Appendix I-C –

Underground Injection Control (UIC) Program Guidelines

C.1 Introduction to UIC Wells

This appendix defines site suitability, treatment requirements, and design criteria for discharges of stormwater to Underground Injection Control (UIC) wells. The requirements of this appendix may be superseded by the Industrial Stormwater General Permit for those permitted sites. See C.19 UIC Program Guidelines – Definitions and Volume I, Section 1.7.12 Underground Injection Control – UIC Program for the UIC well definition and a list of examples.

All UIC wells receiving stormwater, except those located on tribal lands and UIC wells at single-family homes (or duplexes) receiving only residential roof runoff or used to control basement flooding, must be registered with the state of Washington. The majority of UIC wells receiving stormwater runoff can be authorized by the UIC program without requiring individual permits, provided the non-endangerment standard is met by fulfilling the requirements detailed throughout this appendix. Sub-surface infiltration (UIC wells) may be used to provide flow control for stormwater runoff under any of the following conditions:

- Pollutant concentrations expected to reach groundwater will meet Washington State groundwater quality standards.
- Stormwater is treated according to the requirements of this section prior to reaching the aquifer.
- Flows are greater than the water quality design flow rate (see Volume V, Section 4.1 Design Volume and Flow).

The unsaturated geological material between the bottom of the UIC well and the top of an unconfined aquifer, herein called the vadose zone, usually provides some level of treatment by removing contaminants by filtration, adsorption, and/or degradation. In some cases, the treatment provided by the vadose zone is suitable for protecting groundwater quality from contamination by stormwater runoff. In other cases, additional treatment may be required to protect groundwater quality. C.16 Determining Treatment Requirements and C.17 Classification of Vadose Zone Treatment Capacity describe these assessments and their applications.

This appendix does not address the following:

- UIC wells that receive fluids other than stormwater (precluding accidental spills and illicit discharges, which are addressed in Volume IV)
- The infiltration capacity of the vadose zone below the UIC well
- The ability of the UIC well to meet local operational requirements to infiltrate a certain volume of water in a given amount of time (see Volume I, Section 2.4.7 Minimum Requirement #7: Flow Control for more detail on flow control)

The UIC rule, WAC 173-218, requires a well assessment (see C.5 Well Assessment) for UIC wells that were constructed prior to February 3, 2006. The rule refers to these UIC wells as "existing" UIC wells.

The UIC program considers an infiltration trench where the design includes perforated pipe to be classified as a UIC well. Registration requirements do not apply to infiltration trenches without perforated pipes. Infiltration trenches designed, constructed, operated, and maintained according to the specifications in Volume III, Section 3.6 and UIC registration with Ecology can be rule-authorized by the presumptive approach (see C.8 The Presumptive Approach).

C.2 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, an individual permit is not required. Rule-authorization can be rescinded if a UIC well no longer meets the non-endangerment standard, i.e., the discharge does not meet groundwater quality standards.

A UIC well may be rule-authorized when both of the following required actions are completed:

- Submit a registration form to Ecology (unless the UIC well is on tribal land, then registration is through U.S. Environmental Protection Agency (U.S. EPA), Region 10).
- Protect groundwater quality. The discharge from the UIC well must meet the non-endangerment standard.

C.3 Registration

Register UIC wells using Ecology's online registration process. For more information and details on the registration process, visit Ecology's web page for the UIC program.

All UIC wells must be registered except: UIC wells at single-family homes (or duplexes) receiving only residential roof runoff used to collect stormwater runoff from roof surfaces on an individual home (or duplex) or for basement flooding control.

C.3.1 New UIC Wells

Ecology considers UIC wells constructed on or after February 3, 2006, to be new wells. The registration provides Ecology with information to determine if the new UIC well meets the conditions to be rule-authorized:

- Applicants must submit the registration form 60 days prior to construction to allow a full review of the application by Ecology and other interested stakeholders.
- The UIC well must meet the non-endangerment standard, i.e., it complies with all the siting, design, and treatment requirements through either the presumptive approach (C.8 The Presumptive Approach) or the demonstrative approach (C.9 The Demonstrative Approach).

C.3.2 Existing UIC Wells

The UIC rule considers UIC wells constructed prior to February 3, 2006, as "existing". Existing wells used to manage stormwater runoff do not have to meet the new UIC well treatment requirements; however, registration is required if the UIC well is not already registered, and the owners must also complete a well assessment (C.5 Well Assessment) to determine if an existing UIC well is a high threat to groundwater. See WAC 173-218-090(2) and Ecology's UIC web page for more details.

C.4 Meeting the Non-Endangerment Standard

According to WAC 173-218-080(3), UIC wells must be constructed, operated, and maintained in a manner that protects water quality.

C4.1 New UIC Wells

Ecology determines if a new UIC well is either rule-authorized or needs a state waste discharge permit based on whether the UIC well meets the non-endangerment standard.

Designers may either use the presumptive or demonstrative approach described in C4.8 The Presumptive Approach and C4.9 The Demonstrative Approach to meet the non-endangerment standard. UIC wells installed according to the specifications throughout this appendix are not considered a high threat to groundwater.

C4.2 Existing UIC Wells

To determine compliance with the UIC rule, owners of existing UIC wells must complete a well assessment to determine if an existing UIC well is a high threat to groundwater (C.5 Well Assessment). The owner of a UIC well that is a high threat to groundwater must retrofit the well to protect groundwater quality.

C4.3 Requirements for Municipal UIC Wells

The UIC program rule is the regulatory authority for UIC wells in Washington. The UIC program rule applies to Class V wells that receive stormwater regardless of whether a UIC well is located in a municipality permitted under the Phase I or Phase II Municipal Stormwater National Pollutant Discharge Elimination System (NPDES) Permit for Western Washington (MS4 Permit).

The MS4 Permit does not authorize stormwater discharges to/from UIC wells unless the overflow or discharge from a UIC well drains to a NPDES municipal separate storm sewer system (MS4). In those cases, the MS4 Permit does authorize the discharge and the conditions of the MS4 Permit directly apply. For example, if a UIC well is designed to infiltrate the 10-year storm and route larger storms to the MS4, then the requirements of the MS4 Permit apply to the well.

To prevent redundancy between the NPDES and the UIC programs, the UIC program rule allows permitted MS4s that also own or operate Class V UIC wells to satisfy the UIC rule by the presumptive approach (C.8 The Presumptive Approach). MS4 permittees have the option of applying the Stormwater Management Programs (SWMPs) that comply with the MS4 Permit to the areas served by their municipal UIC wells pursuant to WAC 173-218-090(1)(c)(C) in the manner described below. Note that the MS4 Permit does not require jurisdictions to fulfill all the requirements of the UIC program.

Municipalities may fulfill the source control and operation and maintenance requirements for new and existing municipal UIC wells under the following conditions:

- All areas served by municipally owned and operated UIC wells must be included in a Stormwater Management Program (SWMP) that ensures appropriate siting, treatment, design, operation, and maintenance of new municipal UIC wells as well as source control activities (including targeted education and outreach) that are well-suited for the land uses in these areas.
    - MS4 permittees may have a combined SWMP that addresses UIC and NPDES permit requirements together, or they may have two separate SWMPs for the areas served respectively by their municipal UIC wells.
    - In areas not covered by the MS4 permit, municipalities may create a SWMP specifically for the areas served by the municipal UIC wells.
- To comply with the UIC rule, jurisdictions must implement all of the following activities and include them in their SWMP:
    - Register all UIC wells, including existing and new wells.
    - Design, construct, operate, and maintain new UIC wells according to the specifications throughout this appendix.

- Operate and maintain existing wells according to the specifications throughout this appendix.

