum Concentration	# samples	D.L (ug/L)
Anitmony (Sb)	<3.0	ND	23	3.0	<1.0	ND	23	3.0
Arsenic (As)	1.00	6	24	1.0	<1.0	ND	24	1.0
Beryllium (Be)	0.12	0.12	24	0.2	<0.1	ND	18	0.2
Cadmium (Cd)	0.98	4	55	1.0	0.31	0.3	50	1.0
Chromium (Cr)	1.32	12	78	1.0	0.26	2.1	79	1.0
Copper (Cu)	2.86	25	115	1.0	0.82	11	116	1.0
Lead (Pb)	4.36	29	121	1.0	0.32	10	116	1.0
Mercury (Hg)	<5.0	ND	79	5.0	<5	ND	79	5.0
Nickel (Ni)	0.95	11	79	1.0	0.57	8	79	1.0
Selenium (Se)	0.12	0.25	79	0.5	0.10	0.25	79	1.0
Silver (Ag)	0.03	0.61	121	1.0	0.02	0.13	116	1.0
Zinc (Zn)	25.80	810	121	1.0	15.50	730	116	1.0

TABLE G
SUMMARY OF USGS and CITY OF PORTLAND GROUNDWATER MONITORING DATA (1997-2003)

(Data Sources: USGS NWIS Database; City of Portland, 2004)

Pollutant (Average Concentration)	Well Location								MCL (Metals = totals)
	Farragut Park	Fernhill Park	Kenton Park	Ladd Cr.	Northgate Park	Trenton Park	Vernon Park	Woodstock Park	
BTEX (ug/l)	1	1	1	1	1	1	1	1	5 to 10,00
TPH (mg/l)	0.5	0.5 (1.0)	0.5 (1.0)	0.5 (1.0)	0.5 (0.9)	0.5 (1.0)	0.5	0.5	
Benzo(a)pyrene (ug/l)	0.1	0.1	0.1 (0.2)	0.2	0.1 (0.2)	0.1 (0.2)	0.1	0.2	0.2
As-d (ug/l)	2.24 (2.29)	1.37 (1.6)	1.95 (2.22)	0.88 (1.09)	1.54 (1.74)	1.81 (1.98)	1.36 (1.85)	1.41 (1.62)	10
Cd-d (ug/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	5
Cr-d (ug/l)	0.63 (0.78)	2.07 (4.71)	0.42 (0.65)	0.4 (0.71)	0.98 (1.98)	0.84 (0.77)	1.42 (2.05)	0.82 (1.57)	100
Cu-d (ug/l)	0.25 (0.3)	0.41 (6.34)	0.37 (1.47)	0.2	0.39 (2.85)	0.33 (0.46)	0.33 (0.39)	0.46 (0.81)	1300
Pb-d (ug/l)	<0.1	<0.1 (0.21)	<0.1 (1.86)	<0.1	<0.1	<0.1	<0.1	<0.1	15
Zn-d (ug/l)	1.1 (1.12)	1.17 (7.19)	0.68 (36.2)	0.5 (2.18)	3.29 (197)	0.6 (1.31)	0.79 (1.18)	0.56 (1.67)	500
E. Coli (CFU/100 ml)	2	2	2	2	2	2	2	2	1
NO3-NO2-N (mg/l)	4.9 (5.5)	5.4 (5.5)	5.7 (5.9)	3.8	9.5 (11.2)	5.6 (6.2)	5.2 (5.4)	5.6 (6.3)	10
TKN (mg/l)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
TN (mg/l)	5.1	5.6	5.9	4	9.7	5.8	5.4	5.8	

() = Represents highest detected concentration.

TABLE H
Multnomah County Groundwater Data
Selected Metal Analytes (mg/L)

(Source: DEQ LASAR Database)

Station	Lat	Long	Pb(T)	Pb(D)	Cd(T)	Cd(D)	Cr(T)	Cr(D)	Ni(T)	Ni(D)
Deq-3s	45.5475	-122.4606	<0.005	<0.005	<0.01	<0.01	<0.03	<0.03	<0.04	<0.04
19833 NE Sandy	45.5456	-122.4579	<0.005	-	<0.01	-	<0.03	-	<0.04	-
Deq-1Dg(02)	45.5383	-122.4525	<0.005	<0.005	<0.01	<0.01	<0.03	<0.03	<0.04	<0.04
2550 NW Burnside	45.5158	-122.4583	-	-	-	<0.01	-	<0.03	-	<0.04
2698 NE 201st	45.5444	-122.4558	<0.005	-	<0.01	<0.01	<0.03	<0.03	<0.04	<0.04
Mw-4D(01)	45.5464	-122.4519	<0.005	<0.005	<0.01	<0.01	<0.03	<0.03	<0.04	<0.04
6835 NE Columbia	45.5618	-122.5889	-	-	-	<0.01	-	<0.03	-	<0.04
Mw-7 (Nash Pit Landfill)	45.5668	-122.5873	<0.005/<0.1	<0.005/<0.1	<0.01	<0.01	<0.03	<0.03	<0.04	<0.04
Mw-8 (Nash Pit Landfill)	45.5666	-122.5858	<0.005/<0.1	<0.005/<0.1	<0.01	<0.01	<0.03	<0.03	<0.04	<0.04 (max 0.199)
11031 NE Beech	45.5508	-122.5472	-	-	-	<0.01	-	<0.03	-	<0.04
Mw-13Caac1 112th and Holman	45.5683	-122.5506	<0.005	<0.005	<0.01	<0.01	<0.03	<0.03	<0.04	<0.04
13915 SE Romona	45.4811	-122.5181	-	-	-	<0.01	-	<0.03	-	<0.04

(T) = Total Recoverable Metals
(D) = Dissolved Metals

dissolved and total metals in groundwater. The Department's data indicates the dissolved and total metals concentrations are nearly the same (Table H). Most of the groundwater data is from areas that receive UIC discharge of stormwater.

By comparison of metals in stormwater and groundwater (Tables F through H), it becomes apparent that total recoverable metals are not observed in groundwater. In most cases, even dissolved metals are below the method detection limit (Tables G and H). The inference from comparing Table F with Tables G and H is that total metals are likely being attenuated in the unsaturated zone of the unconsolidated sedimentary aquifer. The natural ability of the sediments to filter or attenuate Pb can be discerned from developing an understanding of how Pb is attenuated in soil. Published literature discussing attenuation of lead in soil is abundant.

The absence of Pb in groundwater, introduced either through cesspools or dry wells, indicates effective natural attenuation within the unsaturated zone.

Heavy metal attenuation in biosolids applied to land have been extensively studied. The principles of adsorption and absorption of heavy metals in land application of biosolids apply to natural attenuation of metals in stormwater as it infiltrates through the unsaturated zone. The process of Pb attenuation observed in land application of biosolids and remediation of Pb contaminated soils helps explain the natural attenuation

that occurs in the unsaturated zone underlying the Permittee's UICs. The presence of fine-grained soils (silt and clays), iron, manganese and carbon in the natural soils are key factors to attenuate Pb. Channey, et. al (1999) indicate most elements in natural soils are relatively insoluble or would have already leached from the system.

According to Chaney, contaminants added to the system are "...precipitated, co-precipitated, specifically absorbed on hydrous iron and manganese oxides, chelated by organic matter, or otherwise strongly bonded by soil." The coarse sand and gravel deposits underlying the Portland Basin commonly have clayey silt coatings (Trimble, 1963). The clayey silt coatings likely functions as a bonding source for Pb attenuation. The presence of phosphorous in soil in combination with organic matter will absorb Pb and form relatively insoluble pyromorphite (Shevade, et. al, 2001). This reaction requires available free phosphate ions. The level of total phosphorous in groundwater indicates phosphorous occurs naturally in the sediments. Lagerwerff (1972) discusses soluble (dissolved) Pb affinity to absorb in less soluble organic carbon matrix in association with sulfate, carbonate and phosphate anions. Pb also strongly adsorbs to fine-grained soils and to carbon (organic matter) due to its divalent nature (Lagerwerff, 1972; Brown, et. al., 2003). SWANA, 2004, discusses Pb attenuation mechanism with soil in solid waste landfills. The Pb attenuation processes within a landfill are applicable to the natural environment.

It is reasonable to expect natural attenuation of stormwater pollutants based on published literature and the data summarized in tables D, and F through H. Uncertainty to the extent of attenuation exists. However, the data does not indicate the total recoverable metals commonly observed in stormwater to be in groundwater underlying the areas where UICs are used to manage stormwater disposal. Given the highly permeable nature of the sand and gravel deposits underlying much of the Portland Basin, and available groundwater data indicates minimal, if any, adverse impacts from stormwater discharge, it is reasonable to assume natural attenuation actively occurs within the unsaturated zone. The U.S. Geological Survey is currently studying the shallow lithology within the Portland Basin in order to further understand the composition of the shallow unsaturated zone in areas where natural attenuation are most likely to occur.

4.3.5.3 Dilution Effects in Groundwater.

Dilution effects of the aquifer may also contribute to the observed lack of Pb in groundwater as indicated in Table D. To demonstrate dilution effects, a simple dilution effect analysis was performed to estimate the potential dilution impact on Pb concentration to the aquifer from underground injection of stormwater. This is a conservative analysis as it assumes zero natural attenuation and a constant Pb loading of 0.05 mg/l through

the drywells. The hydraulic conductivity for the unconfined recent alluvial aquifer is 200 feet per day (McFarland and Morgan, 1996). Hydraulic gradient was estimated between 0.0002 and 0.00002 foot/foot (from McFarland and Morgan, 1996). Aquifer thickness was assumed to equal a typical domestic or monitoring well screen interval of 10 feet with mixing across the entire screen interval. A unit aquifer width of 4 feet was assumed to equal the typical diameter of a drywell in Portland. In reality, Pb loading occurs during storm events of sufficient intensity to generate runoff. Such storm events are of limited frequency and duration. The total days of storm events of sufficient intensity (greater than 0.08 inches of rainfall) to generate runoff to a drywell occur, on average, between 60 and 80 days during the wet season (October through May). Ninety percent of precipitation in the Portland Basin occurs during the wet season.

