



SUSTAINABLE GROUNDWATER
MANAGEMENT (SGM)
GRANT PROGRAM



The following is an excerpt from the Indirect Potable Reuse Monitoring Method [MM-05]

SGM Grant Program Requirements for Post-Performance Monitoring and Reporting

Indirect Potable Reuse (IPR) Monitoring Method

Project / Action Type	Indirect Potable Reuse (IPR) projects use highly purified recycled water to recharge aquifers for water supply augmentation.
Similar / Related Project Types	IPR would be implemented in conjunction with recharge projects such as Aquifer Storage and Recovery or Recharge Ponds. IPR may support sustainability indicators such as interconnected surface water, seawater intrusion, and subsidence, as well as potentially support groundwater dependent ecosystems.
Metric	Groundwater levels. Groundwater storage. Applicable water quality constituents.
Measurement Unit	Groundwater levels measured in feet in a consistent vertical datum. Recharge/demand volumes in acre-feet. Concentration or measurement of applicable groundwater quality constituents (typically mg/L), specifically Title 22 requirements from the California Code of Regulations.
Beneficial User	Municipal and domestic water supply (MUN) Industrial service supply (IND) Industrial process supply (PROC) Agricultural water supply (AGR) Groundwater recharge (GWR)

Approach to Implementing Indirect Potable Reuse Monitoring

IPR is one approach being used for groundwater sustainability projects to increase groundwater recharge, reuse existing water supplies, reduce waste discharge, and prevent undesirable results such as seawater intrusion and subsidence. IPR uses wastewater that has undergone advanced treatment (typically microfiltration, reverse osmosis, and ultraviolet light-based advanced oxidation). The advanced treated water is used to augment groundwater storage via injection or surface spreading in recharge ponds or basins. As sustainability benefits should be monitored based on Monitoring Methods for the applicable groundwater recharge project type and sustainability indicators and considerations expected to benefit, this method describes monitoring for groundwater quality impacts from IPR.

The primary concern about IPR projects is that the introduction of a new water source to the groundwater aquifer could impact water quality. Although the source of water is designed to be highly purified and generally expected to improve groundwater quality, adverse groundwater quality impacts could occur due to treatment failures or geochemical reactions between the purified water and aquifer sediments.

Justification

To achieve the GSP sustainability goal, an IPR project needs to show that it does not cause undesirable results for groundwater quality even as it provides the benefits of groundwater recharge (increased groundwater in storage and reductions in groundwater level declines). SGMA defines the groundwater quality sustainability indicator to ensure the groundwater management, including the implementation of projects and actions, does not result in significant and unreasonable groundwater quality impacts.

This Monitoring Method does not describe all groundwater monitoring required by the GRRP regulations and instead considers groundwater monitoring to evaluate undesirable results as primary monitoring. For example, the GRRP regulations provide requirements, such as **tracer studies**, to monitor groundwater to estimate underground retention time. As this is monitoring to prevent potential impacts as opposed to monitoring actual impacts that could be undesirable results, this is not described in this method even though the project proponent will need to follow these requirements related to project permitting. Monitoring such as tracer studies are considered secondary monitoring for the purposes of evaluation of grant outcomes even though they are required by the GRRP regulations. The data from this secondary monitoring should be available for the Department of Water Resources (DWR) to obtain, if requested.

The method described here focuses on primary monitoring for observed impacts to groundwater quality that may lead to undesirable results. However, some of the requirements in the GRRP may overlap with the presented monitoring method.

Tracer studies inject a harmless constituent of known concentration into the subsurface which is monitored at downgradient locations.

They are used in the field to obtain information on the direction and velocity of the flow of groundwater and associated contaminants, and the presence of preferential flow paths.

A Step-by-Step Guide to Applying Indirect Potable Reuse Monitoring Method

1. **Safety plan:** All projects with fieldwork related activities should produce a Safety Plan. Planning for fieldwork and availability of access to the site, such as monitoring wells, is necessary to maintain project safety. IPR projects may require a Safety Plan to address these and other potential safety concerns.
2. **Identify monitoring wells:** Identify monitoring wells used to meet GRRP regulations.

Title 22 (Sections 60320.126 and 226) requires the following monitoring wells.

 - a. One monitoring well located between the IPR recharge basin or well that is between two weeks and six months travel time from the recharge location and at least 30 days upgradient of the nearest drinking water well.
 - b. The second monitoring well is required between the recharge location and the nearest downgradient drinking water well.

Monitoring wells should be located in each aquifer recharged by IPR. Monitoring at wells identified by the project proponent in its Title 22 Engineering Report for meeting these regulations should be

reported to DWR as part of this method. The location of the monitoring network should be easily accessible such that gaining access to the site does not inhibit gathering and downloading data (refer to Step 1).

3. **Identify Representative Monitoring Points (RMP):** Identify RMPs closest to IPR recharge location in aquifers recharged by IPR that are most likely to show groundwater quality impacts. Consistent with reporting requirements in the GRRP regulations (Title 22 Sections 601320.128 and .228), any RMPs that are within ten years travel time of the IPR recharge location should also be identified. Monitoring at these RMPs should be reported to DWR as part of the annual reports.
4. **Monitoring plan:** Implement monitoring plans described in IPR Project Title 22 Engineering Report and, if applicable, under the GSP for the region. These plans may describe the groundwater quality monitoring approach at the wells identified in Steps 1 and 2, including monitoring baseline conditions.
5. **Monitoring:** Sample wells quarterly. This is consistent with the sampling frequency required by GRRP regulations (Title 22 Sections 60320.126 and .226).