Municipalities choosing not to develop and implement the SWMP in areas served by existing Class V UIC wells must:

- Conduct a well assessment (C.5 Well Assessment) for each UIC well, and
- Create a Stormwater Site Plan (SSP) for the area served by each existing municipal UIC well. The SSP will include source control best management practices applicable to the activities present in the area and describe operation and maintenance procedures to keep the UIC well functioning properly to provide necessary treatment to protect groundwater.

All new municipal UIC wells must be sited, designed, constructed, managed, operated, and maintained according to the requirements throughout this appendix.

C.5 Well Assessment

The assessment of an existing UIC well evaluates the potential risks to groundwater from the use of the well and includes information such as:

- The land use and activities around the well (which affect the quality of discharge),
- The local geology,
- Depth of the groundwater table in relation to the UIC well, and
- Whether the UIC well is located in a groundwater protection area.

Use this information to assess whether the well is a high threat to groundwater quality, by applying the information in C.16 Determining Treatment Requirements and C.17 Classification of Vadose Zone Treatment Capacity. If an existing UIC well is located in a groundwater protection area and the assessment determines that sufficient best management practices are not provided under the current conditions, retrofitting is required to protect groundwater quality. Existing UIC wells in groundwater protection areas that receive prohibited discharges (C.12 Prohibitions) must either be decommissioned or the activities must be moved and separated from the areas served by the existing UIC well.

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, if an existing well is moved, it is considered a new well, and the UIC requirements pertaining to new UIC wells apply.

C5.1 Evaluating High Threat to Groundwater

For existing UIC wells, Ecology considers any of the following a high threat to groundwater for which the UIC well must be retrofitted.

- Existing UIC wells receiving prohibited discharges (C.12 Prohibitions); these wells also require a separate groundwater discharge permit.
- Existing UIC wells receiving a high pollutant load where the vadose zone between the bottom of the UIC well and the top of the groundwater has no treatment capacity or the vadose zone conditions are unknown; retrofits must provide treatment prior to the discharge to the well.
- Existing UIC well structures completed below the groundwater table; retrofits must provide separation and, if needed (C.16 Determining Treatment Requirements and C.17 Classification of Vadose Zone Treatment Capacity), treatment. (If a UIC well has standing water when it has not received recent stormwater inflows, it is likely completed below the groundwater table. See WAC 173-218-090(1)(b) for separation requirements between the bottom of the UIC well and the top of the groundwater table.)
- Site-specific information indicates that a groundwater quality problem exists in the vicinity of the existing UIC well.

A UIC well retrofit means to reduce the pollutant load from a UIC well to meet the non-endangerment standard by applying source control activity and/or structural controls such as a treatment BMP or create separation between the base of the well and the top of the groundwater table, WAC 173-218-030.

C.6 Preservation and Maintenance Projects

A preservation or maintenance project is defined as preserving/protecting infrastructure by rehabilitating or replacing existing structures to maintain operational and structural integrity, and for the safe and efficient operation of the UIC well. Maintenance projects do not increase the traffic capacity of a roadway or parking area.

A UIC well that was in use prior to preservation or maintenance 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, if an existing UIC well is moved, it is considered a new well and the UIC requirements pertaining to new UIC wells apply.

C.7 Emergency Situations

In emergency situations, such as roadway flooding, a jurisdiction may install a UIC well that does not meet the requirements in this manual on a temporary basis. When weather

permits, and within a year of the event, the jurisdiction must either fully decommission the well or ensure that the UIC well meets the requirements of the rule.

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 runoff treatment BMPs.

C.8 The Presumptive Approach

New UIC wells that meet all of the requirements detailed throughout this appendix meet the presumptive approach to comply with the non-endangerment standard. Otherwise, the demonstrative approach (C.9 The Demonstrative Approach) is required.

The presumptive approach requires the implementation of BMPs in Volume V and/or Volume IV of this manual or an equivalent manual, adopted at the time of construction. The manual addresses the following issues:

- The potential pollutant loading expected in the stormwater runoff for the planned land use(s) (see C.17 Classification of Vadose Zone Treatment Capacity)
- Source control of pollutants, especially those that are difficult to remove from stormwater by filtration, settlement, or other treatment technologies (see Volume IV)
- Known treatment methods (see Volume V)
- The potential treatment capacity of the vadose zone (see C.16 Determining Treatment Requirements)
- Siting (see C.18 Site Suitability Criteria (SSC))
- Design (see C.10 Siting and Design of New UIC Wells and Volume III for Infiltration BMPs)
- Operation and Maintenance (O&M) (see Appendix I-A - Example Maintenance Checklists)

C.10 Siting and Design of New UIC Wells details the siting and design criteria to meet the presumptive approach for drywells designed to meet runoff treatment. Volume III details the design requirements for infiltration trenches and drywells.

The presumptive approach may not be used when none of the source control or treatment BMPs in the manual are expected to eliminate or reduce concentrations of the pollutant(s) of concern (WAC 173-218-090(1)(i)(D)) to meet the non-endangerment standard.

C.9 The Demonstrative Approach

New UIC wells must meet the demonstrative approach to meet the non-endangerment standard if the presumptive approach is not completely followed, or if for any reason a project proponent chooses not to directly apply all of the requirements of this manual (or an equivalent manual).

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

To be eligible for rule-authorization using the demonstrative approach, the following topic areas must be addressed and 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
- BMP selection process used
- 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 groundwater quality standards and satisfy state all known, available, and reasonable methods of prevention, control, and treatment (AKART) requirements

C.10 Siting and Design Of New UIC Wells

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

C10.1 Minimum Sitting Requirements for Rule-Authorization of New UIC Wells

The following Site Suitability Criteria (SSC) from C.18 Site Suitability Criteria (SCS) apply to all UIC wells:

- SSC-1 Setback Criteria
- SSC-2 Groundwater Protection Areas
- SSC- 3 High Vehicle Traffic Areas
- SSC-5 Depth to Bedrock, Water Table, or Impermeable Layer
- SSC-7 Seepage Analysis and Control
- SSC-8 Cold Climate and Impact of Roadway Deicers

UIC wells may be used provide flow control for stormwater runoff where pollutant concentrations that reach groundwater will meet the Washington State groundwater quality standards in the following situations:

- For flows greater than the water quality design flow rate (see Volume V, Section 4.1 Design Volume and Flow); or
- Where stormwater is treated prior to discharge into the UIC well according to the requirements in C.16 Determining Treatment Requirements.

Furthermore, if SSC-4 Soil Infiltration Rate/Drawdown Time and SSC-6 Soil Physical and Chemical Suitability for Treatment are met, the site is considered to have a high treatment capacity, and the existing site soils may be used to provide runoff treatment for flows through the UIC well (see C.13 Source Control and Runoff Treatment Requirements).

Restrictions on Sitting UIC Wells

- Prohibited areas: A UIC well may not be sited in prohibited areas; see C.12 Prohibitions for the list of areas where stormwater discharges to UIC wells are prohibited.
- Soil contamination: UIC wells may not be sited where there are soil contaminants that could be transported to groundwater unless the site is remediated prior to construction.

Siting UIC Wells Near Drinking Water Wells

Because a UIC well could be a potential source of contamination, it must be sited ≥ 100 feet from a drinking water well, outside of the sanitary control area of a public drinking water system, and ≥ 200 feet from a spring used for drinking water supplies. The design must consider the distance between the UIC well and a drinking water well based on the direction and rate of groundwater flow, and the vulnerability of the drinking water supply well to potential contamination, which is influenced by the following factors:

- Depth/distance from the bottom of the UIC well to the drinking water well screened interval(s), and
- Presence or lack of confining layer(s) between the bottom of the UIC well and the aquifer interval(s) used as the water supply, and
- Characteristics of the geologic material between the bottom of the UIC well and the aquifer.