Example for simple dilution effect scenario.

Assumptions:

1. Discharge occurs at water table, i.e. no unsaturated zone attenuation.
2. $K = 200$ ft/day (McFarland and Morgan, 1996).
3. Aquifer thickness = 10 ft, equivalent to monitoring well screen interval.
4. Unit aquifer = width of drywell x aquifer thickness = 4 feet x 10 feet = 40 ft²
5. i = hydraulic gradient, estimated about 0.0002 foot per foot.
6. $Pb = 0.05$ mg/L; Federal MCL = 0.15 mg/L, in groundwater.

Darcy's Law: $Q = KiA$, $Q =$ Rate of Flow, $K = 200$ feet/day, $A =$ aquifer unit area,
 $i =$ unit hydraulic gradient (dimensionless)

$Q = (200 \text{ ft/day})(0.00002)(40 \text{ ft}^2) = 0.16 \text{ ft}^3/\text{day}$
 Liter conversion: $(0.16 \text{ ft}^3/\text{day})(28.32 \text{ L/ft}^3) = 4.53 \text{ L/day}$

Dilution effect per day = (Pb concentration drywell discharge)/(unit aquifer volume)
 $= (0.050 \text{ mg}) / (4.53 \text{ L}) = 0.011 \text{ mg/l}$

Observed Pb concentrations in stormwater:

National median Pb concentration in stormwater (industrial and transportation land uses) = 0.25 mg/L

ACWA maximum Pb in stormwater (commercial land use) = 0.048 mg/L

City of Portland maximum Pb concentration in stormwater (industrial) = 0.053 mg/l

Dilution effects (no natural attenuation):

- National (median) = $0.025 \text{ mg/L} / 4.53 \text{ L} = 0.0055 \text{ mg/L} = 5.5 \text{ } \mu\text{g/L}$
- ACWA (median) = $0.048 \text{ mg/L} / 4.53 \text{ L} = 0.0106 \text{ mg/L} = 10.6 \text{ } \mu\text{g/L}$
- Portland (median) = $0.016 \text{ mg/L} / 4.53 \text{ L} = 0.0035 \text{ mg/L} = 3.5 \text{ } \mu\text{g/L}$
- Portland (mean) = $0.017 \text{ mg/L} / 4.53 \text{ L} = 0.0038 \text{ mg/L} = 3.8 \text{ } \mu\text{g/L}$
- Portland (Industrial maximum) = $0.053 \text{ mg/L} / 4.53 \text{ L} = 0.0117 \text{ mg/L} = 11.7 \text{ } \mu\text{g/L}$

For the simple analysis presented above, a reduction up to 78 percent in Pb concentration would be expected as a result of dilution only. All estimated dilution concentrations in groundwater are below the federal MCL of 0.015 mg/L for Pb. Observed Pb average concentrations in groundwater (Table D) are below detection limits. When considering that loading occurs at a reduced rate for significantly smaller period of time, the effects of aquifer dilution on Pb concentration are much greater than the estimated in this example. When natural attenuation and filtration are considered in conjunction with aquifer dilution, it becomes apparent why Pb concentration in groundwater, for all practical purposes, is not detected as exhibited in Table D.

Based on USGS, Department and Permittee groundwater monitoring data, there is no indication that elevated levels of Pb in stormwater discharged to UICs has adversely impacted groundwater quality. Also, based on the above Pb discussion in conjunction with observed groundwater quality data and the apparent natural attenuation, the Pb concentration in stormwater discharged into a drywell should not adversely impact to groundwater quality. Therefore, a permit-established MADL of 50 µg/L should be protective of groundwater quality within the permit-established concentration limit variance.

4.3.6 Establishing Arsenic (As) MADL.

The State’s arsenic (As) numeric reference level is 50 µg/L (OAR 340-040-0020, Table 1). The EPA recently revised the federal drinking water standard MCL for As from 50 µg/L to 10 µg/L. In general, the background concentration of As in groundwater within the permitted area is variable. The USGS monitoring well data indicates an As range from 0.88 to 2.24 µg/L. Table I summarizes As concentrations detected in stormwater discharge to UICs in the permitted area. The As concentrations in stormwater discharge are well below the federal MCL and below the general background concentrations of the shallow aquifer. The highest detected total mean As concentration for stormwater in Portland after structural pretreatment is 1.2 µg/L. Table I summarizes the median concentration of As detected in stormwater nationally for a variety of land uses. The national median concentrations are mostly greater than the general groundwater background concentrations for Portland. Based on these comparisons, the Department used the more conservative current federal arsenic MCL for as the MADL in Table I of the permit.

TABLE I SUMMARY OF MEDIAN CONCENTRATION OF TOTAL RECOVERABLE ARSENIC IN STORMWATER BY LAND USE (ug/L)			
Data Source: National Stormwater Quality Database (Pitt, et.al., 2004)			
Land Use	Traffic Volume (TPD)	Median (ug/L)	# Samples
Residential	<1,000	3.0	1507
Mixed Residential	>1,000	3.0	179
Commercial		2.4	213
Mixed Commercial		2.0	131
Industrial		4.0	267
Mixed Industrial		3.0	101
Freeways		2.4	61
Mixed Freeways		3.0	15
Open Space	<1,000	4.0	19
Mixed Open Space		3.0	88

4.4 Establishing Groundwater Compliance Limits.

Groundwater compliance is based on the requirements of OAR 340-040-0030(3)(b), which establishes background water quality as the groundwater concentration limits for a new facility. The Permittee’s UICs qualify as a new facility because the UICs were not under a Department issued permit at the time the groundwater rules were promulgated. OAR 340-040-0030(4) allows the Department to increase a

groundwater compliance concentration above background by establishing a concentration limit variance (CLV). OAR 340-040-0030(4) also provides the criteria for establishing CLVs. Table 1 of the permit of the permit establishes groundwater compliance limits based on background concentration levels and Department initiated CLVs. In Table 1 of the permit, no specific number is provided for the background concentration. It is the Department's intent, under OAR 340-040-0020 and OAR 340-040-0030, that the Permittee determines the site or drywell specific background from the upgradient well when groundwater monitoring is undertaken. The reason for this approach to determine background concentrations is that the concentrations are likely to vary over the large geographic area covered by this permit.

As part of permit development, the Department analyzed groundwater data obtained from the US Geological Survey (USGS), the Permittee and from past Department groundwater investigations within the permitted area and the Portland Basin. These data, for the most part, represent the equivalent of nine quarterly sampling events and provide insight to the general background quality of the shallow aquifer. These data were utilized in determining the Department-initiated CLVs for selected Common Pollutants listed in Table 1 of the permit. In addition, these data provide an indicator of the general background quality of the shallow aquifer. For compliance purposes, the Department will rely upon site-specific background groundwater data over the more general regional conditions.

The numeric groundwater compliance limits listed in Table 1 of the permit are the Department-initiated CLVs. Only selected Common Pollutants in the table have been assigned CLVs. The numeric values are the enforceable groundwater compliance limits applied at the downgradient monitoring well. For those pollutants that have CLVs, a CLV that exceeds the background groundwater quality determined at the upgradient monitoring well is not a permit violation. Any exceedance of a permit-established CLV at the downgradient well is a permit violation, unless the background concentration is greater than the CLV.

The Permittee may request CLVs for other pollutants listed in Table 1 of the permit. The procedures for determining a CLV are provided in OAR 340-040-0030(4). Any request for a CLV for any pollutant listed in Table 1 of the permit must undergo review and comment by the public in accordance with OAR 340-045-0055. The Department can not issue a CLV, if the CLV application occurs after an existing permit-specific concentration limit has already been exceeded at the downgradient compliance point in groundwater (OAR 340-040-0030(4)(a)).

In the event the Permittee undertakes groundwater monitoring as part of a corrective action for an underground injection well where a MADL has been exceeded, the Permittee must install upgradient and downgradient monitoring wells in accordance with OAR 340-040-0030(2). The purpose of the upgradient well is to determine the site-specific groundwater background concentrations. The Permittee must use the up- and downgradient monitoring wells to determine whether impacted groundwater quality has been adversely impacted by underground injection activities.

If, during a groundwater monitoring activity, the target pollutant concentration in the upgradient is equal to or greater than the concentration in the downgradient well, the Permittee has demonstrated the injection activity has not adversely impacted groundwater quality in accordance with OAR 340-040-0030(2). With respect to Permittee's UICs covered under this permit, the Department does not intend that the Permittee should be responsible for groundwater contamination not caused by its UICs. However, if groundwater contamination is caused by the Permittee's UICs, then the Permittee is responsible for any necessary corrective action.

When the concentration of a pollutant in the downgradient exceeds the groundwater compliance limit set in Table 1 of the permit and is greater the concentration for that pollutant in the upgradient well, then the injection activity may have adversely impacted groundwater quality above background. The Department recognizes that the pollutant may be from a source other than the Permittee's UIC(s). However, the most likely source for the pollutants listed in Table 1 of the permit is from stormwater discharge. When it is demonstrated that groundwater has been adversely affected, it is the Permittee's responsibility to demonstrate that the cause of the pollutant in groundwater is not from the Permittee's UIC(s). If it is determined that the pollutant is caused by UIC discharges to the subsurface, the Permittee must enter into an agreement with the Department for under

the Department's Voluntary Cleanup Program (VCP) or Independent Cleanup Program (ICP) before implement remedial actions in accordance with OAR 340-040-0040 to develop remedial action measures for Department approval. The VCP and ICP are cost recovery programs.

In Table 1 of the permit, most listed pollutants have "background" as the groundwater compliance limit. When the term "background" is listed as the compliance limit, the Permittee must determine the background concentration as described above. When a numeric value is listed as the groundwater compliance limit, the numeric value represents the Department-accepted the CLV for that pollutant. The CLVs listed in Table 1 of the permit are the federal MCLs for drinking water.

