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DEPARTMENT OF ENVIRONMENTAL QUALITY CLASS V UNDERGROUND INJECTION CONTROL (UIC) BMPs

A Compilation of Practices to Protect Groundwater

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Department of Environmental Quality Class V Underground Injection Control (UIC) BMPs

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Note to The Reader:

This document represents the agencies recommendations related to Best Management Practices (BMP) for Class V injection wells regulated under the *Safe Drinking Water Act*. The guideline outlines a variety of ways to protect groundwater resources through structural, physical, and managerial practices which can be employed by jurisdictions, industry, and developers. Techniques include pollution prevention, education, land use planning, source separation, spill response, construction, operation, maintenance, and monitoring.

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DEQ Class V Underground Injection Control (UIC) BMPs

1 BACKGROUND

Prior to urbanization, groundwater is recharged primarily by rainfall runoff which is relatively uncontaminated. In the summer, groundwater provides a large portion of the base flow to surface water, while during the winter, streams recharge groundwater. In urban environments, impervious surfaces (roads, parking lots) block normal recharge of groundwater. Stormwater runoff from impervious areas carries about three times the pre-development runoff volume from storm events, increasing the pollution loads to groundwater. In addition, there are other groundwater discharges such as effluent from septic tanks, wastewater from percolation and detention basins, industrial waste injection wells, infiltration from commercial developments, and agricultural irrigation. Cities have typically disposed of runoff through stormwater sewers, discharges to surface water, or discharges to groundwater (through sumps, catch basins, infiltration basins, wetlands, etc.). In recent years, stormwater impacts have come under increasing scrutiny as the risks and impacts have escalated with rapid growth.

Studies by Pitt, Schueler (funded by EPA) and Woodward Clyde have found that there are heavy metals (cadmium, chromium, copper, lead, nickel, aluminum, manganese, iron, and zinc,), toxic organics, nutrients (primarily nitrates and phosphorus), pesticides, other organics such as polycyclic aromatic hydrocarbons (PAH), salts, and microorganisms (bacteria and viruses) in stormwater which are of concern to groundwater (Pitt et al, 1995).

Urban hot spots have been identified that produce significantly greater loadings of hydrocarbons and trace metals than other areas. The hot spots are linked to places where vehicles are fueled, serviced, heavily used, and parked. Land uses cited include: industrial sites (mining, metal plating/galvanizing), scrap yards and processing, boat building/repair, automotive repair, gas stations, and along with convenience store parking lots. In general, studies have found private residential property runoff to be relatively clean, and less likely to contaminate groundwater.

2 OREGON'S SITUATION

The recently released 1995 EPA Toxic Release Inventory (TRI) shows an increase to underground injection (to groundwater) of 19.5 percent. DEQ's Toxic Use Reduction (TUR) program has documented a decrease in most medias but has documented a shift in releases from other sources to groundwater.

Due to recent rapid development and growth in Oregon, less groundwater recharge is occurring as

water is diverted from natural infiltration to surface water; in some areas, this is exacerbating the already low summer flows (where base flow is primarily fed by groundwater) and lowering the depth of potable aquifers (drying up older shallow wells). Untreated stormwater discharged to existing and in-filled wetlands is allowing infiltration of pollution to groundwater resources.

3 TYPES OF BEST MANAGEMENT PRACTICES (BMPs)

Best Management Practices (BMPs) are usually defined as physical, structural, and/or managerial practices that when used singly or in combination, prevent, or reduce the pollution of water. It is more effective to prevent impacts using source control than by using treatment. The three basic types of BMPs are: (a) source control or pollution prevention, (b) treatment, and (c) erosion control. Source controls aim to prevent pollution from occurring, including tracking down and eliminating illegal connections. Treatment facilities remove pollutants by various means (see Guidelines for Stormwater Treatment Facilities). Erosion control deals with the rate, frequency, and flow duration of runoff releases by detaining runoff and through infiltration (see Draft 401 Certification Guidelines or NPS Coastal Guidelines).

The BMPs compiled and discussed here are primarily source controls or pollution prevention practices. They include activity schedules, prohibitions of practices, maintenance procedures, operating methods, practices to control runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Load reduction has traditionally been the criteria used to evaluate the performance of BMPs and treatment designs. While it is useful to compare BMPs, it is limited because it does not track the pollutant outflow concentration. Current studies are showing that BMPs cannot reduce pollution levels beyond a certain point. Metals, in particular, have been detected in outflows exceeding state standards. Irreducible concentrations may represent a real threshold for cumulative development impacts.