Groundwater Protection Areas

At a minimum, basic treatment to remove solids prior to discharge to the UIC well is required for UIC wells located:

- In a wellhead protection area where the drinking water well is categorized with a high-susceptibility rating by the Washington State Department of Health, and/or
- Where a confining layer is not present between the base of the UIC well and the top of the aquifer used as a drinking water source, except when a UIC well receives insignificant and or low pollutant load from stormwater (see Table C.3. Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells).

Refer to Chapter 18.08 GHMC for requirements and additional information that apply to development within groundwater protection areas, such as sole source aquifers, groundwater management areas, wellhead protection areas, and areas designated as Critical Aquifer Recharge Areas. To locate the wellhead areas and the associated water districts in each city, see the Washington State Department of Health (DOH) Source Water Assessment Program maps located at their web page.

C10.2 Design and Construction Requirements for Rule-Authorization of New UIC Wells

In order to be rule-authorized under the presumptive approach, UIC wells must be designed and installed in accordance with this manual or an equivalent manual adopted at the time of construction. The following subsections include additional requirements for design and construction of UIC wells.

Prevention of Clogging During Construction

In order to prevent clogging, UIC wells must be protected from sediment in runoff generated during construction. See Volume II for construction BMPs to prevent other pollutants from entering the UIC well during the construction phase of a project.

Stormwater Infiltration Rate/Drawdown Time

In most cases, UIC wells are designed to completely drain ponded runoff within 48 to 72 hours after flow to the UIC well has stopped. If the UIC well is designed to meet a runoff treatment requirement, the long-term infiltration rate (see Appendix III- A - Methods for Determining Design Infiltration Rates) must be sufficient to accommodate the water quality design flow rate (see Volume V, Section 4.1 Design Volume and Flow).

Vertical Separation for Rule-Authorization Using the Presumptive Approach

WAC 173-218-090 requires that new Class V UIC wells used for stormwater management must not directly discharge into groundwater. A 5-foot separation between the bottom of the well and the top of the groundwater is required, unless a demonstrative approach confirms that a separation of 3 feet will meet the non-endangerment standard.

The required depth to groundwater/vertical separation between the base of the UIC well and the top of the groundwater table for rule-authorization using the presumptive approach depends on the treatment capacity of the unsaturated zone. C.16 Determining Treatment Requirements and C.17 Classification of Vadose Zone Treatment Capacity

provide a method for determining the treatment requirements based on the treatment capacity of the vadose zone and the pollutant loading classification of the stormwater runoff directed to the UIC wells.

The minimum vertical separation is 5 feet between the base of a UIC well and the highest elevation between the seasonal high groundwater table, bedrock, hardpan, or other low-permeability layer.

Vertical Separation When 5-Foot Minimum Separation Cannot be Met

If vertical separation required for the presumptive approach cannot be met:

- Rule-authorization can be obtained using the demonstrative approach (see C.9 The Demonstrative Approach), or
- A reduction in separation to as little as 3 feet can be considered under the presumptive approach provided:
    - The treatment requirements are otherwise met (see C.16 Determining Treatment Requirements and C.17 Classification of Vadose Zone Treatment Capacity), and:
    - The groundwater 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 as adequate to prevent overtopping and meet the SSC specified in this section.

C.11 Operation and Maintenance of UIC Wells

The UIC rule requires that wells are operated and maintained to protect groundwater quality. Maintenance of UIC wells prevents clogging and contamination from materials that collect in the well over time. The following required preventive maintenance activities will help maintain UIC function:

- Treatment for solids removal or a catch basin with a down turned elbow upstream of discharge to the UIC well to promote the long-term infiltration capacity and reduce the need for maintaining the UIC wells, as well as reduce the long-term accumulation of contaminants in the vadose zone
- Frequent inspections and regular maintenance to improve the long-term performance of the UIC wells
- Periodic removal of debris and sediment from the drywell to reduce or eliminate the buildup of materials that could inhibit infiltration
- Checking for structural damage and repair as needed

See Appendix I-A - Example Maintenance Checklists for recommended maintenance criteria and inspection frequencies.

C.12 Prohibitions

UIC wells may not receive stormwater from the activities and conditions listed below:

- Vehicle maintenance, repair, and service
- Commercial or fleet vehicle washing
- Airport/airplane deicing
- Storage of treated lumber
- Generation, storage, transfer, treatment, or disposal of hazardous wastes
- Handling of radioactive materials
- Solid waste handling facilities, including compost and biosolid facilities, except for those that recycle only glass, paper, plastic, or cardboard
- Concrete recycling facilities that generate, store, or handle crushed concrete
- Asphalt recycling facilities that generate, store, or handle crushed asphalt
- Industrial or commercial areas that have outdoor processing, handling, or storage of raw solid materials or finished products unless the facility has specific management plans for proper storage and spill prevention, control, and containment appropriate to the types of materials handled at the facility (see Volume IV for information on stormwater pollution prevention plans and source control)
- Contaminated sites when the stormwater would increase the mobility of the contaminants at the site. For example, a drywell could not be used upgradient of or over the contaminant plume at a leaking underground storage tank site. The stormwater could increase the movement of the contaminants.
- Process water from the production area of an animal feeding operation.
- Land use, activity, or infiltration determined to be a significant contributor of pollutants to waters of the State or a site release of hazardous substances from historical or current activities resulting in contamination of soil, groundwater, surface water, if the groundwater is in direct communication with surface water,

or sediment, which is prohibited under the Model Toxics Control Act (Chapter 173-340 WAC) and Sediment Management Standards (Chapter 173-204 WAC).

Because of the potential to contaminate groundwater, a UIC well must be individually authorized under a waste discharge permit to receive stormwater from any areas subject to the activities listed above. Ecology does not consider conventional runoff treatment to be protective of groundwater in these situations. Stormwater from areas subject to the activities listed above must be handled onsite with a closed-loop system or discharged to the sanitary sewer, permits must be obtained from the City of Gig Harbor Public Works Department at (253) 851-6170.

However, careful design of these project sites may allow UIC wells to handle some of the stormwater runoff that will be generated. Stormwater from any portions of the site or facility that do not come in contact with these activities (or the areas of the facility associated with these activities) are allowed to be discharged to a UIC well following the presumptive approach.

See WAC 173-218-040(5)(b) for a list of other prohibited UIC wells.

C.13 Source Control and Runoff Treatment Requirements

The UIC rule bases source control and runoff treatment requirements on the types and quantities of pollutants expected from the proposed land use contributing storm runoff to the UIC well.

The rule presumes a UIC well meets the non-endangerment standard and is rule-authorized if the designer follows the guidelines in this section based on the following:

- Application of source control BMPs to control loading of pollutants that are difficult to remove from stormwater by filtration, settlement, or other treatment technologies, and

- Appropriate treatment of runoff to remove pollutants, which may be achieved by either or both:

    - Application of treatment to remove pollutants before discharging stormwater into the UIC well

    - Availability of appropriate vadose zone treatment capacity to remove the solid phase of pollutants in stormwater by filtration and adsorption (see C.16 Determining Treatment Requirements and C.17 Classification of Vadose Zone Treatment Capacity)

C13.1 Source Control

Source control is necessary to protect groundwater from pathogens, pesticides, nitrates, road salts and other anti-icing and deicing chemicals, fuel additives, and many other pollutants in urban runoff, as well as accidental spills.

The operational and structural source control BMPs that are also required to meet the non-endangerment standard for various land uses are described in Volume IV or other equivalent manuals. Targeted education and outreach may also be a necessary source control measure.

Source control BMPs can significantly reduce clogging and pollutants, especially solids, and must be used at all project sites. Protect UIC wells during the construction phase to prevent sediment from entering the UIC well. Implement the BMPs in Volume II or in an equivalent manual. Where there are no existing runoff treatment BMPs to practically address a pollutant issue and where filtration by the vadose zone cannot provide adequate removal of pollutants, owners are required to use source control BMPs to meet the non-endangerment standard. Otherwise, the discharge to the UIC well is prohibited (WAC 173-218-090(1)(c)(i)(D)). See C.12 Prohibitions for prohibited discharges.

