



WASHINGTON STATE
DEPARTMENT OF
E C O L O G Y

Guidance for UIC Wells that Manage Stormwater

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Prepared by:

Washington State Department of Ecology
Water Quality Program

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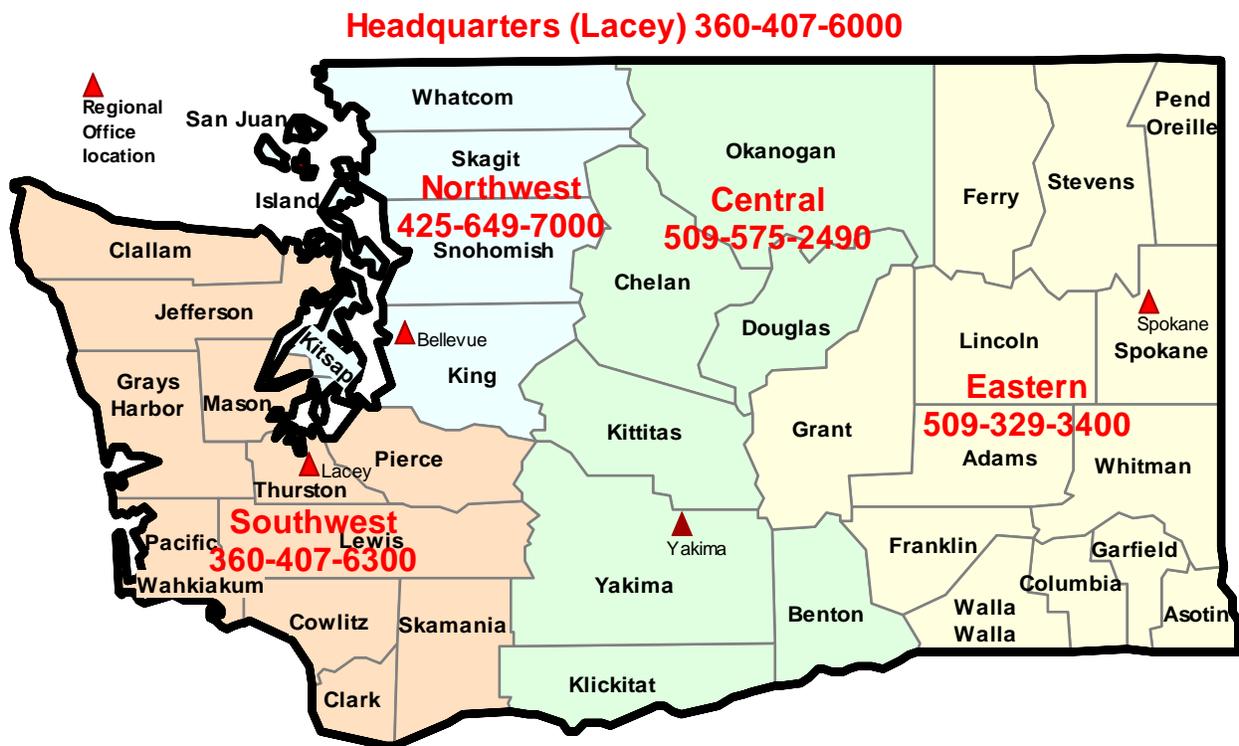
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Chapter 1 – Introduction and Background

This document provides technical guidance for stormwater wells regulated under the Underground Injection Control (UIC) program. For convenience, we will refer to these as UIC wells. UIC wells that are used for stormwater are also commonly referred to as drywells.

The purpose of this document is to provide design and pretreatment best management practices (BMPs) for UIC wells used along roads, parking areas and also roof runoff and built on or after February 3, 2006. These UIC wells are referred to as “new” UIC wells.

The UIC rule, Chapter 173-218 WAC, requires a well assessment for UIC wells that were constructed prior to February 3, 2006. These UIC wells are referred to as “existing” UIC wells. This document can also be used to complete the well assessment for existing wells.

Stormwater

Stormwater is the water from rainstorms or snow melt that runs over land into ponds, lakes, streams, marine waters, wetlands, drainage ditches, evaporation ponds, and drywells.

As stormwater flows, it contacts surfaces that contain pollutants. Roads and parking lots can contribute oils and metals. Roofs on industrial buildings can collect chemicals that are vented out of the building and wash off when it rains. Grassy areas like golf courses, cemeteries, and playing fields may contribute fertilizers and pesticides.

The purpose of managing stormwater is two fold: to prevent flooding and to prevent water pollution. Drainage systems are designed to collect and transport stormwater runoff to prevent flooding, and treatment systems are designed to control pollution. Managing stormwater at the site, such as by using a UIC well, can also contribute to the recharge of ground water resources.

For chemicals that are not easy to remove from stormwater, pollution control means going to the source and preventing it from contacting stormwater in the first place. The methods of preventing stormwater pollution are referred to as “best management practices.”

UIC Program

The Underground Injection Control program was created by Congress to protect underground sources of drinking water from discharges of fluids to the ground. The UIC program in the state of Washington is administered by the Department of Ecology. In 1984, the Department of Ecology adopted Chapter 173-218 WAC - Underground Injection Control to implement the program.

In Washington all ground water is protected equally under RCW 90.48 and Chapter 173-200 WAC Water Quality Standards for Ground Waters of the State of Washington.

The two basic requirements of the UIC Program are:

- Register UIC wells with the Washington State Department of Ecology unless the wells are located on tribal land. (Those wells should be registered with the Environmental Protection Agency).
- Make sure that current and future underground sources of ground water are not endangered by pollutants in the discharge (non-endangerment standard).

Since stormwater picks up contaminants as it runs over the land surface, it can pollute ground water once infiltration occurs.

Pollution of ground water from stormwater discharges can be prevented by careful design of the UIC well, strategic siting and effective operation and maintenance. Pollution can also be prevented by use of treatment before discharge to the sub-surface and by reducing the stormwater contact with potential sources of contamination. These methods are covered in this technical guidance.

1.1 Development of this technical guidance

The UIC rule was revised in consultation with the UIC Rule Advisory Committee. The UIC rule was adopted and became effective on February 3, 2006. A subcommittee of the Stormwater Management Manual for Eastern Washington committee developed the draft version of this document with statewide stakeholder input and public review. This document was originally published as interim technical guidance in Ecology Publication Number 04-10-076, the *Stormwater Management Manual for Eastern Washington*.

This guidance replaces the section in the Department of Ecology *Stormwater Management Manual for Eastern Washington (SMMEW)*, Section 5.6 that refers to UIC wells; however, the rest of the manual applies.

When using this document, please refer also to the Ecology stormwater management manuals for eastern and western Washington or an equivalent department approved manual. An example of an equivalent manual is the Washington State Department of Transportation Highway Runoff Manual:

<http://www.wsdot.wa.gov/fasc/EngineeringPublications/Manuals/HighwayRunoffManual.pdf>

1.2 Definition of a UIC well

A UIC well is a manmade subsurface fluid distribution system designed to discharge fluids into the ground and consists of an assemblage of perforated pipes, drain tiles, or other similar mechanisms, or a dug hole that is deeper than the largest surface dimension (WAC 173-218-030).

Subsurface infiltration systems include drywells, pipe or French drains, drain fields, and other similar devices that are used to discharge stormwater directly into the ground.

Drywells are UIC wells completed above the water table so that the bottom and sides are typically dry except when receiving fluids. Drywells may be stand-alone or as part of a larger drainage system, such as the overflow for a bio-infiltration swale or other stormwater treatment BMP.

Infiltration trenches with perforated pipe are considered to be UIC wells. This type of infiltration trench must be registered with Ecology. However, they must be designed, constructed, operated, and maintained according to an Ecology stormwater manual or another equivalent department approved manual to be rule authorized. This guidance does not apply except for the registration requirement.



Typical UIC stormwater wells (drywells)

The following are not UIC wells; therefore, this guidance does not apply:

- Buried pipe and/or tile networks that serve to collect water and discharge that water to a conveyance system or to surface water.
- Surface infiltration basins and flow dispersion stormwater infiltration facilities.
- Infiltration trenches designed **without** perforated pipe or a similar mechanism.

Chapter 2 – How UIC Stormwater Wells are Regulated

2.1 Using a UIC well for stormwater

This guidance document applies to UIC wells that receive stormwater from roads, parking areas and also roof runoff.

A UIC well may be used to manage stormwater when pollutant concentrations that reach ground water are not expected to exceed Washington State ground water quality standards (Chapter 173-200 WAC). This guidance document describes conditions and requirements that are expected to result in meeting these standards.

UIC wells may be used for overflow from a stormwater facility that is greater than the runoff treatment design storm without further treatment.

2.2 Prohibitions

Stormwater from the areas listed below **may not** be discharged to UIC wells because of the potential to contaminate ground water unless authorized under a permit. Conventional stormwater treatment is not considered protective of ground water in these situations.

Stormwater from these areas must be handled on site with a closed-loop system or discharged to the sanitary sewer if allowed by the local jurisdiction.

The term “area” used here refers to a specific physical portion of an industrial or business facility where the activities occur. Stormwater from other portions of the site that do not contact the areas listed below, such as roofs and parking areas, may be discharged to UIC wells. The requirements for roofs and parking areas described elsewhere in this document must be met.

See 173-218-040(5)(b) for a list of examples of prohibited UIC wells. UIC wells may not receive stormwater from the following types of areas:

- Vehicle maintenance, repair and service.
- Commercial or fleet vehicle washing.
- Airport de-icing activities.
- Storage of treated lumber.
- Storage or handling of hazardous materials.
- Generation, storage, transfer, treatment or disposal of hazardous wastes.
- Handling of radioactive materials.
- Recycling facilities, except for those that recycle only glass, paper, plastic, or cardboard.

- Industrial or commercial areas that have outdoor processing, handling, or storage of raw solid materials or finished products at the facility and are without management plans for proper storage and spill prevention, control, and containment appropriate to the types of materials handled at the facility (see the Ecology stormwater management manuals for information on stormwater pollution prevention plans and source control).
- UIC wells may not be used at contaminated sites when the stormwater would increase the mobility of the contaminants at the site. For example, a drywell could not be used up gradient of or over the contaminant plume at a leaking underground storage tank site. This is because the stormwater could increase the movement of the contaminants.

2.3 Rule-authorization or permit

UIC wells must either be rule-authorized or covered by a state waste discharge permit to operate. If a UIC well is rule-authorized, a permit is not required. Rule-authorization can be rescinded if a UIC well no longer meets the non-endangerment standard. Ecology can also require corrective action or closure of a UIC well that is not in compliance.

