FINAL

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

Department of Environmental Quality

2020 SW Fourth Avenue, Suite 400, Portland, OR 97201
(503) 229-5263

Issued pursuant to ORS 468B.195 and 40 CFR Parts 144, 145 and 146, implementing the Federal Safe Drinking Water Act requirements for Underground Injection Control.

ISSUED TO:
City of Keizer
Stormwater Division
P.O. Box 21000
Keizer, OR 97307

SOURCES COVERED BY THIS PERMIT:
Type of Waste: Stormwater & Incidental Fluids
Outfall: Individual Injection Systems
Method of Disposal: Class V Underground Injection

SYSTEM TYPE:
Class V Underground Injection Control Systems

SYSTEM LOCATIONS:
Multiple locations within City of Keizer

Waters of the State: Groundwater

Effective Permit Issuance Date: October 24, 2013
Permit Expiration Date: September 30, 2023
Permit Number: WPCF-DOM-UIC-103068
DEQ File Number: 119546

This permit is issued based on the Land Use Compatibility Statement in the permit record.

Greg Aitken, RG
Senior Hydrogeologist

10/23/2013
Date

Zach Loboy
Manager, Stormwater

Date

DEFINITIONS

1. *We* or *us* means the Oregon Department of Environmental Quality (DEQ).
2. *You* means the permittee, person, legal entity, organization, or municipality that is applying for or has received coverage under this permit.
3. *Groundwater protectiveness demonstration* and *demonstrate that groundwater is protected* mean that you have modeled or otherwise scientifically shown that the discharge will not cause or contribute (a) to an exceedance of an applicable maximum contaminant level under 40 CFR part 141 or of a groundwater quality reference or guideline level under OAR chapter 340, division 040, at a well that is or could be used for drinking water or (b) to any other reduction in the quality of water withdrawn from a well that makes the water no longer suitable for drinking, irrigation, or other beneficial uses that are made of the water.
4. *Endangerment of health or the environment* means that discharge to an underground injection system is reasonably likely to lead to pollutant concentrations at a point of groundwater use that (a) exceed an applicable maximum contaminant level under 40 CFR part 141, or (b) exceed a groundwater quality reference or guideline level under OAR chapter 340, division 040, or (c) otherwise harm the beneficial use of groundwater. An exceedance of a discharge action level does not in itself constitute an endangerment of health or the environment.
5. *Definitions* of 40 Code of Federal Regulations (CFR) part 144.3 and Oregon Administrative Rules (OAR) 340 Divisions 040, 044, and 045 apply to this permit unless the definitions are inconsistent with the provisions of the permit.

PERMITTED ACTIVITIES

The City of Keizer owns or operates Underground Injection Control systems (UICs, or *injection systems*) to manage stormwater. These injection systems are individual point sources that discharge stormwater and other incidental fluids below the ground surface.

As provided under federal law, this is an *area permit*, which means it covers all permittee-owned or permittee-operated injection systems for stormwater and incidental fluids, located at multiple locations in the City of Keizer.

Until we modify or revoke this permit, or until it expires, we authorize you to construct, install, modify, operate, or close (decommission) injection systems in accordance with this permit. We also authorize you to discharge stormwater or other fluids specifically identified in this permit into injection systems that are under your ownership or operation, or that you will construct, or that will be transferred to your ownership or operation while the permit is in effect, provided you conform to the requirements, limitations, and conditions described in the following schedules:

Schedule A. Control and Limitation Conditions 3
Schedule B. Monitoring and Reporting Conditions 5
Schedule C. Safe Drinking Water Act Compliance Schedule 7
Schedule D. Special Conditions 7
Schedule E. Pretreatment Conditions ..... Not Applicable
Schedule F. General Conditions 9

Any other direct or indirect discharge of waste to waters of the state or to an underground injection system is prohibited, unless specifically authorized by this permit; by another DEQ permit, agreement, authorization, or order; or by Oregon state or administrative rule.

SCHEDULE A
CONTROL AND LIMITATION CONDITIONS

1. **Authorized Discharges.** You may discharge stormwater into your injection systems in accordance with the conditions of this permit. You may also discharge the incidental non-stormwater fluids listed below into your injection systems. If any of these non-stormwater discharges cause or contribute to an exceedance of the action levels in Table 1, you must reduce or eliminate the discharge of pollutants associated with the source.

a. Water line flushing;
b. Landscape irrigation;
c. Uncontaminated groundwater infiltration;
d. Uncontaminated pumped groundwater;
e. Discharges from potable water sources;
f. Water from potable groundwater monitoring wells;
g. Draining and flushing of municipal potable water storage reservoirs;
h. Foundation drains;
i. Air conditioning condensate;
j. Springs;
k. Water from crawl space pumps;
l. Footing drains;
m. Lawn watering;
n. Individual residential car washing;
o. Charity car washing;
p. Vehicle washing that does not use detergents or hot water;
q. De-chlorinated swimming pool and fountain discharges;
r. Incidental street wash water;
s. Routine external building wash-down and pavement wash waters that do not use detergents or hot water.
t. Discharges or flows from emergency fire-fighting activities provided you take precautions, to the extent practicable, to protect injection systems during emergency fire-fighting activities. Wash down of spills into any underground injection system is prohibited;
u. Discharges of treated water from investigation, removal, and remedial actions selected or approved by DEQ pursuant to Oregon Revised Statutes (ORS) Chapter 465 (Hazardous Waste and Hazardous Materials);
v. Start-up flushing of groundwater wells; and
w. Other similar temporary discharges of uncontaminated water.

2. **Action Levels.** We have established action levels for pollutants in Table 1. The action levels are guideline concentrations, not limitations; an action level exceedance, therefore, is not a permit violation. The exceedance of an action level, however, may require corrective action in accordance with Schedule A, conditions 4 and 5. The action levels apply at the point of discharge into the underground injection system. You may request changes to these action levels at any time during the permit period, especially if they change based on a groundwater protectiveness demonstration. After two years of monitoring and a minimum of four samples you may request in writing to DEQ that monitoring of specific pollutants be eliminated based on monitoring results. You must incorporate approved changes into your Underground Injection Control System Management Plan or Stormwater Monitoring Plan, as appropriate.

TABLE 1 – Action Levels for Pollutants	
Monitoring Parameter	**Action Level at Injection Point (µg/L)**
Benzo(a)pyrene	2
Pentachlorophenol	10
Di(2-ethylhexyl)phthalate	300
Lead (Total)	500
Zinc (Total)	50,000
Copper (Total)	1,300

3. **Table 1 Action Level Exceedance.** When stormwater concentrations exceed a Table 1 Pollutant action level, you must respond as described below:
   a. **Table 1 Individual Sample Exceedance.** Individual exceedances may only reflect localized conditions and may not necessarily indicate a system-wide concern. You must take corrective action with respect to the UIC that exceeded the action level as described in Schedule A, condition 5.
   b. **Table 1 Annual Geometric Mean Exceedance.** A geometric mean exceedance may indicate a system-wide risk to groundwater. You must take corrective action in accordance with Schedule A, condition 5 to ensure system-wide protection of groundwater. You must address the area drained by the monitored UICs indicating a system-wide risk to groundwater.