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 contributing areas that discharges to a UIC well
- Spill response planning

Contact the City of Gig Harbor Public Works Department to determine whether specific source control requirements apply to your project in addition to those methods described in this manual for the proposed land use.

C13.2 Runoff Treatment

The BMPs chosen for the site must remove or reduce the target pollutants to levels that will comply with State groundwater quality standards when the discharge reaches the groundwater table or first comes into contact with an aquifer (see Chapter 173-200 WAC). Each BMP is designed to reduce or eliminate certain pollutants. See other sections in Volume V for specific runoff treatment BMP design criteria.

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. Treatment for solids removal (basic treatment) must be designed, constructed, operated, and maintained in accordance with this manual or an equivalent manual.

Designers may alternatively use the demonstrative approach (C.9 The Demonstrative Approach) should they wish to install a BMP that is not included in this manual.

Some pollutants may require additional treatment beyond that provided by the approved BMPs described in other sections in Volume V. The text below discusses these pollutants.

Bacteria

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

Runoff treatment BMPs are unreliable in removing fecal 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 loadings of fecal coliform bacteria, such as animal feeding operations.

Alternatively, runoff from sites generating high loadings of bacteria and pathogens may be:

- Discharge to the sanitary sewer, permits must be obtained from the City of Gig Harbor Public Works Department at (253) 851-6170; or
- Used for crop irrigation, as long as other applicable requirements are met; or
- Directed to a bioretention, biofiltration, or bioinfiltration BMP after the nutrient budget is addressed; or
- Diverted through stormwater treatment wetlands (see Volume V, Section 9.3.3 Stormwater Treatment Wetlands) prior to discharge to a UIC well.

Municipal UIC well owners must implement appropriate source control, targeted education and out-reach, and illicit discharge detection and elimination programs in areas served by their UIC wells to prevent pet wastes from contaminating stormwater and to control other sources of pathogens.

UIC wells in the vicinity of land application areas (i.e., along adjacent roadways) must be protected by appropriate buffers and berms to prevent manure-contaminated runoff from entering the UIC well. Best practices for setbacks, nutrient budgets, and timing of application must also be implemented.

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

Soluble Pollutants, Pesticides, Fertilizer, and Nutrients

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.

Areas such as parks, playgrounds, golf courses, public ball fields, cemeteries, and urban landscape typically use pesticides and fertilizers for landscape management. Examples of

other activities that generate high nutrient loads include commercial composting, commercial animal handling areas, nurseries, and land application areas.

Pesticides include a host of chemicals with varying chemical fate and transport characteristics. Some pesticides travel to groundwater more readily because they are more water soluble and less likely to "stick" or sorb to soil particles. These pesticides need treatment by a biological treatment method, such as a biofiltration swale 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 Ecology for rule-authorization using the demonstrative approach outlined in C.9 The Demonstrative Approach. Nonbiological treatment systems are ineffective at removing these pollutants from runoff. Instead, runoff from these types of landscaped areas should be directed to bioretention, biofiltration, or bioinfiltration systems or constructed wetlands prior to discharge to UIC wells. Stormwater with fertilizer or nutrients may be used to irrigate crops and/or landscaped areas in accordance with other applicable requirements.

Ecology encourages use of the following practices:

- Limited use of applied chemicals
- Site design to minimize runoff from the landscaped surface
- Development of a pesticide management plan

UIC wells in the vicinity of land application areas (i.e., along adjacent roadways) must be protected by appropriate buffers and berms to prevent manure-contaminated runoff from entering the UIC well. Best practices for setbacks, nutrient budgets, and timing of application must also be implemented.

Industrial Activities with Requirements to Monitor for Nitrate, Nitrite, Ammonia, or Phosphorus

The U.S. EPA lists industrial activities that have monitoring requirements for nitrate, nitrite, ammonia, or phosphorus. Runoff from sites where nitrate, nitrite, ammonia, or phosphorus come into contact with stormwater must be directed to one of the following:

- Bioretention, biofiltration, or bioinfiltration systems
- Constructed wetlands prior to discharge
- Sanitary sewer, permits must be obtained from the City of Gig Harbor Public Works Department at (253) 851-6170
- Municipal drainage system that discharges to surface water, if allowed by the City of Gig Harbor Public Works Dept. and following treatment for removal of solids

Facilities may complete a no exposure certification as part of Ecology's UIC well registration process for exemption 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 in C.17 Classification of Vadose Zone Treatment Capacity to determine treatment requirements.

Commercial Site Roofs with Ventilation for Commercial Indoor Pollutants

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 treatment requirements.

In general, this runoff may be classified as a "medium" pollutant loading source (see Table C.3. Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells), and the requirements of this section may be applied to discharges from these areas to UIC wells.

Commercial Site Outdoor Handling or Storage

Treatment for solids removal (basic treatment) is require at commercial sites with outdoor handling or storage of raw solid materials. Examples include gravel, sands, logs, salts, and compost.

Industrial Site 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.

Industrial Site Outdoor Handling or Storage

Owners at industrial sites where outdoor processing, handling, or storage of raw solid materials or finished products, including outdoor loading areas for these materials or products, takes place must provide solids removal (basic treatment). These are sites defined by the U.S. EPA (40 CFR 122.26 (b)(14)).

C.14 Spills and Illicit Discharges

Appropriate spill control, prevention and response measures for various land uses are described in Volume IV. The spill control requirements in Volume IV apply to all stormwater discharges to UIC wells. Any spills that pose a threat to groundwater quality should be reported to Ecology. Petroleum spills that enter a UIC well must be reported to Ecology.

C.15 Deep UIC Wells

UIC wells that extend below an upper confining layer and discharge into the underlying vadose zone are designated by Ecology as deep UIC wells. This includes drywells where

drilling extends through a surficial till layer into the vadose zone below. The City of Gig Harbor may impose additional limits on the total depth of these UIC wells based on specific hydrologic conditions and other considerations.

Ecology recommends that project proponents explore alternative approaches to stormwater management before deciding to use a deep UIC well. Projects using deep UIC wells must provide the following:

- A hydrogeologic study that details the following, to determine if contamination could occur:
    - Consideration of potential changes to the aquifer.
    - Infiltration testing to determine mounding affects.
    - Identification of the direction and rate of groundwater flow.
    - Evaluation of the treatment capacity of the vadose zone (see C.16 Determining Treatment Requirements and C.17 Classification of Vadose Zone Treatment Capacity).
    - Determination as to whether the proposed deep UIC well is located within a groundwater protection area (GWPA) such as a wellhead protection area.
    - If a deep UIC well is located within a GWPA, assessment of the vulnerability of the drinking water supply source as follows:
        - Evaluate whether the introduction of stormwater will affect the quality of the groundwater at the water supply well.
        - Describe the following hydrogeologic factors that may influence the vulnerability of a groundwater supply source:
            - Depth of the drinking water well screened interval in relation to the deep UIC well infiltration depth, and
            - Presence or lack of a confining layer between the land surface and the aquifer interval, and
            - Type of material between the land surface and the aquifer, and between the bottom of the deep UIC well and the aquifer.
- An operation and maintenance manual for the deep UIC wells and treatment structures that includes a schedule for their implementation.
- A list of source control BMPs that will be implemented to minimize solids entering the deep UIC well.
- Description of any additional special runoff treatment needs and site operation requirements.

- A minimum of basic treatment for all discharges to drywells to remove suspended sediments, and to prevent sediment entering the well structure and vadose zone.
- A minimum 15-foot separation between the base of the drywell and the surface of the seasonal high groundwater table.
- Stabilization of the site prior to the drywells going on line to prevent sediment entering the drywells.
- A landscape management plan.
- Sealing of any impermeable layers that are penetrated during drilling, to prevent aquifer interconnection if a perched aquifer or other saturated stratum is penetrated.

