DEQ Reuse Permit Writer's Manual

State of Idaho

Department of Environmental Quality

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Abbreviations, Acronyms, and Symbols

ac	acre
AWC	available water-holding capacity
BNR	biological nutrient removal
BOD	biochemical chemical demand
CEC	cation exchange capacity
c_f	canopy cover fraction
Cl	chloride
$Cmol_c$	centimol positive charge
COD	chemical oxygen demand
DEQ	Idaho Department of Environmental Quality
d_f	density factor
DTPA	diethylenetriaminepentaacetic acid extractable
EDMS	electronic data management system
e_f	efficiency factor
E_i	irrigation efficiency
EPA	United States Environmental Protection Agency
ESP	exchangeable sodium percentage
ET	evapotranspiration
gal	gallon
HLR	hydraulic loading rate
IDAPA	designation for Idaho's administrative rules
IDWR	Idaho Department of Water Resources
IPDES	Idaho Pollutant Discharge Elimination System
IR	irrigation requirement
IWR	irrigation water requirement
kg	kilogram
L	liter
lb	pound
L/T	length per time
MBR	membrane bioreactor
mg	milligram
MG	million gallon
min	minute
mo	month
MU	management unit

NGS	nongrowing season
NRCS	Natural Resource Conservation Service
NTU	neophelometric turbidity unit
NVDS	nonvolatile dissolved solids
P_{def}	precipitation deficit
PO	Plan of Operation
PPT	gross precipitation
PSI	Phosphorus Site Index
QAPP	Quality Assurance Project Plan
RI	rapid infiltration
SAR	sodium adsorption ratio
SAT	soil aquifer treatment
SBR	sequencing batch reactor
TCN	total combustible nitrogen
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
WLAA	well location acceptability analysis
yr	year

1 Introduction

Following the statutory and regulatory framework of the Idaho Department of Environmental Quality's (DEQ's) reuse permitting program, this manual examines technical considerations for developing DEQ's reuse permits. The manual is designed to acquaint new permit writers with the reuse program and the process of permit writing. New permit writers should read this entire manual before starting work on their first reuse permit. The document can also be used by experienced permit writers, or anyone interested in the legal and technical aspects of developing reuse permits.

1.1 Purpose and Scope

This manual provides a general reference for permitting authorities and explains the core elements of the reuse program:

- Overview of the scope and statutory and regulatory framework of the reuse program.
- Essential components of a permit and an overview of the permitting process.
- Different types of permit limits and the legal and technical considerations involved in developing them.
- Legal and technical considerations involved in developing other permit conditions including monitoring and reporting requirements, special conditions, and standard conditions.
- Administrative process for issuing, modifying, revoking, and terminating reuse permits.

This manual is not a standalone reference document for reuse permit development and should be supplemented, where necessary, by additional DEQ state regulations, policy, and topics specific to reuse. Relevant regulations, policy, and other guidance documents are referenced in the text.

1.2 Permitting Authority and List of Applicable Rules

Under the "Recycled Water Rules" (IDAPA 58.01.17), DEQ issues pollution source permits called reuse permits to protect public health and prevent pollution of surface and groundwaters. Reuse is the use of recycled water for beneficial purposes. DEQ promotes, where appropriate, reuse of municipal and industrial recycled water with legal authority from IDAPA 58.01.17.000.

> Pursuant to Title 39, Chapter 1, Idaho Code, the Director of DEQ is authorized to adopt or formulate and recommend to the Board of Environmental Quality, and the Board of Environmental Quality is authorized to adopt rules, regulations and standards necessary and feasible to protect the environment and the health of citizens of the State including provisions for the issuance of pollution source permits, authorized by Section 39-115, Idaho Code, and review of plans and specifications for wastewater treatment facilities, authorized by Section 39-118, Idaho Code.

When writing reuse permits, DEQ permit writers should reference the following rules:

- "Recycled Water Rules" (*IDAPA 58.01.17*)—Establishes the procedures and requirements for the issuing and maintaining pollution source permits for recycled water from reuse facilities (i.e., reuse permits).
- "Wastewater Rules" (*IDAPA 58.01.16*)—Establishes the procedures and requirements for planning, designing, and operating wastewater facilities; discharging wastewater; and human activities that may adversely affect public health and water quality in the waters of the state.
- "Groundwater Quality Rule" (*IDAPA 58.01.11*)—Establishes minimum requirements for protecting groundwater quality through standards and an aquifer categorization process. Permit writers use these rules to assess groundwater impacts from reuse site operations.
- "Water Quality Standards" (*IDAPA 58.01.02*)—Designates uses that must be protected in and of the waters of the state and establish standards of water quality protective of those uses. Restrictions are placed on discharging wastewater and on human activities that may adversely affect public health and water quality in the waters of the state. Unique and outstanding waters of the state are recognized. IDAPA 58.01.02 may apply for reuse sites in proximity to surface water bodies.
- "Idaho Rules for Public Drinking Water Systems" (*IDAPA 58.01.08*)—Regulates the design, construction, operation, maintenance, and quality control of public drinking water systems to ensure that such systems are protected from contamination and maintained free from contaminants that may injure the health of the consumer.
- "Idaho Pollutant Discharge Elimination System Program Rules" (*IDAPA 58.01.25*)—Establishes the procedures and requirements for issuing permits for facilities or activities for which a person is required by Idaho Code and the Clean Water Act to obtain authorization to discharge pollutants to waters of the United States.

1.3 List of Applicable Forms and Templates

The following DEQ forms and templates should be used by the permit writer when constructing a reuse permit:

- *Permit Application Forms* (EDMS 2013AFQ18)—Forms submitted by the permittee when applying for a reuse permit. Permit writers should be familiar with the type of information required in the application forms. The document also includes a checklist for the Preliminary Technical Report and Plan of Operation that permittees may be required to submit with the permit application forms.
- *Reuse Permit Template* (EDMS 2013AFQ14)—Serves as the basis for all DEQ reuse permits issued in Idaho. This template is periodically updated by the State Reuse Permit Coordinator as programmatic needs arise. Before writing a permit, permit writers should confirm they are using the most up-to-date template.
- *Reuse Permit Staff Analysis Template* (EDMS 2013AFQ16)—Per IDAPA 58.01.17.400.05, a staff analysis is required to accompany each draft permit. The staff analysis must briefly state the principal facts and significant questions considered in preparing the draft permit conditions or the intent to deny, and a summary of the

basis for the draft conditions or denial with references to applicable requirements and supporting materials. The template is designed to help permit writers construct a staff analysis, providing relevant considerations for different types of reuse sites. This template is periodically updated by the State Reuse Permit Coordinator as programmatic needs arise. Before writing a staff analysis, permit writers should confirm they are using the most up-to-date template.

2 Reuse Program Overview

2.1 History

Land treatment became increasingly popular during the 1970s due to the Clean Water Act that directed many industrial and municipal facilities to stop using river discharge and divert the treated wastewater stream to crop irrigation and rapid infiltration. Many Idaho food processing facilities chose the land treatment option, which dramatically improved surface water quality.

Land treatment had its challenges, but experience allowed a better understanding of how groundwater contamination related to activities on the land surface and raised awareness of the complexity surrounding land treatment methods. These issues were instrumental in the early development of the wastewater land application permit program in Idaho.

The program regulations were promulgated in April 1988, with companion guidance finalized in March 1988. The 1988 guidance focused on broad aspects for the design and evaluation of applicant proposals. Five years into program implementation, it became apparent that the 1988 guidance required more specificity for the second generation of permits to effectively address environmental and aesthetic concerns such as groundwater contamination and nuisance odors.

In September 1993, a technical work group of agency, industry, municipalities, and technical consultants revised the 1988 guidance to the 1994 Technical Interpretive Supplement. In April 1996, the 1988 guidance and 1994 supplement were combined into the 1996 *Handbook for Land Application of Municipal and Industrial Wastewater*.

In 2002, the 1996 handbook was revised to meet the needs of the regulated community and incorporated two decades of technological advances.

In 2004, DEQ initiated a public participation process, allowing the public to review and provide comments to the existing guidance. In May 2004, DEQ created an electronic web-based revision of the 1996 handbook, reorganized by topic, called the *Guidance for Land Application of Municipal and Industrial Wastewater*.

In 2005, IDAPA 58.01.17 was changed from the *Wastewater Land Application Permit Rules* to *Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater*. In September 2007, further revisions were incorporated, and the title was changed to *Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater*. This title indicated other forms

of reuse (e.g., toilet flushing, recharge, and dust control) were permitted besides land treatment and land application.

In 2011, IDAPA 58.01.17 was revised to the *Recycled Water Rules* and expanded potential uses of municipal recycled water to include fit-for-purpose uses of the various classes. Current and archived rules are found online at the *Idaho Administrative Code.*

2.2 Types of Permitted Facilities

Most wastewater originates from domestic and industrial sources. DEQ issues permits for three types of reuse facilities: municipal, industrial, and combined. These facilities may be publicly or privately owned facilities. The permittee is the person or entity to whom the reuse permit is issued that is legally responsible for complying with the terms of the permit. The following sections discuss the differences between municipal and industrial permitted facilities.

A combined permit includes aspects of both facilities. An industrial facility may treat its industrial and municipal wastewater streams separately and needs a permit that handles both streams appropriately. If the facility is mixing municipal and industrial wastewater or recycled water, the permit is a municipal reuse permit. If the municipal and industrial recycled water streams are reused separately, the facility needs a combined reuse permit.

- Mixed municipal and industrial streams = one municipal reuse permit that contains limits for the combined recycled water.
- Two separated municipal and industrial streams = a combined reuse permit that may contain separate limits for the municipal and industrial recycled water streams, and limits and conditions that apply to both streams.

2.2.1 Municipal Facilities

In IDAPA 58.01.17, municipal wastewater is defined as wastewater that contains sewage and associated solids, whether treated or untreated. Municipal wastewater (also known as domestic wastewater) may contain industrial wastewater (IDAPA 58.01.17.200). Municipal wastewater is collected from homes and businesses and treated in a wastewater treatment system. Examples of municipal wastewater are restrooms (sanitary fixtures and appliances), laundry, and kitchen waste. A wastewater treatment system generates recycled water and may apply for a reuse permit for the allowed uses in IDAPA 58.01.17.

Municipal recycled water is classified in one of five classes (Class A to E) depending on disinfection limits, constituent limits, sampling requirements, and desired uses. A permit writer must select the appropriate classification for recycled water based on the permittee's desired end use to meet all the requirements defined in IDAPA 58.01.17.601.

2.2.1.1 Class A

Class A recycled water receives the most treatment of all the municipal classes and is of the highest quality. Class A recycled water can be used for applications where human contact is

likely, such as distribution to homeowners for irrigating yards and landscape or recharging potable aquifers. The treatment process includes secondary treatment followed by filtration to extremely low turbidity standards before disinfection. The Class A disinfection process must meet strict requirements to ensure pathogen destruction. Class A systems also require additional reliability and redundancy measures and increased monitoring to ensure treatment and effluent quality. Class A recycled water has more uses than other classes with less restrictions and in some cases no restrictions (e.g., no buffer zones). The permit writer should review the following IDAPA 58.01.17 sections specific to Class A recycled water requirements:

- IDAPA 58.01.17.601.01–Class A classification, treatment, and use requirements
- IDAPA 58.01.17.603.01–Class A access, exposure, and signage requirements
- IDAPA 58.01.17.605.03.a–Class A distribution system requirements
- IDAPA 58.01.17.605.03.b–Class A lagoon requirements
- IDAPA 58.01.17.605.03.c and 605.03.d–Class A filtration requirements
- IDAPA 58.01.17.605.03.e–Class A additional reliability and redundancy requirements

2.2.1.2 Class B

Class B recycled water is the second most treated of all the municipal classes and the second highest in quality. Class B recycled water requires similar treatment to Class A systems. The differences include reduced turbidity requirements following filtration and less stringent disinfection requirements. Class B has many uses, but it cannot be distributed to homeowners for residential irrigation. Class B recycled water can be used to irrigate all types of crops, including edible food crops. Class B systems have reduced reliability and redundancy requirements compared to Class A systems. The permit writer should review IDAPA 58.01.17.601.02–Class B classification, treatment, and use requirements.

2.2.1.3 Class C

Class C recycled water systems have secondary treatment (oxidation) and disinfection. Filtration is not a requirement for Class C systems. Disinfection requirements are less stringent than Class B, reducing the allowable uses. For example, Class C recycled water can be used to irrigate fodder crops, processed food crops (food crops that undergo commercial pathogen destroying processes), and some types of orchards. The permit writer should review IDAPA 58.01.17.601.03–Class C classification, treatment, and use requirements.

2.2.1.4 Class D

Class D recycled water has similar treatment to Class C in that oxidation and disinfection are required. The primary difference is that Class D disinfection requirements are an order of magnitude less than Class C requirements. As a result, the allowable uses are more limited, and buffer zones are more stringent. Irrigation of fodder, processed food crops, and forests are allowed uses of Class D recycled water. The permit writer should review IDAPA 58.01.17.601.04–Class D classification, treatment, and use requirements.

2.2.1.5 Class E

Class E recycled water requires primary treatment only (no disinfection). Allowable uses of Class E are very limited due to the high potential pathogen content remaining in the recycled water. The permit writer should review IDAPA 58.01.17.601.05–Class E classification, treatment, and use requirements.

2.2.1.6 Overview of Municipal Recycled Water Requirements

Table 1 and Table 2 compare treatment requirements between the recycled water classes. To use the tables, find the recycled water classification listed horizontally across the top of each table and follow the appropriate column down to determine specific treatment, disinfection, and additional requirements.

Table 1. Municipal recycled water classification disinfection requirements.

Classification		Class A	Class B	Class C	Class D	Class E
Oxidized		Yes	Yes	Yes	Yes	No
Filtered		Yes	Yes	No	No	No
Disinfected		Yes	Yes	Yes	Yes	No
Total coliform (organisms/100 milliliters)	Median results for last x-days for which analysis have been completed	2.2 7-day median	2.2 7-day median	23 5-day median	230 3-day median	No limit
	Maximum in any sample	23	23	230	2,300	No limit
	Monitoring frequency	Daily	Daily	Once weekly	Once monthly	—

mg/L = milligram per liter; min = minute

Table 2. Additional Class A and Class B requirements.

Classification		Class A	Class B
Turbidity (NTU)	24-hour – mean, not to exceed	Granular or cloth media – 2 Membrane filter – 0.02	Granular or cloth media – 5
	Maximum, in any sample	Granular or cloth media – 5 Membrane filter – 0.5	Granular or cloth media – 10
	Monitoring frequency	Continuous	Continuous
Disinfection requirements		CT of 450 mg-min/L with 90 minutes of modal contact time or Disinfection to 5-log inactivation of virus	Total chlorine not less than 1 mg/L after 30-minute contact time or Comparable alternate process
Maximum total nitrogen (mg/L) Monthly arithmetic mean, from weekly composite samples not to exceed		Groundwater recharge – 10 Residential irrigation and other nonrecharge uses – 30	
BOD_5 (mg/L)		Groundwater recharge – 5	

Classification	Class A	Class B
Monthly arithmetic mean, from weekly composite samples not to exceed	Residential irrigation and other nonrecharge uses – 10	
pH Daily grab samples or continuous monitoring	Between 6.0 and 9.0	

NTU = neophelometric turbidity unit; mg/L = milligram per liter; BOD = biochemical oxygen demand

2.2.2 Industrial Facilities

Industrial wastewater is generated at industrial facilities and some commercial operations. Under IDAPA 58.01.17, all wastewater that is not characterized as municipal is industrial, even if the source is not from an industrial facility. Industrial wastewater characteristics vary with changing production rates and schedules and are more variable than municipal wastewater. When permitting industrial facilities, the permit writer should evaluate the presence of metals and toxic substances in the wastewater. The permit writer should also evaluate the possibility of nuisance odor generation and constituent overloading when using high-strength wastewater for reuse (e.g., water with high level of oxygen demand or high concentration of nutrients). These systems may require additional pretreatment and/or special site management practices to provide performance protective of public health and the environment.

IDAPA 58.01.17 specifies industrial recycled water permit conditions and limits be developed on a case-by-case basis, accounting for the type and specific characteristics of the industrial wastewater to be recycled and the treatment necessary to ensure the use of such recycled water is protective of human health and the environment (IDAPA 58.01.17.608). Industrial reuse permits are issued based on the specific characterization of the recycled water and the site-specific conditions. An example of an industrial reuse permit is a food processor with high-strength wastewater (high total dissolved solids and nitrogen) where they treat wastewater with dissolved air flotation and lagoons before land applying to alfalfa. Most industrial reuse permits in Idaho relate to food processing (e.g., potatoes, sugar beets, other vegetables, dairy products, and meat processors).

Unlike municipal recycled water, IDAPA 58.01.17 does not specify disinfection requirements for industrial recycled water. Disinfection of industrial wastewaters is usually not required in reuse permits when there are no sources of human pathogenic microorganisms, such as a municipal lagoon discharge to the waste stream that comingle with the industrial wastewater. Cases exist where pathogenic organisms are present in industrial wastewaters from nonmunicipal sources, and their risk to human health and the environment must be assessed.

2.2.3 Exempt Facilities

When reviewing reuse permit applications, the permit writer must be aware of facilities exempt from the requirement to obtain a reuse permit per IDAPA 58.01.17.100.01. This rule specifies land application wastewater from the following facilities is excluded from permit requirements:

- Livestock truck washing
- Feedlots
- Dairies
- Mining
- Digesters where the digestate is returned to the originating farm

Permit requirements in IDAPA 58.01.17 do not apply to the incidental use of recycled water for landscape irrigation at a municipal wastewater treatment plant when the following applies:

1. No other recycled water use would subject the municipal wastewater treatment plant to IDAPA 58.01.17.
2. Municipal wastewater treatment plant has and is in compliance with an Idaho Pollutant Discharge Elimination System (IPDES) permit.
3. Public access to the area of landscape irrigation is restricted.

2.3 Uses for Recycled Water

Reuse is the use of recycled water for beneficial purposes. In this document, four beneficial reuses are discussed: land treatment, groundwater recharge, dust suppression, and other nonpotable reuse. The intent of IDAPA 58.01.17 is to permit facilities that provide an environmental and societal benefit in the reuse of their recycled water. These benefits may include a reduction in nutrient loading to surface water bodies, decreased pressure on local and regional water supplies, reduction in energy consumption associated with source water location, and agricultural production (EPA 2012 section 1.4, p. 1-5). A permit writer must carefully assess that proposed reuse projects are promoting a beneficial purpose and not a form of wastewater disposal. The permit writer must define each approved use of the recycled water in section 2 of the reuse permit. If applicable, specific crops or vegetation are further defined in section 4.5 of the reuse permit. For example, processed food crops is an approved use in section 2, and the crop is limited to small grains in section 4.5. The reuse permit will address the management units and buffer zones for the use.

Currently, most of Idaho's permitted reuse operations are land treatment. As Idaho's population continues to grow, expansion of other reuse categories is inevitable. The following subsections provide an overview of each reuse category. For municipal recycled water, Table 3 summarizes allowed uses for which a specific classification is required (IDAPA 58.01.17.602.02). Other uses not listed in Table 3 and uses for industrial recycled water are evaluated on a case-by-case basis and approved by DEQ.

Table 3. Uses for municipal recycled water.

Recycled Water Rules	Class A	Class B	Class C	Class D	Class E
Uses Relating to Irrigation and Buffers					
Fodder, fiber crops	Yes	Yes	Yes	Yes	Yes
Commercial timber, firewood	Yes	Yes	Yes	Yes	Yes
Processed food crops or "food crops that must undergo commercial pathogen-destroying processing before being consumed by humans"	Yes	Yes	Yes	Yes	No
Ornamental nursery stock, or Christmas trees	Yes	Yes	Yes	Yes	No
Sod and seed crops not intended for human ingestion	Yes	Yes	Yes	Yes	No
Pasture and animals not producing milk for human consumption	Yes	Yes	Yes	Yes	No
Pasture for animals not producing milk for human consumption	Yes	Yes	Yes	No	No
Orchards and vineyards irrigation during the fruiting season, if no fruit harvested for raw use comes in contact with the irrigation water or ground, or will only contact the inedible portion of raw food crops	Yes	Yes	Yes	No	No
Highway medians and roadside vegetation irrigation on sides	Yes	Yes	Yes	No	No
Cemetery irrigation	Yes	Yes	Yes	No	No
Parks, playgrounds, and school yards during periods of nonuse	Yes	Yes	No	No	No
Parks, playgrounds, and school yards during periods of use	Yes	No	No	No	No
Golf courses	Yes	Yes	No	No	No
Food crops, including all edible food crops	Yes	Yes	No	No	No
Residential landscape	Yes	No	No	No	No
Dust suppression at construction sites and control on roads and streets	Yes	Yes	Yes	No	No
Toilet flushing at industrial and commercial sites, when only trained maintenance personnel have access to plumbing for repairs	Yes	Yes	Yes	No	No
Nonstructural fire fighting	Yes	Yes	Yes	No	No
Cleaning roads, sidewalks, and outdoor work areas	Yes	Yes	Yes	No	No
Backfill consolidation around nonpotable piping	Yes	Yes	Yes	No	No
Soil compaction	Yes	Yes	Yes	No	No
Commercial campus irrigation	Yes	Yes	No	No	No
Fire suppression	Yes	Yes	No	No	No
Snowmaking for winter parks	Yes	No	No	No	No
Commercial laundries	Yes	No	No	No	No
Groundwater recharge through surface application	Yes	No	No	No	No
Subsurface distribution	Yes	Yes	Yes	Yes	No

2.3.1 Land Treatment

Land treatment is the application of municipal and industrial recycled water to the land at a controlled rate in a designed and engineered setting. This activity obtains beneficial reuse of the recycled water to improve environmental quality and achieves treatment and project goals in an environmentally sound manner (EPA 2006 section 1.2, p. 1-1).

