Guidance for Developing a Ground Water Quality Monitoring Program for Managed Recharge Projects by Land Application

State of Idaho
Department of Environmental Quality

July 2017

Printed on recycled paper, DEQ July 2017, PID 9010, CA 82017. Costs associated with this publication are available from the State of Idaho Department of Environmental Quality in accordance with Section 60-202, Idaho Code.

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July 2017

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Acronyms, Abbreviations, and Symbols

ASTM	ASTM International
BMP	best management practice
cfs	cubic foot per second
CLPP	Community-level physiological profiling
DEQ	Idaho Department of Environmental Quality
EPA	US Environmental Protection Agency
E. coli	*Escherichia coli*
GIS	geographic information system
IDWR	Idaho Department of Water Resources
ISDA	Idaho State Department of Agriculture
mL	milliliter
MPN	most probable number
TOC	total organic carbon
TOT	time of travel
USGS	US Geological Survey
VOC	volatile organic compound

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Executive Summary

Managed (artificial) recharge, which is the management of water specifically for the purpose of adding water to the zone of saturation by land application, may be one of several solutions to restore declining water levels in some aquifers. In other western states, permitted programs are used to facilitate increased water storage in aquifers without adverse impacts to ground water quality.

The Idaho Department of Environmental Quality (DEQ) is providing this guidance document to assist interested parties in developing an appropriate ground water quality monitoring program for DEQ review and approval. Because of the variability of site characteristics in Idaho, each project will be reviewed on a case-by-case basis. The details of a monitoring program are expected to vary by site and project; monitoring requirements are flexible once sufficient information is provided to demonstrate ground water quality is improved or maintained by managed recharge activities.

Statement of Intended Use

This guidance is intended to assist entities in developing ground water quality monitoring programs for managed recharge projects by land application, consistent with the applicable provisions of the" Wastewater Rules" (IDAPA 58.01.16.600).

This guidance is not a rule and does not establish regulatory requirements, enforceable standards, or permitting thresholds. Any example distances, time-of-travel assumptions, suggested monitoring locations, or other recommendations are provided solely to inform the design and evaluation of ground water quality monitoring programs and are not applicable for other purposes. Nor are they intended to replace site-specific evaluation or requirements established in statute or rule. DEQ reviews managed recharge projects and associated monitoring programs on a case-by-case basis, considering site-specific hydrogeologic conditions, project characteristics, and applicable regulatory requirements.

Purpose

This guidance will help interested parties develop a ground water quality monitoring program demonstrating that a land application recharge project will not adversely affect a beneficial use of waters of the state. Included in the guidance is a description of those conditions that DEQ will consider in approving a ground water quality monitoring program for a recharge project.

This guidance applies in situations where water is delivered to a wetland, dry streambed, or dry lake bed or basin to offset ground water withdrawal or as beneficial use of a water right when a DEQ-approved ground water quality monitoring program is required.

Projects exempt from this guidance include those operating before January 1, 1985, when provision was made for water quality monitoring at sites where recharge water is land applied under the "Water Quality Standards" (IDAPA 58.01.02) and "Wastewater Rules" (IDAPA 58.01.16). Sites developed before January 1, 1985, that receive water before, during, or after the irrigation season are also exempt from the rule as long as recharge occurs within the

pre-January 1, 1985, site boundary. Any expansion or infrastructure construction at existing sites after January 1, 1985, is subject to the current IDAPA 58.01.16.600. This guidance does not apply to incidental recharge resulting from precipitation; irrigation practices and delivery system leakage; surface water seepage from creeks, streams, or lakes; lagoons; stormwater runoff and storage; lagoons associated with confined animal operations; mining operations; wastewater land applications; early or late season in-canal recharge (before or after the normal irrigation season); emergency flood spills of 7 days or less; or recharge water applied through the use of injection wells. Discussions among Comprehensive Aquifer Management Plan Working Groups attended by representatives from irrigation entities reached consensus that 7 days represents the maximum amount of time typically required for emergency canal operations.

Other situations in which this guidance may not fully apply may include a recharge event (not exceeding 7 days) to determine site feasibility for recharge or a trace test to determine ground water flow direction. For such 7-day or less recharge events, it is strongly recommended that the source water being used for recharge be analyzed for bacteria at a minimum. When recharge occurs longer than 7 days, a DEQ-approved ground water quality monitoring program will be required.

The use of best management practices is required by the "Ground Water Quality Rule" (IDAPA 58.01.11). Thus, if the site is being used for the first time, DEQ may require the interested party to evaluate potential water quality impacts to nearby drinking water wells by conducting water quality testing upgradient and downgradient of the application site before, during, and after recharge. Ground water sampling constituents and sampling frequency should be determined based on site-specific conditions. An evaluation of hydrologic changes such as potential mounding is highly recommended.

If the source of recharge water is treated wastewater, including Class A effluent, the project is subject to the "Recycled Water Rules" (IDAPA 58.01.17). Noncontact cooling water can be land applied as recharge water based on DEQ approval as described in IDAPA 58.01.16.600.04–05.

Authority and Rules that Apply to this Guidance

Authorities for this guidance are defined in the Ground Water Quality Protection Act (Idaho Code §39-102, §39-120), *Idaho Ground Water Quality Plan* (GWQC 1996), IDAPA 58.01.11, and IDAPA 58.01.16.

- The Ground Water Quality Protection Act designates DEQ as the primary agency to coordinate and administer ground water quality protection programs for the state.
- The *Idaho Ground Water Quality Plan* (section V-C) directs DEQ, in cooperation with other appropriate agencies, to develop guidelines, management practices, and rules pertaining to ground water recharge projects.
- IDAPA 58.01.11 establishes minimum requirements for protection of ground water quality through standards and an aquifer categorization process that serves as the basis for DEQ to administer programs that address ground water quality.
- IDAPA 58.01.16 authorizes DEQ to approve ground water quality monitoring programs for aquifer recharge projects by land application.

Specific rules DEQ will consider when reviewing a ground water quality monitoring program for a recharge project include the following:

- IDAPA 58.01.16, "Wastewater Rules," including sections pertaining to applied waters restricted to premises (IDAPA 58.01.16.600.02), monitoring (IDAPA 58.01.16.600.04), and basis for evaluation (IDAPA 58.01.16.600.05)
- IDAPA 58.01.11, "Ground Water Quality Rule," including sections pertaining to management of activities with the potential to degrade aquifers (IDAPA 58.01.11.301) and ground water contamination (IDAPA 58.01.11.400)

Process Overview

The process defined by this guidance includes the following actions:

- *Pre-Project Meeting*—The responsible party interested in conducting a recharge project contacts the appropriate DEQ regional office to set up a pre-project meeting. It is highly recommended that the responsible party review the recharge project outline in Appendix A before the pre-project meeting. Reviewing the outline will assist the applicants with formulating questions and concerns to discuss with DEQ.
- *Program Submittal*—The responsible party submits a recharge ground water quality monitoring program to DEQ that describes the monitoring program to be conducted.
- *Public Notice and Comment*—DEQ may provide public notice to private property owners within the potential zone of influence of the recharge project and to the general public via the agency's website that a recharge ground water quality monitoring program is available for review. DEQ takes public comments into consideration.
- *Evaluation and Review*—DEQ reviews recharge ground water quality monitoring programs on a case-by-case basis and responds within a reasonable timeframe, generally 30 days from the end of the public comment period.
- *Opportunity for Appeal*—Opportunity is provided for appeal of DEQ decisions.
- *Reporting.* The responsible party provides DEQ with a schedule for reporting monitoring results.
- *Project Review and Modification*—DEQ reviews the project data. In the event that water quality is degraded, additional monitoring, modification of practices, or cessation of activity may be required.

Contents of a Ground Water Monitoring Program

A program for monitoring ground water quality for recharge by land application should address the following:

- *Project Description*—This includes legal and physical descriptions of the recharge basin and landownership.
- *Recharge Area Characterization*—This includes soil and geology; hydrogeologic and surface water features; contaminant sources, land use, and vegetation; and measures used to confine recharge water to the recharge site.
- *Recharge Facility Description*—This includes a description of the facility or basin, water delivery system, water quantity measurement system, and any structures/infrastructure or features considered a part of the recharge facility.

- *Evaluation of Potential Impacts*—This is completed to determine if the project will reduce the quality of ground or surface water, cause an exceedance of a ground water quality standard, or adversely affect drinking water or other uses of ground or surface water. Nearby well owners potentially impacted by recharge activities should be identified.
- *Water Quality Monitoring Program*—This includes ambient ground water quality monitoring, locations to sample and monitor, monitoring frequency, field parameters, constituents for laboratory analyses, and best management practices to maintain or improve existing ground water quality.
- *Management Practices*—This includes reporting schedules, contingency planning, and a description of any recharge water treatment processes proposed.

It is highly recommended that the interested party submit the recharge project outline in Appendix A with the monitoring program.

Monitoring Program Approval

Approved ground water quality monitoring programs for land application recharge projects will include appropriate sampling parameters, sampling frequency, and reporting schedules. Failure to implement the approved monitoring program could subject the project owner to an enforcement action.

1 Purpose

This guidance will help interested parties develop a ground water quality monitoring program demonstrating that a land application recharge project will not adversely affect a beneficial use of waters of the state. Included in the guidance is a description of those conditions that the Idaho Department of Environmental Quality (DEQ) will consider in approving a ground water quality monitoring program for a recharge project. The term "should" is used throughout this guidance and is intended to be a suggestion, not a requirement or rule.

This guidance applies in situations where water is delivered with intent of aquifer recharge to a wetland, dry streambed, or dry lake bed or basin to offset ground water withdrawal or as beneficial use of a water right when a DEQ-approved ground water quality monitoring program is required.

Projects exempt from this guidance include those operating before January 1, 1985, when provision was made for water quality monitoring at sites where recharge water is land applied under the "Water Quality Standards" (IDAPA 58.01.02) and "Wastewater Rules" (IDAPA 58.01.16). Sites developed before January 1, 1985, that receive water before, during, or after the irrigation season are also exempt from the rule as long as recharge occurs within the pre-January 1, 1985, site boundary. Any expansion or infrastructure construction at existing sites after January 1, 1985, is subject to the current IDAPA 58.01.16.600. This guidance does not apply to incidental recharge resulting from precipitation; irrigation practices and delivery system leakage; surface water seepage from creeks, streams, or lakes; lagoons; stormwater runoff and storage; lagoons associated with confined animal operations; mining operations; wastewater land applications; early or late season in-canal recharge (before or after the normal irrigation season); emergency flood spills; or recharge water applied through the use of injection wells. Discussions among Comprehensive Aquifer Management Plan Working Groups attended by representatives from irrigation entities reached consensus that 7 days represents the maximum amount of time typically required for emergency canal operations.

Other situations in which this guidance may not fully apply may include a recharge event (not exceeding 7 days) to determine site feasibility for recharge or a tracer test to determine ground water flow direction. For such a 7-day or less recharge events, it is strongly recommended that the source water being used for recharge be analyzed for bacteria at a minimum. When recharge occurs longer than 7 days, a DEQ-approved ground water quality monitoring program will be required.

