Dry Wells

Uses, Regulations, and Guidelines in California and Elsewhere

Dry Well Description and Use

Dry wells are gravity-fed excavated pits lined with perforated casing and backfilled with gravel or stone (Fig. 1). Dry wells penetrate layers of clay soils with poor infiltration rates to reach more permeable layers of soil, allowing for more rapid infiltration of stormwater. They can be used in conjunction with low impact development (LID) practices to reduce the harmful effects that traditional stormwater management practices have had on the aquatic ecosystem. Dry wells not only aid in stormwater runoff reduction, but they can also increase groundwater recharge, are economical, and have minimal space requirements.

Figure 1. Idealized drawing of stormwater infiltration using a dry well

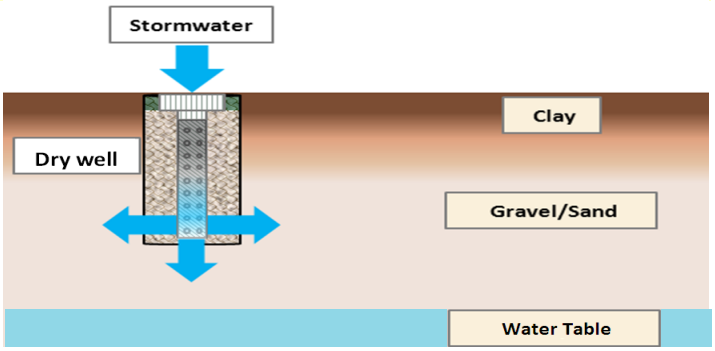


Fig. 2. Dry well installed to receive runoff flowing through a lawn (Source: R. Pitt)

In California, dry wells are used infrequently and with caution due to the concern that they provide a conduit for contaminants to enter the groundwater. In urban environments, scientific reports show a lack of correlation between the use of dry wells and groundwater contamination (Jurgens 2008, Los Angeles 2005). As a consequence, stormwater/LID guidelines often do not include dry wells. Regional Water Quality Control Boards' Standard Urban Stormwater Management Plans (SUSMP) also differ in technical specifications for dry well construction. The California Department of Water Resources' (DWR) well water regulations are interpreted by some to have applicability to stormwater infiltration through dry wells. Due to the desire to maintain high groundwater quality and the lack of clarity about various technical considerations, many are reluctant to incorporate dry wells into stormwater management projects.

U.S. Environmental Protection Agency (EPA) - Region 9 Regulations

Dry wells and other buried infiltrative devices serving lots other than single-family homes are subject to the U.S. Environmental Protection Agency (US EPA) Underground Injection Control (UIC) regulations. A dry well is considered a Class V injection well, which is defined as a conduit for non-hazardous fluids that is deeper than it is wide. Dry wells may be authorized to operate as long as they are registered with the US EPA, and only inject uncontaminated stormwater. The US EPA has no design requirements for dry wells; that responsibility is left to local authorities. However, the following design practices are encouraged:

- Should not be constructed deeper than the seasonal high water table.
- Follow local guidelines for setback distances from the dry well bottom to the water table.
- Go through a thorough site evaluation to prevent the spread of contaminants.
- Utilize pretreatment to remove sediment and the pollutants that they frequently carry.
- Use backfill to improve dry well column stability.

The US EPA has also set forth the following minimum requirements for Class V wells:

- Register injection wells at www.epa.gov/region09/water/groundwater/injection-wells-register.html
- Operate injection wells in a way that will not endanger underground sources of drinking water (USDW).
- Abandoned Class V wells should be properly destroyed, with notification to the US EPA, to prevent movement of contaminated fluids into USDW.

US EPA Regulations (continued)

In California, Class V wells are overseen by the US EPA's Region 9 office. Class V wells already in place that are not in the registry must cease use and the operator must contact the Regional office. An application and inventory form must be submitted, and injection can resume after 90 days, if approved. After an inventory form is submitted, the UIC Program will determine if the user is authorized to "inject". A well will be prohibited if the user endangers drinking water, fails to submit inventory information or an application to the UIC Program, or fails to respond to a written request from the UIC Program. Some dry wells in the State have been constructed without going through this registration process while some counties (e.g., Los Angeles) enforce registration as part of permitting new development.

The Role of the California Regional Water Quality Control Board

The State Water Resources Control Board and the Regional Water Quality Control Boards in California can prescribe requirements for discharges into California waters, including groundwater. Under California's Porter-Cologne Act, the Water Boards have the authority to require a person wishing to operate an injection well to file a report of the discharge. These requirements must implement the Boards' water quality control plans (Basin Plans). The requirements must take into consideration the beneficial uses (domestic water, irrigation, etc.) of the affected water and the water quality objectives necessary to protect these beneficial uses, as well as the need to prevent a nuisance.