Three methods are used for land treatment of recycled water: slow rate, overland flow, and rapid infiltration. These methods employ specific types of distribution systems. Slow-rate systems apply recycled water to a vegetated soil surface, where the water receives treatment as it flows through the plant root/soil matrix (EPA 2006 p. 1-2).

Overland flow systems apply recycled water to relatively impermeable grass-covered soils, where treatment occurs as the water interacts with soil and vegetation. The goal of overland flow is for deep percolation from the site to be minimized.

Rapid infiltration (RI) systems allow complete infiltration of recycled water into the soil followed by subsurface soil percolation where applied recycled water is transmitted down without resulting in excessive mounding. Loading to a rapid infiltration system may not exceed the hydraulic, organic, nitrogen, suspended solids, or other limits specified in the permit or plans and specifications developed pursuant to a permit requirement. The permit writer will consider past operating performance, ability of the soils to treat the pollutants in the recycled water, hydrogeologic characteristics of the site such as permeability and infiltration rates, and other relevant information when determining discharge limitations.

2.3.1.1 Slow Rate

Slow rate land treatment applies recycled water to a vegetated surface (EPA 2006 section 1.4, p. 1-2). In Idaho, slow rate land treatment systems permitted by DEQ include agricultural production and forested systems. The process for selecting and operating irrigation distribution systems for slow rate land treatment systems are the same as for conventional irrigated agriculture. Factors that distinguish slow rate land treatment from conventional irrigated agriculture include the following:

- Recycled water application is limited by water quality and the resulting land-limiting constituent. As a result, a supplemental irrigation water supply may be needed to meet crop water use requirements.
- Recycled water generation and use often occur over a long season compared to conventional irrigated agriculture and as a result may necessitate water storage, or it may occur year-round.
- Maximizing irrigation efficiency is not always the optimum approach for managing recycled water (Crites et al. 2000, p. 237, Type 1 slow-rate system).
- Irrigation rates and frequency of application may differ between slow rate land treatment and conventional irrigated agriculture.
- Crop selection is often determined by operational needs of the system.

2.3.1.2 Overland Flow

Overland flow systems apply recycled water to relatively impermeable grass-covered soils, with treatment occurring as the water interacts with soils and vegetation. The distribution goal of the overland flow systems is to spread the water evenly at the top of the slope, creating uniform flow across the slope. Overland flow is not commonly practiced in Idaho but is an option for appropriate circumstances.

2.3.1.3 Rapid Infiltration Systems

RI systems involve a relatively high rate of infiltration into the soil followed by rapid percolation either vertically or laterally using wetting and drying cycles without producing excessive mounding in the subsurface. The "Recycled Water Rules" (IDAPA 58.01.17) allow for the use of RI systems with recycled water under the requirements of a reuse permit. The reuse permit will specify the treatment of the recycled water allowed for the RI system. IDAPA 58.01.17.606 has specific criteria and requirements that must be met by the RI system.

Plans and specifications must be submitted to DEQ for review and approval before installation and concurrently with the reuse permit application if recycled water will be used. IDAPA 58.01.17 requires a reuse permit for RI systems.

- RI systems that plan for treatment in the soil must be designed and operated to achieve a specified treatment level and monitoring must be in place to establish that level of treatment.
- RI systems that disperse treated recycled water must achieve a reuse permit-specified level of treatment before its use in the RI system. IDAPA 58.01.17 requires any RI system whose beneficial use is groundwater recharge must treat the recycled water to a minimum of Class A standards and comply with IDAPA 58.01.11 (section 2.3.2).

The operation and maintenance manual section included within the Plan of Operations must be completed before use of an RI system as this demonstrates how the permittee will comply and continue to comply with permit requirements.

2.3.2 Groundwater Recharge

Managed recharge, via either direct injection, infiltration, or land application, may be one solution to restore declining water levels in some aquifers. In Idaho, only Class A recycled water is allowed for groundwater recharge (IDAPA 58.01.17.602.02). Groundwater recharge systems must comply with IDAPA 58.01.11 and show no adverse impacts to a beneficial use of waters of the state.

The minimum requirements for site location and aquifer storage time must be based on site-specific modeling. Groundwater recharge systems must be designed and operated in a manner that protects the beneficial uses of groundwater on downgradient properties not under the control of the system owner. Authorization from the Idaho Department of Water Resources (IDWR) is required for groundwater injection wells. IDWR regulates injection wells through the

Underground Injection Control Program under the "Rules for the Construction and Use of Injection Wells" (IDAPA 37.03.03).

Due to the variability of site characteristics in Idaho, the permit writer must review each proposed project on a case-by-case basis. DEQ should involve the State Reuse Permit Coordinator in preliminary meetings for groundwater recharge projects.

2.3.3 Dust Suppression

Use of a dust suppressant alters the physical properties of the road or soil surface so particulate matter no longer becomes airborne (EPA 2004a section 2.4, p. 7). Dust suppressants prevent fugitive dust by the following:

- Encourages soil compaction.
- Agglomerates surface particles.
- Increases surface tension and reduces evaporation.
- Forms a crust on the surface.

Recycled water is not specifically designed to prevent fugitive dust like commercial dust suppressants. Depending on the type of recycled water used, some principles can still be applied. For example, municipal recycled water typically contains minimal salt concentrations and will likely have the same dust control properties as fresh water (i.e., surface particle agglomeration and compaction). Industrial recycled water, typically containing higher salt concentrations, may increase surface tension and reduce evaporation.

For municipal recycled water, IDAPA 58.01.17.602.02 lists Class A, Class B, and Class C for use as dust suppression at industrial, commercial, or construction sites. Except for Class A, comply with the buffer distances when designing dust control at a reuse site. For industrial recycled water, IDAPA 58.01.17 does not specify the types of waters that can be used for dust suppression; the permit writer must determine what is appropriate on a case-by-case basis.

2.3.4 Other Nonpotable Reuse in Urban Areas

Multiple uses of recycled water are allowed in urban settings as shown in Table 3. These allowed uses are generally reserved for the highest qualities of recycled water (Class A and B). Urban uses for recycled water include residential/common area irrigation, toilet flushing, snow making, fire suppression, commercial laundry use, and parks and playgrounds.

In permitting reuse in urban settings due to their proximity to the public, public health concerns should be evaluated based on the class and use of the recycled water.

2.4 Permitted Facility Components

The permit writer must understand all components of the reuse facility that IDAPA 58.01.16 and IDAPA 58.01.17 have authority over to ensure no component of the facility is excluded when writing a reuse permit. A reuse facility is defined by IDAPA 58.01.17 as any structure or system designed or used for reuse of municipal or industrial wastewater, including but not limited to,

industrial and municipal wastewater treatment facilities, pumping and storage facilities, pipeline and distribution facilities, and the property to which the recycled water is applied. The definition does not include industrial in-plant processes and reuse of process waters within the plant (IDAPA 58.01.17.010.24).

In addition to water, reuse facilities generate solids that must be regulated under the reuse permit. Solid waste is regulated under the "Solid Waste Management Rules" (IDAPA 58.01.06). Wastes not regulated under these rules, but regulated under a reuse permit, are specified in IDAPA 58.01.06.001.03.a.i, stating these rules do not apply to the following solid wastes:

> Liquid wastes when the discharge or potential discharge of the liquid waste is regulated under a federal, state, or local water pollution discharge or wastewater land application permit, including management of any solids if management of the solids are addressed in a permit term or condition.

Waste *solids* is used in the Reuse Permitting Program to include sludge and other wastes generated by a reuse permittee. Such wastes are otherwise regulated in a reuse permit. Waste solids may include sludge, vegetative waste, silt, mud containing organic matter, other noninert wastes, and precipitated calcium carbonate and fly ash.

The regulation of municipal sludge/biosolids, as distinct from waste solids, is covered under IDAPA 58.01.16.650 and the "Idaho Pollutant Discharge Elimination System Program Rules" (IDAPA 58.01.25). Industrial sludge is also covered under IDAPA 58.01.16.650. Municipal and industrial sludge/biosolids requirements are discussed in section 4.

2.5 Typical Permit Conditions and Limits

This section provides an overview with objectives for typical limits and conditions found in reuse permits. Section 4 provides details on each section of a reuse permit.

2.5.1 Standard Permit Conditions

IDAPA 58.01.17.500 specifies standard permit conditions required in each permit issued by DEQ. Standard permit conditions include the following requirements:

- Comply with the permit.
- Apply for permit renewal for existing permittees.
- Properly operate and maintain the facility.
- Provide information and records to DEQ when requested.
- Allow DEQ entry and access to the facility.
- Report requirements for all noncompliance.
- Minimize impacts resulting from permit noncompliance.
- Comply with IDAPA 58.01.11 to protect groundwater beneficial uses, prevent groundwater degradation, and adhere to groundwater quality standards.

2.5.2 Reuse Site-Specific and Other Permit Conditions

IDAPA 58.01.17.600 through IDAPA 58.01.17.604 specifies conditions that can be established in permits on a case-by-case basis. These conditions protect the environment and public health. Reuse site-specific conditions include, but are not limited to, the following:

- Duration of the permit (maximum of 10 years)
- Operating seasons
- Treatment requirements
- Buffer distance restrictions
- Fencing and signage requirements
- Recycled water usage requirements (e.g., types of crops allowed)

When reviewing a permit application, the permit writer must consider what site-specific conditions are needed to protect the environment and public health. Consider if the limits and conditions from the previous permit still apply to the facility under the new permit.

2.5.3 Compliance Activities and Schedules

Compliance activities and schedules are facility-specific requirements of the permit that must be completed by the permittee at specified dates within a permit cycle (IDAPA 58.01.17.600.04). Compliance activities found in most reuse permits are as follows:

- Plan of Operation
- Quality Assurance Project Plan (QAPP)
- Lagoon seepage testing
- Activities associated with permit renewal

For permit renewals the permit writer should review compliance activities from the previous permit term for the following:

- All required compliance activities have been submitted and are up-to-date.
- Unresolved compliance issues or necessary changes to the permit are identified.

The permit writer should review any potential compliance activities that could be addressed in the permit application or if needed, as conditions in the new permit. The goal is to reduce, where possible, the need for compliance activities in the permit. The permit writer should then plan for compliance activity completion by the permittee in a timely manner for the activities that cannot be submitted with the permit application. The permit writer should consider all the compliance activity due dates, and the ability of the permittee to complete each compliance activity within the allotted time.

A permit writer may determine that additional compliance activities are needed to address concerns identified during the permitting process. The objectives of the compliance activity section are as follows:

- Create a timeline for submitting standard documents and completing activities during the permit cycle. For new permits, compliance activities can include a timeline for finishing incomplete components of the reuse site.

- Require the permittee to address regulatory and operational issues the permit writer may have discovered while processing the permit application (e.g., addressing operational deficiencies, obtaining additional information regarding an environmental concern, and expanding/reducing operations).

2.5.4 Hydraulic and Constituent Loading Limits

Many of the reuse permits issued in Idaho specify hydraulic and constituent loading limits. These limits are established for management units (MU) within a reuse site. A MU is a portion of the reuse site that is permitted to receive recycled water. Examples of MUs include agricultural fields, rapid infiltration basins, golf courses, and roadways. MUs within a reuse site can have different loading limits depending on the permitting needs.

The objective of a hydraulic loading limit is to constrain the amount of water applied to a specific MU to within site design treatment limitations. Limitations could be based on climate, soil type, and vegetative cover. Many hydraulic loading limits are set to minimize the movement of constituents to groundwater and runoff from MUs. Examples of hydraulic loading limits include the following:

- Agronomic irrigation rates
- Maximum limits based on-site capacity
- No limit but only allowed uses specified (typically reserved for Class A and B municipal recycled water)

The constituent loading limit ensures percolate generated from a MU will (a) protect beneficial uses of groundwater, (b) not cause significant degradation to groundwater (IDAPA 58.01.11.400.02.a), and (c) not cause exceedances of groundwater quality standards (IDAPA 58.01.11.200). In addition, constituent loading limits can be established to ensure the longevity of a reuse site, which may be diminished by overloading of salts and organics. Typical constituents with loading rates in reuse permits include nitrogen, phosphorus, chemical oxygen demand, and nonvolatile dissolved solids.

2.6 Permit Monitoring Requirements

DEQ is dedicated to using and providing objective, correct, reliable, and understandable information. Decisions made by DEQ are subject to public or stakeholder review and scrutiny. DEQ's goal is to ensure that all decisions are based on data of known and acceptable quality. Monitoring at a reuse site provides DEQ with information to make regulatory decisions and determine compliance with permit and rule requirements. The following monitoring may be required in reuse permits:

- Wastewater, recycled water, and supplemental irrigation water constituents
- Wastewater, recycled water, and supplemental irrigation water flow
- Groundwater
- Surface water
- Soil

- Plant tissue
- Meteorological
- Generated solids
- Visual monitoring of reuse site conditions

Not all monitoring listed above will be relevant or needed for every permitted reuse site. Some monitoring is integrated into rule requirements, such as municipal recycled water disinfection monitoring, but other monitoring must be determined on a case-by-case basis. The permit writer must determine appropriate monitoring based on regulatory needs and goals. The following questions can help a permit writer determine the appropriate monitoring requirements for a specific reuse site:

1. What is DEQ trying to protect at the reuse site?
2. What criteria are DEQ using to determine if a resource is protected?
3. What information does DEQ require to determine if protection criteria are met?

Incorporating monitoring requirements into reuse permits is discussed in section 4.

2.7 Facility Reporting and Annual Report Reviews

The annual report discusses data collected during the year and demonstrates the facility's permit compliance to DEQ. The annual report should be generated by a competent environmental professional who is familiar with the permitted facility and can use the monitoring data to write a narrative summary and describe the site conditions as they apply to the use of recycled water.

A reuse permit will define the reporting requirements for an annual report. The reporting requirements include the following:

- Results of all the required monitoring, including laboratory analytical reports (with approved methods listed) and chain-of-custody forms
- Interpretive discussions of all the required monitoring data
- Calculations required to demonstrate permit compliance
- Status of all compliance activities
- Results of backflow testing, repairs, and replacements
- Discussion of major maintenance activities
- Summary of noncompliance events

The permit writer may determine that additional reporting requirements are needed for a specific facility during the permitting process. Additional reporting requirements should serve a regulatory purpose and be clearly written to ensure the permittee understands what is required.

The permittee is required to submit an annual report to DEQ at the same time each year. Once received, DEQ reviews the annual report and determines the permittee's compliance with the

issued reuse permit. In addition to the permit application, the permit writer uses annual reports and reviews to determine permitting goals for subsequent permits.

3 Overview of the Permitting Process

3.1 Steps of Permitting Process

IDAPA 58.01.17.300 and 400 establish requirements for reuse permit applications and application processing procedures. Before processing an applicant's permit application, the permit writer should refer to these sections of IDAPA 58.01.17 to increase the efficiency of the process. Figure 1 shows seven steps of the reuse permitting process with specific procedural details provided in the Kaizen reuse permitting process flowchart (EDMS 2016AFP4). Each step number in Figure 1 corresponds with the following sections to provide the permit writer with additional discussion.

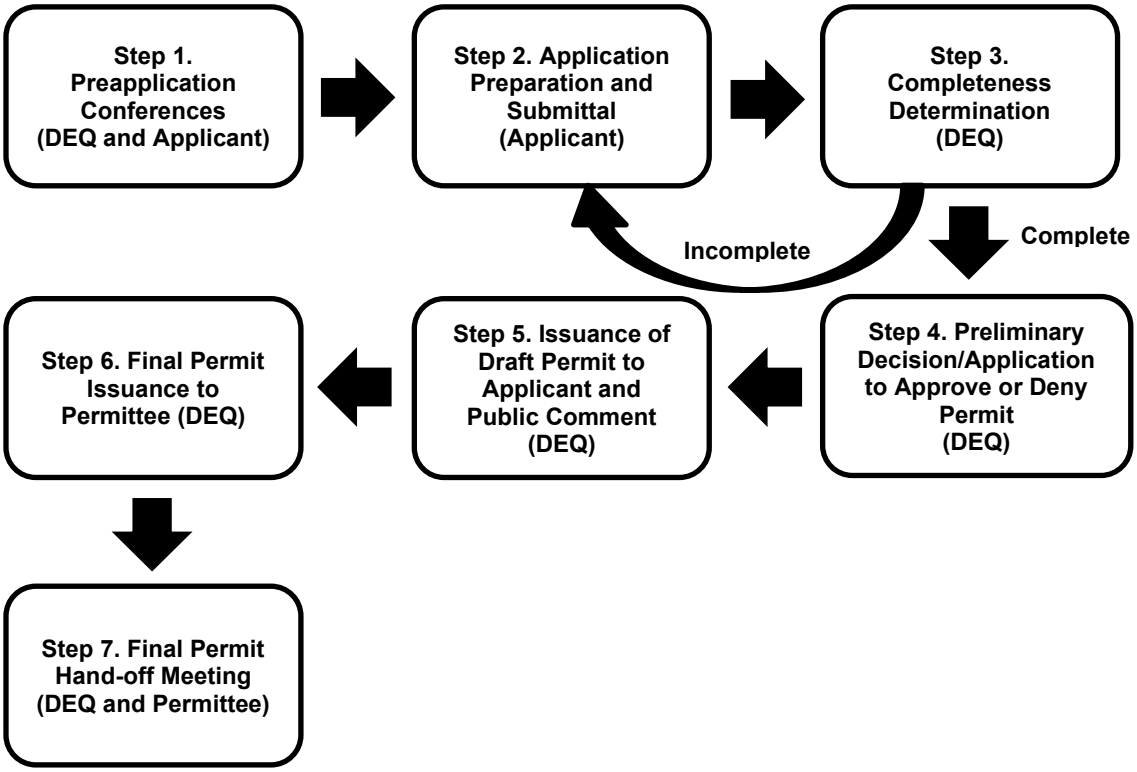


Figure 1. Reuse permitting process steps. The party responsible for the step is shown in parentheses.

3.1.1 Preapplication Conference

The preapplication conference assists the applicant with submitting a complete permit application. This conference ensures permitting submittal requirements are clearly understood by the applicant and addresses any questions they may have about the permitting process. Multiple meetings may be necessary to address site-specific details before submitting an

application. For a new reuse site, IDAPA 58.01.17.300.02 requires a preapplication conference. If the designated permit writer has not recently visited an existing site, they should schedule a short site visit as part of the conference. For a permitted site, the permit writer should schedule the preapplication conference at least 12 months before the permit expiration, which is 180 days before the permit renewal application due date (Figure 1 – Step 1 and EDMS 2010AFQ2 RUT12 Letter 1). Preapplication conferences for renewal applications that will include modifications to the treatment systems or acreage addition may need to be scheduled more than 12 months before permit expiration to ensure all plans and specifications are approved in time.

In initial meetings, the applicant learns about pertinent aspects of the reuse program and briefs DEQ on the proposed project. The permittee should be prepared to discuss the reuse site. Topics of discussion may include treatment processes and recycled water characteristics, soil and groundwater analysis, irrigation systems, final use of the recycled water, landownership, buffer zones, well location acceptability analysis (WLAA) and Plans of Operation. This exchange facilitates preparing the reuse permit application and the entire permitting process.

In 2009, the DEQ reuse program evaluated the permitting process to identify causes of delays in issuing permits. The two major areas identified were (1) incomplete permit applications resulting in resubmittals and (2) too many compliance activities in final permits subsequently using staff time that could otherwise be spent on developing permits. Preapplication conferences are expected to result in fewer incomplete applications.

DEQ Preparation for the Preapplication Conference

The preapplication conference is a collaborative, detailed facility review to clearly define and agree upon the expected content of the permit application; therefore, the permit writer should prepare for the preapplication conference through the following activities:

- Review any materials the applicant submitted before the preapplication conference.
- Review current permit and compliance activities (if an existing site).
- Review the latest annual report and annual report review (if an existing site).
- Review the latest inspection report (if an existing site).
- Review the permittee website for general information for potential wastewater sources.
- Review DEQ files for any legal agreements, such as consent orders or notices of violation and any lease agreements (or licenses, easements, or access agreements) associated with the reuse site. Lease agreements should:
  - Be between the property owner and the person who owns/operates the facility.
  - Cover all the required property.
  - Provide sufficient access to the lease.
- Discuss the following with the applicant:
  - All Plan of Operation and Preliminary Technical Report checklist items.
  - Regulatory permitting schedule.