4. **If discharges from one or more UICs endanger health or the environment, you must:**
   a. Inform us consistent with Schedule F, condition 4(f), and
   b. Take corrective action to eliminate any endangerment of health or the environment. You must complete all corrective actions as soon as practicable, with DEQ approval of work scope and schedule. You must submit updates regarding progress to us at least annually, and you may include them in annual reports required under Schedule B, condition 4.

5. **Corrective Action.** Corrective action always includes actions 4(a) and 4(b) above. It also includes additional actions 5(a) through 5(g) as required to protect groundwater or to demonstrate that it is already protected:
   a. Attempt to identify the source(s) of an exceedance of Table 1 action levels;
   b. When source identification efforts are complete, determine the set of UICs that require corrective action, based on the identified source(s) or other factors;
   c. Assess whether best management practices need adjustment to eliminate or reduce influent concentrations and make appropriate, practicable changes;
   d. Resample the discharge to UICs that had exceedances of Table 1 action levels to allow for calculation of a geometric mean that verifies or invalidates the original influent concentration;
   e. Demonstrate that groundwater is protected through modeling or other approved approach;
   f. Retrofit the affected UIC(s) so that groundwater is protected;
   g. Decommission the UIC.

6. **Site Control Measures and Best Management Practices.** You must implement and maintain site control measures and best management practices to reduce or eliminate pollutants, in accordance with the DEQ-approved Underground Injection Control System Management Plan described in Schedule D, condition 5.

7. **Underground Injection Systems - Horizontal Setbacks.** All injection systems are subject to the following horizontal setback requirements.
   a. **No Further Action.** You do not need to take further action for injection systems that are:
      i. Outside the two-year Time-of-Travel, if one has been determined by the Oregon Health Authority for public water wells, or
      i. More than 500 feet away from a public or private drinking water or irrigation water supply well, if the Oregon Health Authority has not designated a two-year Time-of-Travel.
   b. **Existing Systems within Horizontal Setbacks**. It is not a permit violation for existing injection systems not to meet the horizontal setbacks described above. However, for each existing injection system that does not have the horizontal setbacks described above, you must provide a protectiveness demonstration within one year of discovery. If protectiveness cannot be demonstrated for a UIC, you must complete the following as soon as practicable during the ten-year term of this permit with DEQ approval of a work plan and schedule:
      i. Retrofit or implement a variety of passive, structural, and/or technological controls to reduce or eliminate pollutants to the underground injection system to provide protection; or
      ii. Close the underground injection system.

      You may consider the proposed work approved if you have not received a response from DEQ within 30 calendar days of submitting your work plan and schedule.
   c. **New Systems within Horizontal Setbacks**. You may construct and operate new injection systems inside a horizontal setback if you are able to provide a groundwater protectiveness demonstration for the new injection system.

SCHEDULE B
MONITORING AND REPORTING CONDITIONS

1. **System-Wide Assessment.** We have approved your August 2013 System-Wide Assessment of injection systems you own or operate, in conjunction with the issuance of this permit. By the end of the fifth year of the permit term, you must update the System-Wide Assessment to reflect any changes that have occurred and submit a revised System-Wide Assessment to us. If no significant changes have occurred over the previous five years, you may include the fifth year System-Wide Assessment in the annual underground Underground Injection Control System Report described in Schedule D, condition 5. The revised System-Wide Assessment must include:
   a. An updated inventory of all injection systems that receive stormwater or other fluids and their locations by latitude and longitude in decimal degrees using the NAD 83 datum. If a different datum becomes the standard during the permit term, update the underground injection system inventory using the new datum at the five year review;
   b. An updated estimate of vehicle trips per day for the area(s) drained by the injection systems;
   c. An updated inventory of all injection systems that discharge directly into groundwater;
   d. An updated inventory of all injection systems that are known by the permittee to not meet the setback distances listed in Schedule A;
   e. An updated inventory of all City-owned or operated injection systems that are prohibited by OAR 340-044-0015(2), which includes injection systems in vehicle maintenance areas, fuel dispensing areas, floor pits, non-vehicle maintenance facilities' floor drains, and fire station bay floor drain. For these prohibited systems, you also must report and take corrective actions as described in Schedule D, conditions 4 and 5;

f. An updated inventory of all industrial facilities and commercial properties that pose a risk of pollutant discharge to injection systems that you own or operate.

2. **Stormwater Monitoring Plan.** You must implement your August 2013 Stormwater Monitoring Plan that we have approved within 180 days of issuance of this permit, and comply with the plan requirements. You must submit any proposed revisions to the plan to us, and we must approve the revisions before you may implement them. You may assume that any revisions on which we do not take action within 30 days of submission are approved. The Stormwater Monitoring Plan must be updated by the end of the fifth year of the permit term for adjustments to monitoring and reporting supported by site-specific information collected during the first five years of the permit, consistent with revisions to the fifth-year update to the System-wide Assessment Report described in Schedule B, condition 1.

3. **Groundwater Monitoring.** If you cannot meet the action levels established in Schedule A, Table 1, or other information indicates that your injection systems may be adversely impacting groundwater quality, we may require you to monitor groundwater or take additional actions in accordance with OAR 340-040-0030. Prior to completing such monitoring, you may apply for a concentration limit variance as provided in OAR 340-040-0030. If we grant a concentration limit variance, the action levels established in Table 1 may be revised, as appropriate.

4. **Annual Reporting.** The annual reporting period shall be the fiscal year July 1 to June 30 of the following year. By December 31 of each year, starting in 2014, you must submit an annual Underground Injection Control System Report. Unless we approve otherwise, the annual Underground Injection Control System Report must:
   a. Include the results of your stormwater monitoring conducted in accordance with your Stormwater Monitoring Plan. This must include a spreadsheet of all data from sampled UICs provided in the analytical laboratory reports;
   b. Discuss any Table 1 action level exceedances and actions taken to address the exceedances;
   c. Describe any actions taken to implement the Underground Injection Control System Management Plan required in Schedule D, condition 5, any proposed modifications to the Underground Injection Control System Management Plan, and any additional actions taken to manage your injection systems to ensure groundwater protection;
   d. Describe any actions described in your Underground Injection Control System Management Plan that you were not able to complete and why;
   e. Identify any injection systems that you closed, retrofitted, or installed during the year;
   f. Describe your future (in the next year) known plans to install, modify, convert, or close any underground injection system;
   g. Identify any changes to the key personnel or areas of responsibility for the permit;
   h. Identify any newly-discovered underground injection control system; and
   i. Provide one hard copy and one electronic copy of the annual Underground Injection Control System Report. Copies of laboratory results do not need to be submitted with the annual Underground Injection Control System Report, however you must retain copies of analytical laboratory reports as described in Schedule F condition 3.

5. **Closing an Underground Injection System.** You must provide prior notice of converting or closing any underground injection system you own or operate. Either you may notify us in advance by listing future decommissioning plans in your annual Underground Injection Control System Report as in Schedule B, condition 4 above, or you may notify us in accordance with OAR 340-044-0040.