California's Anti-Degradation Policy

When evaluating the risk and benefits of using dry wells, California's anti-degradation policy (State Water Resources Control Board Resolution No. 68-16) is also considered. The anti-degradation policy protects high quality water (water that is higher in quality than that prescribed by the Water Boards' plans and policies). Degradation of high quality water is permitted only if the discharge provides a maximum benefit to the people of the State, does not violate the Boards' Basin Plans and policies, and when the discharge is controlled by the best practicable treatment. The maximum benefit to the State is determined on a case by case basis taking into account the beneficial uses of the water, economic and social costs, the environmental aspects of the proposed discharge, and the implementation of feasible alternative treatment or control methods. Factors to be considered when evaluating the use of dry wells for stormwater management could involve determining if they:

- Provide an additional source of water to augment the water supply,
- Reduce the negative effects of runoff flowing to surface waters, and
- Minimally impact groundwater quality.

Consideration and interpretation of these and related factors are the basis on which the state's anti-degradation policy is applied to dry well use and siting.

Typical Dry Well Guidelines at the Local Level

Dry Wells and Water Well Protection Policy

Throughout California, county environmental management departments are charged with implementing California DWR regulations (Bulletins 74-81, 74-90) to protect wells used to supply drinking water. These regulations are designed to prevent contamination of groundwater through improperly constructed or decommissioned wells. County staff regularly inspect wells and the area around them to evaluate compliance with regulations. The very process that dry wells are designed to facilitate, namely the infiltration of stormwater, stands in contradiction to the goals of Bulletin 74, which prohibits surface water from entering injection wells. Currently, individual county environmental health departments in California use their best professional judgment to evaluate how to manage this challenge.

Local Guidelines

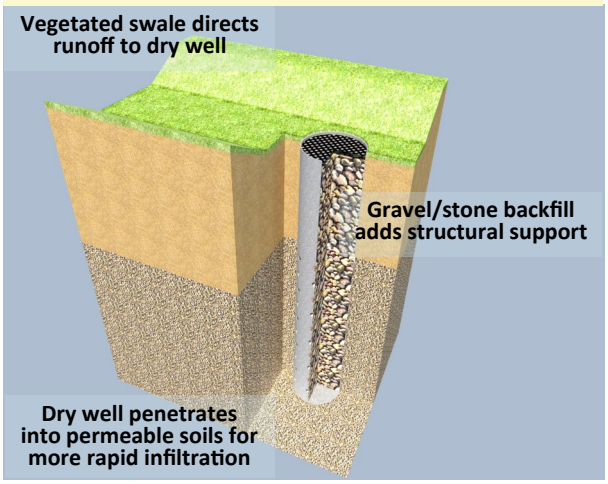
Many requirements and design specifications for dry wells come from guidelines linked to the NPDES (National Pollution Discharge Elimination System) permits, issued by the State or Regional Water Boards. In a few locales, city or county requirements also exist. In Los Angeles County, for example, information on placement and design of dry wells must be submitted as part of the permitting process for new development. Not all cities and counties have such requirements.

Local Guidelines (continued)

Design specifications differ by city/county, with some standards varying significantly. Local authorities should be consulted for specific guidelines. The following lists some of the common standards of the Los Angeles and San Diego SUSMPs as well as the Placer County LID Manual (documents that are linked to NPDES permits):

- Building setback: 10 – 20 feet minimum
- Soil: not suitable in soils with >30% clay or >40% silt
- Water table: 3 – 10 feet minimum separation between dry well bottom and seasonal high water table
- Public supply wells: 100 feet minimum setback
- Separation (center to center): 100 feet minimum
- Penetration: 10 feet minimum into permeable porous soils
- Dry well surface inlet: 3 inch minimum above bottom of retention basin
- Should not be used at sites with a slope >15%. (San Diego does not recommended sites with slopes >40%).

Figure 3. Example dry well system design



In 1951, the Regional Water Quality Control Board in the Bay Area restricted the use of dry wells in an effort to protect groundwater quality. Today, the San Francisco Public Utilities Commission recommends constructing drainage wells that are much wider than deep, therefore, they are not technically dry wells. The City of Modesto is a somewhat unique case in California in that they have been using dry wells for over 50 years as one of their principal runoff management tools. Dry wells are carefully scrutinized under the NPDES/MS4 permit. The Central Valley Regional Board requires the City of Modesto to perform extensive monitoring of stormwater and groundwater. The use of dry wells has not directly resulted in groundwater problems in Modesto (Jurgens 2008).

Dry Well Regulations in Other States

Over a dozen other states have dry well requirements in place. States surrounding California may provide a helpful overview of statewide dry well requirements currently being implemented. Oregon, for example, permits the use of dry wells, but they must be sited and constructed following their guidelines. Dry wells also must be registered with the state prior to construction and a fee, based on a sliding scale that is proportional to risk, must be paid. Arizona is another state that has used dry wells for many decades. They too have a registration system along with a fee system. The table below compares regulations between Arizona and California, both located in US EPA Region 9.