- Documents that can be submitted with the permit application package and reducing the need for compliance activities within the permit (e.g., updated Plan of Operation).

For municipal reuse sites, the permit writer ensures the applicant's file includes up-to-date Public Wastewater System Operator Licensure Record and Idaho Public Wastewater Treatment Plant Classification Worksheet forms. If these two forms have not been submitted or are outstanding, the permit writer should request the applicant complete and submit the forms with the application package.

Some applicants may request a preapplication conference for a preliminary inquiry and schedule another conference when they are more prepared to pursue permitting or a permit renewal. After the preapplication conference, the permit writer issues a letter of needs to the applicant outlining what to include in the permit application submittal (EDMS 2010AFQ3 RUT12 Letter 2). The letter of needs will be referenced when determining if the application is considered complete.

3.1.2 Application Preparation and Submittal

After the preapplication conference, the applicant should prepare the reuse permit application package (Figure 1 – Step 2). The application package is due at least 180 days before a planned reuse activity for new facilities and 180 days before permit expiration for permitted facilities to ensure that a permit can be issued in the needed time frame. DEQ provides the following to aid the applicant in generating an application package:

- "Recycled Water Rules" (IDAPA 58.01.17).
- Reuse permit application forms (EDMS 2015AGH1191)—Includes the application forms, the Responsible Official/Authorized Representative Designation form, and checklists for the Plan of Operation and Preliminary Technical Report.

The application form must be signed and certified as true, accurate, and complete by the responsible official of the proposed reuse facility. DEQ notifies the applicant when the application is received (EDMS 2010AFQ4 RUT12 Letter 3).

3.1.3 Completeness Determination

After the applicant submits a permit application to DEQ, the permit writer begins the review process to determine if the application is complete (Figure 1 – Step 3). For new permits, the application must satisfy all requirements in IDAPA 58.01.17.300.03, which are included in the Preliminary Technical Report checklist. For permit renewals, IDAPA 58.01.17.300.04 specifies that all items in section 300.03 may not be required to be submitted again. For permit renewals, the permit writer determines in the preapplication conference if any of the items in section 300.03 must be submitted with the application. Truncating the permit application contents is reserved for established reuse sites that propose few changes to the permit renewal and where previously submitted information is still relevant.

After application submittal, DEQ must provide written notice to the applicant within 30 days, notifying the applicant that the application is complete or incomplete (IDAPA 58.01.17.400.02). If the application is complete, the permit writer can process the permit and issue a notification letter that includes the following:

- Effective date of the application
- Projected schedule for processing the permit that lists the tentative dates for publishing the preliminary permit decision, or application denial and the date of final permit issuance

If the application is determined incomplete, DEQ must provide written notice specifying deficiencies and the additional required information. Application processing cannot commence until DEQ determines the permit application is complete. The permit writer uses the permit application completeness determination letter (EDMS 2010AFQ5 RUT12 Letter 4a or EDMS 2010AFQ9 RUT12 Letter 4b).

3.1.4 Preliminary Decision/Application to Issue or Deny Permit

Within 30 days of the effective date of the application that was defined in the completeness determination letter, DEQ must issue a preliminary decision to prepare a draft permit or decision denying the application (IDAPA 58.01.17.400.03) (Figure 1 – Step 4). DEQ can deny the application at this step if it is discovered the application omitted or misrepresented pertinent information for permitting the reuse site. Discovering unsuitable site conditions, such as historical storage of hazardous materials on site, could lead to a denied application. A staff analysis (section 4.1.1) is required to justify permit denial and summarize the basis for the denial.

The permit writer uses the preliminary decision letter template (EDMS 2010AFQ6 RUT12 Letter 5).

3.1.5 Issue Draft Permit to Applicant and Public Comment

Within 60 days of issuing the preliminary decision to prepare a draft permit, DEQ issues concurrently a draft permit and staff analysis to the applicant (IDAPA 58.01.17.400.05.a) and for public comment (IDAPA 58.01.17.400.05.b) (Figure 1 – Step 5). The permit writer uses the draft permit transmittal letter template (EDMS 2010AFQ7 RUT12 Letter 6).

The staff analysis briefly states the principal facts and significant questions evaluated in preparing the draft permit conditions and summarizes the basis for the draft conditions with references to applicable requirements and supporting materials. Section 4 provides detail on preparing a staff analysis and a draft permit.

The permit writer submits for permittee and public notice the draft reuse permit and final staff analysis so that they can provide written comments for a period of time (typically 30 days) and in a manner specified in DEQ's notice. DEQ may also provide an opportunity for the public to provide oral comments and that should be discussed with the State Reuse Permit Coordinator. The permit writer provides written responses to the comments received during the public

comment period. Unless public comments indicate substantial changes to the draft permit are warranted, DEQ's responses to public comments are included in the final permit transmittal. If public comments indicate substantial changes to the permit are warranted, DEQ may repeat the draft permit issuance process.

3.1.6 Final Permit Issuance to Permittee

Permit issuance occurs within 60 days from the issuance of the draft permit transmittal letter to the permittee (approximately 180 days after the application is deemed complete; IDAPA 58.01.17.400.06) (Figure 1 – Step 6). The final permit is transmitted to the permittee with an invitation to attend a permit handoff meeting (section 6). The effective date of the final permit is the date of issuance unless a later effective date is specified in the permit (IDAPA 58.01.17.400.07). The permit writer uses the final permit transmittal letter template (EDMS 2010AFQ8 RUT12 Letter 7).

3.1.7 Final Permit Hand-off Meeting

The permit handoff meeting (Figure 1 – Step 7) is between DEQ and the facility's responsible official, authorized representative, environmental supervisor, and facility operators after the final permit is issued. In this meeting, DEQ explains the requirements of the newly issued permit and clarifies the permit contents and responsibilities (section 6).

3.2 Internal Quality Control Steps

The permitting process outlined in section 3.1 requires DEQ and applicant collaboration. DEQ follows several internal quality control steps to issue a reuse permit.

1. **Peer Review:** When a DEQ regional office permit writer completes a first draft of the permit and staff analysis, ensure the draft is reviewed by a peer (manager or more experienced permit writer) before moving to the next step. Peer review focuses on content, organization, grammar, punctuation, and spelling.
    a. If the permit writer is in the Technical Services Division, this peer review step may include a review from another Technical Services Division staff before sending to the regional office for review.
    b. For permit writers who need assistance with technical writing, submit a *work request* to DEQ's Technical Editing group. Notify Technical Editing at least 30 days before review of the draft documents is needed to get into the editing queue. Assistance is also provided in the *DEQ Writing and Style Guide* and on the *Word Help* web page.

2. **State Reuse Permit Coordinator Review:** After the draft permit and staff analysis are peer reviewed, the documents must be reviewed by the State Reuse Permit Coordinator. The State Reuse Permit Coordinator review focuses on the consistency of the document with other reuse permits issued throughout Idaho, state goals, and policy interpretation. The permit writer then adequately addresses the State Reuse Permit Coordinator's comments. Technical Services permit writers should work with

the regional office to address the State Reuse Permit Coordinator's comments. The applicant may be offered a short, preliminary courtesy review before public comment to ensure that errors, omissions, and inaccuracies are addressed before the public comment period. If changes are made as a result of this preliminary review, they will be documented in the staff analysis. When the staff analysis has been finalized, the final staff analysis and draft permit to the applicant are issued and posted for public comment.

3. **Regional Office Administrator Review and Signature:** After the public comment period closes and comments are addressed, the permit writer prepares a final permit transmittal package for the Regional Office Administrator. The Regional Office Administrator reviews the package and if approved, signs and issues the final permit to the permittee. The Regional Office Administrator may want to review the draft permit earlier in the process, and this review can occur simultaneously with the State Reuse Permit Coordinator's review. The Regional Office Administrator must sign the final permit.

4 Writing a Draft Permit

This section details how to construct a draft permit and staff analysis. DEQ's reuse permits include both standard and site-specific language. Standard Permit Conditions are required by IDAPA 58.01.17.500 to be included in all issued permits. Specific permit conditions are necessary to protect the environment and public health and differ from facility to facility (IDAPA 58.01.17.600). The basis for determining specific conditions are established in IDAPA 58.01.17.600.01 but not limited to the following:

- Chemical, biological, physical, and volumetric characteristics of the wastewater and recycled water
- Geological and climatic nature of the facility site
- Size of the site and its proximity to population centers, to ground and surface water, and to domestic water supply wells
- Legal considerations relative to land use and water rights
- Techniques used in wastewater or recycled water distribution and the disposition of vegetation exposed to wastewater or recycled water
- Abilities of soils and vegetative covers to treat the wastewater or recycled water without undue harm to human health and the environment
- Monitoring and record keeping that determine if the facility is operated in conformance with its design and if its design is adequate to protect human health and the environment

Writing a successful draft permit requires reliance on current and historical documents and collaboration with applicant personnel and DEQ technical experts. The permit writer should use the following documents when writing a draft permit:

- Current permit (for permit renewals)
- Staff analysis for the current permit (for permit renewals)

- Completed compliance activities
- Permit application materials
- Reuse site engineering documents (e.g., facility plan, preliminary engineering report, and plans and specifications)
- Reuse site Plan of Operation and QAPP
- Annual reports and DEQ reviews
- Inspection reports
- Compliance and enforcement documents issued by DEQ
- Noncompliance reports and communication

Reuse sites may have unique qualities requiring site-specific limits, conditions, or language not covered in the sections below. The permit writer should carefully select the proper language for each permit and consult with more experienced permit writers when developing reuse permits. In addition, permit writers should seek legal counsel within DEQ for questions about the enforceability of any proposed permit language.

4.1 Definitions

4.1.1 Staff Analysis

A staff analysis briefly summarizes the facts evaluated when preparing the draft permit conditions or intent to deny with references to applicable requirements and supporting materials. DEQ will provide the staff analysis with the draft permit issuance or with the written decision denying the application (IDAPA 58.01.17.400.04).

For new permits and complex permit renewals, the staff analysis should be comprehensive to ensure permit limits and conditions are protective of human health and the environment and are defensible. DEQ's staff analysis template (EDMS 2013AFQ16) provides the permit writer with a framework to complete a comprehensive analysis. For some permit renewals, the permit writer may truncate the staff analysis if historical submittals for the reuse site adequately cover and are relevant for certain sections of the template. If sections of the staff analysis are truncated, the permit writer should provide detailed citations for any historical documents used so the reader can research the cited information.

The permit writer generates a staff analysis first or concurrently when preparing a draft permit because limits and conditions are placed in the permit supported from the staff analysis. The staff analysis provides sufficient technical justification for permit limits and conditions to protect human health and the environment. The justifications should be based on an in-depth review of applicable data.

4.1.2 Draft Permit

No person can operate or continue to operate a reuse facility without a valid permit issued by DEQ (IDAPA 58.01.17.300.01). A permit is the written authorization by DEQ to modify, operate, construct, or discharge to a reuse facility. The person DEQ issues a reuse permit to is the

permittee. In this case, a person is defined as an individual, public or private corporation, partnership, association, firm, joint stock company, joint venture, trust, estate, state, municipality, commission, political subdivision of the state, state, or federal agency, department or instrumentality, special district, or interstate body or any legal entity, which is recognized by law as the subject of rights and duties. Use the most current permit template (EDMS 2013AFQ14) when generating a draft permit.

For each reuse permit, DEQ establishes a permit number in the following format X-XYZ-XY. The first part of the number is either "M" for municipal or "I" for industrial. The second part of the number is the reuse site identifying number, which is unique to reuse sites across the state. The third part of the number is the current permit cycle. For example, the permit number, M-093-06, is a municipal reuse site on the sixth permit cycle. For new permits, contact the State Reuse Permit Coordinator to obtain a permit number. A permit number can only be obtained after an applicant submits a permit application.

A permit's term or duration varies between 5 and 10 years. A 10-year permit term is typically reserved for reuse sites with exemplary compliance history and minimal changes. New permits are typically issued for 5-year terms because the first permit cycle may highlight needed changes in the permit renewal. DEQ may issue renewal permit terms from 6 to 9 years depending on reuse site history, compliance activity schedules, operational constraints, and to aid DEQ with workload allocations.

Use the following principles when writing a draft permit:

- Clearly state each permit limit or condition once.
- Design permits that are understandable and can be implemented by the regulated community.
- Standard language may have historical, policy, and litigious reasons for specific wording. Before changing standard language in the template, consult with the State Reuse Permit Coordinator.

4.2 Reuse Facility Information

4.2.1 Site Location and Ownership

The permit writer should collect information from the submitted application to accurately characterize the site location and ownership. For site location, provide a narrative description and site maps in the staff analysis and draft permit, including the following:

- Reuse site address and location. Provide the geographic location (e.g., global positioning system coordinates or narrative description) if the reuse site does not have a physical address.
- Mailing address for the reuse site (if different from site address).
- Land use and landownership surrounding the reuse site.

Generate a site map for the facility and a map showing the reuse site's location within the region for DEQ's ArcGIS database. To generate maps, submit a request to the Technical Services

Division GIS Coordinators in the Technical Services Division. The request must detail the number of maps needed, what features to include, and time frames. Submit the request as early as possible in the permit writing process to prevent delay in issuing the draft permit. At a minimum, maps should delineate the wastewater treatment plant, lagoons, reuse site MUs, groundwater monitoring points, nearby surface water bodies, and roads.

The permit writer should describe who owns and operates all components of the reuse site. If multiple people are involved, such as where a facility is leasing part of the site, the permit writer should discuss documented agreements between parties. The draft permit should clearly list the Responsible Official and Authorized Representative, including addresses and contact information. The applicant's permit application will denote who assumes these roles during the permit cycle. If there are changes to these personnel at any point before a final permit is issued, the applicant must sign and resubmit the Responsible Official/Authorized Representative Designation form. At the discretion of the permit writer, it may be beneficial to include titles for these positions instead of names to minimize the number of minor permit modifications during a permit cycle.

Review the following definitions for the Responsible Official and Authorized Representative:

- **Responsible Official:** Facility contact person authorized by the permittee to communicate with DEQ on behalf of the permittee on any matter related to the permit, including without limitation, the authority to communicate with and receive notices from DEQ regarding notices of violation, or noncompliance, permit violations, permit enforcement, and permit revocation. The responsible official provides written certification of permit application materials, annual report submittals, and other information submitted to DEQ as required by the permit. Any notice to or communication with the responsible official is considered a notice to or communication with the permittee. Examples of a Responsible Official include, but are not limited to, mayor, plant manager, and environmental manager.
- **Authorized Representative:** Person designated by the Responsible Official to act as the facility contact person for any of the activities or duties related to the permit, except signing and certifying the permit application, which must be done by the Responsible Official. The Authorized Representative acts as the Responsible Official and binds the permittee as described in the Responsible Official definition.

For municipal reuse sites, the permit writer should confirm that the Wastewater System Classification Worksheet has been updated within the last 5 years, and the Public Wastewater System Operator Licensure requirements are met for the personnel operating the wastewater treatment plant and the reuse site (IDAPA 58.01.16.203). Each system must have direct supervision from a responsible charge operator that holds a valid license equal to or greater than the classification of the wastewater system. The system should also have a substitute responsible charge operator to provide direct supervision in the responsible charge operator's absence. Search Idaho's *Division of Occupational and Professional Licenses* to check that the operator licensure requirements are met.

4.2.2 Process Description

The permit writer should have a thorough understanding of wastewater treatment and reuse processes at a proposed site. The applicant must submit a process flow diagram with the permit application that is used when writing the staff analysis. Permit writers new to a project are encouraged to conduct a site visit rather than solely relying on permit application documents to understand the process. Include the following items in a staff analysis:

- Description of general wastewater treatment process, including each unit of treatment and multiple streams if appropriate
- Description of reuse method
- Detailed flow diagram of the entire system
- Description of the recycled water generated (e.g., municipal recycled water class, potato processing, or beet processing)
- Description of solids generation and handling
- Other site-specific aspects to the process (e.g., uses of supplemental irrigation water and the possession of a water right)

The process description in the staff analysis is more detailed than in the permit and follows a narrative format. For the permit, Table 4 shows applicable methods to describe the process. New permit writers should confer with the State Reuse Permit Coordinator to determine the appropriate language to include in the permit. All permit writers should confer with the State Reuse Permit Coordinator for proposed methods not specified in Table 4.

Table 4. Methods of wastewater treatment and reuse to include in the permit.

Category	Methods
Municipal treatment	• Pretreatment (screening, grit removal, equalization) • Primary treatment method (e.g., primary clarifier) • Secondary treatment method (lagoons, conventional activated sludge, oxidation ditch, biofilm reactors, moving bed biofilm reactors, rotating biological contactor, trickling filters, suspended growth biological treatment, membrane bioreactor [MBR], sequencing batch reactor [SBR], anaerobic treatment, secondary clarification) • Tertiary or advanced treatment method (secondary effluent filtration, activated carbon, chemical treatment for phosphorus removal, biological nutrient removal [BNR], ion exchange) • Disinfection method (chlorination, ultraviolet, ozone)
Industrial treatment	Industrial treatment can use treatment methods shown above for municipal treatment. Other industrial treatment methods commonly used are grease removal, dissolved air flotation, filters, settling basins or ponds, aerated lagoons, anaerobic lagoons.
System classification	• Wastewater collection system (I to IV) • Wastewater treatment system (I to IV) • Land Application/Reuse Note: Classification rating forms should be submitted to DEQ at 5-year intervals (IDAPA 58.01.16.202.01a)
Methods of reuse	• Slow rate land application, growing season only • Slow rate land application, growing and nongrowing season • Rapid infiltration • Overland flow • Groundwater recharge • Dust suppression • Nonpotable/urban reuse (e.g., landscape irrigation, toilet flushing, snow making, fire suppression, commercial laundry use, and surface water features). Optional: include typical annual reuse volume and maximum reuse acreage

4.2.3 Site Management History

The permit writer should briefly characterize the site's history in the staff analysis to provide a framework and perspective for permit conditions. For new reuse sites, the characterization will be limited but could focus on the planning and construction stages of the project and prior land use. For permit renewals, limiting the characterization to the previous permit cycle may be adequate if there are not long-standing management issues that span multiple cycles. Include the following items in this characterization:

- Upgrades or modifications to the wastewater treatment system
- Expansion or decrease in the size of the reuse site
- Permit modifications
- Noncompliance issues and enforcement actions
- Changes in site ownership
- Agricultural practices (e.g., crops grown) and future outlook, if applicable
- Major maintenance activities

4.2.4 Climatic Characteristics

Climate is a principal factor in determining permit conditions at land treatment sites. Climate is the average historical weather of an area, including seasonal variations and weather extremes (e.g., prolonged periods of droughts or hurricanes) averaged over a period of at least 30 years (Miller 2000). The permit writer should characterize the climate for any proposed reuse site. This characterization will establish and justify specific permit conditions. For permit renewals, simplify this characterization by using previously submitted assessments if the climate data is still relevant.

Climate establishes many site characteristics:

- Affects the rates of physical, chemical, and biological weathering processes over a large geographic area.
- Influences soil properties.
- Determines the types of vegetation or agricultural crops that may be grown.
- Determines the rates of evaporation and transpiration.
- Determines the amount of precipitation that must be accounted for during site and system design.
- Determines the amount of storage needed for recycled water.

Idaho has a wide range of climates that can have substantial impacts on the appropriateness of permitting certain types of reuse operations. For example, in colder areas of the state that receive higher precipitation, year-round application of recycled water may not be permitted. Table 5 lists climate parameters the permit writer should use for reuse sites.

Table 5. Climate parameters and reuse site considerations.

Parameter	Data to Characterize	Reuse Site Considerations
Temperature	• Daily maximum • Daily minimum	• Appropriateness of winter operations • Equipment needed for winter operations • Odor generation from unit processes • Suitable vegetation • Growing season
Precipitation	• Total mean annual • Mean monthly • Peak storm event • Seasonal means	• Vegetation irrigation water requirements • Runoff and soil erosion • Leaching • Suitable vegetation • Lagoon capacity
Wind	• Speed • Direction	• Odor generation from facility and reuse site • Distance from residential or other sensitive populations • Spray drift

Obtain weather and climate data for the permittees specific area in Idaho from the following:

- *National Oceanic and Atmospheric Administration*
- *AgriMet Cooperative Agricultural Weather Network*
- *Western Regional Climate Center*
- *University of Idaho ET_{Idaho} website*

4.2.5 Soils

Soils play a key role in reuse, as a medium for plant growth, chemical and biological attenuation and transformation of recycled water constituents, and as an ecosystem for microorganisms. The permit writer should characterize site soils, including physical and chemical properties as applicable. Physical and chemical properties of soils may influence where, when, and how much recycled water can be applied to reuse sites.

