

Aquifer Storage & Recovery and Artificial Groundwater Recharge

Background

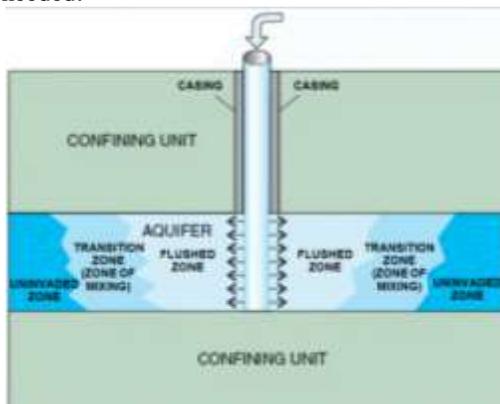
Oregon's rising population has dramatically increased demands on drinking water, as well as on agricultural, ecological and industrial water supplies. However, because surface waters in Oregon are fully allocated much of the year for various water demands, many are turning to groundwater to supply our growing needs.

In several areas of the state, groundwater is consumed faster than it is replaced. One way to address this growing problem is to inject or infiltrate water into underground aquifers during times of plenty, and remove it during drier times of the year. These "water banking" methods are known as Aquifer Storage and Recovery (ASR), and Artificial Groundwater Recharge, also known as Artificial Recharge (AR). This fact sheet explains Oregon DEQ's role in evaluating and permitting these projects, and outlines applicable regulations.

What is an ASR or AR project?

ASR and AR are "tools" that can be used to better match water supply and water demand. Both methods involve diverting water from one source (typically a surface-water source) to an underground reservoir for later retrieval and use. Subsurface injection can be from a well or a series of perforated pipes designed to distribute the source water in the subsurface.

ASR refers to the process of storing water in an aquifer during times when water is plentiful (typically during the winter wet season) and recovering the water during times when it is needed.



Aquifer storage and recovery well in a confined aquifer. Flushed zone contains mostly recharged water. (Image courtesy of USGS)

Many water purveyors use aquifer storage and recovery facilities in Oregon to manage drinking-water supplies. These ASR facilities capture winter surface water flow and treat it to drinking-water standards. The water is then injected into deep aquifers that function as large storage reservoirs. The injected water displaces and mixes with the groundwater, which originates in the aquifer, and is later withdrawn from the aquifer during high-demand, dry summer months.

Artificial recharge is the process of adding water to an aquifer for restoring and managing groundwater resources. The groundwater may or may not be withdrawn downstream from the injection location. In northeast Oregon, AR projects are currently restoring shallow groundwater levels to their past elevations to provide summertime flows to streams through groundwater discharge.



Artificial recharge through a spreading basin in an unconfined aquifer. Stored water is recovered through a well or allowed to discharge into a stream at some point downgradient. (Image courtesy of Oregon Water Resources Department).

How are these projects regulated?

In Oregon, aquifer storage and recovery and artificial recharge projects are jointly regulated by the Oregon Water Resources Department, Oregon Health Authority Drinking Water Program, and DEQ's Water Quality Program.

The Water Resources Department regulates licensing and permitting of ASR projects and regulates water rights for both ASR and AR projects. The agency relies on DEQ and OHA to provide comments and recommended conditions for ASR-limited licenses and permits. DEQ also works with Water Resources staff to ensure ASR licenses and permits meet underground injection



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control and groundwater quality protection requirements. The Water Resources Department aquifer storage and recovery and artificial recharge rules incorporate some DEQ and OHA rules by reference to protect drinking water supplies.

Federal regulations and state rules

The Oregon Administrative Rules and Code of Federal Regulations governing ASR and AR projects include:

- **OAR 690-350**
Water Resources Department ASR and AR requirements that also include OHA drinking water requirements by reference.
- **OAR 340-044**
DEQ Underground Injection Control rules that specify requirements for injection activities.
- **OAR 340-040**
DEQ groundwater quality protection rules that specify what must be done to protect groundwater and prevent pollution.
- **40 CFR 142**
National primary drinking water standards applicable to all UIC activities.
- **40 CFR 144**
Federal UIC regulations applicable to injection activities.

The table on pages 3-4 outlines how these regulations and rules affect use of river water, treated drinking water, treated wastewater and stormwater for aquifer storage and recovery and artificial recharge.

Are there limitations to direct injection of treated water?

Currently, treated drinking water is the only source water explicitly allowed by rule for direct injection into underground sources of drinking water. For example, river water must be treated to meet drinking water standards before it can be directly injected into an underground source of drinking water.

Direct injection of treated stormwater is only allowed under a DEQ water quality permit, and direct injection of treated municipal wastewater or industrial wastewater is specifically prohibited by DEQ rules.

Permitting requirements

Anyone who wants to operate an aquifer storage and recovery or artificial recharge project must obtain either a limited license or a permit from the Oregon Water Resources Department. In addition, anyone seeking to operate an AR

project must obtain a permit from DEQ (if deemed necessary by DEQ).

If the ASR or AR project involves the subsurface injection of water, the applicant must also submit a UIC application to DEQ for authorization by rule. An applicant must apply for a DEQ-issued Water Pollution Control Facility permit if an artificial recovery project cannot meet all DEQ authorization requirements under OAR 340-044-0018.