5.0 SCHEDULE A – DISCHARGE LIMITATIONS AND STORMWATER MANAGEMENT

In Schedule A, the permit establishes permitted and prohibited conditions, water quality limits for stormwater discharge to the subsurface, and groundwater quality compliance limits should groundwater monitoring be under taken. Schedule A specifies fluids which are allowed to discharge into the Permittee's UICs. It establishes the limits under which the Permittee is permitted to operate its UICs.

5.1 Purpose and Intent.

The purpose of the permit is to protect groundwater quality. This is accomplished by establishing limits and conditions on the quality of stormwater and incidental non-stormwater fluids discharged into UICs. Schedule A also sets water quality limits for fluids discharged into the subsurface and groundwater quality compliance limits. The schedule specifically identifies allowable fluids to be discharged into a public UIC. Fluids not identified in the permit are not authorized for discharge into a public UIC.

The Permittee must meet specific water quality limits for fluids discharged into a UIC. These water quality limits are established common urban pollutants and priority pollutants for less frequent screening. The concentration limits are established as Maximum Allowable Discharge Limits (MADLs). In addition to the MADLs, the permit sets detection conditions and actions for priority pollutant screen (PPS) pollutants. The detection of a PPS pollutant or exceeding a MADL concentration, including the annual mean MADL concentration, is not permit violations. However, a failure to take an appropriate action when a PPS pollutant detection or MADL exceedance occurs is a permit violation.

The list of common and PPS pollutants are provided in Table 1 of the permit. The Department may expand the list, if necessary to protect groundwater quality.

Schedule A requires a screening for the PPS pollutants listed in Table 1 of the permit. The screening events must be performed in the 1st, 4th and 9th years of the permit duration. If a PPS pollutant is detected, then increased monitoring for the detected pollutant at the UIC where the detection occurred is required.

Schedule A establishes compliance concentration limits for groundwater in Table 1. Groundwater compliance concentration limits take effect whenever the Permittee undertakes a groundwater investigation under the conditions of this permit. Groundwater investigations not related to the permit, such as leaky underground storage tanks, brownfield property or other investigation purposes are not subject to the conditions of this permit.

Exceeding a groundwater compliance limit, if the exceedance has been demonstrated to be a result of injection activities occurring through UICs owned or operated by the City of Portland, is a permit violation.

Permit conditions under Schedule A include:

- Limitations.
 - Permitted Activities
 - Prohibited Activities
 - Permit Excluded UICs
- Stormwater Quality Discharge Limits.
 - Common Pollutants
 - Priority Pollutant Screen (PPS).
 - Groundwater Quality Concentration Limits.

5.2 Limitations

The limitations section of the permit establishes permitted and prohibited activities with respect to underground injection of stormwater and other fluids that meet permit conditions. The limitation conditions are intended to protect groundwater quality through controlling and limiting discharge to UICs. The Department's intent of permitted and prohibited activities under the permit is discussed below. In all cases, groundwater quality must be protected.

5.2.1 Permitted Activities

By issuing the UIC WPCF permit, the Department recognizes there is a potential risk of groundwater degradation. This risk is present because, by their very nature, UICs provide a pathway for fluids to reach groundwater. Under the permit, the Permittee is required to minimize the potential for groundwater degradation by implementing effective BMPs and meeting conditions established in this permit for stormwater and other incidental non-stormwater fluids discharged to a public UIC.

Specifically, the permit allows the following UIC activities:

- Injection of stormwater runoff into the subsurface under permit specified conditions;
- Continued use of existing public UICs that do not meet the criteria for rule authorization under OAR 340-044-0018(3)(a), provided permit specified conditions are met;
- Incorporates existing public UICs into the permit, provided the UICs meet permit conditions;
- Implementation of BMPs to meet the water quality provisions of the federal SDWA and state groundwater quality protection provisions set forth in 40 CFR Part 144, OAR 340-040, and OAR 340-044; and
- Injection of non-stormwater fluids limited to the following, as long as they meet the conditions of the permit:
 - Landscape and lawn irrigation runoff;
 - Individual residential car washing, which includes community group car washing activities;
 - Water line, fire main and fire hydrant flushing;
 - Discharges from potable water sources, potable groundwater monitoring wells, draining and flushing municipal potable water storage reservoirs provided all waters are potable;
 - Dechlorinated swimming pool or spa water;
 - Discharges from foundation and footing drains, provided the discharges meet the water quality requirements of this permit;
 - Emergency firefighting activities. The Permittee shall take necessary precautions to the extent practicable to protect public UICs during emergency firefighting activities. Wash down of

spills into any UIC is expressly prohibited. In the event of an inadvertent discharge to a UIC of pollutants that may endanger groundwater quality during firefighting activities, the Permittee will undertake appropriate response and corrective actions to assure groundwater is protected; and

- The discharge of any other fluid not specifically identified in Schedule A.3.h, above, or specifically prohibited, may be discharged to a public UIC if the following conditions are met:
 - The discharge fluid water quality complies with the conditions of this permit; and
 - The Permittee has the expressed written permission by the Department for the discharge prior to the discharge of the fluid.

5.2.2 Prohibited Activities

The permit identifies UIC activities that are prohibited. Except as provided in the permit, the Permittee is prohibited from constructing, operating, or maintaining public UICs that inject:

- Stormwater directly into groundwater, including the seasonally high water table.
- Non-incident fluids or stormwater mixed with fluids not covered under this permit, including but not limited to:
 - Runoff from uncovered trash compactor, trash dumpsters and associated storage areas owned by the Permittee; and
 - Loading docks serving facilities owned by the Permittee.
- Any fluids from motor vehicle drains. Motor vehicle drains that discharge to a UIC or directly to the subsurface are prohibited in Oregon;
- Stormwater or other fluids that may cause the movement of a pollutant to groundwater, if the presence of the pollutants will not comply with the groundwater protection requirements of this permit;
- Stormwater or other fluids that may cause the adverse movement of an existing groundwater contamination plume; and
- Stormwater or other fluids that may mobilize pollutants in known or suspected contaminated soils, including contaminated soils left in place under a remedial action which the Department has issued a letter of no further action (NFA), unless such injection is accepted in writing by the Department. Such injection activities without Department acceptance may nullify the Department-issued NFA and reopen the site to further remedial actions.

5.2.3 Discussion of Limitations

The permit requires the Permittee to protect groundwater quality to its highest and best beneficial use while injecting stormwater into the subsurface. This means protecting the groundwater resource at background concentrations, or, at a minimum, to drinking water quality and other human-health based standards. The permit allows the Permittee to exceed background concentrations in groundwater up to the federal MCLs. Exceeding the groundwater quality concentration limits established in the permit is a permit violation, if the exceedance can be reasonably attributed to discharge from a UIC owned by the Permittee. If an MCL is exceeded in groundwater as a result of discharge from the Permittee's UIC, the Permittee is subject to enforcement action from the Department and must undertake specific corrective actions as defined in OAR 340-040-0040 and OAR 340-040-0050. It is the Permittee's responsibility to demonstrate any groundwater exceedance of a groundwater quality limit established is not the result of Permittee's injection activities.

The Department also recognizes that many actions caused by citizens of the Permittee are beyond the Permittee's control. Also, the Department recognizes that the Permittee can not adversely affect emergency action for safety purposes in response to fires. The nature and volume of these permit-specific non-stormwater

fluids, for the purpose of the Class V UIC WPCF permit, are not anticipated to pose a likely adverse impact to the groundwater quality. However, through employee training and public education requirements of the permit, the Permittee is expected and required to take reasonable steps to educate citizens and employees of the City of Portland regarding the potential impact of their actions on the quality of groundwater used by the community.

It is not always possible to prevent fluids from entering UICs during a firefighting emergency. Firefighter and public safety are paramount. The Department expects the Permittee to take all reasonable precautions, to the extent practicable and which do not endanger firefighting personnel or inhibit firefighting activity, to protect UICs from firefighting runoff during commercial or industrial fires. When circumstances require discharge to a UIC during firefighting activity, the Department may require the Permittee to undertake remedial action, as needed and under the oversight of the Department, for any UIC that receives firefighting runoff which may contain pollutants that may cause a violation of permit conditions. In the event there is an inadvertent discharge of pollutants during firefighting activities that may endanger groundwater, the Permittee will undertake appropriate response and corrective actions to assure groundwater is protected. Firefighting activities that include wash down of spills into any UIC is expressly prohibited.

Because the goal of the permit is to protect groundwater quality during underground injection activities, it is important to list, in some cases reiterate, those activities which may pose the greatest risk to groundwater quality during injection. These activities include constructing or operating a UIC:

- If the activity may cause:
 - A violation of the conditions established in this permit.
 - A violation of the state's groundwater protection regulations (OAR 340-040).
 - A violation of the permit groundwater compliance limit.

The MADLs are set at the MCL, unless scientifically valid data is available to document a higher level is allowable. As an example and discussed later, the lead (Pb) MADL is set above the Pb MCL. Any proposed increase in a MADL set in Table 1 of the permit of the permit requires public review and comment.

- If discharge may cause the movement of contaminant either in soil or groundwater. This activity applies to, but is not limited to, areas of redevelopment where past activities resulted in soil and/or groundwater contamination. If injection occurs in an area where soil contamination was left in place, there exists a strong likelihood the contaminants may be remobilized and enter groundwater. Similarly, injection in areas of known groundwater contamination likely may aggravate containment of the groundwater contamination. In both cases, any Department-issued letter of No Further Action (NFA) may be voided resulting in reopening costly remediation actions. Any injection activity in these areas should be reviewed by the Department before injection occurs.

The Department expects the Permittee may partially or completely be able to meet the groundwater protection requirements through implementing BMPs. The Permittee has already demonstrated that many BMPs it employees are effective. Stormwater data related to BMP effectiveness collected by the Permittee and compared to national and regional stormwater data indicate Permittee BMP-treated stormwater meet most of the permit conditions for water quality prior to discharge.