The use of best management practices is required by the "Ground Water Quality Rule" (IDAPA 58.01.11). Thus, if the site is being used for the first time, DEQ may require the interested party to evaluate potential water quality impacts to nearby drinking water wells by conducting water quality testing upgradient and downgradient of the application site before, during, and after recharge. Ground water sampling constituents and sampling frequency should be determined based on site-specific conditions. An evaluation of hydrologic changes such as potential mounding is highly recommended.

If the source of recharge water is treated wastewater, including Class A effluent, the project is subject to the "Recycled Water Rules" (IDAPA 58.01.17). Noncontact cooling water can be land applied as recharge water based on DEQ approval as described in IDAPA 58.01.16.600.04–05.

This guidance defines a process of developing a ground water quality monitoring program that can be used by responsible parties to demonstrate that a recharge project will not adversely affect a beneficial use of waters of the state. This guidance provides the criteria DEQ will use to approve such a program and is not a rule or a rulemaking.

As used within this guidance, a responsible party can be an individual, group, corporation, or other entity that is to be held accountable for implementation of the approved ground water quality monitoring program. The responsible party will be considered the land owner unless explicitly identified as another entity or individual in the monitoring program.

Because of the variability of site characteristics in Idaho, each ground water quality monitoring program will be reviewed on a case-by-case basis.

2 Introduction

An increased demand for ground water, coupled with decreased precipitation and changing irrigation practices, has resulted in declining water levels in some areas of Idaho. Managed aquifer recharge, which is the management of water specifically for the purpose of adding water to the zone of saturation by land application, may be one of several solutions to restore declining water levels in some aquifers.

In many western states, managed recharge is conducted through a permitted program to facilitate increased water storage in aquifers without adverse impacts to ground water quality. In Idaho, managed recharge using injection wells is a permitted activity managed by the Idaho Department of Water Resources (IDWR).

DEQ is proactively providing this guidance document to assist interested parties in developing an appropriate ground water quality monitoring program for review and approval by DEQ. Because recharge projects have the potential to impact ground and inter-connected surface waters, they must comply with state policy, such as the Ground Water Quality Protection Act (Idaho Code §39-102, §39-120) and *Idaho Ground Water Quality Plan* (GWQC 1996). This guidance document will assist the responsible party wanting to comply with the legislative mandates and DEQ rules.

- Section 3 describes the statutes and rules that apply to recharge projects.
- Section 4 outlines specific DEQ rules that apply to recharge projects.
- Section 5 lists the steps necessary to receive DEQ approval of a ground water quality monitoring program for an aquifer recharge project.
- Section 6 provides the responsible party with information necessary to develop a ground water quality monitoring program.

3 Statement of Authority

DEQ's authority is defined in the Ground Water Quality Protection Act (Idaho Code §39-102, §39-120), *Idaho Ground Water Quality Plan* (GWQC 1996), IDAPA 58.01.11, and IDAPA 58.01.16.

3.1 Ground Water Quality Protection Act

The Ground Water Quality Protection Act was introduced as Senate Bill No. 1269 in 1989 and was enacted to include the "State Policy on Environmental Protection," which states that "[i]t is the policy of the state to prevent contamination of ground water from any source to the maximum extent practical" (Idaho Code §39-102(3)(a)) and "[a]ll persons in the state should conduct their activities so as to prevent the nonregulated release of contaminants into ground water" (Idaho Code §39-102(3)(c)). The act also defines agency responsibilities (Idaho Code §39-120) and designates DEQ as the primary agency to coordinate and administer ground water quality protection programs for the state.

3.2 Idaho Ground Water Quality Plan

The Ground Water Quality Protection Act provided for the development of a ground water quality plan to be submitted to and approved by the Idaho legislature. The plan was adopted in 1992 and later revised in 1996 to include the Agricultural Ground Water Quality Protection Program for Idaho (GWQC 1996).

Ground Water Protection Policy I-B of the plan states that "The policy of the state of Idaho is that existing and projected future beneficial uses of ground water shall be maintained and protected, and degradation that would impair existing and projected future beneficial uses of ground water and interconnected surface water shall not be allowed" (GWQC 1996, p. 23). In part, the intent of Ground Water Protection Policy I-B is to "ensure that the quality of ground water that discharges to surface water does not impair identified beneficial uses of the surface water and that surface water infiltration does not impair beneficial uses of ground water (GWQC 1996, p. 24).

Ground Water Quality Monitoring Policy V-C of the plan addresses recharge by stating that "The policy of the state of Idaho is that any program designed specifically for the artificial recharge of ground water, existing or proposed, be consistent with the policies and management objectives for water quality and quantity" (GWQC 1996, p. 43). In part, this policy was adopted because "artificial recharge has the potential to significantly impact the quality of ground water" (GWQC 1996, p. 43). This section of the plan directs DEQ, in cooperation with other appropriate agencies, to develop guidelines, management practices, and rules to ensure that artificial ground water recharge projects comply with the *Idaho Ground Water Quality Plan* (GWQC 1996).

3.3 Wastewater Rules and Ground Water Quality Rule

IDAPA 58.01.16.600 applies to "Land Application of Wastewater(s) or Recharge Waters," which authorizes DEQ to approve ground water quality monitoring programs for aquifer

recharge projects by land application. DEQ is aware of the widespread social and economic considerations of recharge projects and recognizes the importance of these projects to help minimize ground water depletions. DEQ has a regulatory obligation to review monitoring programs for recharge projects and to ensure that ground water will not be degraded and that negative impacts will not occur to a beneficial use of ground or surface water. DEQ may also review the recharge project method of application, site-specific conditions, and source of recharge water to comply with IDAPA 58.01.11.

4 Applicable DEQ Rules

This section describes the specific rules DEQ considers when reviewing a ground water quality monitoring program for a recharge project. As set out below, a ground water quality monitoring program must be developed for recharge projects and is subject to DEQ approval. The monitoring program must contain sufficient information to ensure that beneficial uses are protected. In addition, DEQ rules contain provisions to ensure protection of ground water quality. To help ensure the project is consistent with ground water quality rules, DEQ may also provide comments regarding the ground water recharge project or conditions for approval of the monitoring program.

4.1 Wastewater Rules

The applicable portions of IDAPA 58.01.16.600, "Land Application of Wastewater(s) or Recharge Waters," are discussed below. Rule language is paraphrased to emphasize sections relevant to this guidance.

4.1.1 Applied Waters Restricted to Premises (IDAPA 58.01.16.600.02)

> ... recharge waters applied to the land surface must be restricted to the premises of the application site unless permission has been obtained from the Department authorizing a discharge into the waters of the state.

4.1.2 Monitoring (IDAPA 58.01.16.600.04)

> Provisions must be made for monitoring the quality of the ground water in proximity of the application (recharge) site. The ground water monitoring program is subject to approval by the Department. All data and reports resulting from the ground water monitoring program must be submitted to the Department upon request.

4.1.3 Basis for Evaluation (IDAPA 58.01.16.600.05)

This section describes the physical characteristics of the site that DEQ will consider when reviewing the monitoring program.

> The evaluation for an approval to irrigate, either by sprinkling or flooding or surface spreading of wastewater material or by burying wastewater material or recharge water in the upper soil horizon as a method of treatment, must include, but will not necessarily be limited to, consideration of the following items:

a. . . . Other wastewater(s) or recharge waters will be considered provided it can be shown that land application will not adversely affect current or future beneficial uses of waters of the state.

b. The nature of the soils and geologic formations underlying the application site. The entity proposing the activity must provide reasonable assurance that the soils and site geology will provide the required level of treatment and will not allow movement of pollutants into the underlying ground water.

c. The ability of the soil and vegetative cover on the application site to remove the pollutants contained in the applied waters through the combined processes of consumptive use and biological and chemical inactivation.

4.2 Ground Water Quality Rule

This section lists the applicable portions of IDAPA 58.01.11. Aquifers in Idaho are categorized into three classifications: sensitive resource, general resource, and other resource (IDAPA 58.01.11.300). Each classification requires slightly different management strategies. The Spokane Valley–Rathdrum Prairie Aquifer is the only sensitive resource aquifer in Idaho. All other aquifers in the state are general resource aquifers. Currently, no aquifers are classified as other resource in Idaho.

The "Ground Water Quality Rule" describes management of activities with the potential to degrade aquifers in IDAPA 58.01.11.301 and IDAPA 58.01.11.400 discusses ground water contamination.

4.2.1 Management of Activities with the Potential to Degrade Aquifers (IDAPA 58.01.11.301.01)

01. Sensitive Resource Category Aquifers.

a. Activities with the potential to degrade Sensitive Resource aquifers shall be managed in a manner which maintains or improves existing ground water quality through the use of best management practices and best available methods.

b. Numerical and narrative standards identified in Section 200 shall apply to aquifers or portions of aquifers categorized as Sensitive Resource. In addition, stricter numerical and narrative standards, for specified constituents, may be adopted pursuant to Section 350 on a case by case basis and listed in Section 300.

02. General Resource Category Aquifers.

a. Activities with the potential to degrade General Resource aquifers shall be managed in a manner which maintains or improves existing ground water quality through the use of best management practices and best practical methods to the maximum extent practical…

b. Numerical and narrative standards identified in Section 200 shall apply to aquifers or portions of aquifers categorized as General Resource.

4.2.2 Ground Water Contamination (IDAPA 58.01.11.400)

01. Releases Degrading Ground Water Quality. No person shall cause or allow the release, spilling, leaking, emission, discharge, escape, leaching, or disposal of a contaminant into the environment in a manner that:

a. Causes a ground water quality standard to be exceeded;

b. Injures a beneficial use of ground water; or

c. Is not in accordance with a permit, consent order or applicable best management practice, best available method or best practical method.

02. Measures Taken in Response to Degradation.

a. Except when a point of compliance is set pursuant to Section 401, when a numerical standard is not exceeded, but degradation of ground water quality is detected and deemed significant by the Department, the Department shall take one (1) or more of the following actions:

i. Require a modification of regulated activities to prevent continued degradation;

ii. Coordinate with the appropriate agencies and responsible persons to develop and implement prevention measures for activities not regulated by the Department;

iii. Allow limited degradation of ground water quality for the constituents identified in Subsections 200.01.a. if it can be demonstrated that:

(1) Best management practices, best available methods or best practical methods, as appropriate for the aquifer category, are being applied; and

(2) The degradation is justifiable based on necessary and widespread social and economic considerations; or

iv. Allow degradation of ground water quality up to the standards in Subsection 200.01.b. if it can be demonstrated that:

(1) Best management practices are being applied; and

(2) The degradation will not adversely impact a beneficial use.

b. The following criteria shall be considered when determining the significance of degradation:

i. Site-specific hydrogeologic conditions;

ii. Water quality, including seasonal variations;

iii. Existing and projected future beneficial uses;

iv. Related public health issues; and

v. Whether the degradation involves a primary or secondary constituent in Section 200.