Sensitive groundwater areas include: (a) Wellhead Protection Areas (WHPA) or source water areas, (b) wetlands, (c) riparian areas, (d) groundwater management areas, (e) sole source aquifers, and (f) sites within one-half mile of water quality limited streams.

Topics covered below include source separation, spill response, pollution prevention, and BMPs (maintenance, monitoring, operating procedures) for common site activities and land uses.

4 POLLUTION PREVENTION PLANNING

Stormwater management is best organized with a Pollution Prevention Plan. While a formal plan is not required for subsurface discharge of industrial stormwater, organizing stormwater management throughout a facility can increase efficiency, increase the likelihood of success, and can be used to communicate facility policy to personnel. Pollution prevention often results in reduced future costs of environmental compliance and cleanup. Jurisdictions should integrate pollution prevention in their stormwater and water supply designs.

❶ Stormwater Pollution Prevention Plan

A formal Stormwater Pollution Prevention Plan (SWPPP) is required for NPDES stormwater permits under 40 CFR 122.26 for discharge of industrial site stormwater to surface waters (including wetlands), and is also required in areas adjacent to a water supply for Wellhead Protection/Source

Water. See Oregon's Wellhead Protection Plan Guidelines for more information. SWPPP components include:

- ***Planning & Organization:*** Determine who will be responsible for developing the plan. Evaluate other SWPPPs for similar facility types to determine if there is an overlap of regulations and to establish consistency.

- ***Assessment:*** Assess the materials on site and practices that could lead to contamination. Take an inventory of potential contaminants and identify spill areas (note past locations/ experiences), and create a map showing the location of potential contaminant areas and the location of stormwater drainage areas.

  (a) Inventory the incoming amount of water used;

  (b) Link it to the disposal type on site to track down; and

  (c) Eliminate illegal older connections.

- ***BMP Identification:*** Develop both general housekeeping and targeted operational BMPs as appropriate (see EPA 1992 Stormwater Management for Industrial Activities) such as preventative maintenance, visual inspection, sediment and erosion control, runoff management, employee training, record keeping, and reporting. Targeted BMPs might include ways to prevent contamination of stormwater resulting from washing of fleet vehicles and equipment.

- ***BMP Implementation:*** Implementation should include employee training and education for all parts of the SWPPP. Employees should understand how to perform specific tasks, and why their task is important in preventing contamination.

- ***Evaluation and Monitoring:*** Once a plan is implemented, it is important to evaluate its success or failures. Monitoring before and after controls are in place can be used to verify pollution reduction. Annual site inspections and BMP evaluation by the operators of the facility can also be used. Areas near stormwater drains should be frequently inspected for evidence of contamination, problems should be documented, and added to the plan.

❷ Education Outreach

In this day and age of concern about chemicals, it is important to educate the public about stormwater. Your program should include information on how to dispose of hazardous and toxic chemicals, pet wastes, soaps, paint, and so on for households as well as explaining what options exist for various commercial and industrial sectors. An example of an effective program would be USA's educational flyers on the Tualatin Basin.

❸ Zoning Changes

Many sensitive groundwater areas were designated as buildable years ago, but today will pose a risk to water quality. For instance, the majority of airports today are located in floodplains or wetlands that have been in-filled. These areas provide rapid infiltration of deicing chemicals and airplane fuels which can pollute local groundwater resources. These sensitive sites should not be zoned to allow facilities that generate or use of hazardous/toxic chemicals due to the high risk factor for groundwater contamination. This is of extreme importance to jurisdictions who are totally reliant on groundwater for drinking water, industry, and agriculture.

- Evaluate existing zoning for commercial, industrial, and transportation routes for potential hazards. Consider zoning changes to a more benign use when older facilities close or request retrofitting to protect the groundwater resource.

- Vacant land near sensitive areas should be rezoned to less risky uses; this is particularly important if a city is reliant upon groundwater resources for drinking water, industry, or agriculture.

- New developments should be required to do a site assessment that includes potential impacts to groundwater resources from the proposed development. This should include locating local drinking water wells, wetlands, streams, or stormwater injection wells within 1,000 feet of the site.

- In Oregon, FEMA floodway maps were generated based on data collected in 1960. Cross check to be sure the facility is not located in a floodplain or designated FEMA floodway. If urbanization has occurred, upstream since 1960, be aware that the floodway elevation has likely risen as well (upstream development adds three times the previous amount of runoff during a flood). This will result in older safe development areas and drinking water systems now being at risk. To prevent this, all new developments should be required to do hydrological modeling (see Section 7 — Construction BMPs).

- Protect existing wetlands from future development since they currently provide critical flood storage, enhance water quality, and in the long run are cheaper than building reservoirs. At the least, require buffer set backs from wetlands and riparian areas.