A UIC well may be rule-authorized when both of the following requirements are met:

1. A registration form must be submitted to the Department of Ecology.
2. Discharge from the UIC must not contaminate ground water. This is the “non-endangerment performance standard.”

The requirements to meet the non-endangerment standard are detailed in this guidance document.

2.4 Registration

Residential UIC wells used for roof runoff or basement flooding control are exempt from the registration requirement. All other UIC wells must be registered.

The registration form can be found at the Ecology Web site at <http://www.ecy.wa.gov/programs/wq/grndwtr/uic/index.html>.

UIC wells constructed on or **after** February 3, 2006 are considered to be new. The registration provides the department with information needed to determine if the new UIC well meets the conditions to be rule-authorized.

- The registration form must be submitted prior to construction.
- The non-endangerment standard must be met (see the next section).

UIC wells constructed **prior** to February 3, 2006, are considered to be “existing.”

- Owners of 50 wells or fewer must register their wells by February 3, 2009, and complete their well assessment by February 3, 2011.
- Owners of more than 50 wells must register their wells by February 3, 2011, and complete their well assessment by February 3, 2013.

See section 2.6 and Chapter 173-218-090(2) WAC for more on well assessments.

2.5 Meeting the non-endangerment standard for new wells

The Department of Ecology makes the decision that a UIC well is either rule-authorized or needs a permit based on whether the UIC well meets the non-endangerment standard.

There are two ways for a registrant of a new UIC well to show that the well meets the non-endangerment standard and therefore, isn't required to have an individual permit.

- One way is to follow the requirements in this technical guidance. The Department of Ecology will *presume* that the UIC well meets the non-endangerment standard and the well will be rule-authorized. This is called the *presumptive approach*.
- The other way is for the registrant to *demonstrate* that the non-endangerment standard has been met in some other way. This is called the *demonstrative approach*. This is designed to allow alternative methods to demonstrate that the non-endangerment standard has been met and therefore the UIC well may be rule-authorized.

2.5.1 Using the presumptive approach

To be eligible for rule-authorization using the presumptive approach, the following must be addressed according to this guidance or another equivalent department approved local stormwater manual that includes the requirements in this guidance:

- The potential pollutant loading expected in the stormwater runoff.
- Source control of pollutants, especially those that are difficult to remove from stormwater by filtration, settlement, or other treatment technologies.
- Known treatment methods.
- The potential treatment capacity of the vadose zone.
- Siting.
- Design.
- Operation and maintenance.

The presumptive approach may not be used when BMPs do not exist to remove or reduce a contaminant and/or the vadose zone has no treatment capacity (WAC 173-218-090 (1) (i) (D)).

2.5.2 Using the demonstrative approach

The documentation for the demonstrative approach is a site-specific analysis that demonstrates that the proposed discharge will comply with ground water quality standards.

To be eligible for rule-authorization using the demonstrative approach, the following topic areas must be documented with the UIC well registration.

- Site-specific analysis of pollutant loading.
- Site-specific analysis of the treatment capacity of the vadose zone, if used for treatment.
- How stormwater best management practices (BMPs) were selected.
- Pollutant removal expected from the selected BMPs.
- Technical basis supporting the performance claims for the selected BMPs.
- Assessment of how the selected BMPs will comply with state ground water quality standards and satisfy state AKART requirements.

2.6 Existing UIC wells

UIC wells that were constructed *before* February 3, 2006, have different requirements than wells constructed on or after the revised rule became effective. Existing UIC wells are grandfathered in with respect to the rules that became effective on February 3, 2006.

A well assessment must be completed to determine if any of the existing UIC wells are a high threat to ground water. UIC wells that are a high threat to ground water must be retrofitted to protect ground water quality.

UIC wells constructed prior to February 3, 2006, must also be registered, if this was not previously done.

The following is the definition of a well assessment (WAC 173-218-030):

Well assessment means an evaluation of the potential risks to ground water from the use of UIC wells. A well assessment includes information such as the land use around the well which may affect the quality of the discharge and whether the UIC well is located in a ground water protection area. It may include the local geology and depth of the ground water in relation to the UIC well if the well is considered a high threat to ground water.

This technical guidance may be used as a helpful guide for the well assessment. Here is an excerpt from WAC 173-218-090(2):

“The approach to conducting the well assessment will be determined by the owner. The well assessment evaluates the potential risks to ground water from the use of UIC wells and includes information such as the land use around the well which may affect the quality of the discharge,

and whether the UIC well is located in a ground water protection area. It may include the local geology and depth of the ground water in relation to the UIC well if the well is considered a high threat to ground water. The well assessment requirements will be met if an owner or operator applies the storm water best management practices contained in a guidance document approved by the department to their UIC wells and determines if the UIC well is located in a ground water protection area.”

2.6.1 Evaluating high threat to ground water for existing wells

If an existing well was built according to the specifications in this guidance it is **not** considered a high threat to ground water and does not need to be retrofitted, unless site specific information indicates that a ground water quality problem exists.

The following conditions are considered a high threat to ground water for which existing wells need retrofitting:

- UIC wells receiving prohibited discharges (see Section 2.2 Prohibitions).
- UIC wells receiving a high pollutant load where the vadose zone between the bottom of the UIC well and the top of the ground water has no treatment capacity or the vadose zone conditions are unknown, according to Tables 5.2-5.4 of this guidance.
- UIC well structures completed in ground water. If a UIC well has water in it during the dry season when it has not received any recent discharges, chances are it is sitting in ground water.

2.6.2 Preservation and maintenance projects

A preservation and maintenance project involves removing and replacing a road surface without expanding the impervious surface (*Stormwater Management Manual for Eastern Washington*, pp. 2-9).

The question is whether UIC wells involved in these types of projects are regulated as existing or new wells.

A UIC well that was in use prior to the project is considered an existing well only if it remains in place. The well may be retrofitted or reconstructed in place without being considered a new well. Otherwise, it is considered a new well, and the new UIC requirements apply.

2.6.3 Emergency situations

In emergency situations, such as roadway flooding, a jurisdiction may install a UIC well that does not meet the requirements of this guidance on a temporary basis. When weather permits, and within a year of the event, the jurisdiction should ensure that the UIC well meets the requirements of this guidance.

For example, excessive winter rainfall overwhelms the capacity of the existing drainage system along a road. The water drains onto the road and turns to ice. The jurisdiction installs a new

UIC well to fix the immediate problem and, once the weather permits, implements the required best management practices.

2.7 Requirements for municipalities with national pollutant discharge elimination system (NPDES) permits

Municipalities that are under an NPDES stormwater permit may also have stormwater discharges to UIC wells. The Stormwater Management Program required by the NPDES stormwater permit includes best management practices that also may be applied to stormwater discharges to UIC wells. To avoid duplication, municipalities that are under an NPDES stormwater permit may meet UIC program requirements by applying their Stormwater Management Program to areas served by UIC wells. See Chapter 173-218-090(1) WAC.

Since the NPDES permit does not fulfill all the requirements of the UIC Program, the following must be added to the Stormwater Management Program (SWMP) and implemented:

- UIC wells must be registered.
- New UIC wells must be constructed according to the specifications in this guidance.
- A well assessment must be completed for all existing wells.
- Existing UIC wells that are determined to be a high threat to ground water must be retrofitted.

See the previous section for timelines for registration and well assessments and also for evaluating high threats to ground water.

Chapter 3 – Siting, Design and Construction, Operation and Maintenance

The requirements in this chapter apply to UIC wells built on or after February 3, 2006.

3.1 Siting

3.1.1 Minimum siting requirements for rule-authorization under the presumptive approach

For new UIC wells, the following siting restrictions apply in order to meet the non-endangerment standard under the presumptive approach. See Chapter 2 for an explanation of the presumptive and demonstrative approaches.

- Prohibited areas: A UIC well may not be sited in prohibited areas - see Chapter 2.2 for a list of types of areas where stormwater discharges to UIC wells are prohibited.
- Soil contamination: UIC wells should not be sited where there are soil contaminants that could be transported to ground water unless the site is remediated prior to construction.
- Drinking water wells: A UIC well is a potential source of contamination and should be sited at least 100 feet away from a drinking water well or spring used for drinking water supplies (WAC 173-160-171).

3.1.2 Further siting considerations for UIC wells near drinking water wells

Stormwater infiltrated through UIC wells can contaminate ground water that supplies a drinking water well. Factors that affect the potential for contamination to occur include:

- The direction and rate of ground water flow.
- How far the proposed UIC well site is from a drinking water well.
- The vulnerability of drinking water supply wells to contamination.

A site is not suitable if the placement of the UIC well would cause a violation of Washington State ground water quality standards, WAC 173-200.

3.1.3 Local siting considerations

Check with the local jurisdiction to find out if there are further siting requirements for UIC wells. Setbacks required by local regulations, building code requirements, or other state regulations should be followed.

Local governments may have ordinances that apply to development within groundwater protection areas, such as sole source aquifers, groundwater management areas, wellhead protection areas, and in areas designated as Critical Aquifer Recharge Areas. For more information about well-head protection areas and Critical Aquifer Recharge Areas, consult with your local jurisdiction.

Whether a UIC well may be sited in a wellhead protection zone depends on local ordinances. A jurisdiction may have different requirements for the six month, one-year, five-year, and ten-year time-of-travel zones. These zones express the time it would take a contaminant in ground water to reach the well. Thus if a spill of gasoline entered the ground water within the one-year time of travel, it would show up at the well within a year.

3.1.4 Advisory on infiltration and geologic instability

The focus of the UIC program is to protect the quality of ground water. Slope stability and effects on building foundations are not a regulatory component of the program. However, because infiltration of water can cause extensive problems, this section has been included as an advisory in this guidance to alert UIC well owners to this siting concern.

Ground water is a major factor for slope failures and also can cause major problems with building foundations. Therefore, the effect of the infiltration of water from UIC wells on slope stability and building foundations should be considered when siting UIC wells. These effects should be considered for the site itself and neighboring properties.

Certain observable conditions indicate a higher potential for slope stability problems, including where there is evidence of:

- Existing slope instability, such as landslides or cracks in the ground.
- Existing hydraulic loading, such as slopes with known seeps.
- Other factors that heighten the probability of slope failure, such as the presence of a clay layer or improperly placed fill.