03. Contamination Exceeding A Ground Water Quality Standard. The discovery of any contamination exceeding a ground water standard that poses a threat to existing or projected future beneficial uses of ground water shall require appropriate actions, as determined by the Department, to prevent further contamination. These actions may consist of investigation and evaluation, or enforcement actions if necessary to stop further contamination or clean up existing contamination, as required under the Environmental Protection and Health Act, Section 39-108, Idaho Code

5 Process Overview

An overview of the process to receive DEQ approval of a ground water quality monitoring program for a recharge project is provided below.

5.1 Pre-Project Planning Meeting

The responsible party interested in conducting a recharge project should contact the appropriate DEQ regional office to set up a pre-project consultation meeting. DEQ highly recommends the responsible party review the recharge project outline (Appendix A) before the meeting. Feasibility testing to evaluate potential recharge sites may require developing a ground water quality monitoring program.

5.2 Program Submittal

Responsible parties interested in conducting a recharge project should provide three hard copies and one electronic version of the submitted materials to the appropriate DEQ regional office. The major components of the program include the following:

1. Project description
2. Recharge area characterization
3. Evaluation of potential impacts
4. Water quality monitoring program
5. Management practices

The ground water quality monitoring program for recharge projects should be developed by a qualified party with experience in subsurface resource evaluation practices. Qualified parties are typically environmental consultants with backgrounds in geology, hydrogeology, soil science, and geochemistry or related engineering disciplines. The soil, geology, and hydrologic conditions of both the recharge site and the affected subsurface area, along with the quality of the recharge water and ground water, will determine the specifics of the submitted recharge program.

Recharge projects lasting fewer than 30 days, with a recharge rate of 2 cubic feet per second (cfs) or less are considered small-scale projects. The ground water quality monitoring program for small-scale projects may differ from that of full scale recharge projects. Small-scale projects are discussed in section 6.5.

5.3 Public Notice and Comment

DEQ may provide public notice to potentially affected property owners within the zone of influence regarding the potential risks associated with recharging ground water with surface water. The zone of influence is the minimum distance from the recharge basin that ground water must travel to ensure pathogens (e.g., bacteria, *Cryptosporidium*, and viruses) are removed from the recharge water and the water is safe to drink. DEQ considers a 6-month time of travel (TOT) to be necessary for pathogens in recharge water to degrade naturally in the aquifer. Any modeling inputs or parameters used for TOT calculations should be provided. TOT is described in the *Idaho Source Water Plan* (DEQ 1999), and TOT modeling is described in Haitjema et al. (1994).

Notification may be by certified mail, return receipt requested. Notification may include an opportunity to submit comments to DEQ. DEQ may also provide a public comment period for the general public via DEQ's website. The comment period will extend for 30 days following

posting of the recharge project notice on the DEQ website. All public comments shall be considered during the review period.

5.4 Evaluation and Review

The applicable DEQ regional office will review the submitted ground water quality monitoring program for a recharge project and will consider public comment materials in making its decision. DEQ will respond within a reasonable timeframe, generally 30 days from the end of the public comment period. The DEQ regional office will issue a letter that approves as-is, disapproves, or approves with conditions, the ground water monitoring program for a recharge project (Appendix B contains a sample monitoring program agreement). DEQ may also provide comments regarding the method of application to help ensure the project is consistent with DEQ's ground water quality protection rules. DEQ does not anticipate issuing a wastewater land application permit for a recharge project.

Due to the variability of site characteristics within Idaho, ground water monitoring programs for each recharge project will be considered on a case-by-case basis. As discussed in section 6, case-by-case consideration is based on the information submitted in the program. In addition to hydrogeologic site and soil characterization of the recharge site, the ambient ground water quality is necessary to determine the parameters and frequency of ground water quality monitoring during and after recharge. The number of water quality samples that are adequate for determining the ambient ground water quality at the recharge site will be determined on a case-by-case basis.

5.5 Opportunity for Appeal

Idaho Code §39-107 and the "Rules of Administrative Procedure Before the Board of Environmental Quality" (IDAPA 58.01.23) provide that any person aggrieved by an action or inaction of DEQ, including those related to recharge projects, may file a petition for a contested case with the Board of Environmental Quality within 35 days of DEQ's action or inaction.

5.6 Reporting

The responsible party should provide a reporting schedule for monitoring results, an annual report, and an expedited report when monitoring results meet or exceed an alert level (section 6.4.8). If an alert level is reached, the DEQ regional office should be notified within 24 hours of receiving laboratory results.

Routine water quality reports with field parameter sheets should be submitted to the DEQ regional office by the entity conducting recharge within 10 days of receiving laboratory results. However, the frequency for monitoring may be reduced following review of an annual report.

An annual report is to be submitted to the DEQ regional office within 2 months following the recharge duration or season. The annual report should do the following:

- Describe the recharge activities, including the following:
    - Map of recharge area

    - Photos or drawings of the basin and infrastructure
    - Dates of recharge
    - Diversion rate
    - Volume of recharge
    - Any deviations from the original plan or program
    - Any unexpected occurrence or contingency actions
- Describe monitoring, including the following:
    - Sampling methods
    - Map of sample locations
    - Global Positioning System coordinates of sample locations
    - Sampling dates
    - Water level measurements
- Summarize results, including the following:
    - Dated analytical results in tabular form
    - Description of how results were evaluated
    - Graphics
    - Comparison to ambient (background) water quality
- Draw conclusions and list future adjustments including the following:
    - Successes
    - Problems encountered
    - Improvements or changes planned

Monitoring constituents are discussed in detail in section 6 and listed in Appendix C.

5.7 Project Review and Modification

The DEQ regional office will consult with the DEQ State Office for review of all routine water quality reports during recharge and the annual report following the conclusion of the recharge season. Based on the results of this consultation, modifications to the recharge project may be necessary.

For example, in the event ground water quality is degraded by recharge water, DEQ may require additional monitoring, modification of recharge practices, or cessation of the activity. Additional monitoring may include increased frequency of sampling events at selected wells or installing new monitoring wells. On the other hand, if ground water quality shows no indication of degradation or an improvement in the ground water quality, monitoring requirements may be decreased.

The use of best management practices (BMPs) or best practical methods may be required as modifications to the recharge activity. BMPs that may be applicable as protective measures for recharge projects may be found in Meitl and Maguire (2003) or discussed with the appropriate regional office. Additional BMPs for recharge in Idaho are expected to be developed over time.

6 Contents of a Ground Water Quality Monitoring Program

This guidance assists interested parties in preparing the information that DEQ will consider when reviewing ground water quality monitoring programs. Ground water quality monitoring programs are to be submitted to the appropriate DEQ regional office by the responsible party proposing a recharge project. The responsible party should be identified in the monitoring program. The responsible party is considered the land owner unless explicitly identified as another entity or individual. Two example monitoring programs are provided in Appendix D.

The responsible party should provide assurance that a current or future beneficial use of waters of the state will not be adversely affected by recharge projects. The physical characteristics of the site, nearby wells or potential future wells, existing ground water quality, and water quality of the recharge water will be evaluated to determine if the project protects ground water quality. Potential changes in water quality resulting from the introduction of recharge water into an aquifer by infiltration must be identified.

The contents of a recharge ground water monitoring program should include the elements described in the following sections. Applicants should use the outline (Appendix A) to prepare a monitoring program.

6.1 Project Description

The ground water quality monitoring program for the recharge project should provide a legal description of the recharge site, a physical description of the site, a statement of landownership, a statement of intended purpose of the recharge activity, and expected outcome. The project description should also include the source, diversion location, and type of water used for recharge; the expected volume of water; project duration; project delivery system; and a general site map.

6.2 Recharge Area Characterization

The area to be characterized for the recharge project includes the site and all downgradient areas within the zone of influence. The zone of influence is the minimum distance from the recharge site that ground water must travel to ensure pathogens are removed from the recharge water and the water is safe to drink. DEQ considers a 6-month TOT to be necessary for pathogens in recharge water to degrade naturally in the aquifer. Any modeling inputs or parameters used for TOT calculations should be provided. TOT is described in the *Idaho Source Water Plan* (DEQ 1999), and TOT modeling is described in Haitjema et al. (1994).

The characterization should include information on the recharge area soils, geology, hydrogeology, potential contaminant sources, land use, vegetation, and surface water features. The following maps should be included:

- Soils and geology
- Hydrogeologic and surface water features
- Contaminant sources, land use, and vegetation

6.2.1 Soils and Geology—Map and Description

A soils map and a geologic map of the area should be included and provide the information described in the following sections.

6.2.1.1 Soils Information

Soil infiltration rate should be determined to demonstrate the site's capacity and feasibility for recharge. This type of testing will help interested parties determine if the site is suitable for ground water recharge. Site-specific conditions may require developing a ground water quality monitoring program for feasibility testing activities.

The soil types should be identified by thickness, organic matter content, textural class, bulk density, permeability, available water holding capacity, and cation exchange capacity for each soil type. The Natural Resources Conservation Service (NRCS 2012) and the Idaho Soil and Water Conservation Commission may provide useful soil information.

Test pits or borings may be required to adequately determine soil types and thicknesses in areas with limited existing data; the test pit and boring locations, along with the areal extent of the soils, should be shown on the soils map.

Soils act as a filtration system that removes microbial organisms or as a sorption material for attenuating chemical contaminants in the recharge water. Information on the soils throughout the site is important for developing ground water quality monitoring requirements. These monitoring requirements may be reduced for recharge sites where it can be demonstrated that the nature of the soil at the recharge site will prevent bacteria and pathogens present in recharge water from reaching ground water. Demonstrations may include the following options:

- Construct the recharge site using stormwater infiltration guidelines from the states of Minnesota (Minnesota Pollution Control Agency 2016), Maryland (Center for Watershed Protection and MDE 2000), and Wisconsin (Wisconsin Department of Natural Resources 2014).
- Determine the infiltration rate at the site following an ASTM International (ASTM) standard method that may include the following:
    - Conducting double-ring infiltrometer field tests per ASTM D3385
    - Conducting a single-cylinder infiltrometer field test as described by Bouwer (2002) and Blew et al. (2007)
    - Sampling and analyzing soil per ASTM D2488, ASTM D1452, or the US Army Corps of Engineers Unified Soil Classification System (USACE 1953a,b)
- Use a pretreatment filtering system to capture and temporarily store water for infiltration and pass it through a filter bed of sand, organic matter, soil, or other media slow sand filter as used in Minnesota stormwater infiltration guidelines (Minnesota Pollution Control Agency 2016).

DEQ may consider reduced monitoring at sites with an infiltration rate of 1 inch per hour or less if the site has a minimum thickness of 3 feet of soil that contains at least 20% fine-grained material; is classified according to the US Army Corps of Engineers Unified Soil Classification System as SM, SC, ML, CL, and OL as sampled and tested using ASTM Methods D1452 and D2488; and is not located within 500 feet of a public or private drinking water well.