The Department currently approves decommissioning, abandonment or plugging of Permittee UICs on a case-by-case basis. Schedule D requires the Permittee to develop a Class V stormwater UIC Decommissioning Plan that establishes specific decommissioning criteria to be applied Permittee-wide and to expedite decommissioning, abandonment or plugging UICs. The plan must be protective of groundwater quality. The case-by-case basis for decommission of UICs shall continue until the Decommissioning Plan is accepted by the Department.

The Department requires the Permittee to demonstrate discharges from its Class V UIC stormwater UICs protect groundwater quality by meeting water quality limits for common pollutants in stormwater at least 5 times during the wet season and screen for priority pollutants in the 1st, 4th and 9th years of the permit duration. The Department establishes protocols in Schedule C of the permit when:

- The quality of stormwater discharged into UICs exceeds the permit established limits for the common pollutants listed in Table 1 of the permit or other pollutants as determined by the Department.
- A pollutant on the priority pollutant screen list is detected.

The following sections discuss the Department's intent and expectations of Permittee to comply with the water quality limits and priority pollutant screen.

6.0 SCHEDULE B - MONITORING AND REPORTING REQUIREMENTS

Schedule B establishes the monitoring and monitoring report requirements under the permit. Monitoring is the base upon which the Permittee demonstrate to the Department its stormwater disposal through UICs protect groundwater quality. Schedule B consists of the following sections:

- Stormwater Discharge Monitoring
- Stormwater Sampling Waiver
- Groundwater Monitoring
- Monitoring Plans Modification
- Monitoring Record Keeping and Quality Assurance/Quality Control
- Monitoring Report
- Permittee Monitoring Responsibility

6.1 Stormwater Discharge Monitoring

The Permittee must demonstrate through stormwater discharge monitoring that its underground injection activities protect groundwater quality and comply with permit discharge limits of Schedule A. Before monitoring stormwater discharged into the public UICs, the Permittee must prepare a Stormwater Discharge Monitoring Plan (SDMP) for Department approval. The requirements for a Stormwater Discharge Monitoring Plan (SDMP) are specified in Schedule B.1 of the permit. The Department expects the Permittee to undertake a statistically-based rigorous monitoring program by October 1, 2005. At a minimum, the Permittee must include a Sample Analysis Plan (SAP) and a Quality Assurance Project Plan (QAPP) with the SDMP. The Department's expectations for the SAP and QAPP are discussed in the following subsections.

6.1.1 Sample Analysis Plan (SAP).

The SAP should be based on the number of the Permittee's UICs, traffic volumes and traffic patterns, sample storm event size and intensity, and the analytes specified in Table 1 of the permit. The SAP is required to include the following information:

- A map or maps at a scale sufficient to show the Permittee's entire UIC based on the most current Class V UIC well inventory. The maps should include an overlay of the streets, zoning, public water supply wells, known domestic wells, and wellhead delineation boundaries and geologic or hydrogeologic units for the upper aquifer if they are available.

- A summary of existing published and unpublished (if available) stormwater runoff and groundwater sampling data to demonstrate expected stormwater discharge quality and establish a baseline for groundwater quality, including but not limited to data derived from the Permittee's NPDES MS4 permit, Oregon Association of Clean Water Agencies, the Department, and the U.S. Geological Survey.
- Identify the pollutants to be monitored and the appropriate analytical methods.
- Sampling frequency, storm event size and justification for the frequency and storm event size that generates sufficient runoff to monitor.
- A discussion of the sampling protocols including:
 - Sample site selection procedures and validity of the selection methodology, including any prioritization criteria if applicable.
 - Sample collection point.
 - Analytes and the EPA analytical methods.
 - Sample collection containers, preservatives, sample handling and storage procedures, chain-of-custody, and holding times.
 - Detailed field protocols to be employed during a sampling event, including field preparation, standard field operating procedures, sampling equipment decontamination protocols.
 - Health and Safety plan that include field personnel safety procedures, traffic control, and contingencies.
 - Protocols to assure the sample is representative of storm event, stormwater runoff volume, character, traffic volume and pattern for the sampling point.
- Confirmation sampling protocols, including criteria to initiate confirmation sampling.
- Protocols for data analysis including at a minimum:
 - Protocols to notify the Department when an individual storm event exceedance of a pollutant occurs.
 - Protocols to determine the annual mean.
 - Protocols for statistical evaluation and trend analysis for the system as data accumulates during the permit duration period, including a trend analysis at the 4th and 9th year of the permit.
- Equipment protocols, including equipment maintenance, calibration prior to each sampling event, and contingencies for equipment failure.
- Data analysis and reporting protocols. By July 15 of each year, the monitoring report for the wet season reporting period must be submitted to the Department. The monitoring report must include:
 - A summary of the analytical data, including minimum and maximum detections of all detected pollutants.
 - A map that shows each sample collection location.
 - A description of the each sample location, including, but not limited to:
 - Type and details of UICs sampled;
 - Estimated depth to groundwater and the separation distance between the UIC and the seasonally high groundwater based on the best available data at the time of determination;
 - The geologic or hydrogeologic units that receive the discharge fluids in the unsaturated zone;
 - Type of pretreatment for the UIC system;
 - Date and type of last maintenance and inspection performed on the UIC system prior to the sampling event and a summary of the inspection and maintenance;
 - The traffic volume and nature of traffic for the drywell, i.e. trips per day and relationship to land use category as follows:

a. Residential

- b. Commercial
 - c. Industrial
 - d. Other, includes mixed use (to the extent practicable) and open space; and
- The size and intensity of storm events for sampling, including, but not limited to a discussion of protocols for abnormal weather patterns such as drought or other anomalous weather conditions, the number of storm events sampled, the rainfall for each storm event sampled and the average rainfall for the wet season.

6.1.2 Quality Assurance Project Plan (QAPP).

The QAPP should provide the laboratory and analytical protocols to assure data quality. The QAPP must include, but not necessarily be limited to, the following:

- A description of the project.
- Project organization, roles and responsibilities, including names and contact information for each key individual.
- Quality Assurance (QA) data objectives.
- For any analyte that may be included in the proposed SAP analyte list, quality assurance and quality control information, including US EPA Method for analysis, method detection limit (MDL), reporting limit (RL), and precision and accuracy information (e.g., surrogate and recoveries). All laboratory reporting limits must be less than established federal MCLs or action levels.
- Detailed sampling procedures for all media and methodologies.
- Chain of custody and sample management procedures.
- Instrument calibration procedures and documentation.
- Analytical standard operating procedures.
- Field quality control, including collection of replicates, field blanks, trip blanks, decontamination.
- Laboratory quality control, including matrix spike/matrix spike duplicates, laboratory control samples, surrogates and other relevant laboratory QC. The QAPP must address means of ensuring the sampling point data and procedures will meet appropriate precision, accuracy, sample representativeness, completeness and comparability standards.
- Equipment maintenance as necessary.
- Laboratory and field corrective action.
- Laboratory data package element requirements – not sure what this means.....
- A list of data qualifiers to be employed by the laboratory; data qualified as invalid or rejected by the laboratory shall not be considered representative or accurate for purposes of compliance.
- Identification and contact information regarding laboratory proposed for analytical services. The laboratory must be appropriately certified as required by the State of Oregon for conducting analyses for compliance purposes using methods listed in 40 CFR 136 and/or 40 CFR 141.
- Provisions for responding to analytical or field results in which QC standards established in the QAPP are determined to be inadequate.

6.1.3 Sample Survey Design Plan.

The Permittee must develop a statistically valid sample survey design plan that is representative of the Permittee's entire UIC system. The permit specifies the information required as part of the Sampling Survey Design. The plan should allow the Permittee to demonstrate compliance with MADLS in Table 1 and evaluate long term trends in stormwater quality. Sample survey design must be stratified based on traffic volume in accordance with the permit. Details of the minimum requirements for a sampling survey design plan are provided in the permit. The Sample Survey Design must include a discussion of the statistically-based drywell sampling survey design and how the data will be analyzed.

6.2 Stormwater Sampling Waiver.

When the Permittee is unable to collect or analyze a sample for causes beyond the Permittee's control, the Department provides a waiver process in Schedule B.2. Permittee error or equipment failure due to lack of proper calibration or maintenance are not beyond the Permittee's control and do not qualify for a sampling waiver. The waiver process described in the permit is self-explanatory.

6.3 Groundwater Monitoring Plan.

If the Permittee undertakes groundwater monitoring as a corrective action initiated under the requirements of this permit,; the Permittee must prepare and submit a Groundwater Monitoring Plan (GMP). The GMP must be approved by the Department before any groundwater monitoring is undertaken. It is the Department's intent that the Permittee amend its SWMP to meet GMP requirements. At a minimum:

- The GMP must have a SAP and a QAPP. The GMP SAP and QAPP requirements are much the same as those for the SDMP. Therefore, the SDMP SAP and QAPP may be amended to meet GMP requirements.
- The GMP must comply with the groundwater monitoring requirements of OAR 340-040-0030.
- Monitoring well construction must be in accordance with the Department's groundwater monitoring well construction guidance and comply with Oregon Water Resources Department Monitoring Well Construction regulations (OAR 690-240).
- Groundwater monitoring must comply with the monitoring report requirements of the permit.

6.4 Monitoring Plans Modification.

Permittee must notify the Department and obtain Department acceptance when any monitoring plan under Schedule B is modified. If the modification result in a major deviation from the existing Department accepted plan, the Department may require public notification and comment before accepting the plan modification.

6.5 Record Keeping and Quality Assurance/Quality Control.

The purpose of the record keeping and quality control/quality assurance conditions in Schedule B are to assure data collection, sample analytical methods and record retention requirements are consistent. The record keeping and quality assurance/quality control requirements in the permit are self-explanatory.