A surface seal should also be included in the final completion of a deep drywell.

Ecology recommends hiring a Washington licensed well driller for construction of deep UICs. However, most UIC wells are not regulated by the Well Construction Act.

In the design phase of a deep UIC drywell proposal, the project proponent should notify the drinking water supply purveyor when the proposed UIC well will be located in a wellhead protection area, Critical Aquifer Recharge Area, or a Sole Source Aquifer.

Submittal of a State Waste Discharge Permit application may be required and will be determined on a site-by-site basis following the evaluation of the UIC permit application. Ecology will notify the project proponent if this is the case.

C.16 Determining Treatment Requirements

For all stormwater discharges to UIC wells, some form of treatment is required. Treatment may be provided by the vadose zone or by structural treatment BMPs, and depends on the geologic conditions, the land use, and activities at the project site.

Designers intending to use the presumptive approach can use the tables in C.17 Classification of Vadose Zone Treatment Capacity to identify the necessary level of Runoff Treatment prior to discharge to the UIC well.

Designers for industrial sites with no outdoor processing, storage, or handling of raw or finished products may use the Tables in C.17 Classification of Vadose Zone Treatment Capacity. Designers may not use the tables in C.17 Classification of Vadose Zone Treatment Capacity for stormwater runoff from industrial activities, outdoor processing, storage, or handling of raw or finished products; or areas where stormwater runoff comes into contact with leachate or other prohibited discharges.

Where onsite or nearby geologic and groundwater depth information is available, designers can use the tables in C.17 Classification of Vadose Zone Treatment Capacity to evaluate whether the presumption that a stormwater discharge from a road, commercial site, or residential site to a UIC well meets the non-endangerment standard for solids, metals, oil, grease, and polycyclic aromatic hydrocarbons (PAHs).

Used together, the tables in C.17 Classification of Vadose Zone Treatment Capacity identify Ecology's presumption about the extent to which the vadose zone provides sufficient treatment for a given pollutant loading classification and whether additional treatment is necessary to meet the groundwater quality standards for these pollutants.

Depending on conditions, treatment may be as simple as a catch basin with a downturned elbow, or as complex as an oil/water separator followed by basic and/or metals removal. See Table C.4. Treatment Required for Solids, Oil, and Metals for treatment requirements as a function of pollutant loading classification and vadose zone treatment capacity.

C16.1 Exceptions Based on Site-Specific or Local Studies

Exceptions to the tables in C.17 Classification of Vadose Zone Treatment Capacity may be made under any of the following circumstances:

- Local planning efforts have generated an alternative method that meets the non-endangerment standard based on local conditions. For example, local jurisdictions may choose to allow changes in the pollutant loading categories in Table C.3. Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells based on source control BMPs implemented at a site.

- More detailed site-specific data are gathered by the project proponent and local permission is granted under a locally developed stormwater management program.

- The required thicknesses of the vadose zone treatment layer listed in Table C.2. Vadose Zone Treatment Capacity may be as little as 3 feet for a high-capacity treatment matrix and 6 feet for a medium-capacity treatment matrix when all of the following requirements are met:

    - The UIC well is regulated under a local stormwater management program that satisfies the requirements in C.4 Meeting the Non-Endangerment Standard, and local jurisdiction approves the change in minimum thicknesses.

    - The pollutant loadings are insignificant or low.

    - Reliable onsite information is available. Designers may use borehole logs within 0.25 miles of the proposed UIC well if geologic conditions are consistent.

- Site-specific water level data justifies the minimal separation from the groundwater table in cases where the 3 feet of high-capacity treatment matrix provides the entire separation between the bottom of the structure and the seasonal high groundwater table.
- Potential mounding of infiltrating stormwater above the groundwater table is likely. Additional separation or treatment may be required.

C16.2 Vadose Zone Treatment Capacity

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. Designers may use the tables in C.17 Classification of Vadose Zone Treatment Capacity to evaluate the use of the vadose zone for treatment and to determine treatment requirements to reduce concentrations of these pollutants prior to discharge to the UIC well.

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

Designers can eliminate many of the problems documented in these studies by proper siting, design, maintenance, and use of the UIC well. Additional actions to offset problems are enhanced source control, spill prevention and response plans, and additional treatment prior to discharge to the UIC well, or prohibition of the discharge.

Studies of subsurface infiltration systems also indicate that filtered and adsorbed pollutants accumulate in the vadose zone at depths of less than a few feet below the UIC well at concentrations that may require soil cleanup activities upon decommissioning of a UIC well (Mikkelsen et al., 1996a), (Mikkelsen et al., 1996b), and (Appleyard, 1993).

Because contaminated soil removal and disposal costs can be considerable, project proponents may wish to consider including pretreatment BMPs to remove solids from stormwater runoff and avoid potential cleanup requirements following long-term use of the UIC well.

C.17 Classification of Vadose Zone Treatment Capacity

The treatment capacity of the vadose zone is classified as high, medium, low, or none. Ecology bases these classifications on minimum thickness and the characteristics of the geologic materials that make up the proposed treatment layer.

The tables include several different ways of describing the geologic materials: grain-size distribution, sand-to-fines ratio, well log lithology, geologic names, and infiltration rate, as defined in Table C.1. Examples of Geologic Material Descriptions.

Table C.1. Examples of Geologic Material Descriptions

Geologic Material Description Method	Example
Grain size characteristics	Materials with median grain size < 0.125 mm
Sand-to-fines ratio	Having a sand to silt/clay ratio of < 1:1 and sand plus gravel < 50%
Well log lithology	Sandy or silty clay Silt Clayey or sandy silt Sandy loam or loamy sand Silt/clay with interbedded sand
Geologic name	This category includes geologic terms that indicate provenance, including till, hardpan, caliche, and loess
Infiltration rate	Infiltration rate of ≥ 12 in/hr

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.