6. Summary of Submittals & Notifications.

Submittal/Notification	Permit Reference	Submittal/Notification Requirement	Estimated Date
Progress Report for Corrective Actions	A.4.b	Annually	December 2014, December 2015, December 2016…
Revised System-wide Assessment Report	B.1	End of 5th year of permit term	October 2018
Revised Stormwater Monitoring Plan	B.2	End of 5th year of permit term	October 2018
UIC System Report	B.4	Annually	December 2014, December 2015, December 2016…
Permit noncompliance that endangers human health or the environment	F.4.f	Within 24 hours (verbal) and five days (written)	N/A
Corrective actions for prohibited UICs	D.3	Within 24 hours (verbal) and five days (written)	N/A
Permit Re-application	F.1.d	No later than 60 days before permit expiration	July 31, 2023

SCHEDULE C
SAFE DRINKING WATER ACT COMPLIANCE SCHEDULE

This permit does not require a Safe Drinking Water Act compliance schedule (see 40 CFR 144.53) because you do not own any injection systems known to violate the Safe Drinking Water Act, state or federal underground injection control rules or regulations, or state groundwater quality protection rules.

SCHEDULE D
SPECIAL CONDITIONS

1. **Legal Authority**. Within 18 months of the effective permit issuance date, you must adopt and maintain, through ordinance or other means, adequate legal authority to implement and enforce the provisions of this permit. At a minimum, the legal authority must enable you to:
   a. Implement the DEQ-approved Stormwater Monitoring Plan and Underground Injection Control System Management Plan required in Schedule B, condition 2 and Schedule D, condition 5;
   b. Prohibit discharge to an underground injection system that may cause a violation of the conditions of this permit from publicly or privately owned properties; and
   c. Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with the conditions of this permit.

2. **Permittee Personnel Responsible for Permit.** You must identify the key personnel positions and contact information responsible for establishing and maintaining compliance with all conditions of the permit. Contact information includes the employee's name, phone number, business section where the employee works, and the employee's area of responsibility for the permit. You must notify us in writing of any changes to the key personnel or areas of responsibility for the permit in the annual Underground Injection Control System Report required under Schedule B, condition 4.

3. **Reporting and Corrective Actions for Underground Injection Systems Prohibited by OAR 340-044-0015.** Within 24 hours of discovery you must verbally or in writing provide DEQ with any information you have about prohibited underground injection systems you own or operate. You must submit a written report within five working days of discovery and take the following actions unless otherwise approved by DEQ:
   a. To the extent practicable, you must temporarily divert the discharge away from the UIC within five days of discovering the UIC.
   b. You must permanently close the prohibited injection systems as soon as practicable, with DEQ approval of work scope and schedule.

4. **Underground Injection Systems Discovered After the Permit is Issued.** For any underground injection system you discover or identify after the permit is issued, you must:
   a. Submit the necessary information to us, either with the updated System-Wide Assessment Report or the next annual Underground Injection Control System Report, whichever is submitted first, so that we may add the underground injection system to our underground injection system database;
   b. Include the underground injection system in the first annual Underground Injection Control System Report after you discover or identify it; and
   c. Ensure that the newly identified injection system is represented by either the current DEQ-approved Stormwater Monitoring Plan, or by a revised Stormwater Monitoring Plan that is implemented for the annual monitoring period following discovery of the injection system.

5. **Underground Injection Control System Management Plan.** We approve your August 2013 Underground Injection Control System Management Plan. You must implement the management plan and any update that we approve. You may assume that any proposed revision on which we do not take action within 30 days is approved. Any proposed revision to the management plan must include an updated description, as applicable, of how the elements listed below will be implemented in order to protect groundwater quality:
   a. Stormwater Monitoring Plan, described in Schedule B, condition 2, including how you will use stormwater monitoring results to ensure compliance with the action levels in Schedule A, Table 1;
   b. Injection system decommissioning;
   c. Employee education and public outreach;
   d. Injection system operation and maintenance;
   e. Protecting injection systems from accidental spills or illicit disposal of wastes or contaminants;
   f. Preventing injection of stormwater from City-owned or operated loading docks, refueling areas, areas of hazardous and toxic material storage or handling, materials storage or handling areas, or other discharges that may contain pollutants above levels of concern;
   g. Housekeeping practices to protect groundwater quality;
   h. Facility designs or practices that allow you to block discharge into any underground injection systems in the event of an accident, spill, or emergency fire-fighting activity.

6. **Adaptive Management.** You must follow an adaptive management approach to assess annually, and modify as necessary, any or all existing Underground Injection Control System Management Plan components, and adopt new or revised Underground Injection Control System Management Plan components to ensure the program is efficient and effective. You must at least annually assess the need to further improve groundwater quality and protect groundwater beneficial uses, review of available technologies and practices, review monitoring data and analyses as required in Schedule B, and evaluate resources available to implement the program. You must evaluate trends in emerging pollutant types and concentrations in the fifth year after permit issuance and for the permit renewal application. Your evaluation must address the implications of any significant findings for protection of beneficial uses and for the application of best management practices.

7. **Rule Authorization.** This permit covers all UICs owned or operated by the permittees, including those that have been previously rule authorized.

8. **Permit Shield.** Compliance with this permit constitutes compliance, for purposes of enforcement, with the UIC provisions of the federal Safe Drinking Water Act, implementing federal regulations, and OAR chapter 340, divisions 040 and 044. This provision, however, does not preclude modification, revocation and reissuance, or termination of this permit as authorized by applicable federal and state law.

SCHEDULE E
PRETREATMENT CONDITIONS

Not applicable to this permit

SCHEDULE F
GENERAL CONDITIONS

1. **Standard Conditions.**
   a. **Duty to Comply.** You must comply with all conditions of this permit. Any permit noncompliance is grounds for enforcement action. It is also grounds for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application; except that you need not comply with the provisions of this permit to the extent and for the duration such noncompliance is authorized in an emergency permit under 40 CFR 144.34.
   b. **Penalties for Violations of Permit Conditions.** ORS 468.140 allows us to impose civil penalties up to $25,000 per day for each violation of a term, condition, or requirement of a permit. ORS 468.943 creates the criminal offense of unlawful water pollution in the second degree, for the criminally negligent violation of ORS chapter 468B or any rule, standard, license, permit or order adopted or issued under ORS chapter 468B. In some situations, violations of a term, condition or requirement of the permit may also be a criminal offense, specifically unlawful water pollution in the first degree (a felony) or unlawful water pollution in the second degree (a misdemeanor). [ORS 468.943 and ORS 468.946].
   c. **Duty to Mitigate.** You must take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit. You must take all reasonable steps to minimize or prevent any discharge in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment. In addition, you must correct any adverse impact on the environment or human health or safety resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge.
   d. **Duty to Reapply.** If you wish to continue an activity regulated by this permit after the expiration date of this permit, you must apply for and obtain a new permit. In accordance with OAR 340-045-0040(1), you must submit the application at least 60 days before the expiration date of this permit. We may grant you permission to submit an application less than 60 days in advance of the permit expiration date. We will not grant permission for a renewal application that you submit later than the expiration date of the existing permit.
   e. **Permit Actions.**
      i. We may modify, revoke and reissue, or terminate this permit for cause including, but not limited to, the following:
         (1) Violation. The violation of any term, condition, or requirement of this permit, or a related state rule or statute, or a federal regulation related to underground injection control for injection wells;