6.6 Monitoring Reporting Requirements.

This section of Schedule B establishes the reporting requirements for the monitoring data and analysis. It also establishes the wet season sampling period as October 1 through May 31. The monitoring report is due to the Department by July 15 following the end of the wet season. It also requires the Permittee to report on the priority pollutant screening results in the monitoring report for the 1st, 4th and 9th years of the permit duration.

6.7 Discussion of Schedule B requirements.

Schedule B establishes the monitoring conditions to assure the data is properly obtained and that the integrity of the sample and subsequent laboratory result is maintained.

At a minimum, Schedule B requires a Stormwater Discharge Monitoring Plan (SDMP). The SDMP is the foundation for all monitoring of the UICs. The SDMP includes a Sample Analysis Plan (SAP) and a Quality Assurance Project Plan (QAPP). The purpose of the SDMP is to clearly identify the "when, where, and how" a sample is collected and analyzed to ensure integrity of the sample results.

The Permittee is required to identify the conditions that field sample collection teams will undertake stormwater discharge monitoring. However, the permit requires a minimum of 5 storm events per year, to determine if water quality limits (Table 1 of Schedule A) set in the permit have been exceeded.

With over 8,500 active UICs that discharge stormwater from land uses ranging from open space/residential to heavy industrial, their quality of stormwater can vary as discussed in Section 4.0. The Department determined that land use corresponds with traffic volume and patterns, i.e. Higher traffic volumes and type of traffic results in high pollutants in stormwater runoff. Table A (page 9), which is Table 2 of the permit, relates traffic volume and type with land use.

It is not feasible to sample every active public UIC. The Permittee must still demonstrate that its UIC injection activities protect groundwater quality. Therefore, the Department requires the Permittee to develop and implement a rigorous and statistically valid sampling survey design plan. It is the Department's intent that the sampling survey allow the Permittee to demonstrate compliance with MADLS in Table 1, and evaluate long term trends in stormwater quality. Sample survey design must be stratified based on traffic volume in accordance with the permit. Monitoring locations must be selected in accordance with traffic volumes and land use as identified in Table A.

The permit requires the Permittee to develop, as part of the SDMP, a statistically valid sampling design plan that is representative of its UICs, traffic volumes, traffic patterns and land uses. It is the Department's intent that the Sample Design Plan be weighted by the two traffic volume categories.

Schedule B also establishes a waiver process and conditions under which a waiver may be granted by the Department, if sampling can not be performed. It sets record keeping, quality assurance/quality control and annual reporting requirements for the Permittee's UIC monitoring program.

Under the permit, all monitoring plans must be accepted by the Department before any stormwater or groundwater monitoring initiated under this permit is implemented. Once the Department accepts any plan developed under Schedule B, the plan becomes an enforceable part of the permit. Failure to comply with the SDMP or any of its plans is a permit violation.

The Department recognizes circumstances may occur which are beyond the Permittee's control that interfere with or prevent monitoring during a wet season. The Sample Waiver identifies those conditions acceptable to the Department as reasons a sampling event may be missed. Missing a sampling event for reasons other than those listed in Schedule B.3 of the permit is a permit violation.

7.0 SCHEDULE C - COMPLIANCE AND SCHEDULES

Schedule C establishes the permit compliance requirements including compliance schedules. The Permittee must comply with the conditions of Schedule C which includes compliance dates and schedules for:

- Stormwater Discharge Monitoring Plan.
- UIC Management Plan (UICMP).
- UIC System-wide assessment.
- Priority Pollutant Screen.
- Compliance Response Action.
- Compliance with Groundwater Concentration Limit Variance.
- Corrective Action.
- UIC Registration.
- Monitoring, Records and Annual Reports.

7.1 Stormwater Discharge Monitoring Plan (SDMP)

The Permittee is required to comply with the SDMP requirements of Schedule B and submit to the Department a complete SDMP by July 15, 2005. The Schedule C requirements for the SDMP are self-explanatory.

7.2 UIC Management Plan (UICMP)

The Permittee is required to develop and implement a UICMP. The Permittee may amend its NPDES-MS4 Stormwater Management Plan (SWMP) or develop a separate plan. The Department requires the Permittee to obtain Department acceptance before implementing the UICMP or amended NPDES MS4 SWMP. The UICMP must be submitted to the Department within 18 months after the date of permit issuance. The UICMP Schedule C requirements are self-explanatory.

7.3 UIC System-wide Assessment

OAR 340-044-0018(3)(b) requires municipalities with 50 or more UICs to conduct a system wide assessment. The Permittee is required under this permit to submit the system-wide assessment within 12 months after the issuance date of the permit for Department acceptance. The Schedule C requirements for the UIC System-wide Assessment are self-explanatory. The Permittee must include in the system-wide assessment due within 12 months from the date of permit issuance all public UICs that receive stormwater discharge and all motor vehicle floor drains that discharge to the subsurface. The Permittee must complete its assessment of all other floor drains that discharge to the subsurface within 36 months after the permit issuance date.

The Department expects the Permittee to provide in the annual report at the end of the 3rd year of the permit with its assessment of all non-motor vehicle floor drains that discharge to the subsurface. The Department expects the assessment to include the location of the floor drains, nature of materials stored in the area of the floor drains that may be discharged to the drains, the nature of activities that occur in the area of the drains, and any corrective actions that may be necessary to protect the groundwater resource.

7.4 Priority Pollutant Screen

The Permittee is required to perform the priority pollutant screen of Schedule A of the permit in the 1st, 4th and 9th years of the permit duration. The priority pollutant screen results are to be reported in the monitoring reports of the 1st, 4th and 9th years. The Department expects the Permittee to discuss in the annual report any UIC program changes that may be necessary based on the priority pollutant screen results. The priority pollutant screen requirements in Schedule C are self-explanatory.

For PPS pollutants:

- Detection occurs when that pollutant is present at or above the Department accepted MRL as established in the Stormwater Discharge Monitoring Plan;
- The Permittee must capture “first flush” conditions to the extent possible;
- Detection of a PPS pollutant “triggers” a response action:
 - The Permittee is to comply with the reporting requirements specified in the permit. The Department expects a written notification for the Department’s permit file for tracking purposes within 7 days after the laboratory report of the detection. The Department expects the written notification to be brief. A simple reporting form that includes the reporting information specified Schedule C of the permit is adequate to meet the 7-day reporting requirement;
 - Initiate sampling at the UIC where the detection occurred for the detected pollutant;
 - The permit requires and the Department expects the sampling frequency to be the same as the Common Pollutants; and

- Sampling must continue at the increased frequency until sufficient data is obtained to demonstrate the increased sampling frequency is no longer warranted;
- The Permittee may discontinue the increased sampling frequency without the permit modification process, if the mean concentration of the pollutant determined from 5 or more sampling events within the same wet season is ≤ 50 percent of the MADL established for that pollutant; and
- The Permittee may petition the Department to decrease the sampling frequency, if the mean concentration based on the criteria described above is >50 percent but \leq percent of the pollutant's MADL.

The Department does not consider detection of a PPS pollutant a permit violation. However, failure to monitor for the detected pollutant in accordance with permit requirements at the UIC where the detection occurred is a permit violation.

7.5 Compliance Response Action

When the Permittee exceeds an annual mean concentration for any MADL in Table 1 of Schedule A, the Permittee must take a compliance response action. The Department's expectations of an acceptable compliance response action are presented below. The flow chart of Figure 3 illustrates the Compliance Response action process.

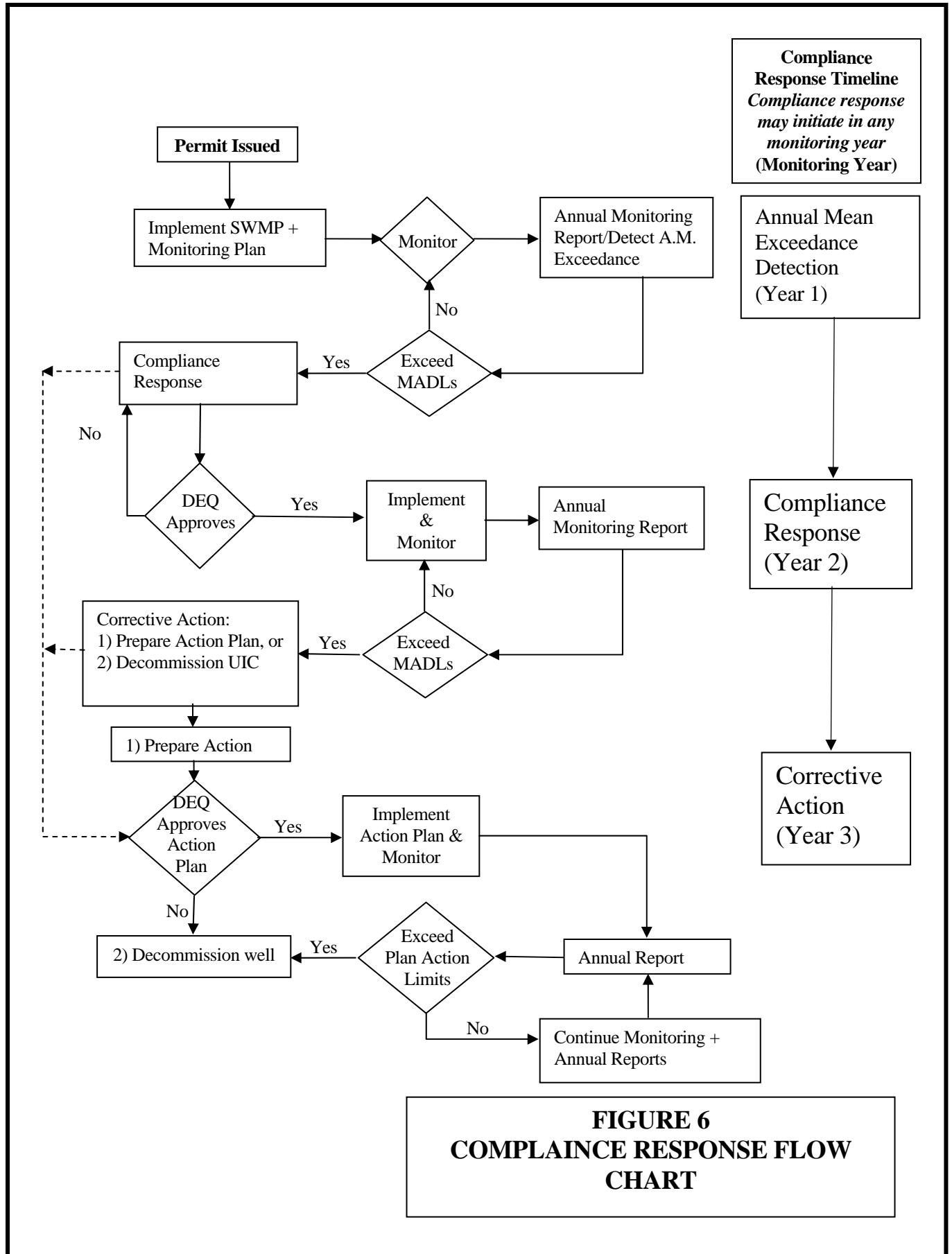
The Safe Drinking Water Act (SDWA) requires meeting federal drinking water quality standards (Maximum Contaminant Levels or MCLs) in groundwater. The State, under its groundwater protection rules, requires a higher resource protection standard, i.e. meet background groundwater quality unless a pollutant at a higher concentration is specifically allowed under a permit (up to, but not exceeding the federal MCL).