A qualified professional engineer or engineering geologist is needed to evaluate slope failure potential.

3.1.5 Advisory setbacks for slopes and building foundations

The following siting considerations are *advised* due to the potential effects of injecting too much water near foundations or near slopes. They are *not* meant to replace the judgment of a professional engineer, engineering geologist, or standard engineering best practices.

- Drywells should be no closer than 30 feet center to center or twice the depth, whichever is greater.
- Drywells should not be built on slopes greater than 25 percent (4:1).
- Drywells should not be placed on or above a landslide hazard area or slopes greater than 15 percent without evaluation by a professional engineer with geotechnical expertise or qualified geologist and jurisdiction approval.

- Drywells should be sited at least 100 feet up-slope and 20 feet down-slope from building foundations.
- Where a UIC well will be situated up-slope from a structure or behind the top of a slope inclined in excess of 15 percent, the minimum setback is typically equal to the height of the slope. This evaluation would need to be done by a qualified licensed professional engineer or engineering geologist.

3.2 Design and construction

3.2.1 Use an approved stormwater manual

In order to be rule-authorized under the presumptive approach, UIC wells must be designed and installed in accordance with the stormwater manual current at the time of construction.

They must also be operated in conformance with stormwater best management practices. This includes the proper selection, implementation, and maintenance of on-site pollution controls using the current stormwater manual published by the department for your region. An equivalent local manual approved by the department may be used instead (WAC 173-218-090(1) (B)).

3.2.3 Prevent clogging during construction

In order to prevent clogging, UIC wells must be protected from sediment in runoff generated during construction. See Ecology stormwater management manuals for source controls to prevent other pollutants from entering the UIC well during the construction phase of a project.

3.2.3 Stormwater runoff flow control

If a UIC well is used to meet stormwater program requirements, the combination of UIC wells and other stormwater facilities at the site must be capable of handling the water quality design runoff treatment storm volume.

The water quality design runoff treatment storm volume is the amount of runoff predicted from the 6-month, 24-hour storm. The objective is to design a facility that accommodates the runoff expected from a typical large storm event.

For UIC wells, an evaluation of the infiltration capacity is necessary to determine if the well will be able to accommodate the necessary volume of water. Infiltration rates lessen over time due to clogging, so the long-term infiltration rate under the worst-case scenario should be accommodated by the design.

The amount of time it takes for water to drain out of a UIC well depends on how fast the soil allows water to infiltrate and how much water the UIC well holds.

The *soil infiltration rate* is the amount of water that infiltrates into the ground in a specified amount of time, usually in inches per hour.

The *drawdown time* is the amount of time it takes for water to drain out of the UIC well, and depends on the construction of the well and the infiltration rate.

In most cases, facilities are designed to completely drain ponded runoff from the flow control design storm within 48 to 72 hours after flow to the UIC facility has stopped.

For stormwater flow requirements under the stormwater program, refer to the Ecology stormwater management manuals or other equivalent department approved local stormwater manuals. Local jurisdictions may also have requirements.

3.2.4 Depth to bedrock, water table, or impermeable layer

Chapter 173-218-090 WAC requires that new Class V UIC wells used for storm water management must *not* directly discharge into ground water. A separation between the bottom of the well and the top of the ground water is required. New UIC wells are those that were constructed on or after February 3, 2006.

Vertical separation for rule-authorization using the presumptive approach

The required vertical separation for rule-authorization using the presumptive approach depends on the treatment capacity of the unsaturated zone and the pollutant loading of the discharge. Chapter five of this guidance includes a method of arriving at the vertical separation and subsequent pretreatment requirements.

The *minimum* vertical separation is five feet between the base of a UIC well and the high seasonal water table, bedrock, hardpan, or other low permeability layer.

When the five-foot minimum separation cannot be met

If the vertical separation required to meet the presumptive approach cannot be met, rule-authorization may be obtained using the demonstrative approach. The demonstrative approach is described in section 2.5.2 of this document.

If the pretreatment requirements are met, a separation down to three feet may be considered if the ground water mounding analysis, the volumetric water holding capacity of the zone receiving the water, and the design of the overflow and/or bypass structures are judged by the design professional to be adequate to prevent overtopping and meet the site suitability criteria specified in this section.

3.2.5 Other advisory design considerations

- Filter fabric (geotextile) may be useful in appropriate situations to prevent sedimentation.
- Check with the local jurisdiction for outflow capacity and other requirements.

The Department of Ecology recommends a two-stage drywell for new drywell installations or when replacing an existing drywell.

3.3 Operation and maintenance

UIC wells need to be maintained in order to avoid clogging and to prevent contamination from materials that collect in the well over time. The following practices help to maintain UIC function:

- Pre-treatment for solids removal is recommended to ensure protection of long-term infiltration capacity and reduced frequency of maintenance.
- Pre-treatment will also reduce the long-term accumulation of contaminants in the vadose zone.
- Frequent inspections and regular maintenance will improve the long-term performance of the facilities.
- The removal of debris and sediment from the drywell prevents the buildup of materials that could inhibit infiltration.

Please refer to the appropriate stormwater manual for maintenance requirements for particular BMPs.

Chapter 4 - Potential Contaminants in Stormwater Runoff

Urban areas and roads may contribute to stormwater contamination. A review of available urban and road runoff data provides information about the following potential pollutants:

- **Cadmium, chromium, lead, iron, and arsenic**

Although these metals are potential pollutants of concern, most of the suspended portion of the total concentrations of these metals in urban and road runoff may be removed by settling or filtration.

This typically leaves dissolved fractions that are expected to meet state ground water quality standards, except for arsenic.

Arsenic from natural sources is known to be present at levels of concern in ground water in many areas of Washington State.

- **Copper, zinc, and total suspended solids**

Typical concentrations in urban and road runoff do not generally appear to be an issue of concern for meeting Washington State ground water quality standards.

- **Coliform bacteria and other pathogens**

Concentrations in urban and road runoff commonly exceed ground water quality standards, and may exceed the capacity of the vadose zone to remove bacteria to a level that meets standards.

Filtration and separation from ground water are considered the most effective means of removing coliform bacteria. Existing runoff treatment technologies have mixed and unreliable results in addressing this issue.

- **Oil, grease and polynuclear aromatic hydrocarbons (PAHs), and fuel additives**

Oil, grease, and PAHs are of potential concern, particularly in the event of a large spill reaching an unprotected UIC well. Fuel additives are also of concern, as they may travel great distances in ground water.

- **Pesticides and nitrates**

Pesticides and nitrates may be a concern in areas where they are intensively applied. Nitrates and pesticides that are water soluble are very difficult to remove from stormwater.

■ **Chloride**

Typical concentrations of chloride in urban and road runoff do not generally appear to be an issue of concern for meeting Washington State ground water quality standards. Frequent use of road salts and other de-icers and anti-icers may result in pollutant concentrations that exceed ground water quality standards.

No runoff treatment technology currently exists to address this issue in a practical manner.

■ **Phosphorus**

Typical concentrations of phosphorus in urban and road runoff do not generally appear to be an issue of concern for meeting Washington State ground water quality standards. Phosphorus in ground water may still be a concern in small lake watersheds.

Table 4.1: Common Pollutants in Stormwater and Some Potential Sources¹

Pollutant	Potential Sources
Lead	Motor oil, transmission bearings, gasoline ²
Zinc	Motor oil, galvanized roofing, tire wear, down spouts
Cadmium	Tire wear, metal plating, batteries
Copper	Brake linings, thrust bearings, bushings
Chromium	Metal plating, rocker arms, crank shafts, brake linings, yellow lane strip paint
Arsenic	Smelters, fossil fuel combustion, natural occurrence
Bacterial/Viral Agents	Domestic animals, septic systems, animal & manure transport
Oil & Grease	Motor vehicles, illegal disposal of used oil
Organic Toxins	Pesticides, combustion products, petroleum products, paints & preservatives, plasticizers, solvents
Sediments	Construction sites, stream channel erosion, poorly vegetated lands, slope failure, vehicular deposition
Nutrients	Sediments, fertilizers, domestic animals, septic systems, vegetative matter
Heat	Pavement runoff, loss of shading along streams
Oxygen Demanding Organics	Vegetative matter, petroleum products

¹ Adapted from a number of sources: Novotny, V. and G. Chesters, 1981. *Handbook of Nonpoint Pollution*. Van Nostrand Reinhold Company, New York, p. 322. Galvin D. and R. Moore, 1982. *Toxicants in Urban Runoff*, METRO Toxicant Program, Report #2. METRO, Seattle, pp 3-89 - 3-92. PTI Environmental Services, 1991. *Pollutants of Concern in Puget Sound*. Puget Sound Estuary Program, U.S. EPA, Seattle, pp 47-51. URS et al., 1988. City of Puyallup, Stormwater Management Program. Technical Memorandum WQ-1: Stormwater Quality Issues. Table 1.

² Although lead is no longer an additive to gasoline, it is still present in the environment in trace amounts and the remaining lead on the ground can be picked up by stormwater runoff.

Chapter 5 – Source Control, Pre-Treatment and Vadose Zone Treatment Requirements

The requirements in this chapter apply to UIC wells built on or after February 3, 2006.

Source control and treatment requirements are based on the types and quantities of pollutants expected from the proposed land use contributing storm runoff to the UIC well.

A UIC well is presumed to meet the non-endangerment standard and is rule-authorized if the guidelines in this document are followed, based on one or more of the following:

- (1) Application of source control measures to control loading of pollutants that are difficult to remove from stormwater by filtration, settlement, or other treatment technologies.
- (2) Application of pre-treatment to remove pollutants before stormwater is discharged into the UIC well.
- (3) Availability of appropriate vadose zone treatment capacity to remove the solid phase of pollutants in stormwater by filtration and adsorption.

5.1 Source Control

Source control BMPs can significantly reduce pollutants, especially solids, and should be employed at all project sites.

Where there are no existing stormwater treatment technologies to practically address a pollutant issue, and where filtration by the vadose zone cannot provide adequate removal of pollutants, source control must be used to meet the non-endangerment standard. Certain discharges to UIC wells are prohibited (see Section 2.2).

Source control is necessary to protect ground water from pathogens, pesticides, nitrates, road salts and other anti-icers and deicers, fuel additives, many other pollutants in urban runoff, and accidental spills.

Wherever practicable, reduce the exposure of stormwater to these contaminants by one or more of the following:

- Careful attention to the product label application rates.
- Targeted product use to avoid contamination of stormwater runoff.
- Careful management of the storage and use of products.
- Separation of areas where products are used from drainage areas that discharges to a UIC well.
- Spill response planning.