(2) Misrepresentation. Obtaining this permit by misrepresentation or failure to disclose fully all material facts; or

(3) Change of condition. A change of any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

ii. You may request a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, but this request does not stay the effectiveness of any permit condition.

f. **Property Rights.** The issuance of this permit does not convey any property rights of any sort or any exclusive privileges.

g. **Permit Reference.** All rules and statutes referred to in this permit are those in effect on the date we issue this permit, or the date we modify the permit to incorporate new provisions as provided in OAR 340-045-0055, whichever occurs later.

h. ***Penalties for False Information.*** Under ORS 486.953, any person who supplies false information to us commits a Class C felony. Under OAR 340-012-0053(1)(b), providing us with false information is a Class 1 civil violation. Providing us with false information includes the following:

i. Falsifying, tampering with, or knowingly rendering inaccurate, any monitoring device or method required to be maintained under this permit;

ii. Making any false material statement, representation or certification knowing it to be false, in any application, notice, plan, record, report or other document required by any provision of ORS chapter 465, 466, 468, 468A or 468B or any rule adopted pursuant to ORS chapter 465, 466, 468, 468A or 468B;

iii. Omitting any material or required information, knowing it to be required, from any document described in paragraph (a) of this subsection; or

iv. Altering, concealing or failing to file or maintain any document described in paragraph (a) of this subsection in knowing violation of any provision of ORS chapter 465, 466, 468, 468A or 468B or any rule adopted pursuant to ORS chapter 465, 466, 468, 468A or 468B.

i. **Duty to Provide Information.** You must furnish to us, within a time specified, any information that we may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. You must also furnish to us upon request, copies of records that this permit requires you to keep.

j. **Need to Halt or Reduce Activity not a Defense.** It is not a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

k. **Permit Modifications.** You may request a permit modification or we can initiate it. Any modification to the permit must be in accordance with the provisions of OAR 340-045-0055 and 40 CFR 144.41, as applicable.

2. **Operation and Maintenance.**

a. **Proper Operation and Maintenance.** You must at all times properly operate and maintain all facilities and systems of treatment and control (and related equipment) that you install or use to comply with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of a back-up or auxiliary facilities or similar systems only when necessary to comply with the conditions of the permit.

b. **Removed Substances.** You must dispose of or otherwise manage any soil, gravel, sludge, liquids, or other materials removed from or adjacent to a UIC in accordance with 40 CFR 144.82(b).

3. **Monitoring and Records.** You must comply with monitoring requirements of 40 CFR 144.51(j) and this condition:
   a. Samples and measurements taken for monitoring must be representative of the monitored activity.
   b. **Records Contents.** Records of monitoring information you must retain include:
      i. The date, exact place, time and methods of sampling or measurements;
      ii. The name(s) of the individual(s) who performed the sampling or measurements;
      iii. The date(s) analyses were performed;
      iv. The name(s) of the individual(s) who performed the analyses;
      v. The analytical techniques or methods used;
      vi. The results of such analyses;
      vii. The nature and composition of all injected fluids until three years after completion of any plugging and decommissioning procedures; and
      viii. We may require the owner or operator to deliver the records to us at the conclusion of the retention period.
   c. **Inspection and Entry.** You must allow us, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:
      i. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
      ii. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
      iii. Sample or monitor at reasonable times, for the purposes of ensuring permit compliance or as otherwise authorized by the Safe Drinking Water Act or state law, any substances or parameters at any location.
   d. **Retention of Records.** You must retain records of all monitoring and maintenance information, including all field notes, calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, all analyses of the data generated, all reports required by this permit, and records of all data used to complete the application for this permit. You must keep them for a period of at least 10 years from the date of the sample, measurement, report, or application. You must make the records available to us upon request.

4. **Reporting and Signatory Requirements.** You must comply with the reporting requirements of 40 CFR 144.51(j) and this condition:
   a. **Planned changes.** You must give us notice of any planned physical alterations or additions to the permitted facility as described in Schedule B, condition 4.
   b. **Anticipated noncompliance.** You must give us advance notice of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.
   c. **Anticipated Violations.** You must give us advance notice of any planned changes in the permitted facilities or activities that may result in violations of permit requirements.
   d. **Transfers** This permit is not transferrable to any person except after giving us notice and meeting the conditions of OAR 340-045-0045. We may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the federal Safe Drinking Water Act (see 40 CFR 144.38; in some cases, modification or revocation and reissuance is mandatory).
   e. **Compliance Schedule.** You must make compliance reports on all interim and final requirements contained in any compliance or implementation schedule included in this permit. The reports must explain the cause of any noncompliance, if known, any remedial actions taken, and the probability of meeting the next scheduled requirements.

f. **Twenty-Four-Hour and Five-Day Reporting.** Unless a different compliance schedule and reporting requirements are otherwise noted in this permit, you must report any non-compliance that endangers health or the environment in accordance with 40 CFR 144.51(l)(6). You must provide any information of non-compliance that endangers health or the environment orally within 24 hours from the time you become aware of the circumstances. You must submit a written report within 5 days of the time you become aware of the circumstances. The written report must contain:
   i. A description of the violation and its cause, if known;
   ii. The period of violation, if known;
   iii. The estimated time the violation is expected to continue if it has not been corrected; and
   iv. Steps taken or planned to reduce, eliminate, and prevent recurrence of the violation.

g. **Other Compliance.** In accordance with 40 CFR 144.51(l)(7), you must report all other instances of non-compliance not reported in Schedule F, conditions 4(e) and 4(f) at the time the annual reports are submitted. The reports must contain the information listed in Schedule F, condition 4(f).

h. **Other Violations.** You must report all permit violations that occurred during a permit-established reporting period in the annual Underground Injection Control System Management Report for that period. The reports must contain the information listed in Schedule F, condition 4(f).

i. **Signatory Requirements.** You must sign and certify all applications, reports or information submitted to us as provided in 40 CFR 144.32.

Report

Permit Evaluation Report

State of Oregon
Department of
Environmental
Quality

City of Keizer
Stormwater Division
Class V Underground Injection Control Systems
Water Pollution Control Facilities Permit No. 103068

Last Updated: Oct. 23, 2013
By: Greg Aitken/Eugene

Table of Contents

Background 1
Overview 1
Compliance with Federal Regulations 2
Groundwater Protection 2
Area Permit Coverage 2
Initial Permit Condition Development 3
Public Involvement 3
Groundwater Protectiveness Demonstrations 4
Permit Template Redraft 4
Permit Conditions 4
Schedule A – Control and Limitation Conditions 6
Schedule B – Monitoring and Reporting Conditions 8
Schedule C – Safe Drinking Water Act Compliance Schedule 9
Schedule D 9
References 10
Attachment A 11

Cities, counties, and businesses have been working diligently to manage their stormwater in a way that will meet today's federal and state rules, protect the health of Oregonians, and preserve the natural resources we all enjoy. Stormwater managers must not only control and balance runoff quantity and quality, but also must protect potable water supplies, aquatic resources, and ecosystems—all while reducing combined sewer overflows and meeting total maximum daily load regulations.