MADLs are established in Table 1 of the permit. The Department defines the point of compliance for MADLs as the end-of-pipe discharge point into a UIC after any pretreatment. When the annual mean concentration of any MADL is exceeded, the Permittee must initiate a compliance response action within the next wet season to bring the MADL concentration into compliance with Table 1 of the permit. Figure 6 outlines the Department's expectation for compliance response and corrective action, if needed, when the annual mean MADL concentration is exceeded. If the Permittee can not bring the annual mean concentration into compliance within the full wet season immediately following the discovery of the exceedance, the Permittee must either take a corrective action or close the UIC. Corrective actions may include, but are not limited to:

- Groundwater monitoring to demonstrate groundwater is not adversely impacted;
- Risk assessment using Department-approved risk assessment protocols; or
- Structural retrofitting the UIC with a filtration system design to remove the pollutant.

The Department does not consider a MADL exceedance for an individual storm event or the annual mean concentration exceedance of a MADL as a permit violation. However, a failure to take action when an annual mean concentration exceeds a MADL is a permit violation. The Permittee must report to the Department any MADL exceedance that occurs during an individual storm event. The reporting requirements are specified in Schedule C of the permit.

At a minimum, the Department, expects the Permittee to notify the Department when an individual storm event MADL exceedance occurs. This may be accomplished by a brief letter to the Department or by a notification form in a format agreed upon by the Permittee and the Department that identifies the pollutant, the UIC drywell



where the exceedance occurred, the date of the exceedance, the concentration detected, a brief explanation of potential causes for the exceedance and a brief description of the Permittee's action to address the exceedance.

If the Permittee can not meet the MADL within the full wet season after discovery of the exceedance, the Permittee is required to initiate a corrective action in accordance with the Department accepted Corrective Action Plan. An example of a compliance response action is provided below.

Compliance Response Example. The annual mean concentration for lead (Pb) at a drywell exceeds the MADL concentration established in the permit. The Permittee notifies the Department of the exceedance and the intended compliance response action based on the CRP and BMP appropriateness to mitigate the exceedance. The Department reviews the compliance response action and BMP, then either approves or denies the compliance response. The Department expects, at a minimum, the Permittee to:

1. Evaluate the exceedance with respect to:
 - a. The Pollutant that caused the MADL exceedance.
 - b. BMP practices employed prior to and during the exceedance designed to remove the pollutant to levels that comply with the MADL.
 - c. The level or degree of exceedance with respect to the MADL.
 - d. The location of the UIC, depth to groundwater, area drained, and underlying hydrogeologic units which may affect attenuation of the pollutant.
 - e. The traffic volume within the area of the drywell where the exceedance occurred.
2. The need to look beyond the specific drywell for compliance, i.e. other drywells within the vicinity may have similar levels of pollutant and may require sampling. The potential cause or causes for the pollutant.
3. Determine an appropriate BMP action to bring the exceedance into compliance with the MADL.
4. Obtain Department acceptance of the evaluation and selected compliance response.
5. Implement the selected compliance response and monitor the drywell or drywells if additional drywells in the vicinity need to be monitored, over the next wet season.
6. If the annual mean concentration exceeds the MADL again, the Permittee repeats the above process.
7. If the Permittee fails to achieve compliance with the annual mean MADL concentration within the wet season immediately following exceedance of the annual mean MADL concentration, then the Permittee must initiate a corrective action in accordance with the Department approved Corrective Action Plan. A corrective action may include, but is not limited to:
 - a. Retrofit the drywell or drywells to meet permit conditions, or
 - b. Decommission the drywell or drywells, or
 - c. Perform a risk assessment in accordance with EPA or Department risk assessment protocols, or,

- d. Conduct groundwater monitoring to demonstrate groundwater quality is not adversely impacted by the exceedance.
- e. Implement additional corrective actions as approved by the Department

The Permittee may elect to decommission the UIC(s) or initiate a corrective action at any time during a compliance response action, which may include groundwater monitoring. The Department, at its discretion may require the Permittee to initiate a compliance response or corrective action based on the annual mean concentration of the pollutant of concern which caused the MADL exceedance. These options are indicated by the dashed path lines in Figure 6. At any time in the during a compliance response action, the Permittee may elect to decommission the drywell(s) or initiate a corrective action, which may include groundwater monitoring. Department's decision to require an immediate corrective action at any point during a compliance response action will include, but not limited to, the following conditions:

- In the best professional judgment of its technical staff based on sound scientific data, the Department deems there is a significant threat to groundwater quality or there is an endangerment to human or aquatic health.
- The compliance response actions proposed by the Permittee are inadequate or inappropriate for the condition causing the compliance response action.
- Conditions have changed such that an immediate corrective action is necessary.

7.6 Corrective Action

The Department considers corrective action necessary when the Permittee fails to meet MADLs after implementation of compliance response actions during the next wet season following discovery, or when a UIC is non-compliant with other the permit conditions. A UIC is non-compliant if it meets one or more of the following criteria:

- UIC systems that are in groundwater;
- UIC systems without effective pretreatment to protect groundwater quality that:
 - Discharge within 500 feet radius from a domestic well, discharge within 500 feet radius from an irrigation well, unless the Permittee demonstrates through Permittee code, ordinance, or other enforceable regulation the irrigation well will not be used for drinking water supply. The irrigation well setback is required because the Oregon Water Resources Department (WRD) neither prohibits conversion of an irrigation well to a drinking water supply well nor require notification to WRD that the well use has changed. Therefore, the Department must treat irrigation wells the same as drinking water wells. With an enforceable regulation to prohibit the conversion of an irrigation well to drinking water well, this non-compliant criteria becomes moot.
 - Discharge within any Department of Human Services (DHS) Wellhead Protection Area 2-year time-of-travel (TOT) delineation. The 2-year TOT may be for a public water supply well outside the Permittee's jurisdiction.
 - Discharge with 500 feet of a public water well public water which does not have a 2-year TOT delineation. Discharge within the backup public water supply well field that meets any of the conditions described in b and c, above.
- UICs that have insufficient separation distance between the bottom of the system and the seasonally high groundwater level to provide adequate removal of bacterial contaminants. Unless otherwise accepted by the Department, the minimum separation distances from the seasonally high water table

to remove bacterial contaminants are:

- For UICs with a maximum depth for injection of 5 feet below ground surface, the minimum separation distance is 5 feet.
- For UICs with a maximum depth for injection greater than 5 feet below ground surface, the minimum separation distance is 10 feet.
- UICs that fail to meet the requirements under Schedule A of the permit or do not comply with any other permit provision.
- When a Concentration Limit Variance (CLV) under Schedule A of the permit is exceeded during groundwater monitoring. Exceeding a CLV requires the Permittee to undertake immediate corrective action in accordance with OAR 340-040-0040.

The permit requires the Permittee to develop a Corrective Action Plan (CAP) within 12 months after issuance of the permit. The CAP is the framework under which the Permittee will implement corrective actions. The Department expects, at a minimum, the corrective action plan to address the following:

- Identification of non-compliant UIC systems.
- Method to rank or prioritize these UIC systems for corrective action implementation.
- A description of the corrective actions the Permittee may implement, including but not limited to, decommissioning, groundwater monitoring, risk assessment, structural retrofitting, and creating increased separation distance between the UIC and the seasonally high water table.
- A description of how to select the appropriate corrective action.
- Method to track non-compliant UIC systems that includes:
 - When discovered as non-compliant.
 - When selected as a corrective action subset.
 - When corrected.
 - Date and how corrected.
- Method of adding new non-compliant UIC systems as they are discovered during the permit duration.

Once a UIC is identified as non-compliant, the Permittee must complete a corrective action within three full Permittee Capital Improvement Project (CIP) cycles from the date of discovery. The Department requires the Permittee to prioritize these UIC systems and identify a subset of the prioritized drywells in each annual report that the Permittee will correct during the CIP cycle immediately following the annual report in which the subset is listed. The Department expects the Permittee to complete the prioritized subset of UICs within the CIP cycle the corrective action was initiated. If a corrective action for a prioritized subset requires more than one annual reporting cycle to complete, the Permittee must submit an implementation schedule for Department acceptance. The implementation schedule must be submitted with the annual report. Under no circumstance shall any non-compliant UIC remain non-compliant more than 3 full CIP cycles after the date of discovery, unless otherwise approved by the Department in writing.