In areas without adequate soil cover, and where the soils are proposed for importation to augment the soil cover at the site, it is strongly recommended the proposal be presented to DEQ before importing soils. Specific details regarding requirements for such sites will be determined on a case-by-case basis.

6.2.1.2 Geologic Information

Geologic features to be identified include lithology, outcrops, faults, fractures, and joint patterns. Exposed rock outcrops, fractures, or faulting zones could act as direct conduits for the recharge water to enter the ground water without the benefit of filtration.

6.2.2 Hydrogeologic and Surface Water Features—Map and Description

A hydrologic map must be provided that includes the location of springs, wells, hydrogeologic boundaries, and surface water features, including canals and diversion structures. The configuration of the recharge site should be depicted on this map, along with the delivery system of the recharge water. In cases of considerable transport distance, a description may be appropriate.

6.2.2.1 Vadose Zone Characterization

The vadose zone is the unsaturated material between the land surface and water table. The monitoring program should provide a description of the vadose zone that includes the thickness, lithologic characteristics, and hydraulic properties (such as hydraulic conductivity and porosity).

6.2.2.2 Aquifer Characterization

An aquifer is a geologic unit of permeable saturated material capable of yielding economically significant quantities of water to wells or springs. A description of the aquifers that will be affected by the recharge activity should include the areal extent, thickness, hydraulic conductivity, boundary conditions, hydraulic gradient, ground water flow direction (regional and local), storage potential, and natural ground water flow velocity. Any modeling inputs or parameters used for TOT calculations should be provided.

In the case of a multiple-aquifer system, the parameters for the portion of the system that will be affected by the recharge activity must be described. A description of the extent, porosity, and thickness of any confining layers should also be provided.

A description of potential impacts that could affect a beneficial use of ground water within the aquifer system should be provided. The anticipated changes in the direction of ground water flow and a description of subsurface geology, including any potential perching units that may intercept the recharging water or impede recharge, should also be provided.

To provide the aquifer characteristics described above, and to determine the availability of existing wells that may serve as sampling sites for the monitoring program, an inventory of up- and downgradient wells is recommended. IDWR maintains a website to search well logs at *www.idwr.idaho.gov/Apps/appsWell/WCInfoSearchExternal*. Copies of well logs within the area should be provided and the wells located on the hydrologic map.

Well logs can provide depth to water, specific capacity estimates, lithologic descriptions of the subsurface, and well construction details. By locating wells on a topographic map, generalized elevations can be determined for the top of casing, water table, and lithologic zones.

Hydraulic conductivity and porosity can be determined from published values for the respective lithology. Ideally, hydraulic conductivity should be determined on a site-specific basis through the use of appropriately designed and conducted aquifer tests.

To evaluate potential impacts from recharge, the zone of influence should be determined and include the nearest downgradient drinking water well within 300 feet of the recharge basin. The spatial extent of the zone of influence can be estimated by multiplying the ground water flow velocity at the site by 6 months. (DEQ considers a 6-month travel time to be adequate for pathogens in recharge water to degrade naturally in the aquifer.) The ground water flow velocity can be calculated from measured or estimated values of the hydraulic conductivity, hydraulic gradient, and porosity.

6.2.2.3 Springs Description

Springs can be located from a site survey, maps, and remote sensing images. Springs within the zone of influence should be noted on the hydrogeologic map. A description of each spring should include the discharge rate and any other pertinent information. Springs may serve as potential sampling sites for the monitoring program.

6.2.2.4 Surface Water Description

Streams (including intermittent), rivers, canals, ditches and any other surface water features should be located on the hydrogeologic map. All structures, diversions, and features associated with recharge operations should also be located on the map.

If the recharge site is within a 100-year flood plain, that information should be provided. Federal Emergency Management Agency maps delineate 100-year flood plain areas and are available at *www.fema.gov*. The 100-year flood plain designations may also be available at county offices. If the recharge site is in an area with a high potential to flood, recharge related structures, including soil cover have the potential to be washed out.

6.2.3 Contaminant Sources, Land Use, and Vegetation—Map and Description

A land use map should be provided that includes the locations of potential contaminant sources; known sources or contaminant plumes; land use structures (such as buildings, roads, etc.); and land use areas, including vegetation type (such as irrigated agriculture, dry agriculture, urban, etc.). County land use maps, tax code maps, Sanborn maps, or comprehensive plans may be a resource.

6.2.3.1 Identifying Contaminant Sources

Potential and known contaminant sources within the immediate recharge site can be determined from site surveys, local knowledge, and geographic information system (GIS) coverages. Source water assessments (DEQ 1999) for local public water supply wells may help identify potential

contaminant sources and are available at the local DEQ regional office or at *www2.deq.idaho.gov/water/swaOnline/Search*.

Potential contaminant sources may include cemeteries; septic systems; sand, gravel, or mineral extraction operations; wastewater treatment facilities; industries; active agricultural land; dairies or other confined animal feeding operations; landfills; underground storage tanks; Resource Conservation and Recovery Act sites; and Comprehensive Environmental Response, Compensation, and Liability Act sites.

6.2.3.2 Land Use Description

Past, present, and projected future land use and related structures at the site must be described. For example, if the site is currently used, or has been used, for a landfill or feedlot, use-related residual contaminants might exist in the area. Information on such contaminants can be obtained from local knowledge, GIS coverages, and a site survey. Public landownership should also be shown on the map.

Previous ownership records can provide historical land use activities and can be obtained from the local county assessor's office. County offices may be able to provide information regarding projected future land use. If land use changes occur during the recharge project, the responsible party may be required to change the sampling program or recharge process.

If the recharge site is located near an urban area or private land with future development potential, the recharge activity could eventually be intercepted by TOT areas for private or public drinking water supply wells.

6.2.3.3 Vegetative Cover Description

The type and distribution of vegetation within the recharge area should be identified. If vegetation is undisturbed, a description of the consumptive use that includes the plant uptake properties should be provided for each plant type. If vegetation is removed, the removal information and yearly maintenance in the basin should be described.

6.2.3.4 Confining Recharge Water to the Recharge Site

Before infiltration, the recharge water must be restricted to the premises of the application site (IDAPA 58.01.16.600.02). Any structural controls or berms required to achieve containment of the recharge water within the recharge site should be shown on the land use map.

6.3 Recharge Project Evaluation and Other Considerations

The responsible party should evaluate the project to determine consistency with the rules set out in section 4. In general, the responsible party should evaluate the project to determine whether the project will result in any of the following:

- Lowering the current quality of ground or surface water
- Exceeding any ground water quality standard in IDAPA 58.01.11
- Adversely affecting drinking water or other uses of ground or surface water
- Creating any health risks, safety risks, or nuisance conditions

For sites that have not been previously used for managed aquifer recharge, DEQ suggests the applicant identify nearby well owners as part of the evaluation of potential impacts from the recharge project. The distance to the closest receptors and ground water velocity will determine if the level of monitoring detail and frequency proposed will ensure that beneficial uses are protected. For example, if the receptors are located within a few hundred feet and ground velocity is fast, then the monitoring frequency will need to be more frequent than if the ground water flow velocity is slow.

All insect and weed control chemicals that may have been used in the recharge site or in the delivery system should be identified to guide the selection of constituents for possible inclusion in the ground water quality monitoring program. Residual concentrations of chemicals can remain in soil long after application may pose a threat to ground water quality if applied incorrectly.

Analytical or numeric modeling can be used to predict mounding and the areal extent of the proposed recharge as a way to estimate the potential area of impact and is highly recommended, especially for sites that have not been previously used for recharge.

Preventive measures, such as fencing designed to prevent animals from entering the recharge basin, may be necessary to prevent introduction of bacterial contaminants at the site that could impact water quality. For safety reasons, signs to notify the public of the recharge practice and the sensitivity of the area may be necessary. BMPs that may be applicable as additional preventive measures or as operational practices for recharge projects may be found in Meitl and Maguire (2003) or from a DEQ regional office.

6.4 Ground Water Quality Monitoring Program

The purpose of a ground water quality monitoring program is to determine the effects of introducing recharge water into the ground water. Several site-specific factors, including site hydrogeology, filtration medium properties, ground water quality of the site, proximity of domestic wells, and recharge water quality will determine the level of detail necessary for the water quality monitoring program. The responsible party should provide a ground water quality monitoring program that adequately evaluates ground water quality, and a location map of the recharge site and sample sites..

The ground water quality monitoring program needs to evaluate potential changes in water quality and water levels resulting from the introduction of recharge water into the aquifer by land application. The program should include a description of equipment used to obtain field parameters, sampling collection procedures, and sample holding times and a description of the quality control and quality assurance measures that will be followed to ensure data integrity. The analytical results will be used to evaluate any changes to ground water quality from the introduction of recharge water. Other nearby hydrologic features, such as springs and recharge basin locations, should be depicted on a recharge site and sample location map. Recharge programs must be developed with appropriate BMPs to maintain or improve existing ground water quality.

The level of detail, or minimum requirements, for each monitoring program will be determined by site-specific hydrogeologic factors. If the recharge water is of higher quality than ground water at the site, or if the basin has high filtration potential, some monitoring requirements or parameters for the project may be reduced or waived depending on site-specific characteristics.

6.4.1 Recharge Facility Description

The responsible party should describe the recharge facility that would include the water delivery system to the site or conveyance system, water quantity measurement system, water quantity measurement frequency, and any berms or other structures/infrastructure that would be part of the recharge facility. All recharge facility components should be included on the recharge site and sample location map.

6.4.2 Ambient Ground Water Quality

The responsible party should provide ambient ground water quality data to characterize ground water quality in the area surrounding the recharge site before initiation of recharge. Ambient ground water quality information may be available from the IDWR Statewide Monitoring Network, United States Geological Survey (USGS), Idaho State Department of Agriculture (ISDA), or DEQ. The number of samples necessary to determine ambient conditions will be determined on a case-by-case basis and will be discussed during the recommended pre-project planning meeting (section 5.1). The results of the ambient ground water quality monitoring will be used to determine the parameters and frequency for water quality monitoring during and after recharge.

Monitoring data for 1 year before recharge is recommended to determine ambient ground water quality. Ambient levels for pathogens in ground water will be considered to be zero unless shown otherwise.

6.4.3 Ground Water Monitoring Location

From the inventory of wells and springs (section 6.2.2.2), the responsible party should suggest locations to monitor ground water quality. Sites should be selected based on their location with respect to ground water flow, well construction details, spring discharge, and access.

The location and number of existing wells and springs will determine whether new monitoring wells are necessary to evaluate ground water quality on a case-by-case basis. Ground water sampling locations should be upgradient and downgradient and be shown on the recharge site and sample location map.

6.4.4 Recharge Water Quality and Monitoring Location

The responsible party should provide ambient recharge water quality data as part of the monitoring program. This information may be available from the USGS Idaho Surface Water Quality Statewide Network, the US Bureau of Reclamation National Irrigation Water Quality Program, the US Army Corps of Engineers, the US Environmental Protection Agency (EPA), or the ISDA Agricultural Surface Water Quality Program.