Obtain initial information on soil types, characteristics, and depths from the *Web Soil Survey* published by the US Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS). While the soil survey is invaluable in documenting the soil types in an area, it does not replace a carefully conducted on-site investigation. For example, an area mapped with marginal soils may disqualify a site as a reuse site, but after a site investigation, the area in question meets the criteria. The NRCS map does not have the resolution to distinguish the site's suitability.

The application checklist asks for site-specific data with the permit application that can be used in DEQ's characterization. For permit renewals, soil monitoring results from the permit cycle may be available for assessment and should be reviewed against soil interpretation guides and for trends. For new sites, the permit writer should investigate the historical uses of the site for any possible sources of soil contamination. Use DEQ's *Source Water Assessment tool* to understand locations of previously contaminated soils and drinking water sources in relationship to the proposed land application site location.

Table 6 and Table 7 list soil properties to consider in the characterization and how they may impact reuse operations and permitting. Select soil properties to characterize based on historical land use, reuse type, and type of recycled water (section 4.9).

Table 6. Soil physical properties and considerations for reuse operations.

Physical Soil Property	Considerations for Reuse
Texture	• Strongly influences the retention of water, nutrients, and pollutants.
Available Water-Holding Capacity	• Critical factor in irrigation scheduling. • Used to determine appropriate winter hydraulic loading limits.
Effective Depth	• Relevant for vegetation root development, retention of applied constituents on soil particles, and microbial degradation of recycled water constituents. • A soil depth of 2 feet or greater is adequate for recycled water application (Pettygrove and Asano 1985; EPA 2006; Crites et al. 2000).
Soil Structure	• One of the principal factors that influence the rate of water movement in soil but can be easily altered by management practices (e.g., tillage, overapplication of sodium or TDS).
Infiltration	• Soils with too rapid permeability can allow recycled water to travel through the root zone without adequate treatment. • Soils with too slow permeability need more intensive management to avoid runoff, erosion, and hydraulic overloading.
Slope	• Influences water accumulation, runoff and erosion, and absorbance of solar energy.

Physical Soil Property	Considerations for Reuse
	• Maximum slope recommended for cultivated agriculture is 12% to 15% (Pettygrove and Asano 1985; EPA 2006).
Drainage	• In well drained soils, water is removed from the soil readily but not rapidly. • Poorly drained and very poorly drained soils are not considered suitable for reuse.
Color	• Bright, uniform colors indicate that a soil is well drained and a seasonal high water table is not present for a significant portion of the year. • Presence of light grayish mottles usually indicates a high water table or poorly drained soil. • Soils with gray mottling near the soil surface are not suitable for agricultural reuse as it indicates saturated soil conditions.

Table 7. Soil chemical properties and considerations for reuse operations.

Chemical Soil Property	Considerations for Reuse
pH	• A key chemical characteristic that influences diverse properties including nutrient availability, functioning of microorganisms, and fate and transport of many contaminants.
Cation Exchange Capacity (CEC)	• Represents nutrient-holding capacity of a soil. • Leaching of nutrients and contaminants more likely to occur in soils with low CEC (<5 $cmol_c$/kg).
Salinity	• Soil salinity can be impacted by natural (shallow water table, saline parent material) and anthropogenic factors (salt-bearing irrigation and recycled water without adequate leaching fraction). • High soil salinity may lead to reductions in crop yield and vegetation growth. • Soils high in sodium can be poorly aerated and have reduced permeability to water.
Macronutrient and micronutrient concentrations	• Six macronutrients for plants are nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur. Groundwater and surface water impacts may be a concern for soils with elevated nitrate-N and phosphorus concentrations. • Seven micronutrients for plants are boron, copper, chlorine, iron, manganese, molybdenum, and zinc. • Deficiencies in essential nutrients can result in reductions in vegetation growth, yield, and quality.
Heavy Metals	• Metals and metalloids to be aware of at reuse sites include cadmium, chromium, copper, lead, mercury, molybdenum, nickel, zinc, arsenic, and selenium. • At certain levels, these elements pose toxicity problems in the environment and may have additional regulations.

Notes: $cmol_c$ = centimol positive charge; kg-= kilogram

4.2.6 Surface Water

The permit writer should identify surface water bodies (e.g., lakes, reservoirs, wetlands, streams, and canals) within a 1-mile radius of the reuse site boundaries. Identify the 25, 50, and 100-year floodplains. DEQ does not recommend constructing reuse sites within a floodplain. If a new reuse site is proposed within a floodplain, the applicant must justify using the site. Consult IDAPA 58.01.02 to determine the established beneficial uses of any nearby surface water bodies.

In addition to beneficial uses, the permit writer should check if a total maximum daily load (TMDL) has been developed for adjacent water bodies. A TMDL is a water quality improvement plan for those water bodies not meeting water quality standards, required by the Clean Water Act § 303(d). Reuse sites near water bodies with a TMDL may require additional protective measures (e.g., MU buffer zones and runoff control structures) to ensure surface water is not impacted. Questions about surface water impairment should be directed to DEQ's regional surface water quality staff.

4.2.7 Groundwater/Hydrogeology

Site-specific geology and hydrogeology are critical components of a reuse site. These factors determine the fate of water and constituents that leach through the soil to groundwater. The applicant should have conducted a hydrogeologic investigation for the reuse site and submitted this information with the permit application. For permit renewals, the permit writer should review and understand any previous hydrogeologic investigations and potential changes in the groundwater. For new reuse sites, the hydrogeologic investigation should be outlined in the preapplication meeting. The permit writer should use the information submitted with the permit application, along with other investigations and reports in the region to characterize the hydrogeologic conditions.

A hydrogeologic investigation characterizes the regional and local hydrogeologic environment with respect to the reuse site and potential or actual impacts from that activity. The scope of the hydrogeologic investigation should be determined based on the complexity of the facility, recycled water characteristics and loading rates, site characteristics, and potential for groundwater quality degradation.

The investigation helps determine the level of monitoring needed to evaluate both site management effectiveness and compliance and accurately assess the facility's impact on groundwater quality. The investigation is critical to designing a monitoring well network, including well locations and construction plans. A groundwater/hydrogeology study should be prepared by a professional geologist and address the following:

- Geology of the surrounding area.
- Aquifer type, groundwater depth, gradient, and flow direction.
- Location and construction of existing wells within 1/4 mile of the proposed site.
- Contaminant transport.
- Groundwater quality.
- Beneficial uses of the groundwater.
- Area of potential and actual impacts.

Groundwater/hydrogeology studies submitted with the application and permit documents should be reviewed by a DEQ hydrogeologist to determine the validity of the study findings.

4.3 Compliance Activities

A compliance activity is a permit requirement that must be completed within a specified time frame during the permit cycle (IDAPA 58.01.17.600.04). These activities include the following:

1. Develop and maintain a Plan of Operations as described in IDAPA 58.01.17.300.05.
2. Develop and maintain a QAPP for monitoring and reporting.
3. Complete an activity to bring the facility into compliance with specific permit or rule requirement.
4. Conduct permit renewal activities.

The permit template has standard compliance activities that are included in most permits. Additional compliance activities may need to be added on a case-by-case basis to address specific issues. The following sections detail how to determine when a compliance activity is warranted, standard compliance activities, site-specific compliance activities, and compliance activity scheduling.

4.3.1 Compliance Activity Inclusion

During the permit writing process, the permit writer must determine what to include as compliance activities in the permit and a time frame for completion. Because compliance activities require time and resources from the permittee and DEQ, ensure compliance activities in the permit (1) serve a clear purpose; (2) are clearly and succinctly written; (3) provide a path for permit compliance; and (4) include attainable deadlines. The list below provides situations when a compliance activity may be warranted in a permit:

- A deficiency in reuse site characterization—For example, aquifer properties may need to be characterized to better understand site impacts.
- The permittee needs to install specific facilities or equipment—For new reuse sites, certain components in the original plan may not be installed by the time the permit is issued. A compliance activity ensures completion of these components. The compliance activity may prevent use of recycled water until the permittee has completed installation.
- Inspections and annual report reviews identify deficiencies—For example, increased loading rates indicate the need for installing a groundwater monitoring network.
- The facility needs to address permit or rule noncompliance—For example, if loading limits are not met due to a short-term operational deficiency, use a compliance activity to require the facility to investigate, determine, and address the cause. Long-term operational deficiencies may need to be addressed through a compliance agreement schedule before issuing a permit.

The permit writer should properly justify a compliance activity in the staff analysis. Compliance activities should not include items that could be addressed during preapplication meetings, site visits, or the permit writing process.

4.3.2 Standard Compliance Activities

The permit template contains the following standard compliance activities:

- Plan of Operation
- QAPP
- Lagoon seepage testing
- Preapplication conference
- Permit renewal application

Although these compliance activities have standard language, the permit writer may modify some of the language to address specific needs at a reuse site. Modifications the permit writer makes to these standard compliance activities must be clearly discussed and justified in the staff analysis.

4.3.2.1 Plan of Operation

The Plan of Operation (PO) compliance activity references IDAPA 58.01.17.300.05 for plan requirements and contains a list of site management plans common to most reuse facilities. The list includes plans for the buffer zone, cropping, emergency operations, grazing management, irrigation and scheduling management, nuisance and odor management, runoff management, well location acceptability analysis, and waste solids management.

Permit writers should modify this compliance activity to (1) add applicable site management plans (e.g., silvicultural plans for forested sites) and (2) delete nonapplicable site management plans. The requirements may be different for new versus existing reuse sites. For a new site, the applicant may have a draft PO constructed, but a final PO must be submitted after the permittee has adequate time to operate the site (typically 12 months). For existing reuse sites, this compliance activity requires the permittee to submit an updated PO that incorporates any new permit requirements or operational changes.

In some instances, the permit writer may exclude the requirement of a PO compliance activity in a permit. This exclusion occurs if the permittee submitted a complete PO with the permit application or if the permit has no new requirements and the current PO is still relevant.

4.3.2.2 Quality Assurance Project Plan

The QAPP outlines the procedures used by the permittee to ensure the data collected and analyzed meets the requirements of the permit. DEQ does not approve QAPPs but reviews them to determine that the minimum United States Environmental Protection Agency (EPA) guidelines and reuse permit requirements are met. The responsibility for validating a facility's sampling data lies with the permittee's quality assurance officer.

Quality data and information are essential to informed decision making. A QAPP ensures that the data collected by monitoring projects are of known and suitable quality and quantity. The QAPP summarizes the data quality objectives of the project and integrates planning,

implementation, and assessment into a single document. Review *EPA's guidance on developing a QAPP.*

The standard compliance activity language for the QAPP may be modified to suit the specific needs of the reuse site. For existing reuse sites, if the QAPP is current the permit may only require an update to incorporate monitoring changes.

4.3.2.3 Lagoon Seepage Testing

Wastewater and recycled water lagoons designed to treat and/or store water must meet the requirements of IDAPA 58.01.16.493.

For industrial lagoons, site-specific details and lagoon water characteristics should be evaluated to determine the need for and frequency of seepage testing. The permit writer should discuss the appropriate seepage testing frequency with the State Reuse Permit Coordinator.

The seepage testing compliance activity requires submitting a testing plan, DEQ approval of the plan, completing the test, and submitting a seepage test report. Review DEQ's guidance for *Evaluating Wastewater Lagoon Seepage Rates.*

If the reuse site does not have lagoons, remove this compliance activity from the template. The permit template for this compliance activity establishes the due date for seepage testing, and the permit writer should ensure appropriate testing frequencies are satisfied. For seepage testing due dates, list the year instead of a specific date.

The permit writer should be aware that lagoon seepage testing determines the liner integrity. As required by IDAPA 58.01.16.493.09.v, a lagoon monitoring well network and monitoring plan may be required to assess compliance with IDAPA 58.01.11.

4.3.2.4 Permit Renewal Compliance Activities

The preapplication conference and permit renewal application compliance activities are included in every reuse permit issued by DEQ. The permit writer may not need to modify the language for these compliance activities as they are required by IDAPA 58.01.17.300. Review sections 3.1.1 and 3.1.2 for more information on each requirement.

4.3.3 Site-Specific Compliance Activities

Additional compliance activities to address site-specific issues should be discussed during permit development with the State Reuse Permit Coordinator and other experienced permit writers. A collaborative approach for writing compliance activities provides programmatic consistency and incorporates successful language used in past compliance activities into the permit. Table 8 shows common compliance activities included in permits and example language.

Table 8. Example language for compliance activities commonly included in reuse permits.

Example Compliance Activity Language
Groundwater Monitoring Plan: The permittee must submit a Groundwater Monitoring Plan, prepared by an Idaho-registered professional, to DEQ for review and approval within 6 months after permit issuance. The plan must include the following: • Determination of groundwater depth and flow direction • Description of the hydrologic setting and aquifer properties • Plans and specifications for a groundwater monitoring well network that provides sufficient groundwater quality data to characterize the impacts of reuse activities and lagoon seepage • Proposed groundwater monitoring including parameters, analytical methods, and frequency • Implementation schedule for the groundwater monitoring well network Once approved, the plan is incorporated into section 5.3 of the permit and is enforceable by reference. The permittee must provide the following information to DEQ for each well within 60 days of installing the monitoring well network approved in the plan: • Monitoring well location coordinates • Monitoring well network map • Well construction details for each well • Depth to groundwater and groundwater elevation in each well • Initial groundwater quality monitoring results from each well
Well Location Acceptability Analysis (WLAA): The permittee must submit for DEQ review and approval a WLAA conducted as outlined in the reuse guidance. After DEQ review and approval, the WLAA is incorporated in the permittee's plan of operation.
Nonvolatile Dissolved Solids (NVDS) Loading Assessment and Management Plan: Within 12 months of permit issuance the permittee must submit an NVDS loading assessment and management plan to DEQ for review and approval. The plan must include the following: 1. Assessment of groundwater quality impacts resulting from recycled water and supplemental irrigation water NVDS loading rates 2. Assessment of crop, soil, and ponding impacts resulting from recycled water and supplemental irrigation water NVDS loading rates 3. Proposed management strategy for reducing NVDS loading rates on MUs to minimize environmental impacts Within 6 months of DEQ review and approval, the permittee must implement the proposed management strategies.

Review the following components of compliance activity language based on Table 8:

- Some compliance activities have multiple components with multiple due dates, and some establish due dates through approval of the submittals. In these cases, the permit writer must clearly delineate milestones and what constitutes achievement of each milestone (e.g., DEQ review and approval).
- Information requested in compliance activities should be as specific as possible and objectives should be clearly represented. If the requested information is too general or ambiguous in nature, DEQ might not obtain useful information in submittals.
- Compliance activities should require implementation by the permittee if applicable. For example, if a compliance activity requires a plan to manage salt loading, but no requirement exists for the permittee to implement the plan, it may not be implemented.

4.3.4 Compliance Activity Scheduling

The permit writer should understand the completion schedule of all compliance activities included in the permit. For permits with multiple site-specific compliance activities, base the

schedule order on the priority of each compliance activity. The schedule should be reasonable for the permittee's budget and workload and should be discussed with the permittee before sending the draft permit out for public comment. All compliance activities should be completed within the permit cycle. In the following example, a compliance activity schedule for a new reuse site permit was issued on January 1, 2019, and expires on January 1, 2024:

1. Plan of Operation: Due 12 months after permit issuance.
2. Quality Assurance Project Plan: Due 12 months after permit issuance
3. Seepage Testing: Must be completed in 2022.
4. Well Location Acceptability Analysis: Due 6 months after permit issuance
5. Preapplication Conference: Due 12 months before permit expiration
6. Permit Renewal Application: Due 6 months before permit expiration

4.4 Management Unit Descriptions

A MU is a uniformly managed portion of the reuse site that is permitted to receive recycled water. During permitting, the MUs are used to describe hydraulic and constituent loading rates and practices. The applicant provides delineations for MUs in the permit application, but the permit writer must confirm the enforceability of the proposed delineations. MUs are typically delineated by field or irrigation system, by soil type, or by historic practices impacting use. Each MU may have different loading rates and management practices (e.g., unique irrigation and cropping practices). If different management practices occur in separate areas of the MU, these separate areas are delineated into MUs. For example, a MU should not grow two crops with significantly different IWR at the same time on different portions of the MU.

Each MU has associated monitoring serial numbers, MU-XYZ-XY, corresponding with the permit serial number (section 4.1.2). Information required in the permit for each MU includes a description, distribution system, irrigation efficiencies (for irrigated sites), and acreage. A MU should have one type of irrigation distribution system, but irrigation efficiencies can be acreage weighted for MUs with more than one type of system.

When reviewing MU descriptions and practices in the application materials or current reuse permit documents, any proposed management activities describing irregular cropping plans or nonuniform application of recycled water should be discussed with the State Reuse Permit Coordinator.

4.5 Hydraulic Loading Limits

A hydraulic loading limit accounts for all water applied to each reuse site MU and addresses the amount of recycled water and supplemental irrigation water that can be applied. Appropriate hydraulic loading rates, in both the growing and nongrowing season (NGS), impact the success of crop yield and nutrient uptake, as well as minimizing adverse environmental impacts from reuse. Hydraulic loading considerations include the following:

- Ability of the soil to receive and transmit water
- Control of runoff

- Control of recycled water ponding and associated nuisance and vector problems
- Selection of vegetation to meet site beneficial use and treatment goals for applied recycled water

4.5.1 Growing Season

The length of the growing season, largely dependent on seasonal temperatures, factors into designing a reuse site. The growing season is determined by climatic conditions, which vary throughout the state. The growing season is typically listed as April 1 to October 31 in reuse permits, but flexibility exists depending on regional conditions. The NRCS *National Engineering Handbook–Irrigation Guide*, Part 652.0408(c) and (d) delineates climatic regions for crops and crop growth (USDA-NRCS 1997). More information on growing season dates and definitions is available from the US Department of Interior, Bureau of Reclamation (USBR) *AgriMet service*.

The permit writer should be cognizant that during the growing season, applications of recycled water are scheduled depending on vegetation water requirements, strength and volume of recycled water, weather conditions, harvesting periods, and maintenance requirements. Deviations from the typical growing season should be evaluated, then discussed with the State Reuse Permit Coordinator, and justified in the staff analysis.

4.5.2 Nongrowing Season

During the NGS (typically November 1 to March 31), most reuse facilities do not land apply. Permit application requests to land apply during the NGS are authorized on a case-by-case basis. The permit writer should be cognizant of climatic, hydraulic, constituent, and management adjustments for the NGS.

NGS hydraulic and constituent loading should conform to the following guidelines:

- Loading will not cause significant degradation to groundwater.
- Loading will preserve beneficial uses of surface and groundwater.
- Loading will not cause prolonged anaerobic conditions to develop in the soil or aquifer, such that the flux of redox sensitive constituents and soluble organics beyond the crop root zone cause significant degradation of groundwater.
- Loading will be sufficiently designed so that later winter and early spring thaw or precipitation events do not cause ponding, runoff, erosion, or rapid percolation through coarse soils.
- Loading will not create or contribute to nuisance conditions, vegetation damage, or adversely affect public health and safety.

4.5.3 Slow Rate Hydraulic Loading Rates (Including Forested Reuse)

The following sections provide information to determine hydraulic loading limits for different types of reuse permitted in Idaho.

4.5.3.1 Irrigation Water Requirement (Growing Season)

How to Calculate the IWR

The irrigation water requirement (IWR) is any combination of recycled water and supplemental irrigation water applied at rates commensurate with the moisture (consumptive use) requirements of the crop. Slow rate land application reuse permits establish the hydraulic loading limit *substantially at the IWR* meaning both deficit and overirrigation should be avoided. The permit writer should verify that the total volume of recycled water the permittee wants to apply is less than the crop IWR. Supplemental irrigation water is used to meet the *substantially at the IWR* requirement.

Idaho-specific evapotranspiration (ET) data and other parameters related to IWRs are found on the *ET_{Idaho} website*. ET is the sum of plant transpiration and evaporation from plant and soil surfaces and is also known as crop water use (Doorenbos and Pruitt 1977).

The IWR is defined as shown in Equation 1:

$$IWR = \frac{IR_{net}}{E_i} = \frac{P_{def}}{E_i}$$

Equation 1. Calculation of the irrigation water requirement.

where:

IR_{net} = net irrigation requirement
E_i = irrigation efficiency
P_{def} = precipitation deficit and is synonymous with IR_{net}

To obtain P_{def} data, the permit writer should access the ET_{Idaho} website and select a weather station that is the closest or with similar latitude and elevation. The listed weather stations are operated by three different networks: the National Weather Service (NWS), Agrimet network (PN-AM, GP-AM, and AM/INL), and the National Interagency Fire Center (RAWS). Some sites will have two weather stations, a NWS station and either an Agrimet or RAWS station. The NWS stations do not have complete meteorological packages, which impacts the accuracy of the calculated Pdef values. The Agrimet or RAWS stations have complete meteorological packages and should always be selected over the NWS stations. If using a NWS station, the permit writer should also verify the station is operational and the data is current. The station summary will list the start and stop dates for the station dataset. If the dataset is not current or a local station for P_{def} data is not available, the permit writer should contact the State Reuse Permit Coordinator to discuss options for calculating site-specific values.