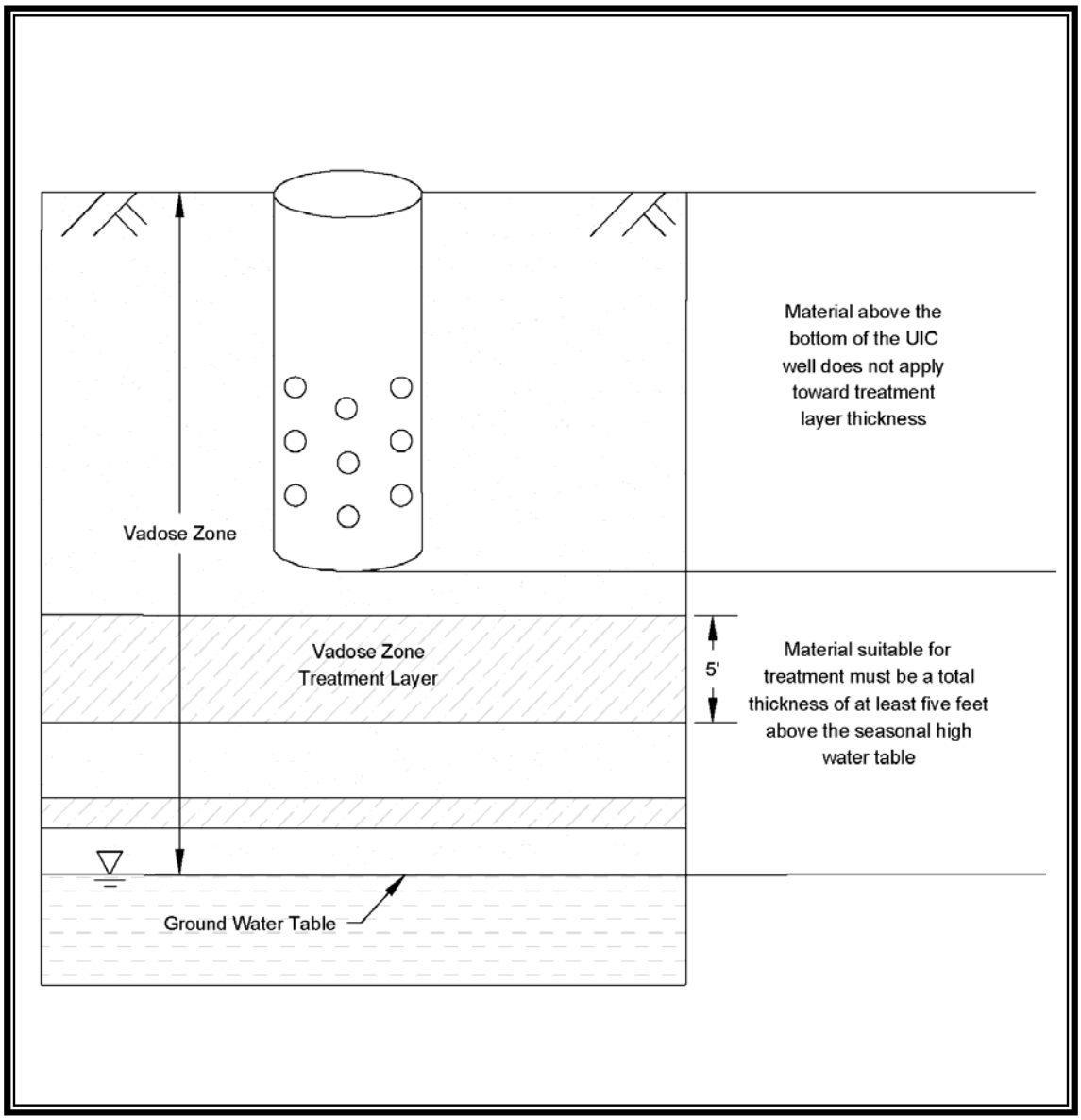
Geologic materials classified as having a high treatment capacity are fine-grained with a greater capacity to filter discharges. These materials also tend to remove pollutants by chemical reactions such as cation exchange capacity (CEC) and sorption. These may be mixtures of materials where silt and clay fill the void spaces in the matrix of the coarser materials. More compaction results in better filtration. High-capacity treatment layers must total a minimum of 5 feet between the bottom of the UIC well and the seasonal high groundwater table to provide an adequate level of treatment (see Figure C.1. Schematic Vadose Zone Treatment Layer Example).

Geologic materials classified as having a medium treatment capacity provide moderate to high filtration and have minor or no chemically reactive characteristics. Medium-capacity treatment layers must total a minimum of 10 feet to provide an adequate level of treatment.

Geologic materials that have a low treatment capacity provide some minimal filtration. Although the sand and gravel mixtures in this category may provide some filtration when the UIC well is initially installed, preferential flow paths develop that contribute to relatively rapid reduction in treatment capacity. Low-capacity treatment layers must total a minimum of 25 feet between the bottom of the UIC well and the seasonal high groundwater table to provide an adequate level of treatment.

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, basic treatment of stormwater (Removal of Solids) is always required prior to discharge to the UIC well, except for sites that are classified as having an insignificant pollutant load in Table C.3. Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells.

Figure C.1. Schematic Vadose Zone Treatment Layer Example



C17.1 Classification of Vadose Zone Treatment Capacity

Site exploration or information from the site or, a site nearby, is required to obtain sufficient data to classify the treatment capacity of the vadose zone materials using Table C.2. Vadose Zone Treatment Capacity.

In some cases, geologic information may be available from regional geology maps in publications from the Washington State Department of Natural Resources or the U.S. Geological Survey, from a well borehole log(s) in the same quarter-section on Ecology's well log web page or from local jurisdictions.

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

- Surface soil maps generally do not provide adequate information although the parent material information provided may be helpful in some locations.
- Verify well borehole log locations because electronic databases contain many errors of this type.
- When using borehole logs, a "nearby" site is generally defined as being within a quarter of a mile, but preferably within 50 to 500 feet of the project site, depending on the heterogeneity of the region.
- Subsurface geology can vary considerably in a very short horizontal distance in many areas of the state. Use professional judgment 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 may apply a conservative design approach, subject to the approval of the local jurisdiction.

The treatment capacity classifications in Table C.2. Vadose Zone Treatment Capacity apply to the vadose zone between the bottom of the UIC well and the top of the highest known seasonal groundwater table. Designers should use Table C.2. Vadose Zone Treatment Capacity to assist in the determination of treatment requirements when using Table C.4. Treatment Required for Solids, Oil, and Metals. If vadose zone conditions are unknown, use "none" for treatment capacity. If thicknesses are less than the listed minimums, use "none" for treatment capacity or consider using the demonstrative approach (see C.9 The Demonstrative Approach). Separation between the bottom of the UIC well and the top of the groundwater table is still required, see WAC 173-218-090(1)(b).

C17.2 Depth to Groundwater

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

Knowledge of the seasonal high groundwater table is especially important for siting UIC wells in areas with seasonal high groundwater table < 15 feet below the bottom of the UIC well.

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

In most cases, one depth to water measurement, such as water level data associated with a single borehole log, is not sufficient to determine the depth/elevation of the seasonal high groundwater table. This is especially true if drilling was conducted outside of the period of seasonal high groundwater levels or following a period of lower than normal precipitation. Seasonal high groundwater tables generally occur during late winter through mid-spring in most of Washington State. In heavily irrigated areas, the seasonal high groundwater table elevation may occur in late summer. The elevation of the seasonal high groundwater table is best determined through installation and periodic monitoring of one or more groundwater monitoring wells at the infiltration BMP location.

At sites where the fluctuation of the seasonal groundwater table is large (several feet) or unknown, designers should err on the side of caution. As described above and reinforced here, UIC wells must not discharge stormwater directly into groundwater.

Table C.2. Vadose Zone Treatment Capacity

Treatment Capacity Classification and Required Minimum Thickness	Description of Vadose Zone Layer[c,d]
HIGH A minimum thickness of 5 feet	Meets all of the following characteristics: • Materials with median grain size < 0.125 mm • Having a sand to silt/clay ratio of < 1:1 and sand plus gravel < 50% • Field-tested saturated hydraulic conductivity below 2.4 in/hr at the bottom elevation of the proposed BMP • Materials with CEC of ≥ 5 milliequivalents CEC/100 g dry soils, and a minimum of 1% organic content, ≥ 18-inch minimum thickness • Typical geotechnical descriptive words for appropriate soils: o Lean, fat, or elastic clay o Sandy or silty clay o Silt o Clayey or sandy silt o Sandy loam or loamy sand o Silt/clay with interbedded sand o Well-compacted, poorly sorted materials *This category generally includes till, hardpan, caliche, and loess.*

Table C.2: Vadose Zone Treatment Capacity (continued)

Treatment Capacity Classification and Required Minimum Thickness	Description of Vadose Zone Layer[c,d]
MEDIUM A minimum thickness of 10 feet	Meets all of the following characteristics: • Materials with average grain size 0.125 to 4 mm • Having a sand to silt/clay ratio from 1:1 and 9:1 and percent sand > percent gravel • Field-tested saturated hydraulic conductivity between 2.4 in/hr and 6 in/hr at the bottom elevation of the proposed BMP • Materials between 2 and 5 milliequivalents CEC/100 g dry soils, and a minimum of 0.5% to 1% organic content, • Typical geotechnical descriptive words for appropriate soils: o Fine, medium, or coarse sand o Sand with interbedded clay and/or silt o Poorly compacted, poorly sorted materials *This category includes some alluvium and outwash deposits.*
LOW A minimum thickness of 25 feet	Meets all of the following characteristics: • Materials with median grain size > 4 mm to 64 mm • Having a sand to silt/clay ratio > 9:1 and percent sand less than percent gravel • Field-tested saturated hydraulic conductivity between 6 in/hr and 12 in/hr at the bottom elevation of the proposed BMP • Materials with CEC of ≤ 2 milliequivalents CEC/100 g dry soils and a minimum of < 0.5% organic content • Typical geotechnical descriptive words for appropriate soils: o Poorly sorted, silty, or muddy gravel o Sandy gravel, gravelly sand, or sand and gravel *This category includes some alluvium and outwash deposits.*