The Department recognizes and anticipates there may be situations where problems or issues are experienced throughout a large portion of the Permittee or apply to a large number of facilities in the UIC system. Issues or

problems that are large or complex in scope are considered to be “regional” in scale. Corrective actions implemented to address these regional issues are termed “regional” corrective actions. A regional corrective action is warranted when implementation or completion of the regional corrective action solution can not be accomplished within three full CIP cycles. When the Permittee is faced with a regional corrective action, the Permittee may apply for a permit modification under OAR 340-045-0055 to address the regional corrective action, or the Department may issue an Order for a regional corrective action.

A permit modification request must include the following information:

- A description, including map, of the boundary area for the proposed regional corrective action;
- A discussion of the reason for the regional corrective action;
- Identification of the UICs that require a regional corrective action, including:
 - The number of UIC systems requiring corrective action;
 - The Department’s UIC Identification Number for each UIC system;
- A description and schedule for any further investigation or evaluation, if needed, prior to making a determination on appropriate actions to remedy the issue;
- Demonstrate compliance with OAR 340-040-0020(11) to determine the appropriate corrective action technology, or how compliance will be achieved; and
- An implementation and completion schedule. Any regional corrective action under a permit modification must be completed within the 10-year duration of the permit from the original permit issuance date. If a regional corrective action can not be completed within the original permit duration, the Permittee may apply for a new permit to incorporate the regional corrective action and change the permit expiration date.

The Department or EQC issued order for the regional corrective action would establish a completion date within the order, which may extend beyond the permit expiration date. A Department or EQC issued order would be a separate action from the permit and will require public comment.

The Permittee and the US EPA have identified non-compliant UICs within the Permittee’s UIC system prior to permit issuance. The Department expects other non-compliant UIC systems to be discovered during the system-wide assessment. For the non-compliant UICs known at the time of the permit issuance, the Department expects the Permittee to submit to the Department in accordance with Table 3 of the permit the following for those UICs known as non-compliant at the time of permit issuance: days after permit issuance:

- A list of the non-compliant UICs.
- The nature of the non-compliant condition.
- The preliminary proposed corrective action for each system.
- A prioritized schedule for development and implementation of a solution to address the non-compliant condition. The implementation schedule must show the decision point for final corrective action designs, and implantation of the corrective actions within the first full CIP after the date of permit issuance.

As previously stated in this report, all plans become enforceable documents under this permit upon Department review and acceptance of the plan. The Department considers design and implementation schedules for corrective actions subject to this condition.

Those prioritized known non-compliant systems that pose the greatest risk to the environment or public health, i.e. within 500 feet of a water supply well (public or private) and terminates in groundwater, must be corrected within one year after the permit issuance date. All other known non-compliant Class V UIC systems may be incorporated into the corrective action plan.

8.0 SCHEDULE D – SPECIAL CONDITIONS

Schedule D provides the special conditions of the permit, including detailed requirements the Permittee must comply with to meet permit conditions, including the requirements established in Schedules A, B and C. Schedule D addresses the following:

- Legal Authority.
- Permit Compliance.
- New and Existing UICs.
- Incorporation of Rule Authorized UICs.
- System-wide Assessment.
- UIC Management Plan (UICMP).
- Corrective Action Plan.
- Monitoring, Records, and Annual Reports.
- Permittee Monitoring responsibility.

Most of the requirements under Schedule D are self-explanatory. The following discussions focus on the Department's expectations for the system-wide assessment, UICMP, Corrective Action Plan, and the Monitoring, Records and Annual Reports requirements.

8.1 System-wide Assessment

Under Schedule A, the Permittee is required to conduct a comprehensive system-wide assessment of its public UICs. This assessment includes identification of motor vehicle floor drains and other floor drains that discharge to the subsurface. State regulations (OAR 340-044-0015(2)(e)) require closure of all motor vehicle floor drains.

All other UIC system-wide requirements under Schedule D are self-explanatory.

8.2 UIC Management Plan (UICMP)

The Permittee is required to prepare and submit to the Department within one year after issuance of the permit a UICMP. It is the Department's intent that the UICMP function as the principle guidance document to:

- Manage the Permittee's UICs.
- Assure the highest and best practicable technologies are being applied to manage stormwater in a watershed context
- Protect the environment and public health while injecting stormwater runoff through implementation of the UICMP and BMPs applicable to the management of the Permittee's stormwater system.

It is the Department's intent for the UICMP work in concert with the Permittee's NPDES MS4 permit Stormwater Management Plan to achieve stormwater management that improves watershed health, which includes groundwater as a drinking water resource, aquifer recharge, and surface water temperature benefits from groundwater base-flow discharge. The Permittee may address in the UICMP how it proposes the UICMP to work in concert with the NPDES MS4 permit and within a watershed health context. The Permittee should include a discussion of the protocols that the Permittee may use to implement the UICMP in a watershed health context.

The Department expects the Permittee to implement the UICMP upon receiving Department acceptance of the plan. The Department expects stormwater quality discharged to a UIC to be improved through vigilant application of the UICMP. The monitoring requirements specified in Schedule B of the permit are intended to provide verification that the Permittee's stormwater injection is performed in a manner that is protective of the groundwater resource.

The Department further expects the Permittee to report annually on the effectiveness of the UICMP and make recommendations for changes to the UICMP through the annual report. If a recommend change results in a major modification of the UICMP, then the UICMP must undergo public comment in accordance with OAR 340-045-0055.

The UICMP has two basic elements, formal plans and formal BMPs. The plans are to function as guidance documents and implementation schedules, completion schedules where appropriate, and detailed protocols to implement the plans. BMPs on the other hand do not have specific plans. These are actions implemented by the Permittee and are subject to change as data becomes available on the effectiveness of each BMP.

8.2.1 Required Plans

The plans required by the permit are:

- Spill Prevention and Pollution Control (SPPC).
- Operations and Maintenance (O&M).
- BMP Testing and Monitoring Plan.
- Abandonment, Decommissioning or Alteration of Public UICs Plan (i.e. Decommissioning Plan).

The Department expects each plan to be stand-alone documents that provide the guidance, protocols and schedules necessary to protect the groundwater resource. The Department expects the Permittee to amend its existing SPPC, O&M and BMP testing plans to include requirements for the Permittee's UICs and non-motor vehicle floor drains that discharge to public UICs. The Department further expects the Decommissioning plan to describe UIC decommissioning protocols including but not limited to, evacuation of fluid and solids from pretreatment systems and the UIC device itself, sample collection and sample testing protocols, solid and liquid waste handling and disposal, sample handling and reporting, and actions when detections exceed Department approved designated risk criteria, and backfilling the UIC cavity in accordance with Department and Oregon Water Resources Department well abandonment requirements. The Department expects the Permittee review the UICMP during year 5 of the permit cycle

8.2.2 BMPs

BMPs are not plans. They are on-going actions continually implemented by the Permittee. BMPs may be directed by the protocols established in UICMP individual plans. UIC BMPs should work in concert with the Permittee's other stormwater management programs such as the Permittee's NPDES MS4 and Watershed Health BMPs. Specific BMPs under this permit include:

- UIC Registration and Database for Public UIC information.

- Employee and Public Education.
- BMP Monitoring.

The Permittee is expected to continue to implement BMPs proven effective to meet the conditions of this permit. The Department further expects the Permittee to continue to explore, test and use new BMPs as they become available provided the new BMPs result in better protection of the groundwater resource.

8.2.2.1 BMP Monitoring.

The Permittee already has a BMP effectiveness testing program required as part of its NPDES MS4 permit. The Department expects the Permittee to expand its existing BMP effectiveness testing program and incorporate BMP monitoring for its UICs in accordance with the BMP testing and monitoring plan protocols. The Department expects the Permittee to utilize this BMP program to evaluate new technologies and develop requirements for Permittee or public implementation of those BMPs proven to be effective to protect the groundwater resource. The Department expects a discussion in each annual report the BMP testing and monitoring program results and a summary of the testing data for BMPs.

8.2.2.2 UIC Registration and Database for Public UIC Information.

The intent of the UIC Registration and database for Public UIC Information is to have the Permittee register its own public UICs, track improvements and decommissioning or abandonment of its UICs, and report to the Department on a quarterly basis any changes to the Permittee's UIC systems that occurred during the previous quarter. The Department also expects the Permittee to make registration information available to the public in accordance with State public records statutes and through the Permittee's existing public records request protocols. The Department further expects the Permittee to honor a public records request for UIC information within a reasonable time frame. In addition, any UIC related information reported to the Department becomes public record.

The Permittee has an existing database for public UICs. This database is an older version of the Department's UIC database. The Department expects the Permittee to upgrade its database with the current Department database. The Department further expects the Permittee to:

- Enter into the database all new public UICs into the database
- Enter into the database all public UICs discovered during the system-wide assessment and public UICs discovered after completion of the system-wide assessment. The Department recognizes that, even with due diligence, some public UIC injection systems may not be identified during the system-wide assessment.
- Report to the Department in electronic format that is compatible with the Department's database all newly registered and decommissioned public UIC systems during the previous quarter by the end of the first week of each quarter.
- Maintain public accessibility to public UICs information through the Permittee's established records request protocols.

8.2.2.3 Employee and Public Education.

This is an on-going BMP as part of the Permittee's NPDES MS4 permit. The Department expects the Permittee to amend this BMP to include education about UICs. The permit covers all public UICs regardless of bureau ownership or management. The permit also identifies BES as the Permittee's agent responsible for implementing the requirements of the permit. Therefore, the Department expects employee education to include all appropriate managers and staff from other Permittee bureaus as well as appropriate BES managers and staff of the requirements of this permit.