After choosing the weather station, select the crop/vegetative cover for each crop type listed in the permit application to obtain the P_{def} data. The summary page will note if the land covers are assumed to be irrigated or rainfed. For irrigated landcovers excluding forested sites, the monthly mean P_{def} values should be selected. For forested sites, consult with the State Reuse Permit Coordinator to determine what monthly exceedance P_{def} values should be selected.

For stations that are assumed to be rainfed landcovers, ETIdaho will provide a rainfed and irrigated P_{def} value for spring and winter grains, turf grass, safflower, and sunflower crops. Always select the irrigated P_{def} values for these crops. For all other crops, the P_{def} values are for rainfed only and will need to be converted to irrigated P_{def} values.

To convert to an irrigated P_{def} value, select the crop to be grown, then select basal ET and record the monthly mean basal transpiration values. Basal transpiration represents ideal water conditions to maximize crop yield. Next, select irrigated grass turf, then select basal ET and record the monthly mean basal transpiration values. Divide the basal transpiration for the crop to be grown by the turf grass basal transpiration to obtain the monthly ratios between the two crops.

For all crops excluding alfalfa, go to the P_{def} page for irrigated grass turf and record the monthly mean P_{def} values and multiply these values by the monthly basal transpiration ratios calculated above. This will produce a Pdef curve that matches the basal transpiration curve for the crop to be grown. Now calculate the IWR as normal. The grass turf basal transpiration is higher than all crops except alfalfa, so there is potential that the calculated IWR could exceed the crop demand. When a conservative IWR is needed (e.g., groundwater quality or water table depth) the monthly 80% exceedance P_{def} values may need to be used instead of the monthly mean P_{def} values. Contact the State Reuse Permit Coordinator to discuss the site details. For alfalfa, the permit writer should use the monthly 20% exceedance P_{def} values to calculate the IWR to provide the additional water needed to meet the crop demand.

Irrigation efficiency represents the amount of water that needs to be applied in addition to the crop requirement for a particular type of irrigation system to meet the component system losses. These losses include wind loss, soil and wet canopy losses, runoff, and leaching. The type and magnitude of these losses depend on the type of irrigation used, and the design and maintenance of the irrigation system. Use the manufacturer recommended irrigation efficiency values. If a recommended irrigation efficiency is not provided, additional irrigation efficiency information for typical irrigation systems is found at the *USBR Agrimet website*. The permit writer should select the most appropriate E_i for the reuse site using these sources. If a reuse site uses different irrigation systems among MUs, select a different E_i for each MU.

4.5.3.2 Nongrowing Season Hydraulic Loading Limit

During the preapplication conference, DEQ should discuss the NGS management practices with the permittee to establish how the calculated limits and actual environmental conditions are applied. For example, freezing conditions, ice accumulation, freezing equipment, and nutrient leaching requirements impact when land application can occur and how much recycled water can be applied in any NGS month. Modeling by the applicant for nutrient loading/leaching may be needed based on the recycled water and soil nutrient constituent concentrations. Modeling needs should be reviewed during the preapplication conference and provided with the application. A DEQ hydrogeologist can determine the validity of the modeling data.

How to Calculate NGS Limit

This section provides guidance on determining NGS hydraulic loading rates (HLR_{ngs}). HLR_{ngs} is a calculated estimate of the NGS recycled water application capacity of the system. The calculation presented is a simplification of the processes occurring.

The method to determine the HLR_{ngs} is designed using minimal input parameters that are readily available. Equation 2 calculates a loading rate that will generate minimal leaching and is expected to be environmentally protective. The appropriate guideline rate obtained must be evaluated on a case-by-case basis with respect to the timing of recycled water land application during the NGS and cumulative precipitation and evaporation (i.e., the available storage capacity at the time of application).

Equation 2 calculates the HLR_{ngs}. This rate is equal to the available water-holding capacity (AWC) of the soil plus the ET_{act} values for the NGS, less the NGS gross precipitation (PPT_{ngs}).

$$\mathrm{HLR_{ngs}} = \mathrm{AWC} + \mathrm{ET_{act}} - \mathrm{PPT_{ngs}}$$ **Equation 2. NGS hydraulic loading rate.**

where:

HLR_{ngs} = NGS hydraulic loading rate
AWC = available water-holding capacity of the soil
ET_{act} = actual evapotranspiration (evaporation) during the NGS
PPT_{ngs} = gross precipitation in the NGS

ET_{act} values during the NGS predominantly represent evaporation from soil following precipitation rather than any ET from dormant vegetation. Values for ET_{act} are obtained on the ET_{Idaho} website. The permit writer can select the corresponding ET_{act} with the predominant vegetation on a MU. Some reuse sites may apply recycled water to bare ground during the NGS after certain crops (e.g., small grain harvest and plow down of stubble). This type of land application should be approved on a case-by-case basis and the State Reuse Permit Coordinator should be consulted.

For NGS hydraulic loading, when the soil is wetted more frequently, the ET may be greater than ET_{act} and be nearer to the potential ET (ET_{pot}) rates provided in ET_{Idaho}. To avoid additional complexity in the calculation, DEQ recommends using the more conservative ET_{act} value, rather than attempting to determine under what conditions ET_{pot} could be used.

The AWC of the soil is calculated for a 60-inch soil depth or a root-limiting layer, whichever is shallowest. AWC values are determined site specifically and can be obtained from several sources. Soil AWC information and soil survey maps are published in the *NRCS Web Soil Survey*.

Soil variability on reuse site MUs means variable AWC values as well. The NRCS soil survey provides an AWC based on either the acreage-weighted average or dominant soil component. The acreage-weighted average method provides an appropriate estimate for the unit. The dominant soil component method is not as comprehensive and should only be used on a case-by-case basis after consulting the State Reuse Permit Coordinator. Make these determinations

on a case-by-case basis, particularly for vulnerable groundwater sites (e.g., nitrate priority areas and sensitive aquifers). For permit renewals the AWC should be recalculated for permittees with NGS HLR near or exceeding the currently permitted limits to ensure the AWC is accurate.

PPT_{ngs} is the gross precipitation (PPT), not effective precipitation (PPT_e), falling during the NGS. This value is the sum of monthly average precipitation values obtained from the ET_{Idaho} website (section 4.5.3.1).

4.5.3.3 Forest and Poplar Site Hydraulic Loading

Although not common, DEQ does permit forested reuse sites, mainly in northern Idaho, for slow rate land application. In Idaho, forested sites could include native pine forests, poplar plantations, and Christmas tree farms. Unlike cropped reuse sites, forested sites may consist of distinct areas of trees and areas with no trees, such as where trees have been cleared for irrigation equipment.

Native species (such as forests) are adapted to natural precipitation and do not need irrigation but will respond to irrigation with increased rates of evapotranspiration and should be managed differently from typical crop sites. The permit writer should contact the State Reuse Permit Coordinator before the site's preapplication conference to discuss the use of a forested site.

4.5.4 Overland Flow Hydraulic Loading Rates

Overland flow systems are not commonly permitted in Idaho, so DEQ relies on EPA's process design manual to determine appropriate hydraulic loading rates (EPA 2006 section 9, p. 9-1 to 9). Review section 9 of EPA's manual when assessing hydraulic loading rates for a proposed overland flow system. The following lists guidelines for overland flow systems (EPA 2006 section 9.1, pp. 9-1 to 2):

- Application slopes should be vegetated and uniformly graded.
- Slopes should be gentle, between 1% and 12%.
- Soils should be relatively impermeable to restrict deep percolation and promote sheet flow down the slope.
- General range for hydraulic loading rates is 0.8 to 4 inches per day (EPA 2006 section 9.2.1, p. 9-4).

4.5.5 Rapid Infiltration System Hydraulic Loading Rates

The RI process design is governed by the infiltration rate into and permeability through the soil to a defined outlet (e.g., groundwater). When permitting RI systems, site design and management must be synchronized. Each RI basin or system must be dosed with a site-specific volume of recycled water over a site-specific period, followed by a site-specific drying period.

IDAPA 58.01.17.606 and EPA 2006 have design, construction, and operating requirements for RI systems.

4.5.6 Recycled Water Groundwater Recharge Through Surface Application Hydraulic Recharge Rates

The permit writer should work closely with the State Reuse Permit Coordinator when the beneficial use for recycled water is groundwater recharge through surface application. Each site may pose unique challenges. The permit writer can consult EPA's *Guidelines for Water Reuse*, section 2.3.3, for an overview of groundwater recharge methods and considerations (EPA 2012, pp. 2-14–2-22). DEQ adapted from EPA (2012 section 2.3.3, p. 2-14) components of a groundwater recharge system to consider in a reuse permit:

1. Source of recycled water (only Class A municipal recycled water and similar quality industrial recycled water).
2. Method to recharge
3. Site location, subsurface, and aquifer storage time
4. Downgradient uses of the groundwater

Groundwater recharge may not include a recharge rate limit but may include conditions to manage recycled water quality. Maintaining or improving existing groundwater quality should be the primary focus of recycled water use with groundwater recharge.

If the method for groundwater recharge is recharge via injection well, the construction and use of the well must be permitted by IDWR. The well must comply with the "Rules and Minimum Standards for the Construction and Use of Injection Wells" (IDAPA 37.03.03).

4.5.7 Dust Suppression Hydraulic Loading Rates

IDAPA 58.01.17 allows Class A, Class B, and Class C municipal and industrial recycled water to be used for dust suppression. The permit writer must consider appropriate recycled water application rates for dust control reuse sites. Determine recycled water application rates based on volumes necessary to adequately suppress fugitive dust. Various best management practice documents provide guidance on selecting appropriate dust control methods and rates for projects. These documents do not specifically address recycled water usage but provide a basis for appropriate loading rates to suppress fugitive dust.

- *Dust Palliative Selection and Application Guide* (USDA 1999)
  - Table 1, pp. 3–7 provides a list of commonly used dust suppressants, typical application rates, and possible environmental impacts.
  - Table 3, p. 12 provides a matrix for selecting dust suppressants based on the project.
- *Fugitive Dust: A Guide to the Control of Windblown Dust on Agricultural Lands in Nevada* (USDA 2007)
  - Appendix II, pp. 25–27 provides a table of dust control management and conservation strategies. These methods could be used on reuse sites to decrease dust generation and reduce the volume of recycled water needed to suppress dust.

- *Unpaved Road Dust Management: A Successful Practitioner's Handbook* (Jones et al. 2013)
  - Comprehensive guide to managing unpaved roads.
- *Potential Environmental Impacts of Dust Suppressants: Avoiding Another Times Beach.* Expert Panel Summary. Las Vegas, NV. May 30–31, 2002 (EPA 2004a)
  - Table 2-2, p. 9 provides typical hydraulic and solids loading rates for unpaved roads and vacant lands.

4.5.7.1 Considerations for Permitting Dust Suppression in Reuse Permits

When permitting dust suppression reuse, consider application rates, MU designation, and monitoring. Both municipal and industrial recycled waters have unique considerations to address. Table 9 presents potential controls to consider when permitting a reuse site for dust suppression.

Table 9. Potential controls to consider when permitting dust suppression reuse.

Goal	Potential Control
Limit loading	• Permit limit for hydraulic and constituent loading that protects human health and environment. • Requires implementation of fugitive dust reducing best management practices.
Limit leaching	• Manages the site to suppress dust and not disposal of recycled water. • Allows applications only during certain times of the year (e.g., high temperatures, low rainfall).
Limit runoff	• Requires runoff prevention structures (e.g., berms and impoundments). • Allows applications only during certain times of the year.

4.5.8 Nonpotable/Urban Reuse

For nonpotable/urban reuse, recycled water use is driven largely by water demand and cost-effectiveness. Section 2.3.4 notes that this type of reuse is typically reserved for the high-quality Class A and B recycled water and permitting should focus on minimizing contact with the public. The permit writer must consider each reuse option that could impact permitted volumes and activities (Table 10).

Table 10. Permitting considerations for nonpotable/urban reuse.

Reuse	Permitting Considerations
Residential/common area irrigation	• For Class A, permit conditions prioritize adequate treatment of recycled water rather than volume used. • For lower classes, hydraulic loading limit could be determined using the IWR calculation for turf grass (section 4.5.3.1). • Depending on the salt concentrations, consider the salt sensitivity of landscape vegetation (EPA 2012 section 3.1.1, p. 3-2). Sensitivity could impact how much recycled water can be applied before vegetation is negatively impacted. • Permit may include conditions to control public access (e.g., public education programs, fencing, signage, and temporary access restrictions).
Toilet flushing and commercial laundry	• Permit conditions prioritize adequate treatment of recycled water rather than volume used. • Permit should include conditions to minimize public exposure (e.g., public education programs and signage).
Snow making	• Permit conditions prioritize adequate treatment of recycled water rather than volume used. • Permit may require runoff structures to prevent snowmelt from entering surface water bodies. • Density of accumulated snow should be considered to determine snowmelt storage needs (EPA 2012 section 3.3.2, p. 3-15).
Fire suppression	• Using recycled water for fire suppression is unpredictable in timing and volume required (WRLA 2021 section 3.2, p. 4). • Permit conditions should prioritize adequate treatment, storage, distribution, personal protection, and education programs for firefighters. • The State Reuse Permit Coordinator should be consulted for this reuse.
Surface water features	• Permit conditions prioritize adequate treatment of recycled water rather than volume used. • Permit requirements are based on the potential for public contact with the use (EPA 2012 section 3.3.1, p. 3-14). • Permit must factor in public health for any recycled water use in a recreational activity in the water feature

4.6 Constituent Loading Limits

Recycled water chemistry and physical characteristics are used in designing, operating, and managing reuse systems. The constituent concentration and flow of recycled water applied to a reuse site are used to calculate constituent loading rates. Loading rates are of critical importance, as they have a direct bearing on the concentration and flow of percolate that may mix with groundwater and should be considered with respect to IDAPA 58.01.11. Constituent loading limits in permits regulate loading from all sources of the constituent applied to the site (recycled water, supplemental irrigation water, supplemental fertilizer, and waste solids).

The following sections discuss constituent loading calculation conventions and both organic and inorganic constituent loading of reuse sites. The primary focus is constituent loading limit calculations at irrigated reuse sites, as these sites commonly have constituent loading limits. Not every constituent listed requires a permit limit, and the permit writer must assess on a case-by-case basis when a limit is warranted.

4.6.1 Land-Limiting Constituent

The treatment capacity of a reuse site is determined by performing a land-limiting constituent analysis to assess the recycled water component that requires the most land for treatment. This analysis should be conducted by the applicant and submitted with the permit application. The land-limiting constituent may be either water (e.g., hydraulic loading in the NGS), or a particular constituent. The land-limiting constituent analysis is needed for evaluating treatment alternatives and determining acreage required.

Municipal recycled water commonly contains low concentrations of nitrogen, phosphorus, chemical oxygen demand (COD), and constituents such as total dissolved solids (TDS), as compared to industrial recycled waters. For these municipal recycled water streams, the amount of water applied to a reuse site is typically limited by the hydraulic loading rate, based on crop water requirements.

With higher strength recycled waters found in some industrial permits or municipal permits that receive industrial wastewater, the amount of applied water may be limited by constituent concentrations (e.g., nitrogen, phosphorus, TDS, or organics). This chemical land-limiting constituent then dictates the amount of water that may be land applied.

4.6.2 Constituent Loading Calculations

The means of calculating constituent and hydraulic loading rates should be clearly articulated in the permit. Although multiple legitimate means to calculate loading rates exist, only one method should be allowed in the permit so that no ambiguities arise. Equation 3 is the basic calculation for constituent loading rates:

$$M = kQC/A = 8.34QC/A$$ **Equation 3. Calculation of constituent loading rates.**

where:

M = mass of constituent applied per acre per unit time (e.g., lb/ac-day, lb/ac-mo, or lb/ac-yr)
Q = flow; volume per unit time (MG/mo or MG/yr)
C = constituent concentration (mg/L)
A = unit area (acres)
k = unit conversion from mg/L to lb/MG (1 mg/L = 8.34 lb/MG)

The following example shows a monthly loading calculation for TDS from a food processing reuse facility. Given a flow of 7.2 MG/mo, and a TDS concentration of 2,500 mg/L, find the mass of TDS applied over 100 acres, in pounds per acre per month.

$$1500\frac{lb}{ac-mo} = 7.2\frac{MG}{mo}\cdot 2500\frac{mg}{L}\cdot 8.34\frac{\frac{lb}{MG}}{\frac{mg}{L}}\cdot\frac{1}{100\ ac}$$

Or accounting for all units:

$$1500\ \frac{lb}{ac-mo} = \frac{\frac{7.2\ MG}{mo}\cdot\frac{2500\ mg}{L}\cdot\frac{1\ kg}{10^6\ mg}\cdot\frac{2.2\ lb}{kg}\cdot\frac{3.79\ L}{gal}\cdot\frac{10^6\ gal}{MG}}{100\ ac}$$

where:

MG = million gallons	L = liter
mg = milligram	kg = kilogram
mo = month	lb = pound
gal = gallon	ac = acre

4.6.3 Establishing Nutrient Loading Limits

A nutrient is any substance that promotes growth and can be taken up by plants or other organisms. Recycled water may contain nutrients, such as nitrogen, phosphorus, potassium, calcium, magnesium, iron, and sulfur, which are essential to crops. Nutrient loading of reuse sites should account for crop needs, uptake, and efficiency of crop uptake.

Determining nutrient loading rates for crops depends on preseason soil nutrient status, crop type and yield goal, and should be included in the permit application. When reviewing the permit application, crop needs for major nutrients such as nitrogen, phosphorus, and potassium can be evaluated using the *University of Idaho crop fertilizer guides*.

Spring soil testing can be performed to determine the nutrients in the soil at the beginning of the season. This testing determines how much of a nutrient should be applied to the crop to achieve a particular crop yield goal.

Demonstrated agronomic utilization (uptake) may also be used to determine appropriate nutrient loading limits in reuse permits. Methodology to determine both nitrogen and phosphorus loading limits are discussed in the following sections.

4.6.3.1 Nitrogen

Nitrogen is often an important constituent of recycled water and may be the limiting constituent in designing a land application reuse system. The permit writer should evaluate the assimilative capacity for nitrogen at each MU. For example, nitrogen may be added at several points in the system through recycled water, fertilizer, or waste solids. Nitrogen is also lost or removed from soil systems through several mechanisms including ammonia volatilization, denitrification, crop uptake and harvest, and leaching (Lehrsch et al. 2001).

Nitrogen loading rates to a reuse site depend on climate, available soil nitrogen, crop type, and yield goals. Nitrogen loading rates should not result in nitrate-nitrogen levels of groundwater at the point of compliance for the reuse site that either exceed the groundwater quality standard of 10 mg/L nitrate-nitrogen (IDAPA 58.01.11.200.01.a) or a permit-specific level as allowed by IDAPA 58.01.11.400.05, or causes a significant degradation as determined by IDAPA

58.01.11.400.02a. Address potential monitoring requirements to verify the reuse system protects ground and surface waters.

Where groundwater is susceptible to impacts from leaching, nitrogen loading rate limits can be set at a fixed value or as a percentage of the crop uptake rate. A fixed nitrogen loading rate may be advisable for certain crops (e.g., forest, turf grass, landscaping) or if site environmental or operational conditions warrant.

When based on crop uptake rates, nitrogen loading rates can be up to 150% of crop uptake depending on the site (Carlisle and Phillips 1976, p. 33), where, for regulatory permitting purposes, crop uptake is determined by crop nutrient removal at harvest. Approximately 33% of nitrogen land applied is lost through various pathways including volatilization, denitrification, microbial and biomass fixation, and leaching. A 150% loading limit represents a nitrogen uptake rate of 100% minus the nitrogen loss. Ranges of limits for nitrogen that appear in permits include the following:

- 150% of typical crop uptake based on plant tissue analyses or standard table values for nonlegume crops. For this option, calculate the annual crop N content (in pounds per acre) by the same crop harvested from a MU for the three most recent years of plant tissue data. The three most recent years the crop was grown does not include the current year (i.e., the loading limit is calculated *before commencing the current crop reporting year*). Select the median value from these data and multiply by 1.5 to get the loading limit (in pounds per acre per year).
- For legume crops (e.g., alfalfa), 150% of typical crop uptake minus the nitrogen fixation rate based on plant tissue analyses or standard table values. Nitrogen fixation typically ranges from 15% to 25% based on the availability of plant available nitrogen in the soil. The permit writer should consider the recycled water loading rate as a percentage of the IWR. The higher the percentage of recycled water component of the IWR, the lower the nitrogen fixation rate will be.
- 150% of uptake values using the *NRCS Crop Nutrient Tool*.
- 150% of nutrient uptake rates as published in standard tables (consult with the State Reuse Permit Coordinator for appropriate tables to use). The permit writer should be cognizant that nutrient uptake rate standard tables are different from fertilizer guides. Permit applications often cite application rates as advised in University of Idaho fertilizer guides as a standard table to establish loading limits. These guides establish an application rate to achieve a specific yield based on a constituent concentration in the soil but does not provide the nitrogen removal rate. For example, the permittee could state their yield goal is 80 bu/acre requiring 350 lb/acre of N, when in reality the field, at best, is only capable of 50 bu/acre and removes just 200 lb/acre of N. Thus applying 225 lb/acre of N in excess of what the permitted limit would be based on 200 lb/acre uptake rate.
- Limits of less than 150% should be considered for sites with specific conditions such as hydraulic loading rates near capacity, high groundwater tables, in a nitrate priority area, or poor soils that hamper the site's ability to remove nitrogen or could allow excess leaching.

