



## **ADMINISTRATIVE PROTOCOL**

### **Recharge**

### **Division One - South Platte River Basin**

Revised May, 2022

The purpose of recharge is to intentionally introduce water into a tributary aquifer through percolation from the surface. The introduction of water to the aquifer causes a like amount of groundwater to discharge at a surface stream in a specific location and time as “accretions” or “recharge credits” available for beneficial use. Recharge as used in this document does not include artificial recharge of the Denver Basin or nontributary aquifers. A Recharge Structure can be:

- A section of ditch, the infiltration from which can be reasonably modeled as a single source of water.
  - A single pond or a group of ponds that receive water from the same delivery location and the infiltration from which can be reasonably modeled as a single source of water.
1. Recharge credits/accretion including timing, location, and amount are determined only in accordance with decrees of the court or written administrative approvals, including Substitute Water Supply Plans (SWSPs). SWSP or water court applications should include the following information about each Recharge Structure:
    - a. map(s) showing the locations of:
      - i. diversion point(s)
      - ii. Recharge Structure
      - iii. measurement structures (inflow, outflow, staff gage);
    - b. listing of the court case number for the decree(s) authorizing the diversion of water into the Recharge Structure and use of the water in a plan for augmentation, if any
    - c. the maximum water surface area of the structure or stage-area capacity curve developed for each Recharge Structure;
    - d. for ditch structures, if the ditch is divided into more than one Recharge Structure, an explanation of how the volume delivered to an upstream reach will be allocated to downstream Recharge Structures in the ditch.
  2. The division engineer will assign the Recharge Structure a WDID number. The WDID number is the identification number that will be used for the administration of the structure and must be included in all correspondence and accounting.
  3. Prior to commencement of construction, the owner/operator of the Recharge Structure must obtain water commissioner’s approval of proposed equipment, installation and construction. Prior to any diversion into the Recharge Structure, the owner/operator must obtain the water commissioner’s written approval of the final construction and equipment installation, as further described below.

- a. The flow into each Recharge Structure must be equipped with a measurement device and a continuous flow data recorder, unless the water commissioner in conjunction with the division engineer determines adequate records may be kept without such equipment. Refer to the [Administrative Protocol and Functional Standards - Surface Water Headgates and Measuring Devices](#), for minimal suggested equipment installation and operation.
  - b. If the Recharge Structure is designed to discharge water via a surface outlet, such discharge must also be equipped with a measurement device and a continuous flow recorder.
  - c. Each Recharge Structure must have a staff gage, or other devices as required, installed to provide a reading of the surface water elevation in the Recharge Structure.<sup>1</sup> The gage installation should be such that the gage registers the lowest water level in the Recharge Structure. The staff gage must be readable from a readily accessible location. The gage shall have permanent demarcations of 0.01 feet, with the whole feet (1.00 feet) clearly and easily identifiable.
4. All Recharge Structures must be maintained in such a way as to minimize consumptive use of the water by vegetation. Existing vegetation shall be mowed or removed prior to and during the running of water into the Recharge Structure. Crops may not be planted in a Recharge Structure during the same irrigation year that it is used as a Recharge Structure without prior approval from the water commissioner or division engineer.
  5. The timing and quantity of recharge credits/accretions is estimated by applying the lagging parameters (or Unit Response Functions “URFs”) in the decree or SWSP to the volume of water infiltrated into the ground (*Infiltrated Volume* as calculated below). One common method for determining the volume of water infiltrated for any time period can be determined by using a daily mass balance calculation, in acre-feet, and solving for the residual volume (R) of unmeasured flows<sup>2</sup> as follows. Other methods for determining the volume of water infiltrated into the ground may be considered on a case-by-case basis:

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<sup>1</sup> Unless an alternate method of measuring or estimating the change in storage has been approved by the Division Engineer.

<sup>2</sup> For more information on the mass-balance equation as it applies to ponds or reservoirs, please refer to Guideline 2019-3, Reservoir Accounting Guideline

$$R = \Delta Storage - Meas. Inflow + Meas. Outflow + Evaporation + ET$$

where,

- a. *R* represents the net sum of all unmeasured flow. When *R* is positive, it represents the volume of unmeasured inflows (i.e., no recharge occurred) and when negative, it represents the volume of unmeasured outflow (i.e., recharge volume) that infiltrated into the ground and can be used, with the lagging parameters, to determine the amount of recharge credit.
  - b. *ΔStorage* is the change in storage volume compared to a previous measurement, typically based on staff gage readings and the stage-capacity table.
  - c. *Meas. Inflow* is the volume of water delivered into the recharge structure,
  - d. *Meas. Outflow* is the volume of water discharged from the recharge structure,
  - e. *Evaporation* is the volume of water lost to evaporation (see item 6, below),
  - f. *ET* is the volume of water lost from the consumption by vegetation located within the recharge structure. Appropriate vegetative consumptive use values, based on publications of actual plant water use, should be used depending on the type of plants that are found to exist, subject to DWR approval.
6. Gross Evaporative losses from the Recharge Structure must be subtracted from the volume of water delivered to the Recharge Structure. Evaporative losses must be accounted for every day the Recharge Structure has a visible water surface. If the Recharge Structure does not have a stage-surface area curve approved by the water commissioner, the maximum surface area of the Recharge Structure must be used to determine the evaporative losses, unless a different method is approved. Gross evaporation should be estimated using the processes described for off-channel reservoirs in [Guideline 2019-3 - Reservoir Accounting Guideline](#). Monthly evaporation estimates may be prorated for days when there is no visible water surface. A lack of visible water surface is determined from a field inspection. Days with no water surface may be entered from the date of field inspection until the next date of water delivery.
  7. Any structure that intercepts groundwater must be permitted as a well and included in a plan for augmentation or SWSP approved by the State Engineer. The Division Engineer strongly recommends avoiding Recharge Structures that intercept groundwater, in order to simplify the accounting process.