The locations for sampling the recharge water should be shown on the recharge site and sample location map, and the water quality of the recharge water should be evaluated to determine that ground water will not be degraded by the introduction of the recharge water. The source of the recharge water, timing, and volume of water to be recharged should also be described. Because the lag time for recharge water to arrive at the recharge diversion is dependent on the distance from the head of the canal, the recharge water sample collection site can be at an upstream location before the recharge basin diversion.

Coliform bacteria are commonly present in untreated surface water that is used for recharge, which is why the physical conditions of the recharge site are so important. The responsible party must demonstrate site conditions will provide the necessary level of treatment to remove microbial contaminants.

6.4.5 Monitoring Frequency

The responsible party should provide a proposed frequency for water quality monitoring as part of the monitoring program. The elements to consider when developing a monitoring schedule are the ground water flow system, availability and quality of the recharge water, and duration of recharge.

Generally, ground water monitoring should occur before, during, and after recharge. The recharge water should be monitored before and during recharge. The monitoring frequency will need to be increased for locations that pose a higher risk of transporting contaminants to the ground water.

DEQ may consider reduced monitoring at recharge sites where it can be demonstrated that any microbial constituent will die before reaching the nearest point of use. Such conditions are dependent on initial microbial concentrations of the recharge water and ground water velocity, which is a function of hydraulic gradient, hydraulic conductivity, porosity, and the distance to the nearest receptors. Examples for microbial transport models in ground water include Yates and Yates (1990) and Harvey (1991). Examples of microbial survival studies include John and Rose (2005).

Dye trace studies may be useful in some projects to determine TOT and flow direction. These studies can demonstrate that recharge activities will not impact nearby beneficial uses. The dye trace study can identify wells impacted by recharge water and assess TOT. Several fluorescent dye trace studies have been conducted and documented on the Snake River Plain by IDWR (2009a,b, 2010, 2011, 2014a,b) (*www.idwr.idaho.gov/press/technical-publications.html*). Resources for hydrogeologic information include published hydrogeologic investigations conducted in the area by various agencies such as DEQ, IDWR, USGS, ISDA, and the Idaho Water Resource Research Institute.

6.4.6 Field Parameters

The responsible party should provide a proposed list of field parameters for water quality monitoring as part of the monitoring program. Field measurements should include static water level measurements in all wells. When monitoring wells, springs, and recharge water, field measurements should include the following:

- Water temperature
- Specific conductance
- Dissolved oxygen
- pH
- Turbidity (optional)

6.4.7 Laboratory Analyses

The responsible party should provide a proposed list of constituents for water quality monitoring; laboratory analyses will be necessary to evaluate chemical and pathogenic microbiological changes in water quality. Constituents of concern are those chemical and pathogenic microbial constituents that may be related to land use along the delivery system and within the recharge area.

All recharge projects should monitor for major anions and cations, metals, bacteria, and nutrients and should include an initial analysis for pesticides and volatile organic compounds (VOCs). The project manager is advised to contact an EPA-certified laboratory for appropriate sample containers and sampling methods. The individual constituents that should be included in initial monitoring are described below and listed in detail in Appendix C (Table C-1).

- *Major Anions*—sulfate, bicarbonate, chloride
- *Major Cations*—calcium, sodium, potassium, magnesium
- *Metals*—arsenic, selenium, cadmium
- *Bacteria*—total coliform and *Escherichia coli (E. coli)*
- *Nutrients*—total phosphorus and nitrate
- *Pesticides*—immunoassay screening or EPA methods, such as 507, 515.2, 515.3, 515.4, or 525.2, for chemicals used in the area or an appropriate alternative analysis

Constituents should be analyzed for total concentrations for comparison to the Idaho "Ground Water Quality Standards" (IDAPA 58.01.11.200). If ambient ground water quality conditions were determined using dissolved concentrations, then dissolved concentrations may be needed for valid comparisons. Based on land use and management practices associated with the recharge project, DEQ may request analysis for additional constituents (Tables C-2, C-3, and C-4).

The responsible party should consult with ISDA to determine the types of pesticides and herbicides used in the recharge area and along the delivery system of the recharge water. The responsible party should contact an EPA-certified laboratory for appropriate analytical methods for the chemicals used.

DEQ may request analyses for constituents such as C*ryptosporidium*, *Giardia*, and viruses such as coliphage. Analyses for total organic carbon (TOC), disinfectants, and disinfectant byproducts (section 6.4.9) may be requested on a case-by-case basis if the recharge water is treated prior to recharge.

TOC is used as an indicator for a range of organic compounds present in surface water. The presence or absence of organic compounds can determine the effectiveness of the filtration medium. DEQ may also request community-level physiological profiling (CLPP), which can be used to differentiate the microbial communities present in surface water from those in ground

water. CLPP can be used to determine if bacteria detected in ground water is influenced by surface water.

Analytical methods for microorganisms are frequently updated. Responsible parties are encouraged to consult ASTM, *Standard Methods for the Examination of Water and Wastewater* (Clesceri et al. 2012), American Public Health Association, American Water Works Association and the Water Environment Federation for the most recent methods.

Initial analytical results, along with site-specific land use, aquifer characteristics, and potential contaminant sources, may be used to determine subsequent monitoring requirements.

6.4.8 Monitoring Results and Alert Levels

A monitoring alert level, as defined below, may be considered a trigger to reevaluate or implement additional measures and to prevent degradation resulting from the recharge project. When an alert level for a constituent is reached, DEQ must be notified within 24 hours and a repeat sample must be taken for confirmation. Alert levels can be found in Appendix C.

An alert level reached in a ground water sample is one of the following:

- For VOCs, synthetic organics, bacteria, and viruses, a detection is the alert level. If *E. coli* is detected in the repeat sample, then analysis for *Cryptosporidium* and *Giardia* will be required and viruses and CLPP may be required.
- For inorganics (other than nitrate), radionuclides, and some secondary or unclassified constituents, half of the ground water standard is the alert level.

For nitrates, the alert level depends on whether the analytical result is less than or greater than half the value of the ground water standard, and to what degree.

- If the analytical result for nitrate is *less than or equal to* half the ground water standard, the following distinctions apply:
    - An alert level is not reached, and no action is required, if the analytical result is *less than or equal to* 25% above the ambient (background) level for the area.
    - An alert level is reached, and additional monitoring may be required, if the analytical result is *greater than* 25% above the ambient (background) level for the area.
- If the analytical result for nitrate is *greater than* half the ground water standard, the following distinctions apply:
    - An alert level is not reached, and no action is required, if the analytical result is *less than or equal to*10% above the ambient (background) level for the area.
    - An alert level is reached, and additional monitoring may be required, if the analytical result is *greater than* 10% above the ambient (background) levels for the area.

If natural ambient (background) levels are above a ground water standard in the area, that natural ambient (background) level may be considered to be the ground water standard for that area. Ambient (background) levels are discussed more fully in section 6.4.2.

If the repeat sample confirms that an alert level has been reached, DEQ must be notified within 24 hours of receipt of results, a report to DEQ must be submitted assessing the following:

- Why the alert level was reached and potential sources
- Additional contingency actions or BMP implementation (possibly additional monitoring)

6.4.9 Recharge Water Treatment

The responsible party should provide a description of any treatment processes applied to the proposed recharge water to minimize or eliminate contamination from entering the ground water system. Should disinfectants be used in any treatment process, the disinfectant and disinfectant byproducts should be considered as contaminants of concern and analyzed accordingly.

6.5 Small-Scale Projects

Projects lasting 30 days or less with a flow rate of 2 cfs or less are considered small-scale projects. DEQ may allow the monitoring requirements for small-scale projects to vary from full-scale recharge projects. However, the recharge site characterization requirements described in section 6.2 of this guidance still need to be satisfied per IDAPA 58.01.16.600.04–05.

If the small-scale recharge project occurs between February 1 and May 1, when the surface water used for recharge is snowmelt and unlikely to contain anthropogenic sources of contamination such as VOCs and synthetic organic compounds, then ground water monitoring will be focused on contaminants that present acute health risks such as bacteria and pathogens. The ground water monitoring program will be based on the concentration of bacteria measured in the surface water used for recharge. Monitoring requirements such as frequency and number of sites will be directly proportional to the bacteria concentration in the surface water used for recharge. Small-scale projects occurring during other times of the year may be required to monitor for additional constituents.

6.5.1 Small-Scale Recharge Monitoring Requirements Evaluation Process

The process for determining monitoring requirements for small-scale recharge projects using surface water is illustrated in Figure 1. Reduced or no ground water monitoring for small-scale projects may be acceptable if any of the following site-specific conditions are met:

- A ground water flow calculation indicates no drinking water wells are located within a 6-month TOT from the recharge site.
- A tracer test indicates drinking water wells are not impacted within a 6-month TOT.
- The infiltration rate throughout the site is measured to be 1 inch per hour or less. For example, a 1-acre site could take 1 cfs at this flow rate and recharge about 2 acre-feet per day.