Source control best management practices required to meet the non-endangerment standard may be found in:

- Chapter 8 of the *Stormwater Management Manual for Eastern Washington* (Department of Ecology Publication # 04-10-076).
- Volume IV of the *Stormwater Management Manual for Western Washington* (Department of Ecology Publication # 99-14).
- Other equivalent department approved manuals.

Contact the local jurisdiction to determine whether specific source control requirements apply to your project in addition to those methods described in Ecology stormwater management manuals for the proposed land use.

5.1.1 General guidelines for spills and illegal dumping

Spill control guidance for various land use types is contained in Ecology's stormwater manuals and is not repeated here, except for some summary information. The spill control requirements in the stormwater manuals also apply to protection of stormwater discharge to UIC wells.

For specific details on spill control requirements, see the following sources:

- Chapter 8 of the *Stormwater Management Manual for Eastern Washington*. (Department of Ecology Publication # 04-10-076)
- Volume IV of the *Stormwater Management Manual for Western Washington*. (Department of Ecology Publication # 99-14)
- Other equivalent department approved manuals.

The following information should be considered:

- UIC wells should be inspected regularly to check for unreported spills.
- All spills must be reported to the Department of Ecology. See <http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm> or Appendix B.
- In the event that a spill occurs and spreads through the vadose zone, the owner or operator must remove and properly dispose of the contaminated soils and replace them with clean materials as soon as practicable.

Depths greater than 25 feet are difficult to clean up with soil removal equipment. If removal of deeper contaminated sediments is not practical, remediation and long-term ground water monitoring may be required. Spill control can help avoid the high costs and difficulties associated with cleanup.

- Local or state authorities may prohibit the use of UIC wells subject to frequent spills or illegal dumping.

These may be areas where incidents have occurred or where there is sufficient evidence that a UIC well would be attractive to illegal dumping. For example, UIC wells at many auto parts shops, restaurants, and food processing facilities have been subject to frequent illicit discharges by customers or employees.

Designers should discuss potential problems with their clients and take care to locate UIC wells to minimize easy, unobtrusive access for illegal dumping.

5.1.2 Spill containment structures

The type of land use will determine if a spill control containment structure is required. See the stormwater manual chapter on source control for more information on spill containment structures and when they are required.

High vehicle traffic areas (see definition below), fueling stations, and other facilities where fueling activities take place, and areas where petroleum products are stored and/or transferred in amounts greater than 1,500 gallons per year, must include:

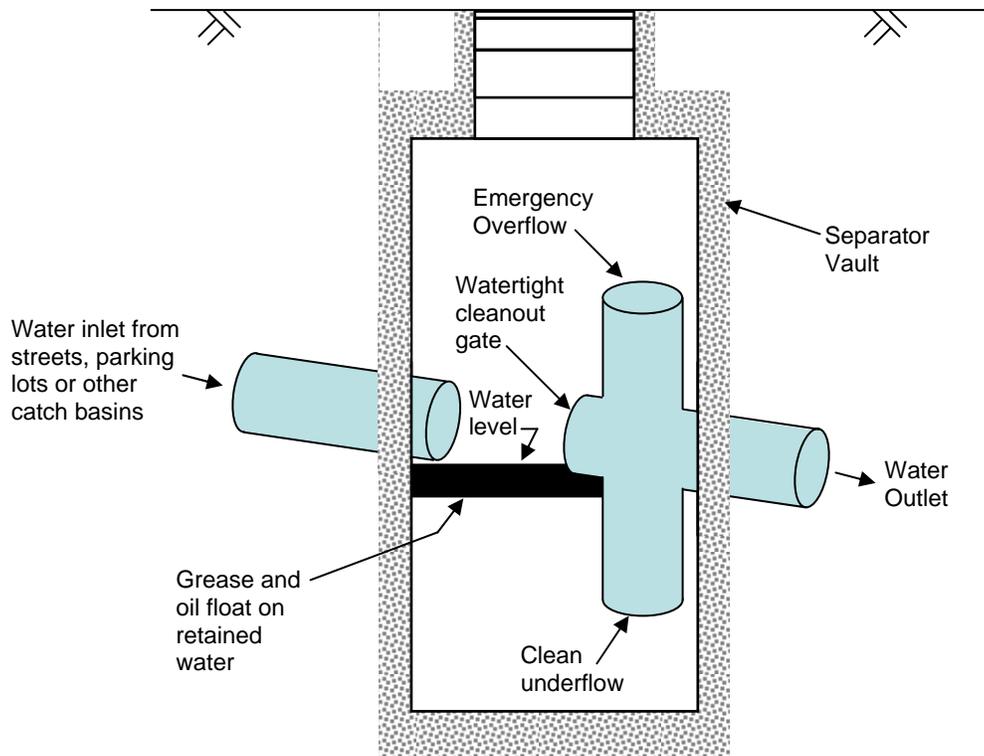
- A spill containment structure.
- A spill prevention control and containment plan (see stormwater management manual).

High vehicle traffic areas are:

- *Commercial or industrial sites subject to an expected average daily traffic count (ADT) ≥ 100 vehicles/1000 ft² gross building area (trip generation).*
- *Road intersections with an ADT of $\geq 25,000$ on the main roadway, and $\geq 15,000$ on any intersecting roadway.*

5.1.3 Spill control devices

Examples of a *spill control device* are a tee section or turn down elbow designed to retain a limited volume of pollutant that floats on water, such as oil or antifreeze. Spill control devices are passive and must be cleaned out to remove the spilled pollutant



Source: 1992 Ecology Stormwater Manual.

Figure 5.1: A spill control (SC) separator. A catchbasin with a T-inlet for temporarily trapping small volumes. Source: 1992 Ecology Stormwater Manual.

At high-use sites except for those listed in the previous section (high traffic areas), the UIC well must include a spill control device.

These high-use sites include:

- Parking areas with trip end count equal to or greater than 300 vehicles or 100 trip ends per 1000 square feet of gross building area.
- A commercial or industrial site subject to use, storage, or maintenance of a fleet of 25 or more diesel vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.). See Chapter 2.2 for prohibitions.
- A commercial or industrial site subject to petroleum storage and transfer in excess of 1,500 gallons per year (does not include locations where heating fuel is routinely delivered to end users and the annual amount of heating oil used at the site is the sole basis for the site meeting this definition; except for heating fuel handling and storage facilities).
- Maintenance and repair facilities for vehicles, aircraft, construction equipment, railroad equipment, or industrial machinery and equipment. See Chapter 2.2 for prohibitions.
- Fueling stations and facilities.
- Outdoor areas where hydraulic equipment is stored.

- Log storage and sorting yards and other sites subject to frequent use of forklifts and (or) other hydraulic equipment.
- Railroad yards.

In eastern Washington only: the following are also high use sites:

- All roads with ADT equal to or greater than 30,000 vehicles per day.
- Commercial on-street parking areas on streets with an expected total ADT count equal to or greater than 7,500.

A spill response plan and employee training are required to reduce the risk of stormwater contamination.

5.1.4 Evaluating the need for spill containment structures or control devices for other situations

A spill containment structure or spill control device should also be used if in the designer's judgment spills are likely during the life of the project (see stormwater management manual).

Impervious surfaces contributing stormwater to UIC structures should be evaluated for risk of exposure to potential spills.

For *traffic surfaces*, the designer should consider whether any of the following conditions are present.

- Locations where traffic accidents are likely to occur, such as the bottom of a steep hill, a dangerous intersection, or a sharp turn in a road.
- Roads in industrial areas or with frequent daily travel by tanker trucks.
- Other situations that increase the risk for accidental spills.

For *commercial and industrial sites*, the designer should consider:

- The types of materials that will be handled and stored at the site.
- Site layout and spill response plans.
- Probable employee training and preparation for responding to a spill
- Protecting the UIC well from receiving spilled material.

5.2 Pre-treatment

The best management practices chosen for the site must remove or reduce the target pollutants to levels that will comply with state ground water quality standards when the discharge reaches the water table or first comes into contact with an aquifer (see WAC 173-200). Each best management practice is designed to reduce or eliminate certain pollutants. See Ecology's stormwater management manuals, to determine the required best management practices that apply to the pollutants at your site, see Chapter 5 of the *Stormwater Management Manual for Eastern Washington* or Volume V of the *Stormwater Management Manual for Western Washington* for best management practices applicable to your site.

These best management practices include filtration and bio-infiltration, water quality vaults and wetpools, oil/water separators, manufactured devices (such as catch basin inserts, media filters, and other emerging technology), and other approved facilities that provide treatment of expected pollutants (using filtration, adsorption, or sedimentation processes) for flows up to the water quality design storm.

Alternatively, project proponents may request conditional approval from Ecology for a new or experimental treatment method following the protocol described in Ecology stormwater management manuals, see *Stormwater Management Manual for Western Washington* (SMMWW), chapter 12 Emerging technologies, or *Stormwater Management Manual for Eastern Washington* (SMMEW) chapter 5.

Pretreatment when space is limited

The Ecology stormwater manuals list treatment technologies that have a relatively small footprint. These include filter systems, such as the Contech Stormfilter, the CDS Media filter, the Contech Vortfilter, the Ecology Embankment, the Aquashield Aquafilter, and the HydroInternational Downstream Defender. More information on the technologies can be found at: <http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html>.

Example: A jurisdiction needs to install a UIC well to prevent flooding of the road. The right-of-way is too narrow to allow a basic treatment structure such as a swale. One solution is to use basic treatment that has a small footprint, including some that fit inside the UIC well.

Alternatively, the demonstrative approach (see Chapter 2) may be used.

5.2.1 Preserving infiltration rates

Removing solids from stormwater runoff before it is discharged to a UIC well helps preserve infiltration rates over the long term. UIC wells used for flow control are required to have solids removed prior to discharge. Pre-treatment for solids removal must be designed, constructed, operated and maintained in accordance with an Ecology stormwater manual or an equivalent department approved local manual.

Coliform bacteria and other pathogens in stormwater come from many sources. Examples are manure fertilizers, pet waste, and confined animal feeding operations.

The NPDES Phase II stormwater permit requires subject municipalities to control sources of pathogens to prevent stormwater contamination. Under the permit, they must address illicit discharges to sewers and educate target audiences about preventing pet wastes from contaminating stormwater. These measures help prevent pathogens from contaminating stormwater. Similar measures can be applied to discharges to UIC wells.