Table C.2. Vadose Zone Treatment Capacity (continued)

Treatment Capacity Classification and Required Minimum Thickness	Description of Vadose Zone Layer[c,d]
NONE Minimum thickness not applicable	Meets any of the following characteristics: • Vadose zone conditions are unknown; or • Vadose zone conditions are known and are characterized in any of the following ways: o Sedimentary materials with median grain size > 64 mm o Total fines (sand and mud) < 5% Field-tested saturated hydraulic conductivity > 12 in/hr at the bottom elevation of the proposed BMP o Materials with no measurable CEC or organic content o Typical geotechnical descriptive words for appropriate soils: ■ Well-sorted or clean gravel ■ Boulders and/or cobbles ■ Fractured rock *This category generally includes vadose zones with conditions that are unknown or vadose zones that are known to be composed of fractured basalt, other fractured bedrock, and cavernous limestone.*

a. This table is applicable to designers intending to use the presumptive approach to identify the necessary level of stormwater treatment prior to discharge to a UIC well. Designers for industrial sites with no outdoor processing, storage, or handling of raw or finished products may also use these tables.

b. This table is not applicable to stormwater runoff from industrial activities, outdoor processing, storage, or handling of raw or finished products; or areas where stormwater runoff comes into contact with leachate or other prohibited discharges.

c. If vadose zone conditions are unknown or if the vadose zone thicknesses are less than those listed, use “none” for the treatment capacity.

d. Separation between the bottom of the UIC well and the top of the groundwater table is required, see WAC 173-218-090(1)(b).

Table C.3. Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells

Classification	Areas Contributing Runoff to the UIC Well
Insignificant	• Impervious surfaces not subject to motorized vehicle traffic or application of sand or deicing chemicals • Unmaintained open space
Low	• Parking areas with < 40 total trip ends per 1,000 square feet (sf) of gross building area or < 100 total trip ends (if you exceed either threshold, move to the Medium Classification) • 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** o Fully controlled and partially controlled limited access highways with ADT < 15,000 o Other roads with ADT < 7,500 vehicles • **Outside Urban Growth Management Areas** o All roads with ADT < 15,000 vehicles
Medium	• Parking areas with between 40 and 100 trip ends per 1,000 sf of gross building area or between 100 and 300 total trip ends (if you exceed either threshold, move to the High Classification) • Primary access points for high-density residential apartments • Intersections controlled by traffic signals that do not meet the definition of a high-density intersection (i.e. A road intersection with a measured ADT count of 25,000 vehicles or more on the main roadway and 15,000 vehicles or more on any intersecting roadway, excluding projects proposing primarily pedestrian or bicycle use improvements) • Transit center bus stops • **Inside Urban Growth Management Areas** o Fully controlled and partially controlled limited access highways with ADT between 15,000 and 30,000 vehicles o Other roads with ADT between 7,500 and 30,000 vehicles • **Outside Urban Growth Management Areas** o All roads with ADT between 15,000 and 30,000 vehicles

Table C.3. Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells (continued)

Classification	Areas Contributing Runoff to the UIC Well
High	• High-use sites o Includes roads with ADT > 30,000 vehicles • 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.)

Notes:

a. This table is applicable to designers intending to use the presumptive approach to identify the necessary level of treatment upstream of a UIC well. Designers for industrial sites with no outdoor processing, storage, or handling of raw or finished products may also use these tables.

b. This table is not applicable to stormwater runoff from industrial activities, outdoor processing, storage, or handling of raw or finished products; or areas where stormwater runoff comes into contact with leachate or other prohibited discharges.

Use the treatment capacity classification from Table C.2. Vadose Zone Treatment Capacity and the pollutant loading classification from Table C.3. Pollutant Loading Classifications for Solids, Metals, and Oil in Stormwater Runoff Directed to UIC Wells to determine the appropriate level of treatment for solids, oil, and metals in Table C.4. Treatment Required for Solids, Oil, and Metals.

Designers may use UIC wells to provide flow control of excess stormwater runoff for flows greater than the water quality design storm where pollutant concentrations that reach groundwater will meet Washington State groundwater quality standards; or where stormwater is adequately treated prior to discharge.

Table C.4. Treatment Required for Solids, Oil, and Metals

Pollutant Loading	Treatment Capacity			
	High	**Medium**	**Low**	**None**
Insignificant	Two-stage drywell[a]	Two-stage drywell[a]	Two-stage drywell[a]	Two-stage drywell[a]
Low	Two-stage drywell[a]	Pretreatment[b]	Pretreatment[b]	Remove solids[c]
Medium	Pretreatment[b]	Remove solids[c]	Remove solids[c]	Remove solids[c]
High	Remove oil[d]	Remove oil[d]	Remove oil and solids[c,d]	Remove oil and solids[c,d]

Notes:

a. A two-stage drywell has a catch basin or other presettling device that traps small quantities of oils and solids. Regularly inspect and maintain the catch basin or other presettling device.

b. Pretreatment removes solids, but at a level less than basic treatment. Ecology's definition for pre-treatment is 50% removal and typically installed upstream of a UIC well.

c. Treatment to remove solids means basic treatment. Removal of solids removes a large portion of the total metals in most stormwater runoff. Any special treatment requirements in this chapter still apply. Owners may use appropriate source control BMPs for low-pollutant-loading sites, in lieu of structural treatment BMPs.

d. Treatment to remove oil is to be accomplished by applying one of the oil control BMPs identified in this manual. See Volume V, Section 10.6.1 for API (Baffle type) Separator and Coalescing Plate (CP) Separator.

- At high-density intersections and at commercial or industrial sites subject to an expected average daily traffic (ADT) count of 100 vehicles/1,000 sf gross building area, sufficient quantities of oil may be generated to justify operation of a separator BMP.
- At other high-use sites, project proponents may select a basic treatment BMP that also provides adsorptive capacity, such as a biofiltration or bioinfiltration swale, a filter, or other adsorptive technology, in lieu of a separator BMP. A catch basin with a turned down elbow is not adequate for oil control in this case.
- The requirement to apply a basic treatment BMP with adsorptive characteristics also applies to commercial parking and to streets with ADT > 7,500.

C.18 Site Suitability Criteria (SSC)

This section provides criteria that must be considered for siting infiltration BMPs. When a site investigation reveals that any of the applicable site suitability criteria cannot be met, appropriate mitigation measures must be implemented so that the infiltration BMP will not pose a threat to safety, health, and the environment.

For site selection and design decisions, a geotechnical and hydrogeologic report shall be prepared by a licensed engineer in the state of Washington with geotechnical and

hydrogeologic experience, or a licensed geologist, hydrogeologist, or engineering geologist. The designer may utilize a team of certified or registered professionals in soil science, hydrogeology, geology, and other related fields.

SSC-1 Setback Criteria

Setback requirements are generally required local regulations, uniform building code requirements, or other state regulations.

These setback criteria are provided as guidance:

- Stormwater infiltration BMPs should be set back at least 100 feet from drinking water wells, septic tanks or drainfields, and springs used for public drinking water supplies. Infiltration BMPs upgradient of drinking water supplies and within 1, 5, and 10-year time of travel zones must comply with Health Department requirements (WSDOH, 2010). Infiltration BMPs that qualify as Underground Injection Control Wells must comply with Chapter 173-218 WAC and the guidance in this appendix.
- Additional setbacks must be considered if roadway deicers or herbicides are likely to be present in the influent to the infiltration BMP.
- From building foundations: ≥ 20 feet downslope and ≥ 100 feet upslope
- From Native Growth Protection Easement (NGPE): ≥ 20 feet
- From the top of slopes >15%: ≥ 50 feet.
- Evaluate onsite and offsite structural stability due to extended subgrade saturation and/or head loading of the permeable layer, including the potential impacts to downgradient properties, especially on hills with known side-hill seeps.