Data and Protocol - Fundamentals

GRRP regulations identify groundwater quality parameters to be monitored during operation of an IPR project as total nitrogen, nitrate, nitrite, contaminants with secondary maximum contaminant limits, and any other contaminants specified by Division of Drinking Water or RWQCB. Table 1 presents an example list of flow and water quality monitoring that may be required under Order from Waste Discharge Requirements and Water Reclamation Requirements. These constituents should be monitored at all monitoring wells identified to meet GRRP regulations and permitting requirements. In addition, constituents identified in the GSP with water quality sustainable management criteria should be monitored at IPR monitoring wells.

Table 1. Example Groundwater Data Monitoring Report (Generally Quarterly)

Sample Location	Parameter	Units	Sample Type	Min Sampling Frequency	Value
ALL	Total flow	MGD or Acre Feet	Recorder	continuous	XX
MM-XX	Water level elevation	Feet	---	quarterly	XX
	Total Residual Chlorine	mg/L	grab	quarterly	XX
	TOC	mg/L	grab	quarterly	XX
	Total Coliform	MPN/ 100 mL	grab	quarterly	XX
	BOD5	mg/L	grab	annually	XX
	Oil and grease	mg/L	grab	annually	XX
	Nitrate-N	mg/L	grab	quarterly	XX
	Nitrite-N	mg/L	grab	quarterly	XX
	Total Nitrogen	mg/L	grab	quarterly	XX
	Total Dissolved Solids	mg/L	grab	quarterly	XX
	Sulfate	mg/L	grab	quarterly	XX
	Chloride	mg/L	grab	quarterly	XX
	Boron	mg/L	grab	quarterly	XX
	Odor	TON	grab	quarterly	XX
	Color	CU	grab	quarterly	XX
	Total Suspended Solids	mg/L	grab	quarterly	XX
	Turbidity	NTU	grab	quarterly	XX
	Foaming Agents	mg/L	grab	quarterly	XX
Specific Conductance	µmhos/cm	grab	quarterly	XX	
Corrosivity	LSI	grab	quarterly	XX	
Silver	µg/L	grab	quarterly	XX	

Iron	µg/L	grab	quarterly	XX
Zinc	µg/L	grab	quarterly	XX
Aluminum	µg/L	grab	quarterly	XX
Manganese	µg/L	grab	quarterly	XX
Copper	µg/L	grab	quarterly	XX
MTBE	µg/L	grab	quarterly	XX
Thiobencarb	µg/L	grab	quarterly	XX
Fluoride	µg/L	grab	quarterly	XX
Other Inorganics with Primary MCLs	µg/L	grab	quarterly	XX
Other Regulated Organics	µg/L	grab	quarterly	XX
Other Constituents/parameters with Secondary MCLs	µg/L	grab	quarterly	XX
Disinfection Byproducts	µg/L	grab	quarterly	XX
Radioactivity	pCi/L	grab	quarterly	XX
Other General Physical and General Minerals	µg/L	grab	quarterly	XX
Other Constituents with Notification Levels	µg/L	grab	annually	XX
Remaining Priority Pollutants	µg/L	grab	quarterly	XX
Identified constituents of emerging concern	µg/L	grab	quarterly	XX

Data Analysis and Reporting

1. **Evaluate data vs. water quality objectives.** Water quality data should be evaluated against maximum contaminant levels for constituents listed in the Title 22 Engineering Report and the GSP. Exceedances may lead to suspension of operation of the IPR project until corrective actions are implemented, or the project proponent can show that exceedances were not caused by the IPR project.
2. **Report data annually to DWR.** Data collected as part of this method will be reported in the Title 22 Annual Report and the GSP Annual Report. For grant compliance, the data can be referenced and summarized to document whether there are groundwater quality impacts from the IPR project and whether the IPR project is contributing to groundwater quality undesirable results. This summary should be included in the larger report to DWR describing the recharge benefits of the IPR project as described in other Monitoring Methods.

Data Standards

Precision and accuracy of water quality sampling should facilitate comparison with water quality objectives. For example, GRRP regulations include a confirmation sampling trigger related to concentrations at 80% of the maximum contaminant limits for nitrate, nitrite, and nitrogen so data precision and accuracy should be able to distinguish above and below the trigger. Data standards will vary by constituent as Division of Drinking Water, RWQCB, or the GSP may require monitoring additional constituents such as arsenic, perfluoroalkyl substances (referred to as PFAS) or other constituents of emerging concern.

Key Protocols

There are several protocols that an IPR project will need to follow:

- DWR's Best Management Practice 1 Monitoring Protocols Standards and Sites - describes protocols for measuring groundwater quality to assist in the establishment of consistent data collection procedures and processes (DWR, 2016)
- Water Quality Sampling Protocol Described in GSP

- California Department of Toxic Substances Control, Representative Sampling of Groundwater for Hazardous Substances Guidance Manual for Groundwater Investigations
- USGS National Field Manual for the Collection of the Water-Quality Data