Private well owners must ensure that their UIC wells are appropriately protected from sources of bacterial contamination.

The following conditions increase the risk for contamination and require additional precautions:

- The UIC well is less than 100 feet from a drinking water supply well and the seasonal high water table is less than 15 feet below the bottom of the UIC well.

Pre-treatment for solids removal is required. This is called *basic treatment* in Ecology's stormwater management manuals.

- The UIC well is less than 1000 feet from a drinking water supply well or less than 100 feet from a surface water body that is impaired due to coliform bacteria, and the vadose zone treatment capacity is categorized as "low" or "none." See Table 5.2 at the end of this chapter.

Pre-treatment for solids removal is required. This is called *basic treatment* in Ecology's stormwater management manuals.

- The UIC well is located where it could receive runoff from areas or sites that generate high coliform bacteria loadings.

Stormwater treatment facilities are unreliable in removing coliform bacteria and other pathogens from runoff. Because of this, UIC wells shall not receive direct stormwater discharges from areas or sites that generate high coliform bacteria loadings, such as concentrated animal feeding operations.

Alternatively, this type of runoff may be:

- Discharged to the sanitary sewer, if this is allowed by the local jurisdiction.
- Used for crop irrigation, as long as other applicable requirements are met.
- Directed to a biofiltration or bioinfiltration system.
- Diverted through constructed wetlands prior to discharge to a UIC well.

5.2.3 Soluble pollutants

Many soluble pollutants that are commonly found in stormwater (including pesticides, fertilizers, road salts, and other chemical pollutants) are very difficult to remove from stormwater. Source controls applicable to the land use and activities at the site are required to reduce the contamination of stormwater from these chemicals.

See Chapter 8 of the *Stormwater Management Manual for Eastern Washington* (Department of Ecology Publication # 04-10-076) or Volume IV of the *Stormwater Management Manual for Western Washington* (Department of Ecology Publication # 99-14) for best management practices applicable to your site.

5.2.3.1 Special requirements

The following land uses, conditions, and activities have special requirements. However, UIC wells located in parking lots or other impervious areas would follow the source control and treatment requirements for solids, metals, and oils.

A. Sites with pesticides, fertilizer, and nutrients in runoff

Areas such as golf courses, public ball fields, and cemeteries typically use pesticides and fertilizers for landscape management. Examples of other activities that generate high nutrient loads include commercial composting, commercial animal handling areas, and nurseries.

Runoff that would violate ground water quality standards because it is contaminated by pesticides or fertilizers and other nutrients should **not** be discharged directly to UIC wells.

Non-biological treatment systems, such as catch basins, are ineffective at removing these pollutants from runoff. Instead, runoff from these types of landscaped areas should be directed to biofiltration or bioinfiltration systems or to constructed wetlands prior to discharge to UIC wells. Stormwater with fertilizer or nutrients may be used to irrigate crops in accordance with other applicable requirements.

The following practices are encouraged:

- Limit use of applied chemicals.
- Design the site to minimize runoff from the landscaped surface.

The term “pesticides” includes a host of chemicals with varying chemical fate and transport characteristics. Some pesticides travel to ground water more readily because they are more water soluble and less likely to “stick” or sorb to particles of earth. These pesticides need to be treated by a biological treatment method, such as a bioswale or constructed wetland. UIC wells that receive stormwater with pesticides that use one of these biological treatment methods are rule-authorized when they are registered, providing this technical guidance is followed.

If UIC owners wish to use a different treatment method for pesticides, they may apply to the department for rule-authorization using the demonstrative approach outlined in this guidance.

B. Industrial activities

The Environmental Protection Agency has listed industrial activities that have monitoring requirements for nitrate, nitrite, ammonia, or phosphorus. This list is reproduced in Appendix A. Runoff from these sites must be directed to one of the following:

- Biofiltration or bioinfiltration systems.
- Constructed wetlands prior to discharge.
- Sanitary sewer if allowed by the local jurisdiction.
- Municipal storm sewer, if allowed by the local jurisdiction and following pre-treatment for removal of solids.

Facilities may complete a *no exposure* certification as part of Ecology’s UIC well registration process to be exempted from these requirements. In order to qualify, no outdoor processing, handling, or storage of raw solid materials or finished products may take place at the facility. Industrial facilities that qualify for no-exposure certification may use the Tables 5.2 – 5.4 at the end of this section to determine pre-treatment requirements.

5.2.4 Solids, metals, and oil

5.2.4.1 Tables to determine treatment requirements

Table 5.2, Table 5.3 and Table 5.4 at the end of this chapter are intended for use in meeting the requirements of the presumptive approach. Project proponents and local jurisdictions following the demonstrative approach may define other treatment capacity categories and pollutant loading requirements (see section 2.5.2).

Where adequate geologic and groundwater depth information are available, Table 5.2, Table 5.3, and Table 5.4 at the end of this chapter can be used to evaluate whether a stormwater discharge from a road, commercial site, or residential site to a UIC well is presumed to meet the non-endangerment standard for solids, metals, oil, grease, and PAHs.

Used together, the tables identify the extent to which the vadose zone is presumed to provide sufficient treatment for a given pollutant loading classification and whether additional pretreatment is necessary to meet the groundwater quality standards for these pollutants.

At sites where the vadose zone is presumed to provide sufficient treatment to protect groundwater quality, pretreatment is not required prior to discharge to the UIC well.

Industrial sites with no outdoor processing, storage, or handling of raw or finished products may also use these tables.

5.2.4.2 Treatment requirements

Commercial roofs

Roof runoff from commercial businesses with ventilation systems specifically designed to remove commercial indoor pollutants must be evaluated on a case-by-case basis to identify the pollutants of concern and the appropriate pre-treatment requirements.

In general, this runoff may be classified as a “medium” pollutant loading source (see Table 5.3 at the end of this chapter), and the requirements of this section may be applied to discharges from these areas to UIC wells.

Industrial roofs

Roof runoff from industrial facilities must be evaluated on a case-by-case basis and should be treated according to the other best management practice requirements for the facility. See the previous page for special requirements for industrial facilities (section 5.4.3.1).

5.2.4.3 Oil control

Treatment to remove oil means to apply one of the separation or adsorption technologies identified in an Ecology stormwater manual.

Stormwater with pollutant loadings in the “high” category, as described in Table 5.4, must be pre-treated for removal of oil.

An oil-water separator should be used at high-density intersections and at commercial or industrial sites subject to an expected average daily traffic count (ADT) ≥ 100 vehicles/1000 ft² gross building area. These areas are expected to generate sufficient quantities of oil to justify the operation of a separator.

Basic treatment that also provides adsorptive capacity may be used at:

- Other sites where oil control is required except for the ones listed above.
- Commercial parking and streets with ADT > 7500. Alternatively, a simple passive oil control device, such as a turned down elbow, may be used.
- In eastern Washington, roads with ADT > 30,000. See table 5.4, footnote 3.

Examples of basic treatment that provide adsorptive capacity include biofiltration swales, bioinfiltration swales, filters, and catch basin inserts. See Ecology’s stormwater management

manuals or other equivalent department approved manuals for more examples and information on these BMPs.

5.2.4.4 Solids removal

Pre-treatment for solids removal is required:

- At commercial sites with outdoor handling or storage of raw solid materials. Examples include gravel, sands, logs, salts and compost.
- At industrial sites listed in Appendix A where outdoor processing, handling, or storage of raw solid materials or finished products, including outdoor loading areas for these materials or products, takes place. These are sites defined by EPA (40 CFR 122.26(b)(14)).

Stormwater associated with construction activities classified under the federal rules, 40 CFR 122.26(b)(14)(x) are exempt from this requirement.

- When an evaluation of storm runoff from roofs subject to ventilation systems that are specifically designed to remove commercial indoor pollutants identifies the need for pre-treatment for solids removal.

5.3 Vadose zone treatment capacity

Studies of stormwater pollutant concentrations in water through and below infiltration systems show mixed results in the effectiveness of vadose zone filtration in protecting ground water quality (USEPA 1999; Pitt *et al.* 1999; Mason *et al.* 1999; and Appleyard 1993).

Many of the problems documented in these studies can be corrected by proper siting, design and use of the facilities, enhanced source control, additional pre-treatment prior to discharge to the facilities, or prohibition of the discharge.

Studies of sub-surface infiltration systems also indicate that filtered and adsorbed pollutants accumulate in the vadose zone at depths of less than a few feet below the facilities at concentrations that may require soil cleanup activities upon decommissioning of a UIC well (Mikkelsen *et al.* 1996 #1 and #2; Appleyard 199.).

Because contaminated soil removal and disposal costs can be considerable, project proponents may wish to consider including pre-treatment facilities to remove solids from stormwater runoff and avoid potential cleanup requirements following long-term use of the UIC well. This caution is addressed to UIC wells receiving runoff from commercial and industrial areas and from traffic areas with moderate to high use. For examples of traffic areas with moderate and high use, see Table 5.3.

In general, the vadose zone may provide adequate filtration, adsorption, and other pollutant reduction capacity to meet the non-endangerment standard for solids, metals, oil, grease, and PAHs. The tables at the end of this section may be used to evaluate the use of the vadose zone for treatment and to determine pre-treatment requirements for these pollutants.

5.3.1 Classification of vadose zone treatment capacity

Table 5.2 classifies the treatment capacity of the vadose zone as high, medium, low, and none. These classifications are based on minimum thickness and the geologic materials that make up the treatment layer.

Several different ways of describing the geologic materials are used, including grain-size distribution, sand-to-fines ration, well log lithology, and geologic names. Examples of these are given in Table 5.1.

Table 5.1: Examples of Geologic Material Descriptions

Geologic Material Description Method	Example
Grain size distribution	Materials with median grain size <0.125mm
Sand-to-fines ratio	Having a sand to silt/clay ratio of less than 1:1 and sand plus gravel less than 50%
Well log lithology	Sandy or silty clay Silt Clayey or sandy silt Sandy loam or loamy sand Silt/clay with inter-bedded sand
Geologic name	This category generally includes till, hardpan, caliche, and loess

The ability of geologic materials to filter or adsorb pollutants such as solids, oils, and metals is related to grain size, the amount of organic matter, and the presence of clays, among other factors. Native organic matter improves adsorption and filtration (Ingloria et. al., 1997) but is rarely found at depths below UIC wells.