One tool that many communities and businesses use to balance these often-competing goals is infiltrating or injecting stormwater below ground. The advantage of managing stormwater below ground is that soils and aquifers have a much higher capacity than rivers and streams to attenuate many contaminants that have a high potential for harm if discharged to sensitive surface waters. Another advantage is that infiltration can improve watershed health by returning aquifer recharge volumes lost during urban development.

The Department of Environmental Quality has received over 60 applications for individual permits to allow underground injection of stormwater. To efficiently issue these permits, we've developed an individual Water Pollution Control Facilities permit template so that our permit writers can focus more on tailoring each permit to meet a community's or business' needs and to spend less time developing permit conditions that can be common to all individual permits.

We designed the WPCF permit template conditions specifically to allow underground injection of permitted fluids while protecting the public's health, safety and welfare, and the environment. The permit template is designed for stormwater underground injection systems for large to moderate size industrial or commercial facilities, municipalities, governmental agencies, and other public entities that own or operate underground injection systems. Although it may be applied to small local government bodies by further tailoring the template conditions, we will be developing a streamlined general WPCF permit for small entities in the near future.

In this permit evaluation report, we discuss how we developed permit conditions, describe the intent of each permit condition, and guide our staff on how to implement permit conditions.

Background

The federal Safe Drinking Water Act regulates underground injection of fluids, and the national program is administered by the U.S. Environmental Protection Agency. In 1983, EPA delegated the Underground Injection Control program to the Oregon Department of Environmental Quality. Accordingly, we issued rules[1] for UIC activities, also in 1983. We revised these rules in 2001 to conform to changes made to the federal UIC regulations in 1999.

Oregon's UIC rules require the owner or operator of a UIC to register the injection system and either obtain authorization by rule[2] or a permit to operate the underground injection systems. Groundwater quality is further protected in Oregon through the state's groundwater quality protection rules[3].

Overview

Stormwater underground injection systems include dry wells, soakage trenches, drill holes, infiltration galleries, or other systems or devices that inject or distribute fluids underground. Best management practices that allow stormwater to infiltrate below ground such as swales, ponds,

[1] Oregon Administrative Rules 340-044.
[2] OAR 340-044-0018.
[3] OAR 340-040.

porous pavers, and porous concrete are not considered underground injection systems, unless such BMPs use perforated pipe to distribute stormwater underground.

Compliance with Federal Regulations

UIC systems are federally regulated. EPA granted delegation of the UIC program to us in 1984. We have the responsibility to ensure permits issued by us comply with the federal UIC permit requirements specified in 40 CFR 144.51. We have carefully compared the permit conditions in the template with these federal requirements. The permit's general conditions in Schedule F meet the UIC permit requirements of 40 CFR144.51. In addition, the permit specifically states all other pertinent local, state and federal regulations apply.

Groundwater Protection

Oregon's policy is to protect groundwater to its highest beneficial use, which is usually drinking water. The permit template sets conditions for horizontal setbacks from domestic, irrigation, industrial, and public water wells to comply with this rule. Because these types of wells are often converted to public or private drinking water supply wells, we consider all water wells the same as domestic and public water wells for setback purposes, unless the applicant can show us that it is unlikely that they will be converted. For instance, a jurisdiction could show that city or county code prohibits new groundwater supply well connections to businesses or residences, or could provide us with a letter from the landowner certifying that the well will never be used as a drinking water source.

The permit does not require the permittee to directly monitor groundwater. Under our groundwater protection rules, *permit-specific concentration limits*[4] for new facilities[5] must be set at background groundwater quality at a downgradient *compliance point* that we choose. Because it is logistically and economically infeasible to use monitoring wells to measure groundwater quality in place (that is, to measure quality at the physical groundwater compliance point) at thousands of injection points, we set what is known as an *action level* at a *detection monitoring point*. This detection point is located at the *point of injection*, or the end-of-pipe discharge point into an underground injection system after any pretreatment of the fluid. We set an action level at a value that we calculate will result in no change in groundwater quality from background at the downgradient, in-groundwater, compliance point. So, the action levels, along with proper implementation of the conditions set in the permit template, will protect groundwater, and meet background groundwater quality concentrations as per the rule.

Area Permit Coverage

The template allows *area permit*[6] coverage, meaning it can be used to administer all the injection systems within a contiguous jurisdiction such as a city or a county. However, industrial or commercial facilities may have multiple locations in several areas of the state, or within differing geologic and geographic areas, and so are not contiguous. For an industrial or commercial facility to obtain area permit coverage, the permittee must group their facilities into areas of common geologic, hydrogeologic, geographic, and climatic conditions.

Under area permit coverage, the permittee may construct, operate, maintain, convert, or plug and abandon underground injection systems covered under the permit, provided they meet conditions

[4] OAR 340-040-0030(3)(b)

[5] A "new facility" means a facility or activity authorized to operate under a DEQ-approved permit for the first time after the effective date of OAR 340-040-0030 (10-27-1989).

[6] Safe Drinking Water Act federal regulation, 40 CFR 144.3

of the permit. If we determine that the permittee is not in compliance with the permit, we may modify or terminate the permit, or require the permittee to take corrective actions to protect groundwater quality. We may also take enforcement action up to and including civil penalty in the event the permittee does not comply.

Initial Permit Condition Development

The local, regional, and national stormwater and groundwater quality protection information we used to develop the template permit conditions includes:

- Data from the development of the City of Portland UIC WPCF permit issued in 2005 and discussed in the permit Fact Sheet. The Fact Sheet is available at: http://www.deq.state.or.us/wq/wqpermit/docs/individual/wpcf/evalrpt.pdf;
- Stormwater data collected by the City of Portland as required by the conditions of their permit;
- UIC monitoring reports submitted by owners of underground injection systems authorized by rule. All monitoring reports are available at DEQ's Northwest Region office;
- City of Portland Decision Making Framework for Groundwater Protectiveness Demonstrations – Underground Injection Control Systems Evaluation and Response (June 2008), which is a conservative vadose (unsaturated) zone model used to predict the concentration levels of contaminants in the City of Portland UIC injection systems that will not pose a risk to groundwater quality. Also, we reviewed groundwater protectiveness demonstrations for four other jurisdictions that used methods similar to the Portland demonstration (Attachment A), including Clackamas County, Surface Water Management Agency of Clackamas County, and Clackamas County Service District No. 1. The reports are available at DEQ's Northwest Region office;
- Compilation and Evaluation of Existing Stormwater Quality Data from Oregon, (Kennedy-Jenks, December 2009), which is a statistical analysis of statewide stormwater data prepared for the Oregon Association of Clean Water Agencies; and
- Groundwater data from the U.S. Geological Survey reviewed as part of the City of Portland UIC permit development. These include decades of monitoring of underground injection activity within the city of Portland. We summarized this information in the Portland UIC WPCF permit Fact Sheet referenced above.

Based on the information described above, we've determined that unsaturated natural earth material between the bottom of the UIC and groundwater effectively provides some treatment of infiltrating stormwater. We have also concluded, based on the decades of Portland injection data, that infiltrating stormwater generally meets the background groundwater concentrations at the water table. Therefore, the action levels we've set in the permit template are protective of background groundwater quality, and groundwater monitoring is not necessary.