- Do not allow new UIC wells in sensitive areas without treatment facilities. Either close existing UIC wells or require retrofitting of older UIC sites in sensitive areas. (7)

5 SOURCE SEPARATION

eparating certain types of activities (i.e., industrial) from potential stormwater interaction is a means of minimizing contamination of surface water and groundwater. This effort should include tracking down and eliminating illegal connections, particularly in sensitive areas.

- Move toxic or hazardous materials handling activities inside so accidental spills cannot be washed into stormwater collectors.

- Install spill containment devices such as curbing, containment dikes, vaults, and covering.

  (a) ***Curbing:*** Curbing can be used to separate potential spill areas from stormwater runoff. Best on small scale areas to prevent spills where liquids are stored or used. Good for drum storage. Relatively inexpensive and easy to install. Not effective in containing larger spills. Grading can be used to facilitate clean up by concentrating contaminants in one part of the curbed area. Spill will need to be cleaned up promptly to avoid overflow to non-curbed areas and to minimized residual contaminants that can be suspended in runoff. It may be possible to recycle spilled materials.

  (b) ***Containment Dikes:*** Containment dikes are designed to hold larger spills. Often made from earth or concrete retaining walls in loading/unloading areas and where liquids are stored above ground. Diking is an effective method of preventing contamination of stormwater runoff, but may be expensive for small facilities due to construction, and maintenance costs. Dikes should be designed to hold at least a volume equal to the largest holding tank on site plus rainfall. Some guidances recommend that at least 10 percent of the total tank volume or 110 percent of the largest tank be retained. Over-

flow of dikes can be prevented through the use of a pumping system or vacuum trucks to remove spill contaminants.

(c) ***Vaults, Sumps with Pumps:*** Add vaults, sumps with pumps to holding areas or low areas so that liquid spills or leaks flow toward a contaminant area. Often used at loading docks. Vaults or sumps are place in the lowest areas with pumps and should be constructed of impentrable materials to avoid leaks into the surrounding soils. Pumps require a high degree of maintenance to avoid clogging. Pumps should be attached to a holding area or sanitary sewer line (if locally allowed, but do not connect if sewer directly discharges to surface waters).

- Covering outdoor materials is an effective way to prevent rainfall and stormwater runoff from contracting contacting potential contaminants. High risk areas can be covered with tarps, plastic sheeting, roofs, or awning. All coverings will need to be inspected for leakage.

- Install plugging devices so that during a flood there is a way to close off stormwater wells; this will limit the potential for local contamination.

- Require vegetated buffer areas to protect sensitive sites (i.e., wetlands) from potential stormwater run-on.

6 SPILL RESPONSE

If a spill or leak occurs at a facility, employees must be trained in spill response procedures. Procedures need to be set up to prevent a spill from reaching a drainage well, areas where spilled materials could potentially flow, who to call for assistance in containing or cleaning up a spill, how to use spill clean-up equipment such as booms, barriers, sweeps and absorbants, and how to properly dispose of spilled materials.

- Spill materials must be available and kept on site at all times.

- Employees should be aware of any local or state, spill response reporting.

- An organized and easy to follow spill prevention, control and countermeasure plan (SPCC) is necessary. SPCC plans are to be prepared in accordance to 40 CFR part 112, and should contain data on where spills may occur and whether it could potentially reach a drainage well. Employees at facilities with SPCC plans should be made familiar with the plan. A SPCC plan should be implemented by facilities which are:

  (a) Not transport related.

  (b) Located where a spill could reasonably be expected to discharge toxic, hazardous, or petroleum based materials into navigable waters of the state. This is particularly important in WQL basins, wetlands, Wild and Scenic Rivers, sites above drinking water intakes, salmon habitat, threatened, and endangered species habitat or Outstanding Waters.

  (c) Located within one-half mile of waters of the state which are likely to be connected hydraulically to surface waters or wetlands.

  (d) Located in Groundwater Management Areas, Wellhead Protection Areas, or Sole Source Aquifers.

  (e) Have total underground oil capacity of more than 42,000 or a total above-ground capacity of more than 660 gallons in a single tank.

(f) Located on or below mapped hazardous areas, such as unstable slopes, active faults, tsunami run up areas, and sites prone to flooding (i.e., old cut off meanders, filled floodway wetlands, and floodplains).

7 CONSTRUCTION BMPs

Heavy equipment, trucks, and vehicles commonly used during construction can be sources of contamination. Construction activities alter the site conditions through grading, dredging and infilling, thus affecting drainage patterns around existing stormwater wells, shallow domestic wells, and wetlands. Sediments can be introduced to nearby surface waters, wetlands, and road stormwater wells (sumps, infiltration swales, and drywells).