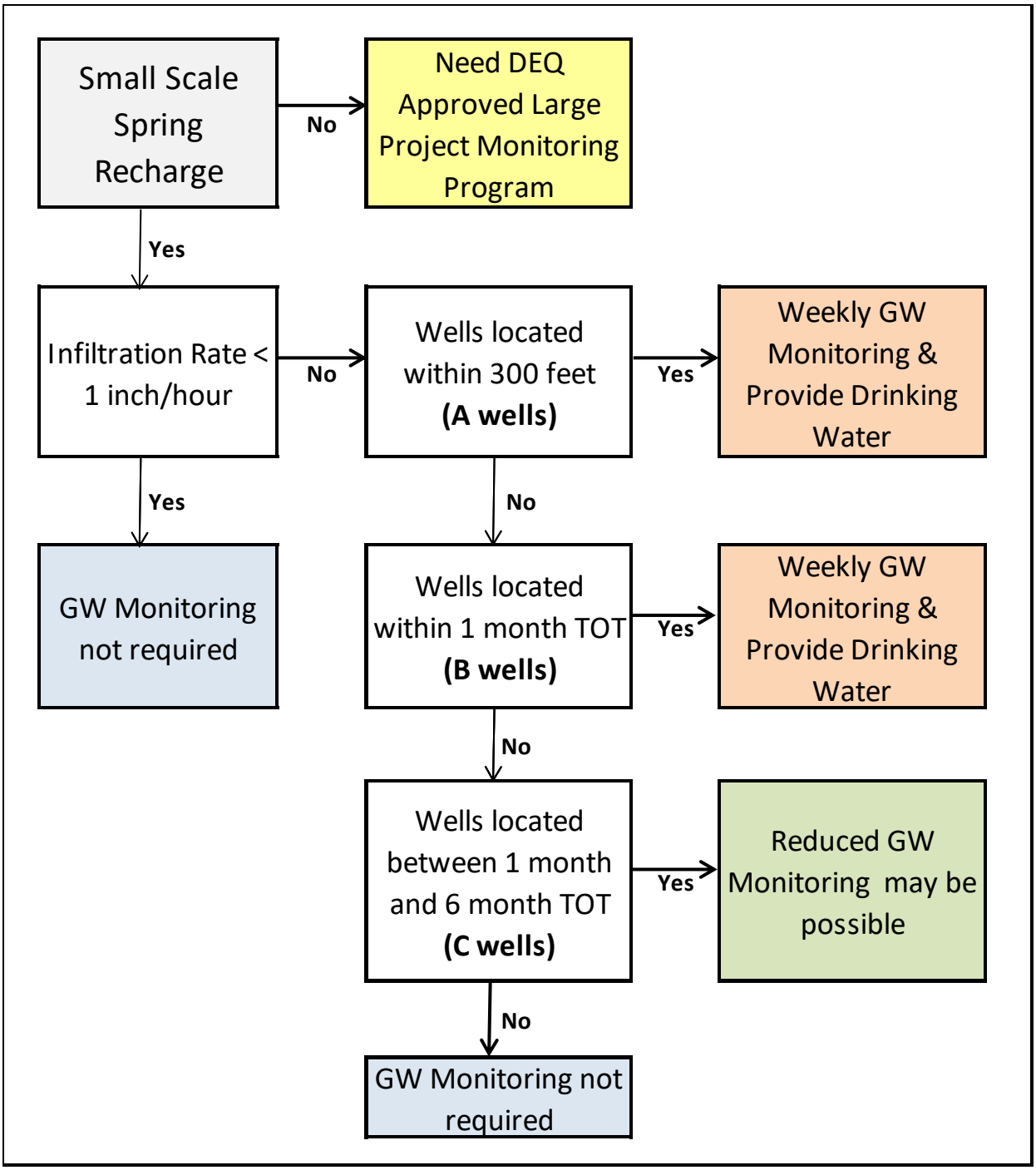

Figure 1. Process for determining monitoring at small-scale recharge sites.

The three alternatives above are believed to provide reasonable assurance that the soils and site geology will provide treatment to remove bacteria and pathogens from the recharge water before reaching the underlying ground water. Depth to ground water and soil geology will be a factor in determining if monitoring is required. For small-scale projects that do not meet one of the three alternatives above, monitoring would be required but limited to total coliform and *E. coli* at drinking water wells located within 300 feet upgradient and cross gradient of the recharge site

and at downgradient drinking water wells within a 6-month TOT. Any modeling inputs or parameters used for calculations should be provided. Methods used for any trace testing or determining infiltration rate should be provided.

The 300-foot distance for monitoring and alternative drinking water supply from a recharge site is based on information from a trace test study DEQ recently completed in the Mountain Home area where a domestic well was contaminated with total coliform and *E. coli* bacteria (DEQ 2016). The trace test proved that a stormwater detention basin had direct connectivity to a local domestic well located 200 feet hydraulically upgradient from the basin. The trace test results showed that dye from the stormwater basin reached the domestic well within 2 hours of 9,000 gallons of water being added to the basin at a rate of 100 gallons per minute, or about 0.2 cfs. Additional testing of ground water samples from the domestic well over a period of 2 weeks confirmed the hydraulic connection with the stormwater basin. The trace test proved that contamination from improperly constructed drainage basins can move laterally on top of impermeable basalt layers in the shallow subsurface at a very rapid rate and contaminate wells with shallow seals in areas with deep water tables (DEQ 2016).

6.5.2 Monitoring Requirements

During recharge activities, ground water and surface water quality monitoring for bacteria should be conducted weekly. Ground water monitoring would be required at all drinking water wells located within a 1-month TOT distance or within 300 feet of the recharge site, whichever distance is farther, during recharge and for approximately 1 month following the completion of the recharge. This monitoring information is necessary to determine if the health of residents relying on wells more distant from the recharge site could be impacted by recharge activities. If bacteria are detected in any samples, an alternative water supply should be provided to the well owner and additional wells downgradient or farther from the detection will require monitoring.

The distance downgradient from the recharge basin for monitoring and the time that will be required to provide an alternative water supply is site-specific and dependent on the following factors:

- The concentration of bacteria in the surface water used for recharge
- The inactivation rate of the bacteria
- The ground water flow velocity of the uppermost aquifer below the recharge site—The ground water flow velocity can be calculated using hydraulic conductivity, gradient, and effective porosity values from DEQ or USGS reports.

The first two factors provide an estimate of the time necessary for the bacteria concentration to decrease to 1 MPN/100 milliliters (mL). The distance from the recharge basin is determined by multiplying the ground water velocity by the time needed to reduce bacteria levels to 1 MPN/100 mL. MPN stands for most probable number and refers to a method that uses dilution cultures and a probability calculation to determine the approximate number of viable cells in a given volume of sample. For example, 50 MPN/100 mL means that the most probable number of viable cells in 100 mL of sample is 50.

An alternative to domestic well monitoring is to provide residents who are within a 1-month TOT area or within 300 feet of a recharge site with an alternative drinking water supply (2 liters/day for each resident) during recharge activities and for approximately 1 month

following the completion of the recharge. Total coliform concentrations in surface water used for recharge, as measured at the MP-31 head gate, ranged from less than 1 to over 4,839 MPN/100 mL (IDWR 2014). Without reasonable assurance of pathogen removal, nearby residences using ground water for drinking water could potentially be consuming insufficiently filtered surface water containing pathogens. Residents drinking water from wells located near recharge basins must be offered an alternative drinking water supply (2 liters/day for each resident) if their wells test positive for total coliform.

6.5.3 Total Coliform Bacteria Inactivation

The phased monitoring approach, where only the wells in close proximity to the recharge site are sampled, is based on scientific data of the inactivation rates of coliform bacteria (John and Rose 2005) and can be used to ensure public health is protected at a minimal cost.

The 1-month TOT determination assumes an initial total coliform concentration in the recharge water of 100 MPN/100 mL and is based on a total coliform inactivation rate in ground water of 0.07 log/day (John and Rose 2005). Using this inactivation rate, recharge water containing a total coliform concentration of 100 MPN/100 mL would require 30 days to decrease two orders of magnitude to a concentration of 1 MPN/100 mL. Recharge water with a bacteria concentration of 1,000 MPN/100 mL would require 45 days to decrease to 1 MPN/100 mL. A plot showing a total coliform inaction rate of 15 days per log cycle is provided in Figure 2.

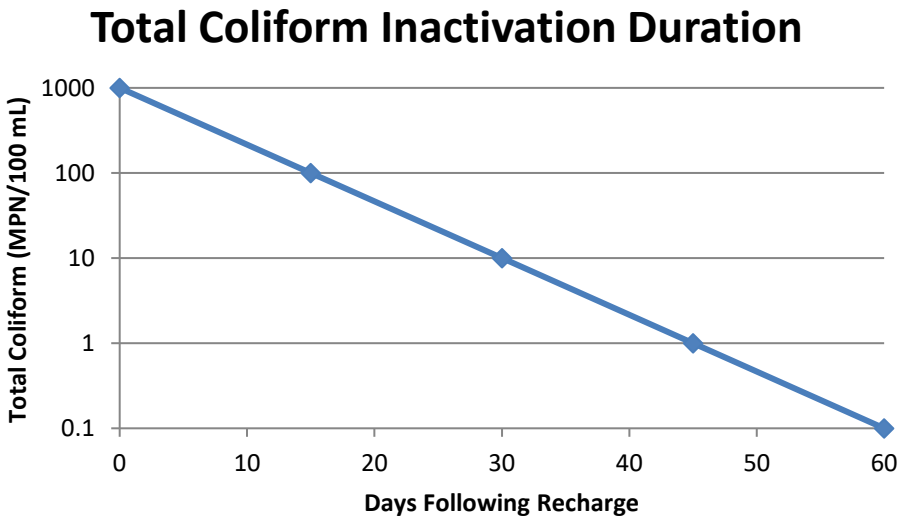

Figure 2. Example of total coliform decay with time.

For example, recharge water with a bacteria concentration of 1,000 MPN/100 mL would require wells within a 45-day TOT to be monitored and provided with an alternative drinking water supply. Recharge water with a bacteria concentration of 10 MPN/100 mL will require wells within a 15-day TOT to be monitored with an alternative drinking water supply (Figure 2).

6.5.4 Time of Travel calculation

The distance required to reduce bacteria from 100 MPN/100 mL in an aquifer with a ground water flow velocity of 12 feet per day is ground water velocity (12 ft/day) × inactivation time (30 days) = distance (360 feet). Ground water velocities in the Eastern Snake River Plain Aquifer range from less than 2 feet per day in the Springdale area of Cassia County (DEQ 2009) to over 1,000 feet per day near Malad Gorge (IDWR 2009a,b, 2010, 2011, 2014a,b).

If *E. coli* is persistently detected in ground water, DEQ may require the recharge to cease until *E.coli* is no longer detected in ground water.

6.5.5 Example Scenarios

The following examples illustrate monitoring requirements for various scenarios.

Scenario 1—A recharge site uses surface water with a total coliform concentration of 80 MPN/100 mL. One well is located within 300 feet upgradient from the recharge site (A well), and three downgradient wells are located within a 1-month TOT (B wells). These four wells should be monitored weekly or residents should be provided with an alternative source of drinking water. Monitoring should continue for 30 days after recharge ceases because approximately 30 days are estimated to be needed to reduce the total coliform from 80 MPN/100 mL to 0.8 MPN/100 mL.

Scenario 2—A recharge site uses surface water with a total coliform concentration of 2,000 MPN/100 mL. One well is located within 300 feet upgradient of the recharge site (A well), three downgradient wells are located within a 1-month TOT (B wells), and two wells are located near the 45-day TOT (C wells). The A and B wells should be monitored weekly, or residents should be provided with an alternative water source. The C wells should be monitored or residents should be provided with an alternative drinking water source if bacteria were detected in the B wells. Monitoring should continue for 60 days after recharge ceases because approximately 60 days are estimated to be needed to reduce the total coliform from 2,000 MPN/100 mL to 0.2 MPN/100 mL.

Scenario 3—A recharge site uses surface water with a total coliform concentration of 500 MPN/100 mL. Two wells are located within 300 feet upgradient of the recharge site (A wells), no downgradient wells are located within a 1-month TOT (B wells), and two wells are located near the 45-day TOT (C wells). The A and C wells would need to be monitored weekly or residents should be provided with an alternative source of drinking water. Monitoring should continue for 45 days after recharge ceases because approximately 45 days are estimated to be needed to reduce the total coliform from 500 MPN/100 mL to 0.5 MPN/100 mL.

Scenario 4—A recharge site uses surface water with a total coliform concentration of 950 MPN/100 mL. Two wells are located within 300 feet cross gradient from the recharge site (A wells), no downgradient wells are located within a 1-month TOT (B wells), and two wells are located near the 75-day TOT (C wells). The A wells would need to be monitored weekly or provided with an alternative water source. If bacteria are detected in the A wells, then the C wells should be monitored weekly or residents should be provided with an alternative source of water. Monitoring should continue for 45 days after recharge ceases because approximately 45

days are estimated to be needed to reduce the total coliform from 950 MPN/100 mL to 0.95 MPN/100 mL.