Public Involvement

We held three draft template review public meetings with interested parties in January, March, and May 2010, and included an opportunity to comment after each public meeting through an internet-based website. We received many comments at the public information meetings and through the website and resolved many of them during a public workshop with the EPA, representatives of the Oregon Association of Clean Water Agencies, and representatives of the environmental group Northwest Environmental Defense Center. We revised the template in 2010 to reflect public comments to the extent they met federal and state UIC regulations or state groundwater protection rules.

We considered federal and state laws, and regulations, and the public comments received during the public meetings and online in writing the final permit template. Because this is a template for an individual permit and not a general permit, we will change conditions in the template to address permittee-specific issues when we draft and issue an individual permit.

Groundwater Protectiveness Demonstrations

After the public comment period for our initial permit template, we reviewed several *groundwater protectiveness demonstrations*, which used well-developed and well-understood fate and transport modeling approaches to evaluate whether contaminant action levels could be raised without adversely affecting groundwater quality or groundwater beneficial uses. The model input parameters were very conservative, meaning the parameters were chosen to represent worse-case scenarios. These demonstrations represent geologic and hydrogeologic conditions common in Oregon including regions of high and low precipitation, porous natural earth materials such as sand and gravel, and fractured volcanic rock.

These conservative demonstrations concluded that action levels could be increased for many common stormwater contaminants without harming human health or having a likely adverse impact on groundwater quality. We agree. We present the details of our technical review in Attachment A.

Protectiveness demonstrations do not necessarily need to use modeling techniques, however. For instance, a very simple demonstration is to show that an injection system is downgradient of a nearby water well, rather than upgradient, or that the nearby water well is deep and confined.

Permit Template Redraft

We began redrafting the permit template after the close of the formal public comment period for the first permit being issued under the 2010 permit template because of the extensive comments from a broad spectrum of the public. During this period, we received additional technical information in the form of four additional groundwater protectiveness demonstrations. The goal of the redraft was to streamline the permit, incorporate the new data and analyses and align it with state rules and federal regulations that protect groundwater quality. We also rewrote the permit template and this permit evaluation report so that they are as clear and simple as possible, as Oregon law[7] requires.

Permit Conditions

The UIC WPCF permit allows the permittee to install, operate, and maintain injection systems which might not otherwise qualify for authorization by rule. It also allows the permittee to continue to operate and maintain injection systems that meet the conditions and action levels set in the permit.

Permit conditions in the template specifically designed to protect groundwater quality include:

- Discharging only stormwater and other approved incidental non-stormwater fluids;
- Setting action levels for pollutants found in stormwater;
- Monitoring and reporting of stormwater to show compliance with action levels;

[7] Oregon Revised Statute 183.750

- Implementing compliance actions for underground injection systems that do not meet action levels;
- Properly building and maintaining underground injection systems;
- Employing BMPs and site controls that minimize the discharge of stormwater contaminants to groundwater;
- Identifying and correcting activities or systems not in compliance with the permit, or otherwise do not meet groundwater protection requirements;
- Allowing injection systems previously *authorized by rule*, meaning a permit wasn't needed for that particular type of system because it was explicitly allowed in rule, to be incorporated into the WPCF permit; and
- Closing prohibited underground injection systems.

Other permit conditions that protect groundwater include:

- A comprehensive system-wide assessment to identify underground injection systems the permittee owns or operates that receive drainage from areas where pollutants may be carried in stormwater;
- A system-wide assessment to identify underground injection systems that do not have minimum horizontal setbacks from wells, and prohibited systems. These injections systems must be prioritized to be addressed as indicated in Schedule D.
- A requirement to develop and carry out robust source control and pollution prevention actions through a comprehensive underground injection system management plan;
- A requirement to implement protection controls for underground injection systems within 500 feet, or the 2-yr time of travel of drinking water or irrigation wells, or show the water wells are protected from stormwater pollutants discharged into the underground injection systems within these setback areas;
- Implement a monitoring program that represents the permittee's underground injection systems to determine the quality of stormwater discharged, and includes regular monitoring of pollutants most commonly detected in stormwater;
- Allow the direct injection of stormwater into groundwater if it will not impair groundwater beneficial uses; and
- Take timely and decisive actions when situations or activities that do not comply with the permit are discovered.

When stormwater monitoring data indicate that concentrations are consistently higher than permit action levels, the permittee is required to take the actions specified in the permit. We may also require groundwater monitoring when action levels are consistently exceeded, demonstrating a likely adverse impact to groundwater quality.

For municipalities (including local and state governmental agencies), the permit covers all publically owned or operated injection systems, regardless of which department, bureau, or district within the municipality is responsible for the injection system, unless the municipality requests otherwise. We will recognize a lead department or bureau in the permit.

The UIC WPCF permit is effective for 10 years from the date we issue it, unless we modify, terminate, revoke, or reissue the permit, or unless the permittee requests permit termination and we grant it. The permittee must maintain permit coverage and renew the permit as long as the permittee operates underground injection systems that do not meet authorization by rule conditions.

The remainder of this permit evaluation report annotates the permit conditions, which are identified in italics.

SCHEDULE A
CONTROL AND LIMITATION CONDITIONS

1. Authorized Discharges.

Condition 1 identifies which fluids can be discharged into underground injection systems. For municipalities, most authorized discharges align with those allowed by the NPDES Municipal Separate Storm Sewer System permit (that is, under what is called an *MS4 permit*). We may approve other similar temporary discharges after we've issued the permit, provided the permittee shows us in writing that the discharge is *de minimis* and complies with OAR 340-040-0020(3) (which states that groundwater must be protected to its highest beneficial use, which is usually drinking water), and the permittee obtains written approval from us prior to discharge.

2. Action Levels.

Condition 2 establishes action levels for discharges to underground injection systems. The listed pollutants are the most frequently detected parameters based on the local, regional, and national stormwater and groundwater quality data we described earlier in this evaluation report.

DEQ has established action levels based on specific site conditions of the permit applicant. The pollutants listed in the table are derived from those that have been detected in urban stormwater. We also considered a more extensive list of pesticides and herbicides commonly used in urban areas. We currently are requiring communities with a MS4 National Pollutant Discharge Elimination System (NPDES) permit to sample and evaluate which pesticide and herbicide are most prevalent Oregon urban stormwater. These studies should be finished within five years. We intend to use the results of these studies to consider pesticide and herbicide screening as part of the five-year review of each UIC municipal permit.

3. Action Level Exceedance.

Both the federal and state rules require the permittee to take corrective action when contaminant discharges could potentially pose a threat to human health or the environment. Condition 3 tells the permittee what those actions should be. If there is an imminent endangerment to human health or the environment, federal requirements of 40 CFR 144.53 apply. An example of an imminent endangerment would be a spill of a hazardous material, toxic substance, or petroleum product of sufficient quantity to adversely affect groundwater quality or into an injection system within any drinking water well setback area.

When an exceedance of an action level occurs during a single sampling event at high-risk injection points, the permittee can propose identifying the potential source(s), assess whether the best management practices (BMPs) they implement need adjustment, make appropriate changes to reduce or eliminate the pollutant, and track results through monitoring.

4.&5. Corrective Action

These conditions address the corrective actions required by the permit to eliminate any endangerment of health or the environment caused by UICs.