High Treatment Capacity

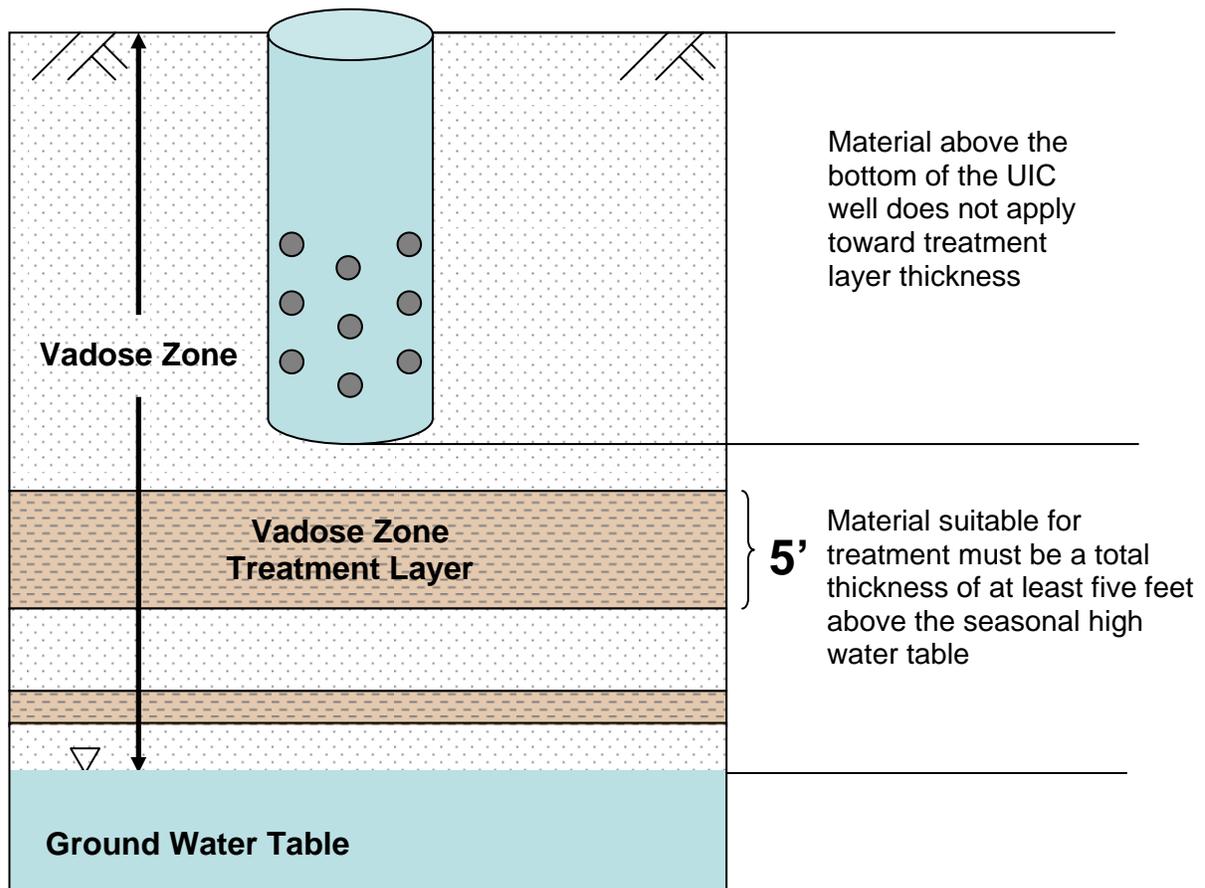


Figure 5.2: Schematic Vadose Zone Treatment Layer Example

Geologic materials that are classified as having a *high treatment capacity* are fine-grained with a greater capacity to filter discharges. These materials also tend to remove pollutants by chemical reactions such as cation exchange capacity and sorption. These may be mixtures of materials where silt and clay fill the void spaces in the matrix of the coarser materials. More compaction results in better filtration. High treatment capacity layers must total a minimum of five feet between the bottom of the UIC well and the seasonal high water table.

Geologic materials that are classified as having a *medium treatment capacity* provide moderate to high filtration and have minor or no chemically reactive characteristics. Medium treatment capacity layers must total a minimum of ten feet.

Geologic materials that are classified as having a *low treatment capacity* provide some minimal filtration. Although the sand and gravel mixtures in this category may provide moderate filtration when the UIC well is initially installed, preferential flow paths develop that reduce this capacity. Low treatment capacity layers must total a minimum of 25 feet between the bottom of the UIC well and the seasonal high water table.

Geologic materials that are classified as having *no treatment capacity* do not provide filtration to remove pollutants. Since this type of material does not have treatment capacity, pre-treatment is always required except for sites that are classified as having an insignificant pollutant load in Table 5.3.

5.3.2 Vadose zone materials

In most cases, site exploration will be required to obtain sufficient data to determine the treatment capacity of the vadose zone materials using Table 5.2, in particular where reliable regional information or nearby borehole logs are not readily available.

In some cases, geologic information may be available from regional geology maps in publications from the Department of Natural Resources or U.S. Geological Survey, from a well borehole log(s) in the same quarter-section on the Ecology Web site, see <http://apps.ecy.wa.gov/welllog/> or from local governments.

The following should be kept in mind when using these sources.

- Surface soils maps generally do not provide adequate information although the parent material information provided may be helpful in some locations.
- Well borehole log locations should be verified as electronic data bases contain many errors of this type.
- When using borehole logs, a nearby site is generally within a quarter of a mile and preferably within 50 to 500 feet, depending on the heterogeneity of the region
- Subsurface geology can vary considerably in a very short horizontal distance in many areas of the state. Professional judgment should be used to determine whether the available data are adequate or site exploration is necessary.

Alternatively, for small projects where site exploration is not cost-effective, a design professional might apply a conservative design approach subject to the approval of the local jurisdiction.

5.3.3 Depth to ground water

The minimum required separation between the bottom of the facility and the highest seasonal water table depends upon the characteristics of the vadose zone, the potential for mounding of infiltrating stormwater above the water table, and the degree of certainty of available data as to the seasonal high water table elevation.

Knowledge of the seasonal high water table is especially important for siting UIC wells in areas with seasonal high water table less than fifteen feet below the bottom of the UIC well.

Significant mounding of infiltrating stormwater can occur above the water table (Appleyard, 1993) and UIC wells must not discharge stormwater directly into ground water at any time. This applies even if the groundwater level is rising in response to the UIC discharge.

Water level information is also needed to confirm the thickness of the treatment layer in the vadose zone between the bottom of the UIC well and the highest known ground water level. Ground water depths may be available from the following sources.

- Site exploration
- Department of Ecology, <http://apps.ecy.wa.gov/wellog/>
- Department of Natural Resources
- U.S. Geological Survey publications
- Local governments

Water level data associated with a single borehole log may be insufficient to determine the seasonal high water table. This is especially true if the borehole drilling followed a wet season with lower than normal precipitation or occurred outside of the season when water tables are normally the highest. Seasonal high water tables generally occur during late winter through mid-spring in most of Washington State. In heavily irrigated areas, the seasonal high water table elevation may occur in late summer.

At sites where the fluctuation of the seasonal water table is large (several feet) or unknown, designers should err on the side of caution. UIC wells must not discharge stormwater directly into ground water.

5.3.4 Exceptions to tables 5.1 through 5.3 based on site-specific or local studies

Exceptions to the tables may be made when:

- Local planning efforts generate an alternative method that meets the non-endangerment standard based on local conditions.
- More detailed site-specific data are gathered by the project proponent and local permission is granted under a locally developed stormwater management program.

When local planning efforts generate an alternative method

Local planning may generate alternate methods that may be used instead of the one used in Table 5.2, Table 5.3 and Table 5.4. For example, local jurisdictions may choose to allow changes in the pollutant loading categories in Table 5.3 based on source control activities at a site. The local alternative method must meet the non-endangerment standard based on local conditions.

When there is site-specific data and local permission is granted

The minimum vadose zone treatment layer thicknesses listed in Table 5.2 may be changed to three feet for a high-capacity treatment matrix and to six feet for a medium-capacity treatment matrix when the following requirements are met.

- The UIC well is regulated under a local stormwater management program approved by the department, and the local authority approves the change in minimum thicknesses.
- The discharge is to a publicly-owned UIC well.
- The pollutant loadings are insignificant or low.

- Reliable on-site information is available. If local geology does not vary greatly, borehole logs within one-quarter mile of the proposed UIC well may be used.
- If the three feet of high-capacity treatment matrix provides the entire separation between the bottom of the structure and the seasonal high water table, site specific water level data must be collected to justify the minimal separation from the water table.
- The potential for mounding of infiltrating stormwater above the water table must be evaluated. If mounding is likely, then additional separation or pre-treatment is needed

5.3.5 Tables to determine pre-treatment requirements for solids, metals, and oils

The following three tables help UIC well owners determine what pre-treatment is required for discharges from roads, parking areas or roofs for solids, metals, and oil. These tables may also be used at industrial sites where stormwater has no contact with outdoor industrial activities outdoors. In this case, a *no-exposure certificate* must be submitted (see Ecology’s website at <http://www.ecy.wa.gov/biblio/ecy070228.html>).

- **Vadose zone treatment capacity:** Table 5.2 categorizes the treatment capacity of the vadose zone beneath the UIC well. If vadose zone conditions are unknown or the minimum thickness is not present, use “None” for treatment capacity.
- **Pollutant loading:** Table 5.3 categorizes the amount of pollutant loading for solids, metals and oil in stormwater runoff that will be discharged to a UIC well.
- **Pre-treatment requirements:** Table 5.4 crosses Table 5.2 and Table 5.3 to give the appropriate treatment level for the vadose zone conditions and the expected pollutant loading.

Example of how to use tables 5.2 – 5.4

A customer-only parking lot for a proposed retail store will average 250 vehicles per day according to estimates. A well log from a location within one-quarter mile shows that ground water is at an estimated depth of 26 feet below ground surface. The well log also shows that there is a layer of fine sand from 2 feet to 28 feet below ground surface. The bottom of the UIC well is at 14 feet.

Table 5.2 shows us that fine sand is in the medium vadose zone treatment category.