- Do not disturb an area until it is necessary for construction to begin. Install downslope and side slope perimeter controls before disturbing the land. Do not remove temporary perimeter controls until after all upstream areas are stabilized.

- Cover and stabilize all exposed areas after vegetation removal.

- Construction of infiltration measures should be delayed to the end of the construction project when upstream drainage areas have been stabilized.

- Install detention structures (see Stormwater Treatment Facility Design Guidelines and Erosion Control Guidance) on site to limit movement of sediments.

- Construction vehicles should not be parked, fueled, or serviced up gradient within 100 feet of a stormwater well or wetlands to minimized potential contamination from leaks or spills.

- Stormwater inlets constructed prior to operation should be protected so that untreated stormwater runoff does not enter the facility without first being filtered or treated.
- Maintain natural drainage patterns and site discharges at natural locations to the maximum extent possible; otherwise, unanticipated impacts may occur to existing nearby wetlands, streams, and shallow drinking water wells.

- Proposed projects must identify the upstream/up-gradient and downstream/down-gradient area for potential impacts in an off-site analysis report. This is to demonstrate that the proposed project neither aggravates an existing drainage problem or creates a new drainage problem. The upstream/up-gradient portion of the study shall encompass the entire tributary drainage that drains to the proposed site and the downstream/down-gradient portion shall extend from the site discharge point to a point on the drainage system where the proposed project site constitutes a minimum of 15 percent of the total tributary drainage area, but in no event less than one-half mile.

8 OPERATIONAL BMPs

Best Management Practices (BMPs) for common site activities can contribute to stormwater contamination, such as loading and unloading materials, above-ground storage tanks and materials storage, vehicle, engine, or equipment maintenance. Operational BMPs are an effective and inexpensive way to prevent contamination of stormwater (see EPA 1992 Stormwater Management for Industrial Activities). Direct discharge of untreated stormwater to groundwater is prohibited. All sites should provide some treatment of stormwater (see DEQ Guidelines for Stormwater Treatment Facilities). Biofiltration appears to be the most environmentally effective treatment at this time.

Methods currently in use, such as direct discharge into a dry well or sumps, do not provide adequate groundwater water quality protection for commercial, transportation, or industrial sites. Untreated stormwater discharges to natural wetlands are illegal under the *Clean Water Act*, and should not occur adjacent to wetlands due to the potential for groundwater contamination. Created wetlands or mitigation wetlands are protected as natural wetlands and cannot be used to treat stormwater.

❶ Vehicle, Engine, and Equipment Fueling

There are several aspects of fueling activities that can lead to contamination of stormwater. Spills and leaks can occur during the delivery of fuel and oil to above-ground/underground storage tanks, from vehicles to the tank, contact between rainfall or stormwater and the refueling area, and washing the refueling area.

- This can be dealt with by installing spill and overflow prevention equipment on storage tanks, discouraging topping off of vehicle fuel tanks, and covering refueling areas to prevent direct contact with rainfall.
- Refueling areas should be paved with concrete instead of asphalt to avoid infiltration of spilled fuel and oil into the pavement.
- Refueling areas should be graded with dikes or curbs installed to prevent stormwater from flowing across the area.
- Roof down spouts and washing should be discouraged near stormwater wells.

❷ Vehicle Maintenance

Routine maintenance of equipment and vehicles generates oil, grease, automotive fluids, battery acid, and other hazardous or toxic chemicals that can enter storm drains. In addition, leaks from vehicles or equipment in storage areas and improper disposal of maintenance materials (greasy rags and used oil filters) can be a problem.

- Vehicles and equipment should be inspected for leaking fluids and drip pans used. Drip pan contents need to be disposed of properly.
- When possible, separate the work area from those in contact with rain water.

❸ Equipment Washing

Wash water can contain oil, grease, sediments, and other fluids. These harmful contaminants can migrate into stormwater drains after rainfall when vehicles or equipment are washed outside.

- Use biodegradable detergents that contain no phosphates.
- Wash vehicles in designated areas that are diked and graded so that wash water will flow into a treatment facility.
- Recycle wash water.
- Do not wash the under body of a vehicle or degrease near a stormwater well.

❹ Material Loading/Unloading

Material loading/unloading outside at loading docks or terminals can be a source of contamination, along with spills or leaks from vehicles, if conducted near a stormwater drain. Stormwater contamination has occurred when materials were transferred by truck, forklift, conveyor belt, or by crane. Accidents have occurred transferring liquids, gases, or dry chemicals between a truck, railroad car, plane, boat, or storage facility.