Meeting the water quality requirements established in the permit requires public participation. The Department expects the Permittee to include public education for UIC systems with its on-going public education program for its NPDES MS4 permit. It is the Department's intent that the public education includes citizen responsibility to not discharge unauthorized fluids to public UICs. The education should raise public awareness that discharge to a UIC will eventually reach groundwater, which is part of the Permittee's and its citizens' drinking water supply. The education should include information how citizens can better protect their drinking water resource and how their personal actions can either adversely or positively impact groundwater quality. The Department expects a discussion of its education BMP activities in each annual report in the same manner as the Permittee reports on implementing its education BMP under the NDES MS4 permit.

8.3 Corrective Action Plan (CAP)

Schedule D provides the requirements for the CAP. The CAP must be accepted by the Department. The Department's intent for the CAP is that it provides the corrective action options the Permittee may implement as part of its corrective actions. The CAP must:

- Identify each corrective action option.
- Identify when it should be utilized
- Demonstrate it meets the requirements of OAR 340-040-0040 for remedial actions.
- Demonstrate the corrective action option represents the highest and best practicable option in accordance with the requirements of OAR 340-040-0020(11) for the public UIC that requires a corrective action.

The Department expects the Permittee to comply with the CAP requirements of Schedule C and Schedule D and the Department's expectations, as explained in this evaluation report, for the CAP. The Department further expects the Permittee to identify in each annual report the corrective action option selected from the Department accepted CAP that the Permittee will implement for the public UIC identified for corrective action in each annual report.

The specific CAP requirements under Schedule D.7 are self-explanatory.

8.4 Monitoring, Records, Monitoring Report and Annual Report

Schedule D specifies the monitoring, records, monitoring report and annual report requirements. The permit requires monitoring of stormwater quality discharged into the Permittee's UIC. It requires the Permittee to retain its monitoring records. It also requires the Permittee to submit each year a monitoring report that summarizes the monitoring data and an annual report for the public UICs. The Department's expectations for each of these permit requirements are provided below

8.4.1 Monitoring and Records Retention.

The Permittee is required to monitor the quality of stormwater discharged to its UIC. It is the Department's intent to have public UIC monitoring to coincide to the extent practicable with the monitoring for the Permittee's NPDES MS4 permit requirements. The benefit of this coordinated monitoring is to maximize monitoring efficiencies while meeting the monitoring requirements for the UIC WPCF and NPDES MS4 permits.

Although occasional storm events occur during the dry season, the greatest potential impacts to groundwater within the Portland Basin occur during the wet season. The Department defines the wet season under this permit as the period beginning October 1 and ending the following May 31. Correspondingly, the dry season extends from June 1 to September 30. The Department expects the Permittee to monitor its public UICs during the wet season beginning October 1, 2005. This wet season period is generally consistent with NPDES MS4

wet season. The defined period for the wet season is intended to capture first flush events and subsequent storm events of the long wet period.

The Permittee is required to report the monitoring results for the wet season by July 15 immediately following the wet season. The Department expects the monitoring report to include

- A summary of the UICs sampled;
- The storm events sampled;
- The traffic pattern and volumes, in accordance with Table 2 of the permit, associated with each UIC sampled; and
- A summary of the monitoring data.

The Permittee is not required to submit the laboratory reports, but is required to maintain the reports, field notes and any other record for UIC monitoring in accordance with Schedule F.1 requirements and make them available to the Department upon request.

The Permittee is required to maintain its monitoring and other pertinent records for its UICs for a minimum of 10 years. Monitoring records include all pertinent records related to monitoring and maintenance of the Permittee's UIC, including but not limited to, laboratory reports, field sampling records, field equipment calibration and maintenance records, and UIC inspection and maintenance records. Other pertinent records include, but are not limited to, the Permittee's original permit application and all supporting documentations, records of UIC inspection and maintenance, and reports filed with the Department as required under the permit with all supporting documentation.

8.4.2 Monitoring Report and Annual Report.

The permit requires 2 annual reports, a monitoring report and an annual review report of the Permittee's UIC. The monitoring report is due on or before July 15 following each wet season. The annual review report is due on or before November 1 of each year. The Permittee's requirements and the Department's expectations for these reports summarized below.

8.4.2.1 Monitoring Report.

The Permittee is required to submit to the Department an annual monitoring report separate from the Permittee's annual review report. The Department considered including the UIC monitoring in the annual review report. However, submittal of the annual review report occurs after the onset of the following wet season. The Permittee's discussion of MADL exceedance for individual storm events and annual mean concentrations, and actions taken by the Permittee would not occur in a timely manner if included in the annual review report. Therefore, the Department decided an abbreviated monitoring report due by July 15 following each wet season is warranted for timely reporting and Department review and acceptance of Permittee actions pertaining to MADL exceedance during an individual storm event or exceedance of a MADL annual mean concentration. It is the Department's intent that the monitoring report be brief, focused on summarizing the laboratory data, identifying UICs sampled during the set season that do not meet permit conditions, and specifically discuss the following:

- A summary of the monitoring data for each UIC. The Permittee does not need to submit laboratory reports. However, the Permittee must retain the laboratory reports and provide them to the Department upon request;
- A list of the Class V UIC system sampled during the wet season and a list of new UICs for the next wet season monitoring period;
- A summary of the traffic volume and pattern for each UIC sampled;
- A summary of the storm events monitored, including storm event intensity and duration;

- A list of UICs sampled where any MADL annual mean concentration was exceeded either during a single sampling event or as an annual mean concentration, identification of the pollutant(s) of concern, and a location map of the UIC;
- A brief discussion of the cause of the exceedance if known, and actions taken during the wet season to reduce the concentration of the pollutant of concern during the wet season;
- The proposed compliance response action, for Department acceptance, to be implemented prior to the next wet season; and
- A discussion of land use activity changes accepted by the Permittee such as zoning changes that may impact stormwater runoff quality through changing traffic volumes or traffic patterns or new industries that may store, handle or use hazardous or toxic materials as defined under SARA Title III.

The Department expects the detailed discussion of the UIC and BMP testing monitoring data, analysis, observations and recommendations, and new monitoring location for the next monitoring period to be discussed in detail in the annual report.

8.4.2.2 Annual Report.

The Permittee must annually review and report to the Department its UICMP, BMPs and overall UIC program in accordance with the provisions of the permit. The annual report is due no later than November 1 of each year. The Department expects the annual review and report to be similar in content and format as the annual NPDES MS4 report. The annual UIC reporting period should coincide with the NPDES MS4 annual reporting period. If the Permittee can realize efficiencies by combining the UIC annual report with the NPDES MS4 annual report, the Permittee may do so. However, the Permittee needs to clearly identify in a combined annual report those sections that address the conditions of this permit. In addition to the above requirements and expectations, the Department expects the annual report to include the following:

- The number of new public UICs installed during the annual reporting period.
- The number of existing UICs discovered during the reporting period,.
- The number of UICs decommissioned or abandoned during the reporting period.
- A summary of UIC inspections and maintenance activities, including but not necessarily limited to:
 - UIC system identification;
 - Date of inspection and/or maintenance and date of last inspection and/or maintenance;
 - Inspection observations or type of maintenance;
 - Level of sediment in catch basins, sediment manholes and drywell and rate of sediment accumulation for the drywell if available; and
 - Recommended changes to inspection and/or maintenance schedules, as appropriate, based on field inspections and rates of sediment accumulation based traffic volumes, traffic patterns, and maintenance history;
- A discussion of BMPs implemented during the reporting period, including but not limited to:
 - A summary of the BMPs implemented during the annual reporting period;
 - A summary and analysis of BMP monitoring results;
 - Analysis of BMP the effectiveness of the BMP tested; and.
 - Recommended changes to BMP implementation;
- A discussion of any monitoring waivers requested during the reporting period wet season, field equipment failures or missed monitoring events;
- A prioritized list of all non-compliant Class V UIC injections systems, including:
 - The date discovered and the corrective action completion date. The corrective action completion

- date includes 3 full CIP budget cycles;
 - A discussion of corrective actions completed during the annual reporting period;
 - A prioritized subset of the non-compliant UICs to be corrected during the next annual reporting period and the proposed corrective action for each UIC on the subset list if available; and
 - A list of UICs that require more than one annual reporting period to correct the non-compliant condition and the Department accepted completion date and a discussion as to why the corrective actions can not be completed within one annual reporting period;
- A discussion of all corrective actions taken during the reporting period;
 - An analysis of the UIC monitoring data for the reporting period, including a cumulative trend analysis of monitoring data for UICs from previous reporting periods and tabulated results of all pollutants detected at or above the analytical detection limit MRL throughout the reporting period; and
 - A discussion of the review of the UICMP effectiveness and any proposed changes to the UICMP. Any changes to the UICMP must be accepted by the Department before the changes are implemented.

8.5 Permittee Monitoring Responsibility

The Permittee is responsible for the operation and maintenance of its public UICs in a manner that protects the quality of the groundwater resource as defined in this permit. The Permittee is also responsible to adequately characterize the fluids discharged into its public UICs. Further, it is the Permittee's responsibility to demonstrate to the Department through annual reports that the groundwater resource is protected for its intended beneficial use, which is usually drinking water, while operating and maintaining its public UICs, including the addition of new and abandonment of old public UICs.

It is the Department's intent that, by complying with the conditions set forth in this permit and by controlling through implementation of the UICMP and its BMPs, the quality of stormwater or other fluids, as specifically identified, in the permit discharged into a public UIC, the Permittee is protecting groundwater resource without the necessity to monitor groundwater quality. It is also the Department's intent that the Permittee may need to monitor groundwater quality if the Permittee is not able to demonstrate compliance with the conditions of the permit, which are designed to protect groundwater quality. In the event the Permittee fails to meet permit conditions, the Department will initiate enforcement action under OAR 340-012 and may require groundwater monitoring.

9.0 SCHEDULE F – GENERAL CONDITIONS

Schedule F contains the general permit conditions applicable to all UIC WPCF permits and include:

- Standard conditions;
- Operations and maintenance;
- Monitoring and reporting on monitoring results;
- General reporting requirements, and
- Definitions of terms used in the permit.

These general conditions of Schedule F are self-explanatory.

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