6.6 Water Quality Management Practices

Management practices should be in place to address report scheduling and contingency planning.

6.6.1 Reporting Schedule

Important reporting commitments associated with recharge project operation include the following:

- The responsible party should provide a reporting schedule for monitoring results, the annual report, and for expedited reports when monitoring results meet or exceed an alert level. Any treatment to the recharge water addressed in section 6.4.9 should be reported.
- If an alert level is reached, the DEQ regional office should be notified within 24 hours of receiving laboratory results. DEQ will immediately notify the homeowner by phone if ground water quality standards (IDAPA 58.01.02) are exceeded that pose a health threat.
- Routine laboratory analyses and field sheets for recharge and ground water quality monitoring should be submitted to the DEQ regional office within 10 days of receiving laboratory results.
- An annual report for the project should be submitted to the DEQ regional office within 2 months following the conclusion of the recharge duration or season for the year.

Reporting requirements may be reduced following review of an annual report. The annual report will outline the previous year of recharge activities, including a summary of all water quality monitoring results and recorded hydrogeologic changes along with a map showing monitoring locations.

6.6.2 Contingency Plan

A contingency plan should be developed and submitted as part of the monitoring program to address potential emergency situations at the recharge basin and in the recharge water delivery system. The contingency plan should address what actions will be taken by the responsible party in the event of an emergency. Examples of emergency situations include the following:

- Misapplication of pesticides or herbicides to either the recharge basin or the water delivery system during a period of recharge
- An accident involving a vehicle along the delivery system
- Aerial application of pesticides or herbicides to the recharge basin or along the delivery system
- Basin stability, such as sinkhole development

A notification procedure and plan of action should be included in the contingency plan.

7 Monitoring Program Approval

DEQ is authorized to approve ground water quality monitoring programs for land application recharge projects (IDAPA 58.01.16.600). Approval of a ground water quality monitoring program for recharge by land application will be considered on a case-by-case basis based on the information submitted in the program. Approved monitoring programs will include appropriate sampling locations and analyses (number and type), sampling frequency, and reporting. Failure to comply with the approved monitoring program is a violation of DEQ's rules and may subject the project to an enforcement action.

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Glossary

Aquifer A geologic unit of permeable saturated material capable of yielding economically significant quantities of water to wells or springs.

Beneficial Uses Various uses of ground water in Idaho including, but not limited to, domestic water supplies, industrial water supplies, agricultural water supplies, aquacultural water supplies, and mining. A beneficial use is defined as actual current or projected future uses of ground water.

Best Available Method Any system, process, or method that is available to the public for commercial or private use to minimize the impact of point or nonpoint sources of contamination on ground water quality.

Best Management Practice (BMP) A practice or combination of practices determined to be the most effective and practical means of preventing or reducing contamination to ground water and interconnected surface water from nonpoint and point sources to achieve water quality goals and protect the beneficial uses of the water.

Best Practical Method Any system, process, or method that is established and in routine use that could be used to minimize the impact of point or nonpoint sources of contamination on ground water quality.

Class A Effluent Class A effluent is treated municipal reclaimed wastewater that must be oxidized, coagulated, clarified, and filtered or treated by an equivalent process and adequately disinfected. For comprehensive Class A effluent criteria and permitting requirements, refer to IDAPA 58.01.17, "Recycled Water Rules."

Constituent Any chemical, ion, radionuclide, synthetic organic compound, microorganism, waste, or other substance occurring in ground water.

Contaminant Any chemical, ion, radionuclide, synthetic organic compound, microorganism, waste or other substance that does not occur naturally in ground water or naturally occurs at a lower concentration.

Contamination The direct or indirect introduction into ground water of any contaminant caused in whole or in part by human activities.

Degradation The lowering of ground water quality as measured in a statistically significant and reproducible manner.

Delivery System	An existing canal system used for carrying surface water to an infiltration basin.
Ground Water	Any water of the state that occurs beneath the surface of the earth in a saturated geological formation of rock or soil.
Ground Water Quality Standard	Values, either numeric or narrative, assigned to any constituent for the purpose of establishing minimum levels of protection.
Infiltration Basin	A natural depression in the earth's surface that may be capable of holding water that is intended to percolate through soils and geologic formations to an aquifer.
Land Application	A process or activity involving application of wastewater, surface water, or semiliquid material to the land surface for the purpose of disposal, pollutant removal, or ground water recharge.
Managed Recharge	Management of water specifically for the purpose of adding water to the zone of saturation by land application.
Natural Background Level	The level of any constituent in the ground water within a specified area, as determined by representative measurements of the ground water quality unaffected by human activities.
Noncontact Cooling Water	Water used to reduce temperature and does not come into direct contact with any raw material, intermediate product, waste product (other than heat), or finished product. Noncontact cooling water can be land applied as recharge water as discussed in the "Wastewater Rules," IDAPA 58.01.16, based on DEQ approval as described in sections 600.04–05.
Projected Future Beneficial Uses	Various uses of ground water, such as drinking water, aquaculture, industrial, mining, or agriculture that are practical and achievable in the future based on hydrogeologic conditions, water quality, future land use activities, and social/economic considerations.
Qualified Party	An individual or firm with experience in soils, geology, hydrogeology, hydrology, or similar field and recognized in Idaho as a registered professional geologist, engineer, or environmental health professional.
Recharge	The process of adding water to the zone of saturation.

Recharge Area	An area where water infiltrates into the soil or geological formation and percolates to one or more aquifers. For the purpose of this guidance, a recharge area does not include areas with incidental recharge by precipitation, irrigation practices and conveyance system leakage, surface water seepage from creeks, streams or lakes, lagoons, stormwater runoff and storage, lagoons associated with confined animal operations, mining operations, wastewater land applications, or recharge water applied through the use of injection wells.
Recharge Water	Water that is specifically used for the purpose of adding water to the zone of saturation.
Responsible Party	The entity that is accountable for implementing the approved ground water quality monitoring program plan. The responsible party may be the landowner, operator, project manager, or benefactor. The responsible party must be identified in the monitoring plan.
Time of Travel (TOT)	The time required for a contaminant to move in the saturated zone from a specific point to a well.
Wastewater	Unless otherwise specified, sewage, industrial waste, agricultural waste, and associated solids or combinations of these, whether treated or untreated, together with such water as is present.
Zone of Influence	The distance from a recharge basin that ground water must travel in the subsurface to ensure that pathogens (e.g., bacteria, *Cryptosporidium*, and viruses) are removed from the recharge water and the water is safe to drink.
Zone of Saturation	The zone in which the voids in the rock or soil are filled with water at a pressure greater than atmospheric. The water table is the top of the saturated zone in an unconfined aquifer.

Appendix A. Recharge Project Monitoring Program

Print Form

Idaho Department of Environmental Quality Guidance for Managed Recharge Projects

Ground Water Quality Monitoring Program Components: Land Application of Recharge Water Projects

Operator Information

Operator/Organization | Contact Name

Address

Phone | Email

Project Description

Physical Description of the Recharge Site:

Legal Description: Township | Range | Section

Landownership | Recharge Area (acreage)

Project Purpose

Flow Rate | Project Start Date | End Date

Expected Total Volume per Season

Recharge Area Characterization

Soils Information

Soil thickness of 3 feet? ○ Yes ○ No

Remarks

Soil composed of 20% fine-grained material? ○ Yes ○ No

Remarks

Pretreatment filtering system proposed? ○ Yes ○ No

Remarks

Soil infiltration rate and method for determining:

Soil type and classification description:

Geologic Information

Map provided of soils and lithology, outcrops, faults, fractures, joint patterns, geology, and structures? ○ Yes ○ No

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Print Form

Idaho Department of Environmental Quality Guidance for Managed Recharge Projects

Hydrologic Information

Map provided that includes the location and name of springs, wells, hydrogeologic boundaries, surface water features (e.g., streams, lakes, reservoirs, rivers, canals), diversion structures, recharge site configurations and delivery system? ○ Yes ○ No

Description of other pertinent information included in monitoring program? ○ Yes ○ No

Is the site located within a 100-year floodplain? ○ Yes ○ No

Vadose Zone

Lithology

Hydraulic properties or infiltrate rate

Depth to water

Cumulative thickness of material above the water table and any perched zones

Aquifer Characteristics

Well logs within and surrounding recharge site attached? ○ Yes ○ No

Thickness

Hydraulic conductivity

Hydraulic gradient

Boundary conditions

Regional ground water flow direction

Local ground water flow direction (if different than regional)

Summary of lithology

Ground water flow velocity (include model inputs or calculation parameters)

Has a 6-month TOT calculation been completed from the recharge site? ○ Yes ○ No

Has a trace study been completed from the recharge site? ○ Yes ○ No

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Print Form

Contaminant Sources, Land Use, and Vegetation Map and Description

Potential or known contaminant sources:

Land Use Description

Describe historical, present, and future potential land use of the recharge area:

Vegetative Cover Type

Describe species present, consumptive use, and potential impacts:

Water Quality Monitoring Program Recharge Water and Ground Water Sampling Locations (include map)

Provide ambient ground water quality data.

List locations sampled. Sites should be selected based on the location with respect to ground water flow and well construction details The locations of monitoring sites should intercept all possible ground water flow directional changes caused by introducing recharge water to the aquifer.

	Upgradient		Downgradient
1.		1.	
2.		2.	
3.		3.	
4.		4.	

List sample location, field parameters, and sampling dates for ambient ground water:

List ambient (background) and proposed initial constituents for ground water. Attach results in a separate table.

Major anions	
Major cations	
Bacteria	
Metals	

Print Form

Nutrients

Pesticide analysis conducted? ○ Yes ○ No Provide results in a separate table.

VOC analysis conducted? ○ Yes ○ No Provide results in a separate table.

Additional analysis:

Field parameters:

Sample frequency:

Recharge Water Monitoring

Provide a map of proposed locations of ground water monitoring sites to capture the effects of recharge? ○ Yes ○ No

Provide a map of proposed locations for monitoring recharge water to characterize water used for recharge? ○ Yes ○ No

Provide list of background recharge water quality and field parameters to be used for recharge and list the constituents, field parameters, frequency of monitoring of the recharge water, and treatment. Provide results in a separate table.

Appendix B. Monitoring Program Agreement

Project: _____

Location: _____

Project Purpose: _____

Project Duration: _____

Property Owner: _____

Operator: _____

Responsible Party: _____

The ground water quality monitoring program for _____ recharge project is hereby approved by the Idaho Department of Environmental Quality (DEQ) pursuant to IDAPA 58.01.16.600, "Wastewater Rules, Land Application of Wastewater(s) or Recharge Waters."

The number of sample sites, constituents, frequency, and reporting schedule are defined and described in the program. DEQ has determined the monitoring program to be protective of ground water quality beneficial uses when adhered to as described. Failure to comply with the monitoring program is a violation of DEQ's rules, and the responsible party may be subject to enforcement action.