- Check the loading and unloading vehicles for leaks.

- Perform unloading/loading activities in specially designed areas.

- Loading areas should be covered to limit exposure to rainfall.
- Dikes should be constructed around loading/unloading areas to reduce risk.
- Direct roof runoff from loading areas.

❺ Above-Ground Storage of Liquids

Spills or leaks of hazardous materials from above-ground containers can accumulate and wash into stormwater drains.

- Regularly check above-ground containers for leaks, spills, or signs of corrosion.
- Train employees in spill response.
- Cover storage tanks to prevent contact with rainfall.
- Construct dikes around the above-ground storage container area

❻ Outdoor Material Storage

Materials stored outside are exposed to rainfall; their runoff can contaminate stormwater (i.e., road salt).

- To reduce contact with rainfall and runoff, store materials indoors, cover with a roof, or water proof tarp.
- Place materials on an impervious surface to prevent groundwater contamination.
- Dike the area around the raw material storage area to prevent runoff from entering stormwater wells.

9 MAINTENANCE BMPs

evelopment of stormwater maintenance standards are strongly advised. Maintenance standards should include catch basins, dry wells, detention ponds, etc. Clean-out periods can vary from every 6 months to every 5 years depending upon the site. Recommended cleaning in the Pacific Northwest is for spring and early summer after the heavy winter storms have passed.

The frequency with which catch basin traps (sumps) and dry wells should be inspected and cleaned will vary with the site activities and the potential amount of sediment that might be carried away in the site's stormwater runoff. Cleaning prevents the buildup of a floating oil layer and a bottom sediment layer. When these layers build up, oil and sediment are drawn into the well contaminating it. The main groundwater concerns: lead, TPH, and nitrate/nitrogen.

A high level of contaminated suspended solids are normal (for instance: phosphorus, metals, and organics tend to be sorbed to the sediments). Petroleum hydrocarbons and metals are common in urban areas along with fecal coliform, pesticides, and nutrients. In general, Department of Transportation sediments should be considered to be contaminated.

- Recommended frequencies are quarterly to annually depending upon the regional rainfall and depth of the well.
- Initially inspect frequently to determine the rate of buildup of floating and sediment layers, then develop a cleaning schedule based on the observed buildup.
- Dry wells can be cleaned by jetting; partially filled with water, inject compressed air at the bottom of the well, forcing the sediment out the top.

- Vactor trucks can be used to clean storm drain facilities; remove standing water and sediments. Set up vactor truck, waste disposal sites for proper treatment.

  (a) When potentially contaminated sediments are removed with a vactor truck, they should be held in a lined bermed area separate from other loads and tested.
  (b) Liquids should be tested for pH, EP Tox, halogenated hydrocarbons, and fish bioassay.

  (c) Solids should be tested for EP Tox, halogenated hydrocarbons, zinc, fish bioassay, and PAH.

- Disposal options for sediment include:

  (a) Unregulated fill (illegal);

  (b) Demolition landfill (if not contaminated);

  (c) Lined landfill (if contaminated); or

  (d) Licensed TSD (for oily contamination).

  At a minimum, catch basin sediments should be disposed of at a demolition landfill (oil being what is commonly found).

- Problems:

  (a) Often cited problems with catch basin, sump, and dry well sediments are that jurisdictions may illegally reuse it as fill material. Sediment stockpiles, when left uncovered, can cause pollution problems which are compounded when runoff drains off site into surface and groundwater.

  (b) Do not use for wetland fill, road building, or development near riparian areas.

  (c) Decant water should not be discharged to surface, groundwater, wetland, or abandoned gravel pits.

  (d) Control groundwater discharge and runoff from landfills. Do not use sumps or drywells.

10 MONITORING AND SAMPLING

Monitoring is strongly suggested for sumps, or dry wells are located in the vicinity of sensitive areas such as WHPA, within one-half mile of a wetland or surface water. This can be used to detect illegal stormwater connections and improper disposal.

- Require and approve:

  (a) A sampling program for stormwater drains in sensitive or problem areas.

  (b) A groundwater monitoring plan.

  (c) A stormwater treatment operation and maintenance schedule.

- Performance bonding should be considered to ensure compliance with the standards, particularly in sensitive areas.

11 REFERENCES

(1) Watershed Protection Techniques.

(2) Puget Sound Stormwater manual.

(3) EPA Stormwater Manual.

(4) Herrera Survey on Vactor Trucks.

(5) Golder Sump study.

(6) EPA's Draft UIC Class V Stormwater Guidance.

(7) DEQ UIC Internet Site: *http://waterquality/DEQ.state.or.us/wq/groundwa/uichome.htm*.

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