Alfalfa (and other legumes) presents a unique case when calculating nitrogen loading limits because it can fix[1] atmospheric nitrogen in addition to its ability to take up plant-available nitrogen (nitrate-nitrogen, ammonia-nitrogen) from the soil.

Horneck (2006) states the proportion of alfalfa nitrogen fixation ($N_{fixation}$) in a nitrogen adequate environment is 10% to 20% of the crop nitrogen content (N_{crop}), or 20% to 25% of N_{crop} according to Lamb et al. (1995) (cited in Hermanson et al. 2000). Horneck (2004) used a value of 20% in alfalfa calculations. Koenig et al. (2009, p. 3) also recommended an 80% nitrogen uptake estimate (i.e., 20% fixation). For reuse permitting, choose a general N fixation value for a crop (e.g., alfalfa) for the life of the permit to determine nitrogen loading limits and permit compliance. Values chosen may be reevaluated during repermitting of the new permit cycle. Calculating nitrogen uptake for a legume crop is shown in Equation 4.

$$N_{uptake} = N_{crop} \cdot (1 - N_{fixation})$$

Equation 4. Alternate equation to calculate crop N content from crop uptake and nitrogen fixed from the atmosphere.

In the permit, the permit writer may account for the nitrogen fixation portion of crop nitrogen content using one of the following strategies:

- A footnote stating: Crop uptake for nitrogen fixing crops, defined here as legumes must be calculated by assuming a portion of crop nitrogen content is fixed from the atmosphere. Values for the proportion of crop nitrogen content fixed from the atmosphere may be used if DEQ provides written approval before the growing season begins.
- List the nitrogen loading limit for legume crops as a lower percentage limit (i.e., <150%).

4.6.3.2 Phosphorus

Phosphorus is a required nutrient for plant growth and is a common constituent in municipal and certain industrial wastewaters. Phosphorus is a significant contributor of pollution to surface water bodies leading to eutrophication in lakes and reservoirs and may increase the occurrence of harmful algae blooms, low dissolved oxygen, undesirable plant growth, and fish kills. Phosphorus reaches surface water bodies via runoff from sites or discharge from aquifers to surface waters, providing baseflow to streams, rivers, and lakes. Address any potential for phosphorus contamination of surface water from groundwater interconnections (considering time of travel and distance) when developing reuse permits.

Phosphorus is relatively nonmobile in the soil, especially in acidic soils (below approximately 5.5 pH) or alkaline soils (above approximately 7.2 pH), either adsorbing onto soil colloids or precipitating. Excessive phosphorus loading can result in phosphorus migration below the root zone where it is unavailable for crop uptake.

[1] The rhizobia bacteria associated with alfalfa roots fix atmospheric nitrogen that subsequently can be taken up by the plant.

Reuse permits may include limits on the amount of phosphorus allowed for application to a reuse site. Phosphorus loading limits are employed for sites close to surface water and where phosphorus is elevated in the soil profile. Address potential monitoring requirements to verify the reuse system is protective of ground and surface waters. Common limits for phosphorus that appear in permits include the following:

- 125% of typical crop uptake based on plant tissue analyses (i.e., divide by an uptake efficiency factor of 0.8). Phosphorus loss pathways do not include an atmospheric component, and more of the applied phosphorus is held in the soil profile, assuming conditions for runoff and erosion are not present. The 125% of typical crop uptake is more conservative than the 150% for nitrogen to account for the absence of atmospheric pathways but still acknowledge all applied phosphorus may not be immediately available to a crop (e.g., immobilization, precipitation, and adsorption; Hyland et al. 2005).
- 100% or less of typical crop uptake based on plant tissue analyses for sites where groundwater interconnection with surface water exists and a breakthrough study indicating there is a potential for leaching.
- 100% or 125% of uptake values using the NRCS Crop Nutrient Tool.
- Other site-specific limits allowed by DEQ.

Nitrogen and Phosphorus Guidelines for Groundwater Interconnection

Nitrogen and phosphorus leaching from reuse sites may present a risk of contamination to surface water depending on site-specific conditions and operations. The conditions to consider include nutrient loading, irrigation practices, hydrogeologic conditions, and time and distance to gaining surface water bodies. Discuss these conditions during the preapplication conference if groundwater interconnection is a possible concern.

For sites with a groundwater interconnection to surface water, review the following criteria for groundwater and soils when preparing the reuse permit:

- Groundwater concentrations of total phosphorus at downgradient compliance wells should be less than the threshold level as determined by a professional geologist (with review and approval by qualified DEQ staff) on a site-specific basis. If the orthophosphorus concentration (i.e., concentration of phosphate ion expressed as phosphorus) in upgradient groundwater is greater than this threshold level, no increase in phosphorus should be allowed to occur at downgradient compliance wells.
- With interconnections, TMDLs on the impacted surface water body must be considered (*Total Maximum Daily Loads*).
- Plant-available soil phosphorus values measured in the specified soil depth increment should be less than the thresholds in Table 11, depending on groundwater depth and analytical method.

Table 11. Idaho soil phosphorus threshold values for surface water and groundwater (Sheffield et al. 2008, table 2).

Primary Resource Concern	Soil Sample Depth Interval	Phosphorus Threshold Concentration (mg/kg)	
		(Olsen Method)	(Bray 1 Method)
Surface water runoff	0 to 12 inches	40	60
Groundwater, fractured bedrock, cobbles, or gravel	18 to 24 inches	—	—
<5 feet deep	—	20	—
>5 feet deep	—	30	45

If phosphorus levels exceed the goals established, a permittee may prepare a site-specific analysis (e.g., phosphorus sorption, transport modeling, and site life calculations) to demonstrate that an alternative limit or approach protects potentially impacted surface waters. Upon review and approval by a DEQ hydrogeologist, incorporate the alternate limit or approach into the permit or use as appropriate.

Given the complexities and uncertainties involved in determining appropriate phosphorus loading limits, the permit writer has a variety of tools to assess phosphorus loading at a reuse site. One approach is to use a Phosphorus Site Index (PSI; EDMS 2023AGH644) developed in both Maryland and Delaware and modified for use in Idaho (Leytem et al. 2017).

The PSI assesses the potential for P loss considering site and transport characteristics (soil and hydrologic properties), and sources of P and management practices (rate, method, timing of application, and soil P test data). Input parameters are available from the NRCS Web Soil Survey and with knowledge of the site in question, the assessment procedure is straightforward to use. Depending on the results of the point factoring calculation, loss potentials are rated from low to very high (Leytem 2019). In certain permitting contexts where P application and management may influence surface waters, the PSI is a screening tool to employ.

4.6.4 Establishing Other Constituent Loading Limits

4.6.4.1 Biochemical Oxygen Demand and Chemical Oxygen Demand

Soil has long been identified as an effective medium for assimilating organic material. Biochemical oxygen demand (BOD) measures the rate that microorganisms use oxygen to stabilize or break down (oxidize) the organic matter in wastewater biologically. COD measures the amount of organic matter that can be broken down (oxidized) chemically.

High levels of BOD indicate high levels of organic matter in wastewater. The typical range of BOD in municipal wastewater ranges from 100 to 300 mg/L of BOD. BOD is measured using a procedure that measures the amount of oxygen used by a wastewater sample incubated at 20°C for 5 days. The amount of organic material measured is referred to as BOD_5, referring to the 5-day length of the test.

Because the chemical oxidant may react with substances that cannot be broken down by bacteria, COD results are not directly related to BOD_5. However, COD can be used as a means of rapidly estimating the BOD_5 of a sample if BOD_5-to-COD ratios are developed for a particular

system. COD analysis can provide an estimate of the amount of organic material in the recycled water in 3 to 4 hours and is used as an alternative to BOD_5 analysis.

COD measurement is useful for evaluating reduction conditions that influence the soil's chemical environment. The degree of oxygen demand imposed on the soil system influences whether the soil is aerobic or anaerobic and the chemical processes taking place in the system that make the system susceptible to nuisance odors and leaching to groundwater.

In most cases, the organic material content of municipal recycled waters is not the limiting factor in their rates of application and a limit does not need to be included in the permit. Industrial recycled waters, such as from food processing, may have a COD content sufficiently high to become a limiting factor. When applying high COD (i.e., high-strength) recycled waters, oxygen may be quickly depleted. If the soil pores are clogged by wastes or waterlogged, the air diffusion is restricted, the decomposition rate is lowered, and the chemical end products will differ. Some of these by-products cause nuisance odors. Odors can be controlled by maintaining conditions favorable to aerobic (oxygen present) waste decomposition. Under anoxic (oxygen absent) conditions, some elements within the soil, such as iron and manganese, are reduced to soluble and mobile forms.

Baseline COD loading of reuse sites during the growing season and NGS, should be 50 lb/ac-d, calculated as an average across the season. For some municipal and most industrial reuse permits with high-strength recycled waters, due to less biological activity during the NGS, lower COD limits of 25 lb/ac-d to 35 lb/ac-d are required to prevent nuisance odor and redox conditions from developing. Sites with high-strength recycled water should discuss COD loading with the State Reuse Permit Coordinator to understand site-specific details for managing NGS applications.

4.6.4.2 Salt

DEQ sets salt loading limits using the concentration of NVDS in recycled water (where NVDS = total dissolved solids (TDS) – volatile dissolved solids). The NVDS analysis and calculation yields an estimate of the inorganic constituents in the dissolved phase. NVDS loading limits are more common in industrial recycled water permits; however, NVDS should be assessed in the staff analysis for both industrial and municipal recycled water permits.

Determining the appropriate salt loading rate for a reuse site depends on allowable impacts to the aquifer, aquifer characteristics, and soil quality for crop health. If an adequate supply of good quality supplemental irrigation water is nearby, salts can be managed in the soil profile to not accumulate to detrimental levels, even at relatively high salt loading rates (Robbins and Gavlak 1989). Groundwater modeling is usually indicated for reuse sites that propose or have elevated salt loadings, and this information could be required in the permit application.

To protect groundwater quality and sustain soil productivity, permitted reuse facilities causing significant TDS impacts to groundwater, or which pose a risk of causing significant impacts, should develop site-specific NVDS management plans. Plans should include, but not be limited to, the following:

- Identify representative monitoring sites to measure NVDS.
- Characterize all known sources of inorganic NVDS.
- Analyze alternatives to isolate and reduce NVDS being generated or land applied.
- Evaluate the expected improvements to groundwater quality.
- Implement a schedule for NVDS reduction.

4.6.5 Recommended Constituent Concentration Limits in Recycled Water

Determining which constituents to assess is based on the type of recycled water proposed for reuse. Typically, a reuse permit does not include constituent concentration limits except for Class A recycled water (BOD, nitrogen, and turbidity) and Class B recycled water (turbidity). However, it should be evaluated if there is a need for concentration limits for constituents based upon specific treatment methods, uses, and site-specific details.

Table 12 provides recommended maximum metal concentrations for irrigation. Table 13 recommends pH levels and concentration limits for TDS and chlorine residual concentration limits of recycled water applied to crops.

Table 12. Recommended water quality criteria for irrigation (EPA 2012 table 3-5).

Constituent	Maximum Concentrations for Irrigation (mg/L)	Remarks
Aluminum	5.0	Can cause nonproductiveness in acid soils, but soils at pH 5.5 to 8.0 will precipitate the ion and eliminate toxicity.
Arsenic	0.10	Toxicity to plants varies widely, ranging from 12 mg/L for Sudan grass to less than 0.05 mg/L for rice.
Beryllium	0.10	Toxicity to plants varies widely, ranging from 5 mg/L for kale to 0.5 mg/L for bush beans.
Boron	0.75	Essential to plant growth, with optimum yields for many obtained at a few-tenths mg/L in nutrient solutions. Toxic to many sensitive plants (e.g., citrus) at 1 mg/L. Usually sufficient quantities in reclaimed (i.e., recycled) water to correct soil deficiencies. Most grasses are relatively tolerant at 2.0 to 10 mg/L.
Cadmium	0.01	Toxic to beans, beets, and turnips at concentrations as low as 0.1 mg/L in nutrient solution. Conservative limits recommended.
Chromium	0.1	Not recognized as an essential growth element. Conservative limits recommended due to lack of knowledge on toxicity to plants.
Cobalt	0.05	Toxic to tomato plants at 0.1 mg/L in nutrient solution. Tends to be inactivated by neutral and alkaline soils.
Copper	0.2	Toxic to many plants at 0.1 to 1.0 mg/L in nutrient solution.
Fluoride	1.0	Inactivated by neutral and alkaline soils
Iron	5.0	Not toxic to plants in aerated soils but can contribute to soil acidification and loss of essential phosphorus and molybdenum.
Lead	5.0	Can inhibit plant cell growth at very high concentrations.
Lithium	2.5	Tolerated by most crops at concentrations up to 5 mg/L. Mobile in soil. Toxic to citrus at low doses; recommended limit is 0.075 mg/L.
Manganese	0.2	Toxic to many crops at a few-tenths to a few mg/L in acidic soils.

Constituent	Maximum Concentrations for Irrigation (mg/L)	Remarks
Molybdenum	0.01	Nontoxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high levels of available molybdenum.
Nickel	0.2	Toxic to many plants at 0.5 to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.
Selenium	0.02	Toxic to plants at low concentrations and to livestock if forage is grown in soils with low levels of selenium.
Tin, tungsten, and titanium	—	Effectively excluded by plants; specific tolerance levels unknown.
Vanadium	0.1	Toxic to many plants at relatively low concentrations.
Zinc	2.0	Toxic to many plants at widely varying concentrations; reduced toxicity at increased pH (6 or above) and in fine-textured or organic soils.

Table 13. Recommended constituent limits for irrigation water (EPA 2004b table 2-7).

Constituent	Recommended Limit	Remarks
pH	6.0–8.0	Most effects of pH on plant growth are indirect (e.g., pH effects on heavy metals' toxicity described above).
TDS	500–2,000 mg/L	Below 500 mg/L, no detrimental effects are usually noticed. Between 500 and 1,000 mg/L, TDS in irrigation water can affect sensitive plants. At 1,000 to 2,000 mg/L, TDS levels can affect many crops and careful management practices should be followed. Above 2,000 mg/L, water can be used regularly only for tolerant plants on permeable soils.
Free chlorine residual	<1 mg/L	Concentrations greater than 5 mg/L causes severe damage to most plants. Some sensitive plants may be damaged at levels as low as 0.05 mg/L.

4.6.6 Constituent Loading Limits on Forested Sites

For forested sites irrigated with recycled water, DEQ determines nitrogen and phosphorus loading limits differently than the methods discussed above. Unlike cropped sites where nutrient uptake data are obtained through harvests each year, forested sites may not be timbered for decades, and nutrient loading limits must be determined by another method. The permit writer should contact the State Reuse Permit Coordinator for details including determining nitrogen and phosphorus loading limits with forested sites.

4.7 Buffer Zones

Recommended buffer zone distances, signage, and posting guidance for both industrial and municipal reuse sites are provided in the following sections.

IDAPA 58.01.17.604.01 requires establishing buffer zone distances to:

- Protect public health by limiting exposure to recycled water and conditions associated with reuse facilities.
- Protect waters of the state, including surface water, groundwater, and drinking water supplies.
- Ensure the use of recycled water is restricted to within the physical boundaries of the reuse facilities.

Buffer zones provide distance between the boundary where reuse activities occur, and vary in distances depending on the feature of interest:

- Inhabited dwelling
- Public or private water supplies
- Surface water
- Man-made water conveyances
- Areas of public access

Reuse site buffer zones must comply with applicable statutes, rules, regulations, and local zoning ordinances. If possible, required buffer zones should be owned or otherwise under the operational control of the permittee to prevent activities (such as potable well or housing construction) that may compromise the effectiveness of the buffer zones and distance requirements specified in the permit.

The permittee is responsible for meeting horizontal setback distances to cover buffer distances. A reuse buffer zone does not convey any real property rights for land not owned or leased to the facility. DEQ should encourage permittees to either secure enough property to ensure they can incorporate all buffer zones within their property and apply only recycled water to land they control, or garner easements or other legal agreements that would allow use of adjacent land outside of their ownership for buffer zones (e.g., prohibiting construction of homes, canals, or wells).

4.7.1 Municipal Reuse Buffer Zones

Table 14 presents information the permit writer should use to establish buffer zones for municipal recycled water reuse operations. These buffer zone ranges have demonstrated they are protective of public health. To use the table, read vertically to find applicable site or facility conditions and associated buffer zone and fencing recommendations.

For example, Scenario 4 uses municipal recycled water with effluent of advanced secondary quality (Class B). The reuse site is in a residential area, and the recycled water is sprinkler irrigated. Continuing down the column, buffer zone distances and fencing recommendations are provided.

Table 14. Buffer zone guidance for municipal recycled water reuse sites.

	SCENARIOS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Recycled Water Classification																				
Class E	E					E					E					E				
Class D		D					D					D					D			
Class C			C					C					C					C		
Class B				B					B					B					B	
Class A					A					A					A					A
LOCATION																				
Residential or Suburban Area	E	D	C	B	A						E	D	C	B	A					
Rural or Industrial Area						E	D	C	B	A						E	D	C	B	A
APPLICATION METHOD																				
Sprinkler Irrigation	E	D	C	B	A	E	D	C	B	A										
Furrow, Flood, or Other Surface Application Method											E	D	C	B	A	E	D	C	B	A
RECOMMENDED BUFFER ZONES BETWEEN REUSE SITE AND: (in feet)																				
Dwellings	**1000**	**500**	**300**	**100**	**0**	**1000**	**500**	**300**	**100**	**0**	**300**	**300**	**50**	**50**	**0**	**300**	**300**	**50**	**50**	**0**
Areas Accessible to the Public	**1000**	**300**	**50**	**0**	**0**	**1000**	**300**	**25**	**0**	**0**	**100**	**100**	**50**	**0**	**0**	**50**	**50**	**0**	**0**	**0**
Natural Surface Water Bodies	**100**	**100**	**100**	**10[a]**	**10[a]**	**100**	**100**	**100**	**10[a]**	**10[a]**	**100**	**50**	**50**	**10[a]**	**10[a]**	**100**	**50**	**50**	**10[a]**	**10[a]**
Man-made Water Conveyances	**50**	**50**	**50**	**10[a]**	**10[a]**	**50**	**50**	**50**	**10[a]**	**10[a]**	**50**	**25**	**25**	**10[a]**	**10[a]**	**50**	**25**	**25**	**10[a]**	**10[a]**
Public Water Supply Wells or Springs[b]	**1000**	**1000**	**1000**	**100**	**50**	**1000**	**1000**	**1000**	**100**	**50**	**1000**	**1000**	**1000**	**100**	**50**	**1000**	**1000**	**1000**	**100**	**50**
Private Water Supply Wells or Springs[b]	**500**	**500**	**500**	**100**	**50**	**500**	**500**	**500**	**100**	**50**	**500**	**500**	**500**	**100**	**50**	**500**	**500**	**500**	**100**	**50**
Drinking Water Reservoirs and Agricultural Reuse Sites[c]	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**	**500**
Irrigation Wells	**Buffer distances between irrigation wells and reuse activities should be determined on a case-by-case basis. A 50-foot buffer zone is recommended for all scenarios.**																			
RECOMMENDED FENCING																				
High Security (example: 6-foot cyclone with barbed wire)	**E**	**D**									**E**	**D**								
Medium Security (example: 6-foot woven fence)			**C**			**E**	**D**						**C**			**E**	**D**			
Low Security (example: three-wire pasture fence)								**C**										**C**		
None Recommended				**B**	**A**				**B**	**A**				**B**	**A**				**B**	**A**

a. Buffer zones should be determined on a case-by-case basis near surface waters and man-made water conveyances. The Recycled Water Rules do not require buffer zones for Class A recycled water. However, in cases where surface waters are in proximity to Class A recycled water application areas, DEQ determined that IDAPA 58.01.17.602.02 is not applicable. Buffer zones to surface waters, or other mitigation measures, may be necessary to prevent unauthorized surface water discharge, to be determined on a site-specific basis.

b. The recommended buffer zones for private and public water supply wells may not be appropriate in all circumstances. Section 9.3.3.1 of the DEQ reuse guidance provides a decision flow chart summarizing the well location acceptability analysis (WLAA). This analysis is based on the hydrogeology of the area, well construction, recycled water class, vadose and aquifer travel times and is used to determine the acceptability of private and public water supply locations in relation to sites irrigated with recycled water. The WLAA is more technically defensible, and preferred, than generic buffer distances provided in Table 2. The Recycled Water Rules do not require buffer zones for Class A recycled water, but a buffer zone for wellhead protection is appropriate for Class A systems. IDAPA 58.01.08.900.01 Table 1 requires a minimum buffer zone of 50 feet for "any potential source of contamination" and a public water system well. Additional requirements for Class A infrastructure, including distribution systems, are outlined in IDAPA 58.01.17.603.01. The Idaho Source Water Assessment Plan (DEQ 1999, p. E-6) recommends a fixed-radius 1,000-foot time of travel boundary for transient noncommunity wells (MDH 1998).

c. The buffer zone for drinking water reservoirs is a DEQ rule requirement (IDAPA 58.01.08.544.02.c).