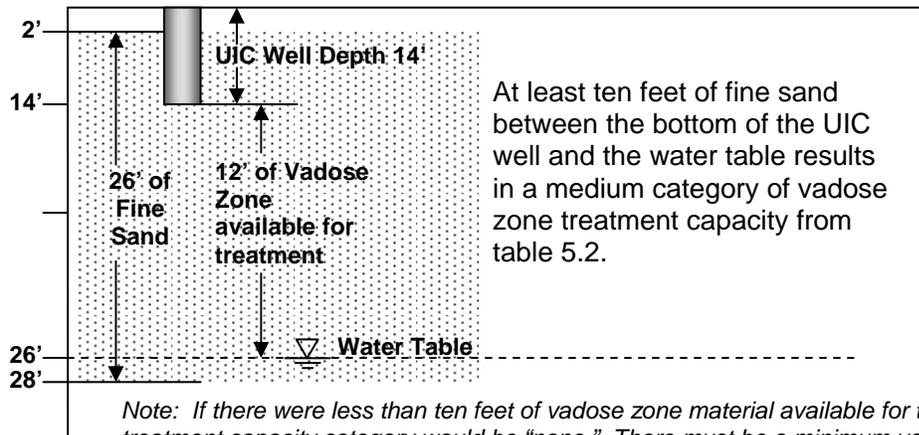
We now need to determine if there is a minimum of ten feet of vadose zone material that qualifies for the medium treatment category. We also need a vertical separation of five feet between the bottom of the UIC well and the water table; however, if there is at least ten feet of vadose zone material between the bottom of the well and the water table, this condition has been met.

The distance between the bottom of the UIC well and the water table is 12 feet and the entire 12 feet consists of medium sand.

⇒ **A minimum of ten feet of medium sand is present. The vadose zone treatment capacity is medium.**

Table 5.3 shows us that the medium category includes parking lots with traffic from 100 to 300 total trip ends.

⇒ **Therefore, the pollutant loading category from table 5.3 for 250 visits to the parking lot per day is medium.**



Note: If there were less than ten feet of vadose zone material available for treatment, the vadose zone treatment capacity category would be "none." There must be a minimum vertical separation of five feet between the bottom of the UIC well and the water table except as noted in this document.

Figure 5.3: Vadose Zone Treatment Capacity Example Diagram

Table 5.4 shows us that a medium vadose zone treatment (from table 5.2) capacity and medium pollutant load (from table 5.3) requires the use of a two-stage drywell.

Table 5.2: Vadose Zone Treatment Capacity

The treatment capacity classifications describe the vadose zone between the bottom of the UIC well and the top of the highest known seasonal water table. This table will be used to determine pre-treatment requirements when using Table 5.4. If vadose zone conditions are unknown, use *None* for treatment capacity. If thicknesses are less than those listed, use *None* for treatment capacity or you may consider using the demonstrative approach, see section 2.5.2. Separation between the bottom of the UIC well and the top of the water table is still required, see WAC 173-218-090(1) (b).

Treatment Capacity Classification and Required Minimum Thickness	Description of Vadose Zone Layer
<p style="text-align: center;">HIGH</p> <p style="text-align: center;">A minimum thickness of five feet</p>	<p>Materials with median grain size < 0.125 mm Having a sand to silt/clay ratio of less than 1:1 and sand plus gravel < 50% Lean, fat, or elastic clay Sandy or silty clay Silt Clayey or sandy silt Sandy loam or loamy sand Silt/clay with inter-bedded sand Well-compacted, poorly-sorted materials This category generally includes till, hardpan, caliche, and loess</p>
<p style="text-align: center;">MEDIUM</p> <p style="text-align: center;">A minimum thickness of ten feet</p>	<p>Materials with median grain size 0.125mm to 4mm Sand to silt/clay ratio from 1:1 to 9:1 and percent sand > percent gravel Fine, medium or coarse sand Sand with interbedded clay and/or silt Poorly-compacted, poorly-sorted materials This category includes some alluvium and outwash deposits</p>
<p style="text-align: center;">LOW</p> <p style="text-align: center;">A minimum thickness of twenty-five feet</p>	<p>Materials with median grain size > 4mm to 64mm Having a sand to silt/clay ratio greater than 9:1 and percent sand less than percent gravel Poorly-sorted, silty or muddy gravel Sandy gravel, gravelly sand, or sand and gravel This category includes some alluvium and outwash deposits</p>
<p style="text-align: center;">NONE</p> <p style="text-align: center;">Minimum thickness not applicable</p>	<p>Materials with median grain size >64mm Having total fines (sand and mud) less than 5% Well-sorted or clean gravel Boulders and/or cobbles Fractured rock This category generally includes fractured basalt, other fractured bedrock, and cavernous limestone</p>

Table 5.3: Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells

These are the categories of pollutant loadings used to determine whether the facility is exempt from the pre-treatment requirement when using Table 5.4.

Classification	Areas Contributing Runoff to the UIC Well (ADT = Average Daily Traffic)
Insignificant	Impervious surfaces not subject to motorized vehicle traffic or application of sand or deicing compounds Un-maintained open space
Low	Parking areas with <40 trip ends per 1000 SF of gross building area or <100 total trip ends Other land uses with similar traffic/use characteristics (e.g. most residential parking and employee-only parking areas for small office parks or other commercial buildings) Inside Urban Growth Management Areas Fully controlled and partially controlled limited access highways with ADT less than 15000 Other roads with ADT less than 7500 vehicles per day Outside Urban Growth Management Areas All roads with ADT less than 15000 vehicles per day
Medium	Parking areas with between 40 and 100 trip ends per 1000 SF of gross building area or between 100 and 300 total trip ends Primary access points for high-density residential apartments Intersections controlled by traffic signals that do not meet the definition of a high-density intersection (see Glossary) Transit center bus stops Other land uses with similar traffic/use characteristics (e.g. visitor parking for small to medium commercial buildings with a limited number of daily customers) Inside Urban Growth Management Areas Fully controlled and partially controlled limited access highways with ADT between 15000 and 30000 vehicles per day Other roads with ADT between 7500 and 30000 vehicles per day Outside Urban Growth Management Areas All roads with ADT between 15,000 and 30,000 vehicles per day
High	High Use Sites In eastern Washington, all roads with ADT >30000 vehicles per day High-density intersections Parking areas with >100 trip ends per 1000 SF of gross building area or >300 total trip ends On-street parking areas of municipal streets in commercial and industrial areas Highway rest areas Other land uses with similar traffic/use characteristics (e.g., commercial buildings with a frequent turnover of visitors, such as grocery stores, shopping malls, restaurants, drive-through services, etc.

Table 5.4: Pre-treatment Required for Solids, Oil and Metals

Find the *Treatment Capacity Classification* from Table 5.2 and the *Pollutant Loading Classification* from Table 5.3. Use Table 5.4 to determine the pre-treatment requirements for solids, oil, and metals based on these classifications. Pre-treatment technologies for solids, oil, and metals removal are provided by the Department of Ecology stormwater manuals.

Treatment capacity Pollutant loading	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>None</i>
<i>Insignificant</i>	None	None	None	None
<i>Low</i>	None	None	None	Remove solids ²
<i>Medium</i>	Two-stage drywells ¹	Two-stage drywells ¹	Remove solids ²	Remove solids ²
<i>High</i>	Remove oil ³	Remove oil ³	Remove oil and solids ^{2,3}	Remove oil and solids ^{2,3}

¹ A **two-stage drywell** is a catch basin or other pre-settling/spill control structure that traps small quantities of oils and solids. The catch basin or other pre-settling/spill control device must be inspected and cleaned regularly (see the operation and maintenance requirements in Ecology stormwater management manuals).

² **Treatment to remove solids** means basic treatment. See the definition for basic treatment in the glossary. Removal of solids should remove a large portion of the metals in most stormwater runoff. Any special treatment requirements in this chapter still apply. For **low** pollutant loading sites, implementation of appropriate source control BMPs may be employed in lieu of structural treatment BMPs (see Ecology stormwater management manuals).

³ **Treatment to remove oil** is to be accomplished by applying one of the technologies identified in the Ecology stormwater management manuals.

At high-density intersections and at commercial or industrial sites subject to an expected average daily traffic count (ADT) of 100 vehicles/1000 ft² gross building area, sufficient quantities of oil will be generated to justify operation of a separator BMP.

At other high-use sites, project proponents may select a basic runoff treatment BMP that also provides adsorptive capacity, such as a biofiltration or bioinfiltration swale, a filter or catch basin insert, or other adsorptive technology, in lieu of a separator BMP. The requirement to remove oil for all roads with ADT > 30,000 applies only in eastern Washington. For these roads in eastern Washington, an oil control facility is not required; instead a basic treatment facility with sorptive characteristics (i.e., swale or sand filter) is required.

This requirement to apply a basic treatment facility with adsorptive characteristics also applies to commercial parking and to streets with ADT > 7500; alternatively a simple passive oil control device such as a turned down elbow may be used.

Chapter 6 – Bibliography

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Chapter 7 – Glossary

All known and reasonable treatment (AKART)

All known, available, and reasonable methods of prevention, control, and treatment. The most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge. The concept of AKART applies to both point and nonpoint sources of pollution. Best management practices (BMPs) typically applied to nonpoint source pollution controls are considered a subset of the AKART requirement. The *Stormwater Management Manual for Eastern Washington* may be used as a guideline, to the extent appropriate, for developing best management practices to apply AKART for stormwater discharges. AKART and Best Available Treatment (BAT) are roughly equivalent state and federal terms for the same concept.

Average daily traffic (ADT)

The average daily traffic is an estimate of how many cars use a roadway in a day, on average. Average daily traffic counts are generated when roadways are designed.

ADT count estimates may be obtained from:

1. The document *Trip Generation* (Institute of Transportation Engineers).
2. A traffic study prepared by a professional engineer.
3. A transportation specialist with expertise in traffic volume estimation.

Where used for UIC projects, ADT counts are to be estimated for twenty years after project completion. For project sites with seasonal or varied use, evaluate the highest period of expected traffic impacts.

Basic treatment

Treatment of stormwater with the goal of removing at least 80 percent of the solids present in the runoff using one of the treatment facilities or methods identified in Ecology stormwater management manuals. Basic treatment is required for all discharges where removal of solids is identified as a requirement. Additional treatment to remove metals, oil or phosphorus may be required at some sites or for some receiving water bodies.

Design storm

A prescribed hyetograph or precipitation distribution, and the total precipitation amount for a specific duration recurrence frequency. The design storm is used to estimate runoff for a hypothetical rainstorm of interest or concern for the purposes of analyzing existing drainage, designing new facilities, or assessing other impacts of a proposed project on the flow of surface water. Different design storms are

described for eastern and western Washington in Ecology stormwater management manuals.