Meeting drinking water requirements

The federal Safe Drinking Water Act requires that treated water meet national drinking-water standards. These standards are concentration-based and have restrictive concentration limits for pollutants common to surface water, including cryptosporidium, giardia lamblia, viruses, legionella, total coliform, fecal coliform, *E. coli*, and turbidity. The federal drinking water act also requires treated water to not adversely affect human health.

Protecting groundwater

State rules require that groundwater be protected to the highest beneficial use, which is usually drinking water, for which the naturally existing background concentration is typically adequate.

Facilities using ASR and AR direct injection into groundwater must implement highest and best practicable methods to prevent pollutants from moving to groundwater and to minimize groundwater quality degradation. To determine the highest and best practicable methods to achieve this goal, an applicant must consider available technologies for treatment and waste reduction, cost effectiveness, site characteristics, and pollutant toxicity and persistence.

For more information

For questions about ASR or AR underground injection activities, you may also contact the UIC Senior Hydrogeologist, DEQ regional hydrogeologist, Portland, at 503-229-6371, or call toll-free in Oregon at 1-800-452-4011, ext. 6371.

Alternative formats

Alternative formats (Braille, large type) of this document can be made available. Contact DEQ's Office of Communications and Outreach, Portland, at 503-229-5696, or call toll-free in Oregon at 1-800-452-4011, ext. 5696; fax to 503-229-6762; or email to deqinfo@deq.state.or.us

People with hearing impediments may call 711.

**FEDERAL REGULATIONS AND STATE RULES FOR
ASR AND AR PROJECTS**

Federal Regulations and State Rules	River Water	Treated Drinking Water	Treated Wastewater	Stormwater
FEDERAL				
40 CFR 144.11. Any underground injection, except into a well authorized by rule or except as authorized by a permit issued under the UIC program, is prohibited.	X	X	X	X
40 CFR 144.12. No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142 or may otherwise adversely affect the health of persons.	X	X	X	X
40 CFR 144.82 (a). Prohibits movement of fluids unless conditions of 40 CFR 144.12 are met.	X	X	X	X
40 CFR 144.82 (c). Must comply with UIC Program requirements in 40 CFR Parts 144 through 147.	X	X	X	X
40 CFR 144.82 (d). Must comply with state UIC requirements, if state requirements are more stringent than federal requirements.	X	X	X	X
40 CFR Part 142. Provides the National Primary Drinking Water Standards (Maximum Contaminant Levels) applicable to all UIC activities; includes limits for Cryptosporidium, Giardia lamblia, heterotrophic plate count, Legionella by specifying they meet surface water treatment rule requirements.	X	X	X	X
40 CFR Part 142. National Primary Drinking Water Standards: Total Coliform, includes fecal coliform and <i>E. coli</i> - See Notes # 4 and 5 of the standard. (http://www.epa.gov/safewater/contaminants/index.html).	X	X	X	X

Federal Regulations and State Rules	River Water	Treated Drinking Water	Treated Wastewater	Stormwater
STATE				
OAR 340-044-0011(5)(e). Aquifer storage and recovery and artificial groundwater recharge wells are Class V UIC wells. In general, fluids being injected must have a water quality equivalent to the natural background groundwater quality.	X	X		X
OAR 340-044-0012 (1). Any injection activity is prohibited unless it is authorized by rule or allowed under a DEQ issued permit.	X	X	X	X
OAR 340-044-0014 (1). Prohibits underground injection activities if requirements of 40 CFR 144.12 are not met, or the activity fails to comply with groundwater protection requirements of OAR 340-040.	X	X	X	X
OAR 340-044-0015(2)(f). Prohibits direct injection of industrial or municipal wastewater into an underground source of drinking water.			X	
OAR 340-044-0015(2)(g). Prohibits the injection of agricultural drainage water into an underground source of drinking water.			X	
OAR 340-044-0018. Prescriptive state requirements for authorization by rule. Presumes groundwater quality is met when rule requirements are met.	X	X		X
OAR 340-044-0018(1)(c). Cannot authorize by rule if Primary Drinking Water Standards or natural background concentrations are exceeded.	X	X		X
OAR 340-044-0018 (3)(a)(A). Cannot authorize by rule if stormwater is mixed with other fluids.				X
OAR 340-044-0018 (3). Allows stormwater injection as authorized by rule provided: (A) stormwater is not mixed with other fluids or wastes, (B) no other methods of disposal are appropriate, (C) no domestic wells are present within 500 feet, (D) injection is outside a 2-year time-of-travel zone, (E) the injection well does not exceed 100 feet below ground surface, and (F) the stormwater is treated to prevent groundwater contamination.				X
OAR 340-040-0020(3). Protect groundwater to the highest beneficial use, which is usually drinking water.	X	X	X	X
OAR 340-040-0020(11). Employ the highest & best practicable methods to prevent pollution of groundwater to protect public health and the environment.	X	X	X	X
OAR 690-350. WRD ASR and AR requirements; includes OHA drinking water requirements by reference.	X	X	X	X
OAR 690-200. WRD rules governing water supply well construction and maintenance standards.	X	X	X	X
OAR 690-220. WRD rules governing water supply well abandonment.	X	X	X	X