Table 15 summarizes the signage and posting requirements from IDAPA 58.01.17.603.

Table 15. Signage requirements and posting requirements and recommendations.

Recycled Water Class	Signage at Irrigated Site (English[a])	Signage around Lagoons (English[a])	Posting: Required/Recommended
Class A	"Caution: Recycled Water – Do Not Drink" or equivalent[b]	"Caution: Recycled Water – Do Not Drink" or equivalent[c]	See IDAPA 58.01.17.603.01(a) and (b) for further identification and signage requirements.
Class B	Same as Class A	"Wastewater Treatment Facility – No Trespassing" or equivalent[b,d]	Required: around the perimeter of the irrigated area. Recommended: posted every 500 feet around the perimeter of the reuse areas and at any points of access into the reuse areas.
Class C and Class D	"Warning: Recycled Water – Do Not Enter" or equivalent[b]	Same as Class B	Same as Class B
Class E	Same as Class C and Class D	Same as Class B	Required: around the perimeter of the irrigated area. Recommended: posted every 250 feet around the perimeter of the reuse areas and at any points of access into the reuse areas.

a. Translate signs into a second language, reflecting the demographics of the area surrounding the reuse site.
b Equivalent language is approved on a case-by-case basis with concurrence from the State Reuse Permit Coordinator.
c. IDAPA 58.01.16.493.09.c(iii) specifies warning sign language around wastewater lagoons. For Class A lagoons containing highly treated wastewater, some may be landscape impoundments, DEQ determined the warning sign language specified in IDAPA 58.01.17.603.01.b(ii) is preferable.
d. Recommended language—IDAPA 58.01.16.493.09.c(iii) specifies that the language "designate the nature of the facility and advise against trespassing.

4.7.2 Industrial Reuse Buffer Zones

Table 16 provides recommended buffer zone distances for industrial recycled waters. To use the table, read vertically to find applicable site or facility conditions and associated buffer zone, fencing, and posting recommendations. For example, if the reuse site is in a rural area and sprinkler irrigated, buffer zone guidance is in the Scenario 3 column.

Greater buffer zone distances may be needed if the recycled water has industrial contaminants that warrant a more protective buffer zone. The permit writer will determine those distances on a case-by-case basis.

Table 16. Buffer zone guidance for industrial recycled water reuse sites.

	Scenarios			
	1	**2**	**3**	**4**
Location				
Residential or suburban area	X	X	—	—
Rural or industrial area	—	—	X	X
Application Method				
Sprinkler irrigation	X	—	X	—
Furrow, flood, or other surface application method	—	X	—	X
Recommended Buffer Zones between Reuse Site and the following (feet):				
Dwellings	300	200	300	200
Areas accessible to public	50	50	50	0
Natural surface water bodies	100	100	100	100
Man-made water conveyances	50	50	50	50
Public water supply wells or springs	1,000	1,000	1,000	1,000
Private water supply wells or springs	500	500	500	500
Drinking water reservoirs	500	500	500	500
Irrigation wells	Determine on case-by-case basis			
Recommended Fencing				
Low security (three-wire pasture fence)	X	X	—	—
None recommended[a]	—	—	X	X
Recommended Posting				
None recommended[a]	—	—	—	—

a. Fencing and posting may be required in a permit depending on site-specific conditions (IDAPA 58.01.17.616.02).

4.7.3 Consideration for Alternative Recycled Water Buffer Zones

Where alternative buffer zones are requested, consult the State Reuse Permit Coordinator early in the discussion. The applicant/permittee should submit justification to DEQ when proposing an alternative buffer zone distance. The justification should be site-specific and scientifically based to demonstrate how public health and the waters of the state will be protected.

4.8 Other Permit Limits and Conditions

Reuse permits include a section with limits and conditions unique to each permit. The permit writer may remove or add permit requirements based on applicability to the reuse site. Table 17 lists the typical permit limits and conditions and discusses language selection.

Table 17. Typical other permit limits and conditions included in reuse permits.

Category	Discussion
Operating seasons	The dates shown in the template for growing season (April 1 through October 31) and NGS (November 1 through March 31) are typical for many locations in Idaho. In areas of colder climates, the growing season will likely be shorter, and it may be necessary to revise these dates. Section 4.5 provides additional information.
Reporting year designation	The reporting year for most annual reports is November 1 through October 31 to capture the NGS period and following growing season. Some permits may specify shorter or longer growing seasons, and the reporting year will match these variations. Some permits may specify a reporting year from January 1 through December 31 if the facility only applies recycled water during the growing season.
Operator certification and endorsement	Permit condition is included to require appropriately certified personnel to operate municipal reuse sites. The permit template includes standard language for this requirement.
Disinfection limits in recycled water	For municipal reuse sites, the permit writer should list the disinfection requirement for the reuse site based on the recycled water class. IDAPA 58.01.17.601 and section 2.2.1 provide additional information.
Crop or vegetation allowed	Entries in this section vary depending on the reuse site. Crops and vegetation at municipal sites are regulated by IDAPA 58.01.17.602.02. Industrial reuse sites do not have specific rule requirements, and restrictions should be based on characteristics of recycled water applied. Consider the following options to include in this section: • List of crop or vegetation type allowed based on class of municipal recycled water or characteristics of industrial recycled water used. • Reference to plan of operation or cropping plan for allowable crops. • Statement that crops grown for direct human consumption (those crops that are not processed before consumption) are not allowed.
Grazing	Grazing restrictions for municipal recycled water are covered in IDAPA 58.01.17.602.02. Restrictions for industrial recycled water should be made on a case-by-case basis. Refer to the *University of Idaho Agricultural and Life Sciences* for proper grazing management (Shewmaker and Bohle 2010).
Posting and fencing	Refer to Table 14, Table 15, and Table 16 for what to include in this section.
Construction plans	Under Idaho Code § 39-118, IDAPA 58.01.16, and IDAPA 58.01.17, this condition ensures the permittee is not allowed to construct, modify, or expand the reuse site without approval by DEQ. The permit template includes standard language for this requirement.
Records retention	Permit condition is included to establish how long the permittee should retain permitting records. The permit template includes standard language for this requirement.

For Class A and B recycled water, additional treatment requirements are needed:

- Filter operations and turbidity limits (Class A and B)
- Maximum total nitrogen concentration limit (Class A)
- Maximum BOD_5 concentration limit (Class A)
- Required pH range (Class A)
- Disinfection system operational limits/requirements (Class A)

The permit writer may document site-specific limits and conditions based on zoning or operational use requirements, and site conditions referenced from the facility's reuse permit application, discussion at the preapplication conference, or previous DEQ documentation. Some examples may be recycled water constituent concentration limits, user agreement

requirements, operational constraints, minimum groundwater depth for application, and safety requirements.

4.9 Monitoring Requirements

Monitoring requirements, when conducted correctly and reported to DEQ, provide data that assist with determining if a facility is complying with a reuse permit. The following sections discuss typical monitoring requirements in reuse permits to help the permit writer determine when specific monitoring should be required. Typical monitoring requirements include wastewater, recycled water, supplemental irrigation water, groundwater, soil, and plant tissue monitoring. Occasionally, reuse permits also include meteorological, waste solids, and surface water monitoring. Additional monitoring not specified here can be included in a reuse permit as determined on a case-by-case basis.

4.9.1 Recycled Water Monitoring

The quality and quantity of recycled water applied to a reuse site should be monitored on a regular basis. Recycled water sampling and analysis requirements are determined based on individual recycled water characteristics, site-specific considerations, and regulatory requirements.

Recycled water monitoring at a reuse site provides a timely and cost-effective assessment of the adequacy of wastewater treatment unit process operations and operation and management procedures. Recycled water chemistry sampling and accurate flow monitoring are needed to calculate the overall constituent loadings on each MU. The calculated loadings are compared to the constituent loading limits in the permit when determining permit compliance.

4.9.1.1 Constituent Monitoring

4.9.1.1.1 Monitoring Location Determination

Recycled water and wastewater monitoring locations are specified in reuse permits as WW-XYZ-XY. The location where a sample is collected makes a substantial difference in the monitoring results, and the samples should represent the recycled water during the monitoring period. The permanent sampling locations should be determined and identified in permit application materials and included in the Plan of Operation and QAPP. The applicant should provide a description of the sampling station location, and in most cases, process flow diagram and description of the flows and processes involved in wastewater treatment.

More than one sampling station may be needed, e.g., for two separate water streams that are not mixed but are used separately.

For municipal recycled water, the total coliform point of compliance is when the system completes final treatment and disinfection as defined in the permit. Recycled water disinfection requirements after storage are determined by DEQ on a case-by-case basis considering class

and uses of recycled water, reuse site design, and protection of human health and the environment (IDAPA 58.01.17.601.06).

4.9.1.1.2 Sample Type

Types of recycled water samples are grab, composite, and continuous (Table 18). The sample type required depends on these factors:

- Parameter to be monitored.
- Temporal and spatial variability of the water sampled.
- Type of limit. Limits based on instantaneous values may be sampled using grab sampling techniques. Limits based on average values or daily maximums may be sampled using time or flow-proportioned composite samples. These limits are acceptable for certain conventional pollutants, nutrients, and bioaccumulative pollutants, for which percent removal and total loading to the receiving water are of concern.
- Additional sampling information is provided in the *Handbook for Sampling and Sample Preservation of Water and Wastewater* (EPA 1982).

Table 18. Sample types used with recycled water and information to determine when a type should be used.

Sample Types	When Appropriate
Discrete grab sample	• Water characteristics are relatively well mixed. • Water does not flow to reuse site on a continuous basis (EPA 2010 section 8.1.4.1, p. 8-7) • Information about instantaneous concentrations at a specific time is needed (EPA 2010 section 8.1.4.1, p. 8-7). • Collection of variable sample volume is desired (EPA 2010 section 8.1.4.1, p. 8-7). • To corroborate results from composite samples (EPA 2010 section 8.1.4.1, p. 8-7). • Desired parameters are not amendable to compositing (e.g., temperature, total coliform; EPA 2010 section 8.1.4.1, p. 8-7).
Sequential grab sample	• Effective for determining variations in media characteristics over short periods.
Composite sample	• Water characteristics are variable (EPA 2010 section 8.1.4.2, p. 8-7). • Measurement of average concentration during the compositing period is needed (EPA 2010 section 8.1.4.2, p. 8-7). • Measurement of mass loadings per unit of time is needed (EPA 2010 section 8.1.4.2, p. 8-7).
Continuous	• Option for limited number of parameters such as flow, turbidity (IDAPA 58.01.17.601.01b and 02b), temperature, pH, conductivity, and dissolved oxygen.

Sample collection equipment is designed to collect different types of water samples. Refrigerated, automatic samplers collect daily composite samples and keep samples at appropriate temperatures for preservation. Portable automatic samplers collect hourly composite samples and are easily moved to different locations (Metcalf and Eddy 2003, p. 182). Some composite samplers collect time-weighted samples, collecting identical sample volumes over time. Other samplers collect flow-weighted samples, collecting varying sample numbers and volumes proportionate to measured flows over time.

In the permit, the permit writer should list the sample type that will be used during the permit cycle.

4.9.1.1.3 Monitoring Frequency

Recycled water monitoring frequency is determined based on the measured or estimated variability and class of recycled water produced. Typically, reuse permits require recycled water constituent monitoring on a monthly frequency. For municipal recycled water, monitoring frequency for total coliform and a few other parameters is determined by IDAPA 58.01.17. Table 19 and Table 20 provide for more information.

Other factors for determining sampling frequency include the following:

- Facility size and design capacity
- Treatment type
- Compliance history
- Number of pollutant sources from a facility
- Monitoring cost relative to the facility's capability and benefits obtained
- Environmental significance of constituents
- Detection limits and analytical precision and accuracy
- Facility production schedule (seasonal, daily, and year-round)
- Plant wash down or cleanup schedule
- Batch type process and discharge or continuous operation

4.9.1.1.4 Monitoring Parameters

Chemical analytical parameters monitored in recycled water are determined from permit application data, facility wastewater generation history, permit limits, and recycled water characteristics of similar facilities. Industrial facilities may have different chemical monitoring parameters than municipal. The permit may require monitoring of constituents in the recycled water for reasons other than to determine compliance with loading or other regulatory limits. Additional parameters to monitor may include chemicals or substances that could upset the treatment system. These substances could be introduced from raw materials, compounds resulting from chemical interactions, or impurities in raw materials including solvents. Table 19 provides the parameters for permit-required recycled water monitoring for reuse sites.

Supplemental irrigation water quality is often measured at recycled water facilities to account for constituent loading from salts, total nitrogen, and sometimes phosphorus.

Table 19. Typical recycled water monitoring parameters and respective rationale (DEQ 2014b, section 5).

Parameter	Monitoring Justification
pH	• Monitoring when pH is outside of the ideal range (6–9). • Used to indicate changes in the characteristics of recycled water.
Dissolved oxygen	• Low dissolved oxygen concentrations (<1.0 mg/L) indicate inadequate aeration or an excessive amount of organic material entering the system.
Biological oxygen demand	• Surrogate measurement for the concentration of oxygen demanding substances in wastewater. • Required analyte for Class A recycled water systems.
Chemical oxygen demand	• Measures the quantity of chemically oxidizable substances present in wastewater. • Used for industrial sites to assess COD loading rates.
Nitrogen	• Total nitrogen is used to calculate nitrogen loading rates to the reuse site. • Different species (ammonium, ammonia, nitrite, and nitrate) can be required if there is good reason.
Salts	• Measured in a variety of ways including the conversion of electrical conductivity measurements to a total dissolved solids value and analyzing for NVDS or total dissolved inorganic solids. • NVDS monitoring indicated where salt loading to a reuse site may adversely affect groundwater TDS levels or where a previously contaminated site is monitored for remediation efforts.
Common ions	• Major cations (calcium, magnesium, potassium, and sodium) and anions (carbonate, bicarbonate, chloride, and sulfate) can be monitored to assess environmental impacts. • Chemical signatures of different waters identified and used to determine the extent of groundwater mixing.
Metals	• Monitored if concerned about accumulation in soils could become toxic to plants, humans, and animals. • Monitored if toxic metals (arsenic, cadmium, chromium, lead, mercury, and nickel) are a concern.
Chlorine	• Maintaining a total chlorine residual is required for Class A and Class B recycled waters. • Sometimes required for Class C and D to ensure adequate disinfection.
Turbidity	• Turbid water can clog or plug irrigation nozzles and pipes. • Turbid water shields particle-associated pathogens and reduces disinfection efficacy. • Limits specified for Class A and Class B recycled water.
Phosphorus	• Indicated when a concern exists for surface water impacts. Facility water has significant phosphorus concentration and concern exists for phosphorus overloading to soils, and/or the permit specifies a loading limit.
Microorganisms	• Required (total coliform) in municipal reuse permits for all classes of recycled water except for Class E. • Industrial sites need to establish if microorganisms of concern are present in recycled water.

4.9.1.2 Flow Measurement

Accurate flow measurement of recycled water is needed for reuse operations because it determines hydraulic and constituent loading rates for site management and permit compliance[2].

Strategies and effectiveness for measuring flow to a reuse site depend on design of the system and should be discussed during the preapplication conference. Both recycled water and supplemental irrigation water flows must be accurately measured when applied to a reuse site. Recycled water may be from more than one source, such as silt water (flume water transporting potatoes or beets) and process water. If the flows are mixed, the flow monitoring point must represent the waters from the sample collection point.

4.9.2 Groundwater Monitoring

Groundwater monitoring determines whether recycled water is used in a way that protects waters of the state for existing and projected future beneficial uses. Groundwater monitoring provides the following information:

- Assess compliance with a reuse permit and the "Groundwater Quality Rule," including groundwater quality standards (IDAPA 58.01.11.200).
- Define ambient conditions and establish a water quality baseline for the facility.
- Evaluate a facility's impact on groundwater, including any groundwater quality changes that affect reuse site management.
- Evaluate and modify treatment processes, management, and loading practices to protect and maintain groundwater quality.

Occasionally circumstances occur where groundwater monitoring may not be necessary, such as where recycled water constituent loading rates are below levels of regulatory concern (i.e., de minimis rates).

Although monitoring wells are the primary means of assessing groundwater quality associated with reuse systems, in some situations their use would be impractical, such as long unsaturated or saturated contaminant travel times (resulting from deep groundwater, low percolate generation, and low permeability of vadose zone). In those cases, the time interval between reuse activities and environmental response would be too large to provide timely feedback for management or compliance.

Alternatives to groundwater monitoring are considered on a case-by-case basis. A decision flowchart (Figure 2) helps to determine whether groundwater monitoring is practical and needed at a reuse site.

[2] IDWR requires certain water sources to have state-approved flow measurement devices. See the IDWR water measurement web page for a list of approved closed conduit meters.

4.9.2.1 Monitoring Well Network Installation

DEQ must review and approve proposed monitoring well design and locations before well construction. Siting of monitoring wells in relation to a reuse site and other possible sources of contamination must be coordinated with DEQ as part of the reuse permitting process.

The permit applicant must submit certification to DEQ that indicates monitoring well construction is adhering to the proposed monitoring well design. The certification may consist of as-built diagrams stamped by an Idaho-registered professional geologist or professional engineer or prepared by someone under the direct supervision of an Idaho-registered professional geologist or professional engineer. A detailed lithologic log for each monitoring well should also be provided to DEQ.

All monitoring well construction must conform to the "Well Construction Standard Rules" (IDAPA 37.03.09). Monitoring wells require an IDWR-issued permit when constructed more than 18 feet in vertical depth to evaluate, observe, or determine the quality, quantity, temperature, pressure, or other characteristics of the groundwater or aquifer.

4.9.2.2 Constituent Monitoring

The permit writer should prepare for the preapplication conference by understanding the physical site characteristics and potential impacts from constituents. The preapplication conference should include a discussion with the permittee about developing an effective groundwater monitoring system capable of detecting contamination (Figure 2).

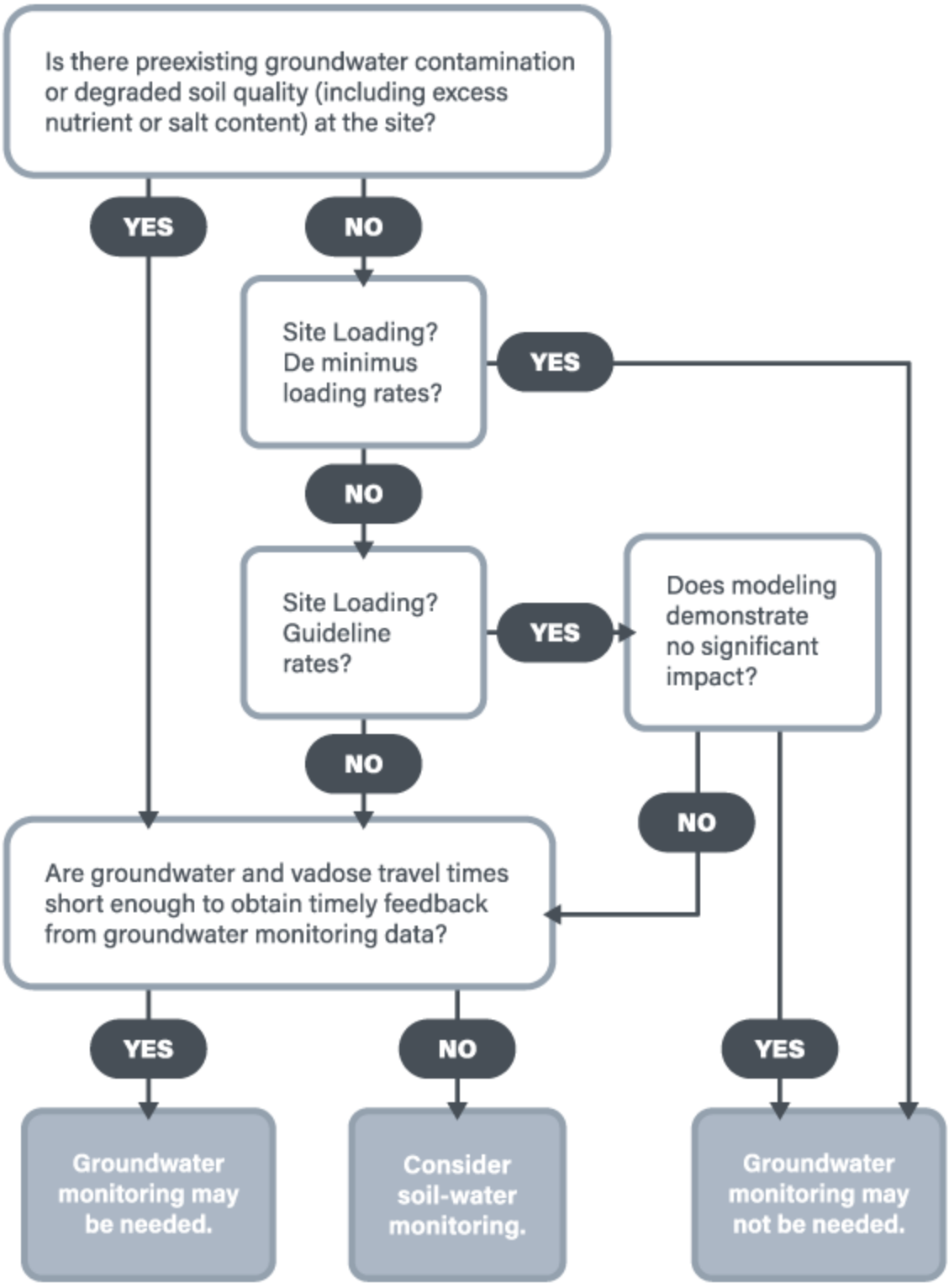


Figure 2. Decision flowchart to determine whether groundwater monitoring is needed at a reuse site.