DEQ Regional Office Administrator	**Date**
Responsible Party	**Date**

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Appendix C. Constituents and Alert Levels

Table C-1. Constituents included in initial ground water quality monitoring for recharge by land application projects.

	Constituent/Parameter	Standard[a]	Alert Level
		(mg/L unless otherwise specified)	
Major Anions	Bicarbonate	—	—
	Chloride	250	125
	Sulfate	250	125
Major Cations	Calcium	—	—
	Magnesium	0.05	0.025
	Potassium	—	—
	Sodium	—	—
Metals	Arsenic	0.05[b]	0.025
	Cadmium	0.005	0.0025
	Selenium	0.005	0.0025
Bacteria	*Escherichia coli* (*E. coli*)	Less than 1 viable colony or colony-forming unit/100 mL using any EPA-approved method	Detection
	Total coliform	1 colony-forming unit/100 mL	Detection
Nutrients	Nitrate + nitrite	10	5
	Total phosphorus	Concentration before recharge (background)	Detection above background
Pesticide analyses	site-specific	Varies	Detection
VOC analyses	site-specific	Varies	Detection
Field parameters	Temperature, specific conductance, dissolved oxygen	N/A	N/A
	pH	>=6.5 to <=8.5	Detection below or above standard range

Notes: mg/L = milligram per liter; mL = milliliter; N/A = not applicable
[a] All concentrations are based on total concentrations from unfiltered samples.
[b] Idaho's standard for arsenic differs from EPA's drinking water standard, which is 0.010 mg/L.

Additional analyses maybe required for some of the constituents listed in Tables C-2, C-3, and C-4 if land use indicates the potential for contamination by any of these constituents.

Table C-2. Ground water quality primary constituent standards (IDAPA 58.01.11.200.01).

Chemical Abstract Service Number	Constituent	Standard	Alert Level
		(mg/L unless otherwise specified)	
7440-36-0	Antimony	0.006	0.003
7440-38-2	Arsenic	0.05[a]	0.025
1332-21-4	Asbestos	7 million fibers/L longer than 10 µm	3.5 million fibers/L longer than 10 µm
7440-39-3	Barium	2	1
7440-41-7	Beryllium	0.004	0.002
7440-43-9	Cadmium	0.005	0.0025
7440-47-3	Chromium	0.1	0.05
7440-50-8	Copper	1.3	0.65
57-12-5	Cyanide	0.2	0.1
16984-48-8	Fluoride	4	2
7439-92-1	Lead	0.015	0.0075
7439-97-6	Mercury	0.002	0.001
—[b]	Nitrate (as N)	10	5[c]
—[b]	Nitrite (as N)	1	0.5
—[b]	Nitrate and nitrite (both as N)	10	5[c]
7782-49-2	Selenium	0.05	0.025
7440-28-0	Thallium	0.002	0.001
15972-60-8	Alachlor	0.002	Detection
191 2-24-9	Atrazine	0.003	Detection
71-43-2	Benzene	0.005	Detection
50-32-8	Benzo(a)pyrene (PAH)	0.0002	Detection
75-27-4	Bromodichloromethane (THM)	0.1	Detection
75-25-2	Bromoform (THM)	0.1	Detection
1563-66-2	Carbofuran ran	0.04	Detection
56-23-5	Carbon Tetrachloride	0.005	Detection
57-74-9	Chlordane	0.002	Detection
124-48-1	Chlorodibromomethane (THM)	0.1	Detection
67-66-3	Chloroform (THM)	0.002	Detection
94-75-7	2,4-D	0.07	Detection
75-99-0	Dalapon	0.2	Detection
103-23-1	Di (2-ethylhexyl) adipate	0.4	Detection
96-12-8	Dibromochloropropane	0.0002	Detection
541 -73-1	Dichlorobenzene m-	0.6	Detection
95-50-1	Dichlorobenzene o-	0.6	Detection
106-46-7	1,4(para)-Dichlorobenzene or Dichlorobenzene p-	0.075	Detection
107-06-2	1,2-Dichloroethane	0.005	Detection
75-35-4	1,1 -Dichloroethylene	0.007	Detection
156-59-2	cis-1, 2-Dichloroethylene	0.07	Detection
156-60-5	trans-1, 2-Dichloroethylene	0.1	Detection
75-09-2	Dichloromethane	0.005	Detection
78-87-5	1,2-Dichloropropane	0.005	Detection

Chemical Abstract Service Number	Constituent	Standard	Alert Level
		(mg/L unless otherwise specified)	
117-81-7	Di (2-ethylhexyl) phthalate	0.006	Detection
88-85-7	Dinoseb	0.007	Detection
85-00-7	Diquat	0.02	Detection
145-73-3	Endothall	0.1	Detection
72-20-8	Endrin	0.002	Detection
100-41-4	Ethylbenzene	0.7	Detection
106-93-4	Ethylene dibromide	0.00005	Detection
1071-83-6	Glyphosate	0.7	Detection
76-44-8	Heptachlor	0.0004	Detection
1024-57-3	Heptachlor epoxide	0.0002	Detection
118-74-1	Hexachlorobenzene	0.001	Detection
77-47-4	Hexachlorocyclopentadiene	0.05	Detection
58-89-9	Lindane	0.0002	Detection
72-43-5	Methoxychlor	0.04	Detection
108-90-7	Monochlorobenzene	0.1	Detection
23135-22-0	Oxamyl (Vydate)	0.2	Detection
87-86-5	Pentachlorophenol	0.00 1	Detection
191 8-02-1	Picloram	0.5	Detection
1336-36-3	Polychlorinated biphenyls (PCBs)	0.0005	Detection
122-34-9	Simazine	0.004	Detection
100-42-5	Styrene	0.1	Detection
1746-01 -6	2,3,7,8-TCDD (Dioxin)	3.0 x 10-8	Detection
127-18-4	Tetrachloroethylene	0.005	Detection
108-88-3	Toluene	1	Detection
—[b]	Total Trihalomethanes [the sum of the concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform)]	0.1	Detection
8001 -35-2	Toxaphene	0.003	Detection
93-72-1	2,4,5-TP (Silvex)	0.05	Detection
120-82-1	1,2,4-Trichlorobenzene	0.07	Detection
71-55-6	1,1,1 -Trichloroethane	0.2	Detection
79-00-5	1,1,2-Trichloroethane	0.005	Detection
79-01-6	Trichloroethylene	0.005	Detection
75-01-4	Vinyl Chloride	0.002	Detection
1330-20-7	Xylenes (total)	10	Detection
—[b]	Gross alpha particle activity (including radium-226, but excluding radon and uranium)	15 pCi/L	7.5 pCi/L
—[b]	Combined beta/photon emitters	4 millirems/yr effective dose equivalent	2 millirems/yr effective dose equivalent
—[b]	Combined Radium-r26 and radium-228	5 pCi/L	2.5 pCi/L
—[b]	Strontium 90	8 pCi/L	4 pCi/L
—[b]	Tritium	20,000 pCi/L	10,000 pCi/L

Chemical Abstract Service Number	Constituent	Standard	Alert Level
		(mg/L unless otherwise specified)	
—[b]	Total Coliform[d]	1 colony forming unit/100 mL	Detection
	Escherichia coli (E. coli)	Less than 1 viable colony or colony-forming unit/100 mL using any EPA approved method	Detection

Notes: µm = micrometer; pCi/L = picocurie per liter; mg/L = milligram per liter; mL = milliliter
[a] Idaho's standard for arsenic differs from EPA's drinking water standard, which is 0.010 mg/L.
[b] No Chemical Abstract Service Number exists for this constituent.
[c] Refer to section 6.4.8 of the guidance for alert levels.
[d] An exceedance of the primary ground water quality standard for total coliform is not a violation of these rules. If the primary ground water quality standard for total coliform is exceeded, additional analysis for *E. coli* will be conducted. An exceedance of the primary ground water quality standards for *E. coli* is a violation of the "Ground Water Quality Rule" (IDAPA 58.01.11).

Table C-3. Secondary constituent standards (IDAPA 58.01.00.200.01.b), constituents under Water Quality Standards (IDAPA 58.01.02.201.01.c).

Constituent	Standard	Alert Level
	(mg/L unless otherwise specified)	
Acrolein[a]	0.0032[c]	0.0016[b]
Aluminum	0.2	0.1
Chloride	250	125
Color	15 color units	7.5 color units
Foaming Agents	0.5	0.25
Iron	0.3	0.15
Manganese	0.05	0.025
Odor	3.0 threshold odor number	1.5 threshold odor number
Phosphorus, Total[c]	Concentration before recharge	Detection above background
Phosphorus, Ortho[c]	**Concentration before recharge**	**Detection above background**
pH	≥6.5 to ≤8.5 standard units	<6.5; >8.5 standard units
Silver	0.1	0.05
Sulfate	250	125
Total Dissolved Solids	500	250
Zinc	5	2.5

Notes: mg/L = milligram per liter
[a] Indicator of surface water influence (IDAPA 58.01.02.210.01.c).
[b] Common ions or other constituents for which no standard has been developed, but useful for evaluating water chemistry.
[c] Narrative standard; no numerical standard for phosphorus in ground water—may impact surface water quality.

Table C-4. Microbial constituents.

Constituent	Standard	Alert Level
	(mg/L unless otherwise specified)	
Total coliform[a]	1 colony-forming unit/100 mL	Detection
E. coli bacteria[a,b]	Less than 1 viable colony or colony-forming unit/100 mL using any EPA-approved method	Detection
Heterotrophic Plate Count (HPC)[c]	500 colonies/mL	250 colonies/mL
Cryptosporidium[a]	99% removal	Detection
Giardia lamblia[a]	99.9% removal	Detection
Viruses[a]	99.99% removal	Detection

Notes: mg/L = milligram per liter; mL = milliliter
[a] National Primary Drinking Water Standards, Environmental Protection Agency
[b] Bacterial constituents for follow-up sampling and analysis upon a positive total coliform result
[c] HPC is used as an indicator of recharge basin filtration efficiency.

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Appendix D. Example Monitoring Programs

Following are examples of ground water quality monitoring programs for recharge projects by land application of recharge water with the intention of infiltration from the surface to underlying aquifers. As stated in the guidance, the requirements for monitoring will be determined by site-specific hydrogeologic factors.

In 2013, the City of Gooding initiated an investigation into using recharge to offset water right issues and subsequently developed an Idaho Department of Environmental Quality (DEQ) approved recharge project in 2014. The City of Gooding's ground water quality monitoring program provides an example of a monitoring program that was approved by DEQ under the authority of the "Wastewater Rules" (IDAPA 58.01.16.600). DEQ is responsible, under the "Ground Water Quality Rule" (IDAPA 58.01.11), for protecting present and future beneficial uses of the waters of the state.

Technical staff from the Idaho Department of Water Resources also prepared a ground water quality monitoring program for the Milepost 31 Recharge Site.

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City of Gooding Recharge Program

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Milepost 31 Recharge Site Ground Water Quality Monitoring Program

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