High-use sites

High-use sites generate high concentrations of oil either because of a high traffic turnover or the frequent transfer of oil and other petroleum products. These sites generate enough oil to be effectively removed with treatment. A high-use site is any one of the following.

- High-density road intersections with an expected ADT of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway. This does not include improvements that are primarily for pedestrian or bicycle use.
- Commercial or industrial sites with an expected trip end count equal to or greater than 100 vehicles per 1000 square feet of gross building area.
- Fueling stations and facilities.
- Petroleum storage and transfer in excess of 1,500 gallons per year at commercial or industrial sites. This includes heating fuel, handling, and storage facilities. This does not include locations where heating fuel is routinely delivered to end users.
- Fleets of 25 or more diesel vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.) used, stored, or maintained at commercial or industrial sites.
- Maintenance and repair facilities for vehicles, aircraft, construction equipment, railroad equipment, or industrial machinery, and equipment.
- Outdoor areas where hydraulic equipment is stored.
- Log storage and sorting yards and other sites subject to frequent use of forklifts and (or) other hydraulic equipment.
- Railroad yards.
- In eastern Washington only, the following are also high use sites:
 - Customer or visitor parking lots with an expected trip end count equal to or greater than 300 vehicles.
 - Commercial on-street parking areas on streets with an expected total ADT count equal to or greater than 7,500.

Metals treatment

Treatment of stormwater with the goal of removing dissolved metals in the runoff by applying one of the technologies identified in Ecology stormwater management manuals.

Non-endangerment	To prevent the movement of fluid containing any contaminant into the ground water if the contaminant may cause a violation of the <i>Water Quality Standards for Ground Waters of the State of Washington</i> , or may cause health concerns. (See Chapter 173-218 WAC Underground Injection Control Program.)
Oil control	Treatment of stormwater with the goal of removing oil by applying one of the technologies identified in Ecology stormwater management manuals.
Poorly-sorted	The grain size distribution of a solid material composed of a mixture of grain sizes.
Solids removal	Structural pre-treatment of stormwater using any of the methodologies in Ecology stormwater management manuals that are intended to provide for removal of at least 80 percent of the particles in the runoff by settling and/or filtration. Called <i>basic treatment</i> in Ecology stormwater management manuals.
Source control	A structure or operation intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. See Chapter 8 of the <i>Stormwater Management Manual for Eastern Washington</i> (Ecology Publication # 04-10-076) or Volume IV of the <i>Stormwater Management Manual for Western Washington</i> (Ecology Publication # 99-14).
Stormwater management program (SWMP)	A combination of stormwater management activities planned and implemented by a local jurisdiction to reduce pollutants in urban runoff and protect water quality in the receiving waters. An SWMP may also be called, or include, a UIC management plan developed by the local government.
Stormwater treatment	Use of a structural BMP or the vadose zone below a UIC well to remove pollutants from stormwater.
Well-sorted	The grain size distribution of a solid material composed of grains of the same size.

Appendix A – Benchmark Monitoring of Runoff for Nitrate, Nitrite, Ammonia, or Phosphorus for Certain Industrial Activities

EPA rules (40 CFR 122.26(b)(14)) require benchmark monitoring of runoff for nitrate, nitrite, ammonia or phosphorus for certain industrial activities, as follows:

- Facilities subject to stormwater effluent limitations guidelines, or new source performance standards specified in 40 CFR Subchapter N, or Toxic Pollutant Effluent Standards under 40 CFR Subchapter D.
- Facilities listed under the following Standard Industrial Classifications (SIC):

24xx	Lumber and Wood Products (except 2434 - Wood Kitchen Cabinets, see last bullet in this Appendix)
26xx	Paper and Allied Products (except 265 - Paperboard Containers; and 267 - Converted Paper and Paperboard Products, see last bullet in this Appendix)
28xx	Chemicals and Allied Products (except 283 - Drugs; and 285 Paints, Varnishes, Lacquers, Enamels, and Allied Products, see last bullet in this Appendix)
29xx	Petroleum and Coal Products, (except 2951 - Asphalt Concrete Plants, must apply for the sand and gravel general permit)
311x	Leather Tanning and Finishing
32xx	Stone, Clay and Glass Products (except 323 - Glass Products made from purchased glass, see category 11) and (except 3273 - Ready-Mixed Concrete, must apply for the sand and gravel general permit)
33xx	Primary Metals Industries
3441	Fabricated Structural Metal
373x	Ship and Boat Building and Repairing
10xx	Metal Mining
12xx	Coal Mining
13xx	Oil and Gas Extraction
14xx	Mining and Quarrying of Nonmetallic Minerals, except Fuels (except 1411 - dimension stone; 1422 - Crushed and Broken Limestone; 1423 - Crushed and Broken Granite; 1429 - Crushed and Broken Stone, Not Elsewhere Classified; 1442 - Construction Sand and Gravel; 1446 - Industrial Sand, 1445 - Kaolin and Ball Clay; 1459 - Clay, Ceramic, and Refractory Minerals, Not Otherwise Classified; 1499 - Miscellaneous Nonmetallic Minerals, Except Fuels; must apply for the sand and gravel general permit)

- Hazardous waste treatment, storage, or disposal facilities, including those operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA).
- Landfills, land application sites, and open dumps that receive or have received any industrial wastes (waste that is received from any of the facilities described in this appendix) including those subject to regulation under Subtitle D of RCRA.
- Recycling facilities, facilities involved in the recycling of materials, including metal scrapyards, battery reclaimers, salvage yards, and automobile junkyards, including but limited to those classified as Standard Industrial Classification 5015 and 5093.
- Steam electric power generating facilities, including coal handling sites.
- Transportation facilities classified under SICs below, which have vehicle maintenance shops, equipment cleaning operations, or airport deicing operations. Only those portions of the facility that are either involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, airport deicing operations, or that are otherwise identified under one of the other 11 categories of industrial activities listed in this appendix that are associated with industrial activity.

40xx	Railroad Transportation
41xx	Local and Interurban Passenger Transportation
42xx	Motor Freight Transportation and Warehousing (except 4221 Farm Product Warehousing and Storage; 4222 Refrigerated Warehousing and Storage; and 4225 General Warehousing and Storage; see last bullet in this Appendix)
43xx	United States Postal Service
44xx	Water Transportation
45xx	Transportation by Air
5171	Petroleum Bulk Stations and Terminals

- Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated to the disposal of sewage sludge, that are located within the confines of the facility, with a design flow of one million gallons per day or more, or required to have an approved pretreatment program under 40 CFR Part 403. Not included are farm lands, domestic gardens or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility or areas that are in compliance with Section 405 of the CWA.

- Facilities under the following Standard Industrial Classifications:

20xx	Food and Kindred Products
21xx	Tobacco Products
22xx	Textile Mill Products
23xx	Apparel and Other Textile Products
2434	Wood Kitchen Cabinets
25xx	Furniture and Fixtures
265x	Paperboard Containers and Boxes
267x	Converted Paper and Paperboard Products
27xx	Printing, Publishing and Allied Industries
283x	Drugs
285x	Paints, Varnishes, Lacquers, Enamels, and Allied Products
30xx	Rubber and Miscellaneous Plastic Products
31xx	Leather and Leather Products (except 311 Leather Tanning and Finishing, see Category 2)
323x	Glass Products Made of Purchased Glass
34xx	Fabricated Metal Products (except 3441 Fabricated Structural Metal, see Category 2)
35xx	Industrial and Commercial Machinery and Computer Equipment
36xx	Electronic and Other Electrical Equipment
37xx	Transportation Equipment (except 373 Ship and Boat Building and Repair, see Category 2)
38xx	Measuring, Analyzing, and Controlling Instruments, Photographic, Medical and Optical Goods; Watches and Clocks
39xx	Miscellaneous Manufacturing Industries
4221	Farm Product Warehousing and Storage
4222	Refrigerated Warehousing and Storage
4225	General Warehousing and Storage

Appendix B – Report a Spill

 [Washington State Department of Ecology : Spills Home](#)

How To Report a Spill

Spills of oil or hazardous materials must be reported.

Who to Call

National Response Center: 1-800-424-8802

AND

Washington Emergency Management Division: 1-800-258-5990 OR 1-800-OILS-911

AND

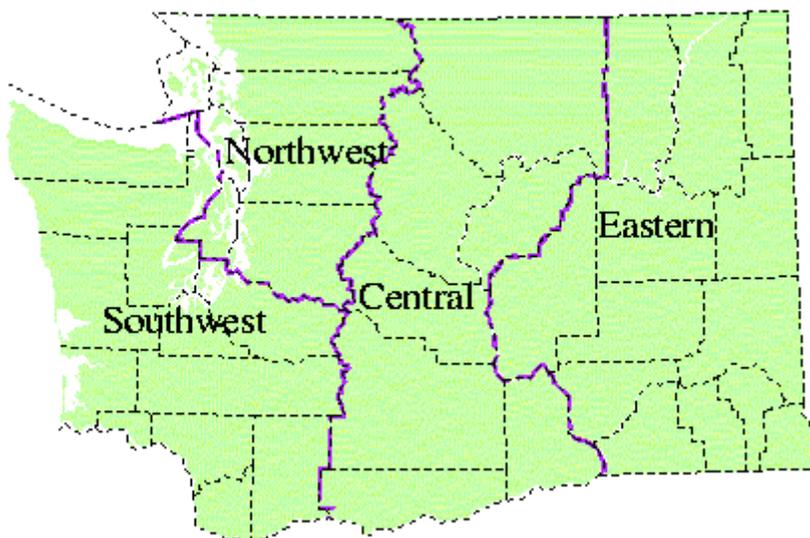
Appropriate Ecology regional office:

Northwest Region: 1-425-649-7000
(Island, King, Kitsap, San Juan, Skagit, Snohomish, and Whatcom counties)

Southwest Region: 1-360-407-6300
(Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, and Wahkiakum counties)

Central Region: 1-509-575-2490
(Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, and Yakima counties)

Eastern Region: 1-509-329-3400
(Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, and Whitman counties)



Useful Information

NOTE: You may request that your personal information be kept confidential.

To the best of your ability, please be ready with the following information:

- Where is the spill?
- What spilled?
- How much spilled?
- How concentrated is the spilled material?
- Who spilled the material?
- Is anyone cleaning up the spill?
- Are there resource damages (e.g. dead fish or oiled birds)?
- Who is reporting the spill?
- How can we get back to you?