Arizona	California
Falls under USEPA Region 9 UIC program for Class V injection wells.	Falls under USEPA Region 9 UIC program for Class V injection wells.
Dry wells **must** be registered with the Arizona Department of Environmental Quality (ADEQ). Fee are required when registering.	Regional Water Quality Control Boards **can** prescribe discharge requirements for injection wells.
Requires Aquifer Protection Permit and approval by ADEQ prior to construction.	No statewide permitting requirements for the use of dry wells.
Requires information on design, pollutant characteristics, and closure strategy.	Regional Water Quality Control Boards may require a report of discharge and other information. No formal, statewide process for registration or monitoring.
Requires monitoring, recordkeeping and reporting, contingency planning, discharge limitations, a compliance schedule, and closure guidelines.	Injection well requirements must protect beneficial uses (comply with the Anti-Degradation policy).
A general permit covers facilities that have obtained a NPDES/MS4 permit and have a stormwater pollution prevention plan implemented.	Requirements may vary by region and municipality.

Regulations in Other States (continued)

Pennsylvania, New Jersey, Washington, and Hawaii are a few of the others states with dry well regulations and guidelines. In New Jersey, some communities require dry well installation for all new and major remodels related to residential construction. They are typically designed to temporarily store and infiltrate roof runoff. Dry wells in New Jersey are prohibited in industrial or other areas where toxic chemicals might be used. In contrast, in Pennsylvania dry wells are permitted in industrial areas with restrictions, but not along roadways. In Washington, dry wells must be registered and constructed to specifications. The regulations of these states vary with respect to dry well design, use of pretreatment, separation from drinking water sources, distance from the water table, and other factors.

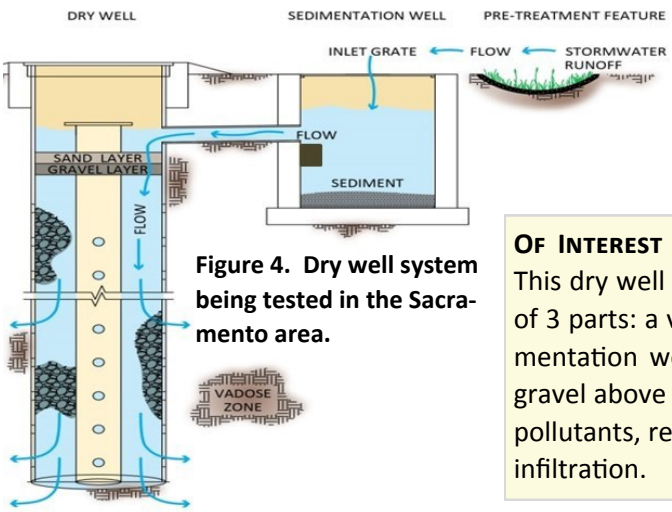


Figure 4. Dry well system being tested in the Sacramento area.

Of Interest Most dry wells are not holes in the ground filled with rocks. This dry well system (left) is being tested in the Sacramento area. It consists of 3 parts: a vegetated pretreatment feature, a structural pretreatment sedimentation well, and the dry well itself, which contains layers of sand and gravel above the rocks. The goal of this design is to maximize the removal of pollutants, reduce clogging of the dry well, and promote efficient stormwater infiltration.

Conclusions

Currently there are no uniform state regulations or guidelines for dry wells in California. However, the Regional Water Quality Control Boards have the discretion to issue waste discharge requirements and to interpret and apply the Anti-Degradation policy to the construction of new dry wells. Therefore, most regulations and guidelines occur at the city or county level and vary by region. Available information suggests that dry wells can be used safely if careful site evaluations are performed to determine if a dry well is suitable for the location. They can be an alternative to typical storm drainage systems that provide numerous benefits, including reducing localized flooding, recharging the aquifer, supporting the implementation of LID practices in areas with clay soils, thereby minimizing alterations to the hydrologic cycle which have damaging effects on valuable aquatic resources.

Useful Links and References

General Information

US EPA Class V Injection Well Information
http://water.epa.gov/type/groundwater/uic/index.cfmvv

US EPA California Injection Well Guidelines
http://www.epa.gov/region9/water/groundwater/uic-pdfs/calif5d-muniguide.pdf

Forms and Registration

EPA Region 9 Injection Well Registration
http://www.epa.gov/region09/water/groundwater/injection-wells-register.html
Region 9 Injection Well Contact: r9iwells@epa.gov

References

Jurgens, B.C., K.R. Burow, B.A. Dalgish, & J.L. Shelton. 2008. Hydrogeology, water chemistry, and factors affecting the transport of contaminants in the zone of contribution of a public-supply well in Modesto, eastern San Joaquin Valley, California. National Water Quality Assessment Program, U.S. Geological Survey, Scientific Investigation Report 2008-5156. http://pubs.usgs.gov/sir/2008/5156/pdf/sir20085156.pdf

The Los Angeles and San Gabriel Rivers Watershed Council. 2005. Los Angeles Basin Water Augmentation Study, Phase II Final Report. Los Angeles, CA. Posted at:
http://watershedhealth.org/Files/document/265_2005_WAS%20Phase%20II%20Final%20Report_2005.pdf

This factsheet was prepared by the California Office of Environmental Health Hazard Assessment, which is working with the City of Elk Grove on a Proposition 84 funded study of the potential risks to groundwater quality associated with the use of dry wells. Written by Nelson Pi & Ary Ashoor. For more information, contact Barbara Washburn, PhD at barbara.washburn@oehha.ca.gov.