6. Site Control Measures and Best Management Practices.

We've evaluated the BMP requirements for MS4 communities and have found that most of the MS4-required BMPs also are also effective for meeting underground injection system permit requirements, and have found that they conform to OAR 340-040-0020(11) requirements. For those communities that have both MS4 discharges and underground injection discharges, we consider the overlap areas between the two permits as part of their overall stormwater system management approach.

Community- and site-specific BMPs and other site controls that the permittee will use to minimize the discharge of pollutants to groundwater should be described in the underground injection system management plan described in Schedule D of the permit.

7. Underground Injection Systems - Horizontal Setbacks.

The state UIC rules presume that injection systems within horizontal water well setbacks could pose a health risk to persons [OAR 340-044-0014(1)]. Condition 7 applies to injection systems the permittee knows of at the time we issued the permit. It also applies to injection systems located within a setback area discovered during or after the Schedule B system-wide assessment.

The reason for identifying those systems that inject stormwater into groundwater within a setback is because the state rules require that the permittee show that the injection will not harm (endanger) groundwater quality, groundwater beneficial uses, or human health. Once these systems are flagged in the system-wide assessment, the permittee will be able to prioritize which systems to address first.

We may allow existing injection systems to operate or may allow new injection systems that do not meet the horizontal setback distance under certain conditions. The permittee must show through scientific methods (such as transport modeling) that operating the injection system meets the permit's groundwater protection requirements.

SCHEDULE B
MONITORING AND REPORTING CONDITIONS

1. System-Wide Assessment.

DEQ has approved the permittee's August 2013 System-Wide Assessment to comply with the WPCF permit's requirements. During the fifth year of the permit, the permittee must reassess its underground injection systems and submit an updated system-wide assessment at the end of that year, including all injection systems added or closed during the first five years of the permit. The intent of this assessment update is to make any adjustments to the monitoring and reporting based on site-specific information collected during the first five years of the permit. If there are no changes to the permittee's underground injection systems, the permittee may report that the system is unchanged in the required annual report for the fifth year. We also intend to use the fifth year reassessment to evaluate the merit of monitoring injection systems for emerging contaminants (e.g., pesticides) based on the monitoring results from the NPDES MS4 communities reported to us.

2. Stormwater Monitoring Plan.

DEQ has approved the permittee's August 2013 Stormwater Monitoring Plan to comply with the WPCF permit's requirements. The plan describes how the permittee plans to sample the

underground injection systems identified by their system-wide assessment. The purpose of the monitoring is to help us and the permittee understand what contaminants may be present in stormwater under their jurisdiction, and to support an adaptive management strategy that favors effective best management practices or engineering controls.

3. Groundwater Monitoring.

Based on our technical review of the fate and transport of common stormwater pollutants, we expect that we will rarely need to require groundwater monitoring. This condition is in the permit to align it with the groundwater quality protection rules.

4. Annual Reporting Conditions.

Because a municipality's UIC and NPDES MS4 permit requirements overlap in many areas, the permittee may combine the annual reporting requirements of these permits,

5. Closing an Underground Injection System.

The permittee must provide prior notice of converting or closing any underground injection system they own or operate.

SCHEDULE C
SAFE DRINKING WATER ACT COMPLIANCE SCHEDULE

A UIC permit may, when appropriate, specify a compliance schedule leading to compliance with the Safe Drinking Water Act as expressed in 40 CFR 144.53. Underground injection control systems that endanger human health typically will be subject to the federal corrective action requirements of 40 CFR 144.53. Other conditions that would meet a federal compliance schedule condition under the Safe Drinking Water Act are permit-specific and we will evaluate them on a case-by-case basis as we issue permits.

The permittee's UIC permit does not require a Safe Drinking Water Act compliance schedule (see 40 CFR 144.53) because the permittee does not own any injection systems known to violate the Safe Drinking Water Act, state or federal underground injection control rules or regulations, or state groundwater quality protection rules.

SCHEDULE D
SPECIAL CONDITIONS

1. Legal Authority.

The permittee needs to adopt and maintain the legal authority to implement and enforce permit conditions and provisions.

2. Permittee Personnel Responsible for Permit.

The permittee must identify key positions and the names, mailing addresses, work locations, responsibilities, of persons in those positions. The permittee must submit, in writing, timely updates to key personnel or personnel responsibility.

3. Reporting and Corrective Actions for Underground Injection Systems Prohibited by OAR 340-044-0015.

Prohibited underground injection systems are identified in OAR 340-044-0015. Under no circumstance are discharges allowed into prohibited injection systems. The most common prohibited underground injection system is the injection system that receives wastes from vehicle repair or maintenance activities. This includes vehicle wash water discharge to the injection system if the engine or undercarriage is washed.

Federal law (40 CFR 144.85) required prohibited underground injection systems to have been closed by April 2005. We recognize that some prohibited underground injection systems might still be in operation. This condition specifies the reporting and corrective actions the permittee must take if they discover a prohibited injection system. Operating a prohibited injection system is a Class I violation subject to enforcement action under OAR 340-012-0055(1)(p) and ORS 468.B.025(a). Although we do not intend to take enforcement action if the permittee complies with the requirements of this condition, the permittee must orally report prohibited injection systems to DEQ within 24 hours of discovery, and immediately implement the condition requirements.

4. Underground Injection Systems Discovered During or After the System-Wide Assessment.

At a minimum, we expect the system-wide assessment to include information for each injection system identified in the system-wide assessment. For any injection system discovered during the system-wide assessment or post-assessment, the permittee must provide information regarding the injection systems in accordance with OAR 340-044-0020.

5. Underground Injection Control System Management Plan.

DEQ has approved the City of Keizer's August 2013 underground injection control system management plan.

6. Adaptive Management.

This condition requires that the permittee use an adaptive management strategy to evaluate and refine their approach for protecting groundwater and its beneficial uses, including application of best management practices. Consideration must be given for emerging pollutant types and concentrations in the fifth year after permit issuance and for the permit renewal application.

7. Rule Authorization.

All UICs owned or operated by the permittee are covered under this permit, including those that have been previously rule authorized.

References

City of Portland, Bureau of Environmental Services, 2008, Decision making framework for groundwater protectiveness demonstration, underground injection control system evaluation and response.

Kennedy-Jenks, 2009, Compilation and evaluation of existing stormwater quality data from Oregon, prepared for the Oregon Association of Clean Water Agencies

Attachment A: Groundwater Protectiveness Model Reviews

Currently, municipalities are applying to DEQ for stormwater UIC WPCF permits. Several of them have asked to use a groundwater protectiveness demonstration to address conditions presented in the UIC permit template. The result, a pollutant fate and transport model was developed and submitted to us for review. The purpose of this is to document the results of our review.

We received and reviewed models for Redmond, Bend, Gresham, Clackamas County, and Portland. We also searched scientific journal articles to independently corroborate the modeling results.

Because each model uses city or county-specific parameters, we refer you to the thorough, well-documented reports that accompany each model for those specific details. In this attachment, we focus primarily on the appropriateness of the model and its general input parameters.

Summary

The models use an advection-dispersion equation and conservative input parameters to estimate the concentrations of classes of chemicals at the base of a stormwater injection system. The model was peer-reviewed by the well-respected S. S. Papadopulos and Associates consulting firm that specializes in groundwater modeling, and their suggestions were incorporated to make the model more precise and conservative. The approach outlined in the model reports supports an increase in the effluent action levels currently listed in the municipal underground injection control permit template.