SSC-2 Groundwater Protection Areas

A site is not suitable for an infiltration BMP if the infiltration BMP will cause a violation of Ecology's Ground Water Quality Standards (Chapter 173-200 WAC). See SSC-3 High Vehicle Traffic Areas through SSC-6 Soil Physical and Chemical Suitability for Treatment, and SSC-8 Cold Climate and Impact of Roadway Deicers for measures to protect groundwater quality. Local jurisdiction staff and local ordinances should be consulted for applicable pretreatment requirements if the project site is located in an aquifer sensitive area, sole source aquifer, wellhead protection area, or critical aquifer recharge area.

SSC-3 High Vehicle Traffic Areas

An infiltration BMP may be considered for runoff from areas that require an oil control BMP per Volume V, Chapter 2 – Treatment Facility Selection Process. For such applications, provide the oil control BMP upstream of the infiltration BMP to ensure that

groundwater quality standards will not be violated and that the infiltration BMP is not adversely affected.

SSC-4 Soil Infiltration Rate/Drawdown Time

Infiltration Rates: measured (initial) and design (long-term)

For infiltration BMPs used for Runoff Treatment purposes, the measured (initial) soil infiltration rate shall be 9 in/hr or less (For Permeable Pavements, this rate can be 12 in/hr or less). Design (long-term) infiltration rates up to 3.0 inches/hour can also be considered, if the infiltration receptor is not a sole-source aquifer, and in the judgment of the site professional, the treatment soil has characteristics comparable to those specified in SSC-6 Soil Physical and Chemical Suitability for Treatment to adequately control the target pollutants. Project sites with infiltration rates lower than those identified in the infeasibility criteria may be used for infiltration of stormwater if the local jurisdiction approves the design.

The design infiltration rate should also be used for maximum drawdown time and routing calculations.

Drawdown Time

For infiltration BMPs designed strictly for Flow Control purposes, there isn't a maximum drawdown time.

For infiltration BMPs designed to provide Runoff Treatment, document that the Water Quality Design Volume (as described in Volume V, Section 4.1 Design Volume and Flow) can infiltrate through the infiltration BMP surface within 48 hours. This can be calculated by multiplying the horizontal projection of the infiltration BMP mid-depth dimensions by the estimated design infiltration rate, and multiplying the result by 48 hours.

This drawdown restriction is intended to meet the following objectives:

- Aerate vegetation and soil to keep the vegetation healthy.
- Enhance the biodegradation of pollutants and organics in the soil.

Note: This is a check procedure, not a method for determining infiltration BMP size. If the design fails the check procedure, redesign the infiltration BMP.

SSC-5 Depth to Bedrock, Water Table, or Impermeable Layer

The base of infiltration basins or infiltration trenches shall be ≥ 5 feet above the seasonal high-water mark, bedrock (or hardpan) or other low permeability layer. A separation down to 3 feet may be considered if the groundwater mounding analysis, volumetric receptor capacity, and the design of the overflow and/or bypass structures are judged by the site professional to be adequate to prevent overtopping and meet the other site suitability criteria specified in this section.

SSC-6 Soil Physical and Chemical Suitability for Treatment

This SSC applies to infiltration BMPs that intend to use native soil to provide Runoff Treatment. If the native soils do not meet the criteria below, Runoff Treatment must be prior to infiltration either by a layer within the infiltration BMP (such is the case for Bioretention), a Runoff Treatment BMP upstream of the infiltration BMP, or a layer of engineered soil that meets the criteria below. Refer to Volume V, Chapter 2 – Treatment Facility Selection Process for guidance to determine the appropriate level of Runoff Treatment, based on land use and project type, that is necessary to precede the infiltration BMP.

Consider the soil texture and design infiltration rates along with the physical and chemical characteristics specified below to determine if the soil is adequate for removing the target pollutants. The following soil properties must be carefully considered in making such a determination:

- Cation exchange capacity (CEC) of the treatment soil must be ≥ 5 milliequivalents CEC/100 g dry soil (USEPA, 1986). Consider empirical testing of soil sorption capacity, if practicable. Ensure that soil CEC is sufficient for expected pollutant loadings, particularly heavy metals. CEC values of > 5 meq/100g are expected in loamy sands (Buckman and Brady, 1969). Lower CEC content may be considered if it is based on a soil loading capacity determination for the target pollutants that is accepted by the local jurisdiction.

- Depth of soil used for infiltration Runoff Treatment must be a minimum of 18 inches. Depth of soil used for infiltration Runoff Treatment below Permeable Pavement that is a pollution-generating hard surface may be reduced to one foot if the permeable pavement does not accept runon from other surfaces.

- Organic Content of the treatment soil (ASTM D 2974): Organic matter can increase the sorptive capacity of the soil for some pollutants. A minimum of 1.0 percent organic content is necessary.

- Waste fill materials shall not be used as infiltration soil media nor shall such media be placed over uncontrolled or non-engineered fill soils.

Engineered soils may be used to meet these design criteria. Field performance evaluation(s), using protocols cited in this manual, would be needed to determine feasibility and acceptability by the local jurisdiction.

SSC-7 Seepage Analysis and Control

Determine whether there would be any adverse effects caused by seepage zones on nearby building foundations, basements, roads, parking lots or sloping sites.

SSC-8 Cold Climate and Impact of Roadway Deicers

Consider the potential impact of roadway deicers on potable water wells in the siting determination. Implement mitigation measures if the infiltration of roadway deicers could cause a violation of groundwater quality standards.

C.19 UIC Program Guidelines - Definitions

Groundwater Protection Area

The area surrounding a drinking water source evaluated as part of SSC-2 Groundwater Protection Areas that includes the wellhead protection area and may also include aquifer sensitive areas, sole source aquifers, groundwater management areas, or critical aquifer recharge areas.

Sanitary Control Area

The inner circle of a wellhead protection area maintained around a drinking water source to minimize direct contamination at the wellhead and reduce the possibility of surface flows reaching the wellhead and traveling down the casing (WAC 246-290-135).

Susceptibility

The ease with which contaminants can move from the land surface to the aquifer, based solely on the types of surface and subsurface materials in the area. Susceptibility usually defines the rate at which a contaminant will reach an aquifer unimpeded by chemical interactions with the vadose zone media.

Susceptibility Drinking Water Source

Sources rated highly susceptible by DOH and any drinking water source where a deep injection well will be placed within a groundwater protection area.

Vulnerability

Vulnerability is a water source's potential for contamination. Two factors influence vulnerability:

- Physical susceptibility to contaminant infiltration. Susceptibility depends on conditions that affect the movement of contaminants from the land surface into a water supply. This includes the depth of the well, its construction, the geology of the area, the pumping rate, the source(s) of groundwater recharge, and the aquifer material.

The source's risk of exposure to contaminants. The risk of exposure is measured by determining whether contaminants were used in the water supply area. However, each type of contaminant may behave differently in the environment, making it difficult to predict groundwater pollution from surface exposure accurately. For this reason, susceptibility is the key factor used in determining vulnerability. See Washington *State Wellhead Protection Program Guidance Document* (WSDOH, 2010).

Wellhead Protection Area

The area surrounding a drinking water source that is focused on protection from potential contamination that typically includes four or five zones: a sanitary control area, Zone 1 (1-year travel time), Zone 2 (5-year travel time), Zone 3 (10-year travel time), and an additional buffer zone (if warranted) (WAC 246-290-130 and WAC 246-290-135).