GeoNote 18

URBAN STORM WATER DISPOSAL BY INJECTION WELLS

The disposal of storm water and snow melt from streets and parking lots is a recurring problem for urban planners and city engineers. In uninhabited areas, water sinks into the ground, is taken up by plants, evaporates, and flows downhill to streams and rivers. With urbanization, paved areas inhibit the natural surface infiltration and biological uptake and cause the accumulating water to pond or, in extreme cases, to flood.

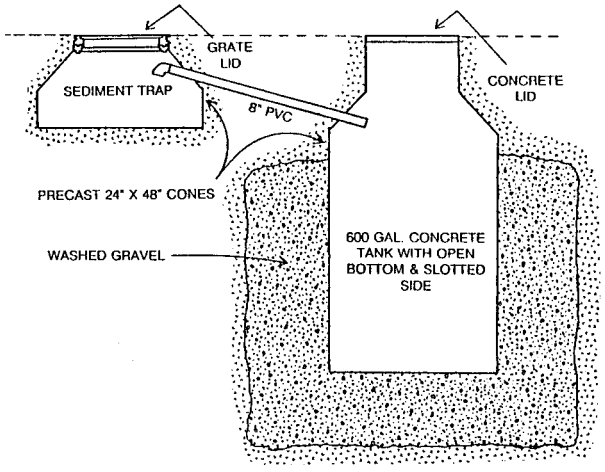
Roadways and parking lots must be kept free of ponded water to remain functional. A variety of methods have been devised to dispose of urban runoff. The most expensive is "sewering," which involves a network of basins and pipes below the ground. Water collected by this system can be routed directly to a surface disposal site, such as a river or canal (storm sewer), or first to a treatment plant (sanitary sewer) for the removal of contaminants.

In Idaho as in other parts of the country, a common method of storm water disposal has been the use of injection wells, also called dry or drain wells. These wells do not produce water but rather move runoff into the ground to eliminate it from the surface. Storm water injection wells typically range in depth from a few feet to tens of feet. The wells usually inject water into the dry pore space above the water table (the unsaturated zone) from where it may percolate downward to mix with ground water beneath the water table (the saturated zone). For this disposal method to work, however, geologic formations with abundant porosity and permeability must exist for the water to be accepted and transmitted effectively.

Storm water drain wells are used extensively in two regions of the state. The Panhandle area around Coeur d'Alene relies on approximately 2,500 shallow drain wells generally less than 18 feet deep. This area has been particularly conducive to the use of drain wells, because it is underlain by a sand and gravel unit, the Rathdrum Prairie aquifer, that readily allows infiltration of injected runoff.

Southern Idaho is the other region where storm water drain wells are also widely used. In the Boise area, shallow drain wells may be modified by gravel-filled excavations to hasten infiltration. In this area, water is injected into unsaturated soil or shallow geologic deposits, such as sand, gravel, or alluvium. In Wendell, Shoshone, Gooding, and Idaho Falls, some deeper wells that were formerly used for the disposal of irrigation runoff from gravity irrigated fields have assumed a new use for the disposal of urban runoff. Injection in this area is generally into the fissures and voids of fractured basalt, a dark volcanic rock.

Urban storm water contains many contaminants that can adversely affect the quality of ground water. The first surge of surface water entering a drain well (or the "first flush," as it is commonly called) can be conspicuously laden with surface contaminants such as metals, volatile organic compounds, sediment, and bacteria. If contaminant-laden water percolates through the unsaturated zone, many substances can partially filter out, decompose, absorb or adsorb, be eaten by indigenous bacteria, or be otherwise neutralized or prevented from reaching the ground water. When water is injected into open fractures leading directly to the water table, contaminant removal mechanisms are diminished, and purification may rely principally on dilution by ground



Schematic drawing of a typical shallow injection well for storm water. The sediment trap (left) removes some contaminants in waste water prior to disposal and must be cleaned periodically.

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water and the mechanical filtration within the aquifer. Unfortunately, the subsurface can be an extremely complex geologic and biologic environment, and there are rarely mechanisms in place that allow us to predict the effect of these wells, and the substances they inject, on the quality of the ground water.

Without a satisfactory method of evaluating the influence of disposal wells on ground-water quality, conservation measures can be taken at the surface to limit or prohibit certain types of contaminants from reaching the ground water through injection wells. A popular and effective method of retaining many contaminants at the surface is to construct a grassy "swale" around the well opening. This grass-lined basin promotes the settling and biological uptake of runoff contaminants, while still allowing the full use of the injection well for runoff disposal. Other alternatives include a storm or sanitary sewer and surface collection and detention that can be implemented at greater cost. In addition, storm water disposal wells can be designed with a sediment trap or sand filter which reduces suspended sediment and associated contaminants.

While injection wells may be an economical method for disposing unwanted surface runoff, planners and engineers cannot ignore their actual or potential influence on ground-water quality. Wherever feasible, injection wells should be designed to keep contaminants at the surface where they can be more readily degraded or assimiliated.

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