Introduction

A groundwater consulting firm, GSI Water Solutions, was retained by the five applicants, and they developed a spreadsheet-based model to evaluate whether stormwater injection wells have the potential to affect nearby drinking water wells. Based on the model results, GSI also proposed city/county-specific action levels for incorporation into their clients' permits.

Governing advection-dispersion equation

The model uses a one-dimensional pollutant fate and transport equation to estimate pollutant attenuation during transport in the unsaturated zone. This advection-dispersion equation incorporates sorption, biotic and abiotic degradation, and dispersion, and is solved for a series of pollutants that represent a specific class of chemicals. For instance, the Redmond model calculated attenuation for copper, lead, toluene, pentachlorophenol, di(2-ehtylhexyl)phthalate, benzo(a)pyrene, naphthalene, and 2,4-D, which represent the metal, volatile organic compound, semivolatile organic compound, polycyclic aromatic hydrocarbon, and pesticide classes.

The governing equation was reviewed and thoroughly vetted by S. S. Papadopulos and Associates (2008), and we refer you to their analysis for further details. We agree that the governing equation used in the models is appropriately used for establishing conservative action levels.

Input parameters

The magnitude of pollutant attenuation during transport through the unsaturated zone at the base of a stormwater injection system is controlled by physical and chemical properties of the unsaturated zone and the pollutant. These properties are used in the governing equation, and include:

Hydrogeology: the reports and the models are based on local geology and hydrogeology information obtained from a variety of published and unpublished data. Where multiple sedimentary interbeds existed, GSI conservatively selected the geologic formation with the highest hydraulic conductivity as representative of the formation into which injection points were installed.

Hydraulic conductivity is a soil-property constant that is proportional to groundwater velocity. Because stormwater injection systems do not have water flowing into them constantly, soil within an injection point is typically unsaturated, and so it would be technically appropriate to use unsaturated hydraulic conductivity. However, GSI chose to use saturated hydraulic conductivity as a simplifying assumption. This is conservative because unsaturated hydraulic conductivity is always lower (that is, water flows more slowly) than saturated hydraulic conductivity because unsaturated flow paths are more tortuous (crooked or winding paths). Hydraulic conductivities in the models were based on injection-well infiltration tests, and in the event that multiple conductivities were measured, GSI conservatively selected a higher-end value, which results in faster transport than in reality.

Porosity is the percent of void space in soil or in the case of fractured bedrock, the percent of void space in soil filling fractures in the rock. Values were selected from literature based on soil texture, and were appropriately selected.

Soil moisture content is the percent of water in soil, and is equal to or less than porosity. GSI set the soil moisture equal to porosity, which is conservative.

Hydraulic gradient, also known as pressure gradient, is a measure of the driving force for groundwater flow. GSI conservatively used a gradient equal to one, which is the maximum gradient possible.

Pore-water velocity is the rate at which water moves downward through the unsaturated zone, and is also known as *average linear velocity*, *specific discharge*, or *Darcy velocity*. Pore-water velocity is calculated using hydraulic gradient, hydraulic conductivity, and porosity. The velocities used are conservative because the values in the calculation are conservative.

Soil bulk density is the density of soil, including soil particles and pore space. It is calculated using sediment density (typically 2.65 g/cm^3) and porosity.

Fraction of organic carbon is a dimensionless measure of the quantity of organic carbon in soil (that is, grams of carbon per gram of soil), and is used to estimate the capacity of a soil to adsorb pollutants. Pollutants are retarded (move more slowly) in the subsurface when they are sorbed by organic carbon. The models used the simplifying assumption that sorption occurs only on organic carbon, which eliminated other retardation mechanisms such as cation-exchange capacity. This assumption is conservative because it results in less pollutant sorption, which allows pollutants to be transported further and faster in the model than they would under actual conditions. The organic carbon fraction was estimated from total organic carbon stormwater data results for each city or county.

Organic carbon partitioning coefficient is pollutant specific, and governs the degree to which the pollutant will partition between the organic carbon and water phases. Higher partition coefficients indicate that the pollutant has a higher tendency to partition in the organic carbon phase (and therefore move more slowly in groundwater), and lower coefficients indicate that the pollutant will have a higher tendency to partition in the water phase (and therefore move more quickly in groundwater). Organic carbon partition coefficients were assumed to be either the lowest-reported literature value or one calculated by empirical equations, which ever was lower (i.e., more conservative).

Distribution coefficient is a measure of the distribution of metals between solid (sorbed to solids or organic materials) and dissolved phases.

Degradation rate constant (biodegradation rate). Microbial processes break down organic compounds down into other, typically less toxic substances. The degradation rate of these compounds is chemical-specific, and depends on whether the unsaturated zone is aerobic or anaerobic. Metals (copper and lead) are elements and therefore do not undergo degradation, and so the rate constant is not used for them. GSI compiled rate constants from literature, and chose a 25th percentile value (meaning the model assumes that organic compounds degrade less rapidly than under actual conditions), which is conservative.

Infiltration time is the length of time during the year that rainfall occurs and causes runoff into an underground injection system. The models use site-specific rainfall data to calculate a geometric mean for infiltration time. This is a reasonable approach.

Initial concentrations of the modeled pollutants were derived from city/county-specific stormwater sampling data.

Report conclusions

The model simulation results, using conservative assumptions and input parameters, indicate that concentrations of copper, lead, antimony, zinc, pentachlorophenol, di(2-ethylhexyl)phthalate, benzo(a)pyrene, and 2,4-D could be significantly higher than the effluent action levels currently listed in the UIC permit template. We agree that the action levels included in the permit template can be raised for these chemicals, as supported by these modeling efforts.

References

GSI Water Solutions, 2012, Technical Memorandum, Proposed Alternate Action Levels for the City of Gresham UIC WPCF Permit – DEHP, Antimony, and Zinc.

City of Portland, Bureau of Environmental Services, 2008, Decision-making framework for groundwater protectiveness demonstration, underground injection control system evaluation and response.

GSI Water Solutions, 2011, Technical Memorandum, Pollutant Fate and Transport Model Results in Support of the City of Bend UIC WPCF Permit – Groundwater Protectiveness Demonstration and Proposed EDLs

GSI Water Solutions, 2011, Technical Memorandum, Pollutant Fate and Transport Model Results in Support of Clackamas County WES' UIC WPCF Permit – Groundwater Protectiveness Demonstration and Proposed EDLs.

GSI Water Solutions, 2011, Technical Memorandum, Pollutant Fate and Transport Model Results in Support of the City of Gresham UIC WPCF Permit – Proposed EDLs

GSI Water Solutions, 2011, Technical Memorandum, Pollutant Fate and Transport Model Results in Support of the City of Redmond UIC WPCF Permit – Groundwater Protectiveness Demonstration and Proposed EDLs

Kennedy-Jenks, 2009, Compilation and evaluation of existing stormwater quality data from Oregon, prepared for the Oregon Association of Clean Water Agencies

S. S. Papadopulos and Associates, 2008, Peer review of UIC Category 4 Groundwater Protectiveness Demonstration