4.9.2.2.1 Monitoring Location Determination

Groundwater monitoring points are specified in reuse permits as GW-XYZ-XY. Groundwater compliance monitoring involves sampling and analysis of groundwater from designated wells comparing analytical results to IDAPA 58.01.11 regulations and permit-specific limits for compliance.

When reviewing groundwater monitoring well network plans, consider the following criteria in approving proposed groundwater monitoring locations:

- Be as near to the reuse site as practical.
- Use monitoring wells located hydraulically downgradient of the reuse activity with corresponding upgradient wells to compare results with background.
- Use monitoring wells that are properly constructed and screened at the groundwater interface to ensure year-round monitoring.

4.9.2.2.2 Monitoring Frequency and Parameters

Monitoring frequency is scheduled so that samples will detect contamination if it is present, while ensuring discrete, independent samples. The frequency of groundwater monitoring should be determined on a site-specific basis. Factors include information from hydrogeologic investigations, land management and loading rates, and quality of recycled water.

If needed, groundwater monitoring is generally conducted twice a year, once in the spring and once in the fall, to account for any groundwater impacts from seasonality. A quarterly monitoring frequency may be warranted for reuse sites where the presence of impacts during the year needs to be better characterized.

Monitoring frequency may be adjusted during permit renewal based on the history of the site performance. For example, monitoring may be decreased if background and seasonal variations in groundwater quality were characterized, and the data support that a less frequent sampling interval will not miss significant periods when elevated levels may be present.

Table 20 lists common permit-required groundwater monitoring analytical parameters for reuse sites. Additional parameters may be required on a site-specific basis.

Table 20. Typical groundwater monitoring parameters and respective rationale.

Parameter	Monitoring Justification
Nitrate	• Primary Groundwater Quality Rule constituent (10 mg/L), meaning health-related concerns. • Groundwater contamination could result from nitrogen overloading on the reuse site.
Total dissolved solids	• Secondary Groundwater Quality Rule constituent (500 mg/L), meaning aesthetic-related concerns. • May represent the general impacts of all inorganic species (salts) being land applied.
Metals	• If identified as a concern, DEQ recommends analyzing both total and dissolved metals. • Groundwater Quality Rule establishes secondary constituent standards for iron and manganese as 0.3 mg/L and 0.05 mg/L, respectively.

Parameter	Monitoring Justification
	• Elevated iron and manganese concentrations can be common downgradient of sites with excessive COD loading rates.
Common ions	• Major cations (calcium, magnesium, potassium, and sodium) and anions (carbonate, bicarbonate, chloride, and sulfate) can be monitored to assess environmental impacts. • Chemical signatures of different waters can be identified and used to determine the extent of groundwater mixing.
Field parameters	• pH, specific conductance, dissolved oxygen, and temperature (USGS 2006, p. 106). • Verify when effective well purging has occurred and when groundwater has stabilized to ensure the groundwater sampled is representative of water in the aquifer. • Verify laboratory measurements, indicate sample deterioration, detect abnormalities, and indicate groundwater contamination (Davis 1988).
Groundwater depth and elevation	• Allows for determining direction of groundwater flow and gradient. • Necessary parameters for all wells in a monitoring well network.
Total phosphorus	• Elevated groundwater concentrations could signal breakthrough of recycled water through coarse vadose material. • Monitor phosphorus if there is groundwater to surface water interconnection. • Requirement to monitor orthophosphorus in addition to total phosphorus may be needed if colloidal influence is a concern.
Chloride	• Useful at sites with elevated chloride concentrations in recycled water. • Could be used as a *tracer* in certain instances.
Coliform bacteria	• Primary Groundwater Quality Rule standards for total coliform, fecal coliform, and *Escherichia coli.* • May indicate if effective treatment is occurring in rapid infiltration and slow rate systems.

4.9.3 Soil Monitoring

The regulatory use of data from soil monitoring differs from groundwater monitoring. Soil monitoring data are used in a less direct way than groundwater monitoring data. Soil monitoring at reuse sites can help with agronomic decisions and nutrient management (e.g., agronomy, fertilizing rates, leaching potential) and soil quality.

4.9.3.1 Nutrient Management

Nutrient management involves testing for macronutrients and micronutrients so nutrient loading through recycled water or fertilizer can be managed to maximize both crop growth and the efficiency that nutrients are used.

Limited soil nutrient analyses are often required in reuse permits to compare nutrient levels with typical agricultural soil concentrations. Nutrient concentrations showing an increasing trend may indicate a groundwater concern if accumulated nutrients migrate to groundwater. DEQ does not recommend using soil monitoring as a surrogate for groundwater monitoring.

Permitted nutrient loading rate limits are based on crop nutrient removal. Soil monitoring in reuse permits provides additional feedback to ensure that best management practices are removing sufficient nutrients and not allowing groundwater degradation to occur. Soil

monitoring should occur in the spring to evaluate NGS loading practices when crop uptake is not occurring.

4.9.3.2 Soil Quality

Soil monitoring is used to assess soil quality. Monitoring involves initially characterizing the chemical and physical properties of soils and conducting ongoing monitoring to assess changes over time. Certain parameters are indicators of soil quality. Sodium adsorption ratio or exchange sodium percentage can indicate soil infiltration problems. Elevated electrical conductivity/salinity may indicate crop yield decrement or crop death. Specific ion toxicity in soil may be due to elevated chloride or other phytotoxic constituents. Elevated soil concentration of redox sensitive species (iron and manganese) can indicate excessive recycled water organic loading when compared to ambient levels in agricultural soils not used for reuse. The accumulation of soil constituents from recycled water application may signal a potential risk to groundwater, given leaching conditions.

4.9.3.3 Constituent Monitoring

Monitoring multiple soil depths characterizes the degree of constituent migration. Reuse permits should require sample at depths of 0–12 inches, 12–24 inches, and 24–36 inches. Municipal facilities may only require sampling at depths of 0–12 inches and 12–24 inches, or if minimally loaded, may not require soil monitoring at all.

4.9.3.3.1 Monitoring Location Determination

Soil monitoring units are specified in reuse permits as SU-XYZ-XY and correspond with the respective MU from which soils are sampled and composite samples are prepared. Composites samples should be collected from a minimum of 5 subsamples within the MU for those less than 15 acres in size and 10 subsamples for those greater than 15 acres in size. Representative samples are critical for obtaining valid and interpretable analytical results.

4.9.3.3.2 Monitoring Frequency

The frequency of soil monitoring depends on the quality of recycled water, reuse site management, loading rates, and site-specific factors. A common monitoring frequency in reuse permits is annual spring sampling. Spring and fall monitoring have separate purposes, and the permit writer should assess the need for one or both during the permitting process (Table 21).

Modify soil monitoring frequency as necessary to effectively monitor environmental responses to reuse activities. For permit renewals, both the applicant and DEQ should evaluate the efficacy of past monitoring conducted, and sites with consistent soil constituent levels may reduce the frequency from annually to once at the beginning and once at the end of a permit cycle.

Table 21. Justification for soil monitoring in different seasons.

Season	Justification for Monitoring
Spring	• Assesses both nutrient status and, in certain cases, soil quality status before the growing season. • Assists in determining fertilizer requirements.
Fall	• Used for evaluating the efficiency of nitrogen removal over the crop growing season. • Could be used to calculate leaching during the NGS with the spring soil sample.

4.9.3.3.3 Monitoring Parameters

Common analytical parameters recommended for soil monitoring include initial characterization of baseline soil conditions and ongoing monitoring (Table 22). Macronutrients and micronutrients are not usually an environmental concern at reuse sites. These analytes should be monitored at a frequency recommended by agronomists (crop consultants) to determine their nutrient status.

Table 22. Typical soil monitoring parameters and respective rationale.

Parameter	Monitoring Justification
Cation exchange capacity (CEC)	• Represents nutrient holding capacity of a soil. • Leaching more likely to occur in soils with low CEC (<5 $cmol_c/kg$). • Appropriate monitoring frequencies for CEC would be initially for site characterization or beginning and end of the permit cycle.
Chloride (Cl^-)	• Elevated Cl^- concentration in recycled water could create toxicity concerns for some crops. • Appropriate for facilities with high chloride constituents in the recycled water.
DTPA[a] iron and manganese	• Corroborate depressed redox conditions in the soil due to organic overloading. • Corroborate the reversal of depressed redox conditions caused by previous organic overloading. • Appropriate for food facilities at guideline loading rates or higher, and municipal facilities at high loading rates for hydraulic or COD loading.
Electrical conductivity	• Indirect measurement of soil salt content. • High salt loadings from recycled water can cause salt buildup and crop yield decreases. • Typically monitored annually or biannually.
Exchangeable sodium percentage (ESP) or Sodium adsorption ratio (SAR)	• Index for potential sodium influence on soil. • Soils with elevated SAR (>13) may experience infiltration problems due to deflocculation of soil colloids. • ESP >15 may indicate sodic or alkali conditions. • Appropriate monitoring frequencies for SAR or ESP would be initially for site characterization or beginning and end of the permit cycle.
Nitrate and ammonium	• Plant available nitrogen species important for determining the nutrient status of soils. • Nitrate is very mobile and may leach to groundwater. • Typically monitored annually or biannually.
Organic matter	• Effects physical and chemical functions. • Monitored for initial characterization but continued monitoring unneeded unless there is good reason to (e.g., sites with significant waste solids application).
pH	• Chemical characteristic and influences diverse properties including nutrient availability, functioning of microorganisms, and fate and transport of many contaminants.

Parameter	Monitoring Justification
	• Typically monitored annually or biannually.
Soil texture	• Available water-holding capacity is a function of soil texture and is a useful parameter in respect to NGS recycled water loading. • Appropriate monitoring frequencies would be initially for site characterization.

a. Diethylenetriaminepentaacetic acid extractable

4.9.4 Crop Plant Tissue and Yield Monitoring

Crop monitoring includes maintaining a chronology of cropping activities, plant tissue monitoring, and crop yield estimation. Cropping activity chronology includes dates of planting, harvest, tillage operations, fertilizer application, and dates when crop health was observed. Crop yield estimation calculates crop uptake of nutrients and salts for regulatory compliance.

4.9.4.1 Plant Tissue Monitoring for Nutrient Uptake

Plant tissue monitoring determines the nutrient status of a growing crop to calculate nutrient uptake rates. Instances occur in reuse permitting where plant tissue monitoring would not be necessary. For example, when certain sites are loaded below agronomic rates, DEQ-approved crop nutrient concentration values in published standard tables may be used instead of obtaining lab analysis.

Monitoring Frequency and Parameters

Plant tissue sampling and analysis and yield measurement are done at harvest. Measure yield on an as-harvested basis (i.e., when the crop is removed from the field). For hay crops, each cutting is a harvest, so samples should be taken and yield measured from each cutting and each reuse site MU. For crops harvested once at the end of the growing season, sample and measure yield at that time.

Parameters of interest for plant tissue monitoring at reuse facilities include moisture content, nitrogen, phosphorus, and ash (ash is a measure of inorganic material). The permit should specify monitoring for total nitrogen and allow the permittee the flexibility to choose the preferred approved analytical method.

4.9.5 Other Monitoring

Instances may occur when other monitoring is required for parameters not discussed above. Monitoring is required when the permit writer has identified unique conditions at a reuse site that warrant further assessment. Examples of other monitoring in reuse permits include but are not limited to the following:

- Waste solids
- Surface water
- Meteorological
- Lysimeter

- Process control

4.10 Reporting Requirements

All data collected under the reuse permit must be submitted to DEQ in an annual report; the minimum reporting is specified in the reuse permit. Reuse permits typically specify an annual report submittal due date of January 31 of each year. The permittee has 3 months to complete the annual report from the end of the reporting year (October 31). Other annual report due dates may be selected if the permittee requests additional flexibility, but the permit writer must balance this request with DEQ providing feedback to the permittee before specific operating seasons (i.e., growing season).

4.10.1 Annual Report Requirements

The annual report summarizes data collected during the year and documents the permittee's compliance with the reuse permit. The annual report must be prepared by a competent environmental professional who is familiar with the permitted facility and can use the monitoring data to describe the site conditions as they apply to the reuse of the recycled water. The permit requires submitting the annual report to DEQ as follows:

1. Detailed results of the required monitoring described in the permit. The report must present all monitoring data in summary tables to expedite review. If the permittee monitors any parameter for compliance purposes more frequently than required by the permit, include the monitoring results in the calculations and data reported in the annual report.
2. A brief interpretive discussion of the results of all required monitoring data in the permit. Discuss data quality objectives, validation, and verification and explain what the data show about permit compliance and reuse site environmental impacts.
3. Status of all work described in the compliance activity section of the permit.
4. Results of all backflow testing, repairs, and replacements required by the permit.
5. Discussion of major maintenance activities such as major equipment replacement, lagoon liner maintenance, and wastewater treatment and reuse facility maintenance.
6. Summary of all noncompliance events that occurred during the reporting year. Noncompliance events to discuss include, but are not limited to, exceedance of permit limits, complaints, missed monitoring events, incorrect monitoring dates or frequencies, dry monitoring wells, uncontained spills causing runoff, construction without DEQ engineering plan approval, construction without engineering inspection, and reporting incorrect acreage.
7. Laboratory analytical reports that show results, analytical methods, and practical quantitation limits for monitoring specified in the permit. Chain-of-custody forms, supporting information for laboratory analytical reports, and quality assurance documentation may also be submitted review on request by DEQ.
8. Calculations and results for various parameters. Modify the table in the permit template to meet specific permitting needs. If the permit writer identifies a

calculation needed for annual report not specified in the template, provide a clear justification in the staff analysis for the calculation. This justification should include an example of the required calculation to prevent any divergence between the permittee and DEQ.

Annual report submittals must include a certification statement that is signed, dated, and certified by the permittee's responsible official or an authorized person representing the responsible official. If an annual report is submitted without a certification, DEQ requires resubmittal of the annual report before beginning review. Once submitted, DEQ will conduct an annual report review to determine the permittee's compliance with the reuse permit.

4.10.2 Emergency and Noncompliance Reporting

The permittee must report all noncompliance incidents to the applicable DEQ regional office orally within 24 hours and in writing within 5 days from the time the permittee became aware of any noncompliance that may endanger human health and the environment with an action plan for correcting the violation according to the standard permit conditions. For public health emergencies, the permittee is required to call the 24-hour Idaho Emergency Medical Services Communications Center emergency number at (800) 632-8000 and the appropriate DEQ regional office.

All instances of unpermitted wastewater discharges to surface waters of the United States must be reported to DEQ's IPDES Program.

4.11 Standard Permit Conditions

Every reuse permit contains a section of standard permit conditions defined in IDAPA 58.01.17.500. Section 8 of the permit template lists the standard permit conditions and should not be changed without conferring with the State Reuse Permit Coordinator.

4.12 General Permit Conditions

The reuse permit section on general permit conditions is based on cited rules at the time of permit issuance. The language in this section is standard and should not be changed by the permit writer. This section covers the following:

- Backflow prevention
- Application restricted to premises
- Health hazard, nuisances, and odors
- Solids management
- Temporary cessation and closure
- Plan of operation
- Seepage testing requirements
- Groundwater Quality Rule

4.13 Site Maps

The final section of the reuse permit includes maps for the reuse site. Section 4.2.1 notes the permit should include at least two maps (facility map and regional map). The permit template contains instructions for generating site maps. For larger reuse sites, the permit writer may find that additional maps are needed to ensure features are clearly visible. For example, if a permittee has two distinct reuse areas, generate a separate map for each area.

5 Draft Permit Issuance and Public Comment

5.1 Draft Permit and Draft Staff Analysis Review

The draft permit and staff analysis should be sent to the regional engineering manager for review, then to the program office for review and approval. Once approved, the staff analysis should be finalized. A courtesy review of the draft permit and final staff analysis should be offered to the applicant with a date for when the documents will be posted for public comment, and when the applicant should respond by. If changes are made resulting from this courtesy review period and before draft permit issuance, they should be documented in the staff analysis. The draft permit and final staff analysis should be sent as PDF documents.

5.2 Posting Documents for Public Comment

Providing for public participation on a draft reuse permit is specified in IDAPA 58.01.17.400.05.b. DEQ typically provides a minimum 30-day public comment period for draft permits. The notice to the public may occur on the same day the applicant is issued the draft permit or a short time later to provide the applicant with additional review time. The process for issuing a draft permit for public comment is as follows:

1. Permit writer obtains approval from State Reuse Permit Coordinator and Regional Office Administrator to release the draft permit for public comment.
2. Permit writer requests the public notice from Communications and Outreach staff. Complete the form for *public outreach opportunities*.
3. Communications and Outreach provides a draft public notice to the permit writer to verify the content and dates (Figure 3).
4. Permit writer completes the cover letter (EDMS 2010AFQ7 RUT12 Letter 6 – Draft permit transmittal letter) addressed to the permittee to match the posted public comment dates.
5. Permit writer issues in PDF form the draft permit, final staff analysis, and cover letter to the permittee.

Once the comment period expires, the notice terminates on DEQ's website.

January 11, 2023

Contact: Tyler Ayers, Water Quality Engineer, tyler.ayers@deq.idaho.gov

STANLEY – The Idaho Department of Environmental Quality (DEQ) is seeking comment on a draft water reuse permit renewal for Stanley Sewer Association.

Stanley Sewer Association, Inc. currently operates a Class C municipal recycled water facility that serves the city of Stanley and the United States Forest Service Redfish Lake recreation area. The association currently operates the reuse system under permit M-156-04 and applies approximately 13.4 million gallons of recycled water annually on 103 acres of native vegetation.

The facility's current permit expired on October 31, 2022 and the proposed draft permit would reauthorize operations for an additional 10 years.

The draft reuse permit establishes monitoring requirements, limits on nutrient and hydraulic loading, and conditions established by DEQ to protect public health and the environment. As part of the permitting process, the permittee was also required to show that its operation would not cause public health or environmental concerns.

The permit materials are available for public review at DEQ's State Office (1410 North Hilton Street), DEQ's Idaho Falls Regional Office (900 N. Skyline, Suite B), and on DEQ's Public Comment Opportunities page.

Written comments will be accepted through February 10, 2023, at 5 pm MST. Submit comments electronically on DEQ's website or by mail or email to:

Tyler Ayers
900 N. Skyline, Suite B
Idaho Falls, ID 83402
tyler.ayers@deq.idaho.gov

Related Documents

Draft renewal reuse permit
Draft staff analysis

Figure 3. Example draft public comment notice.

5.3 Responding to Public Comments

The public comment opportunity on a draft permit may result in DEQ receiving feedback from individuals and agencies. DEQ will draft a response that considers each comment and supportive rationale before making final decisions for the permit. A standard itemized response document (EDMS 2010AFQ8 RUT12 Letter 7) is used. The response should include the following elements:

- Original comment received.
- Changes in any condition of the draft permit resulting from the comment (include section and page numbers).
- Written response to the original comment. If DEQ does not make any changes to the draft permit based on the comment, DEQ needs to justify the rational.

If information submitted during the public comment period results in substantial changes to the draft permit, one of the following actions can occur:

- A new draft permit with an addendum to the staff analysis is prepared, and the public comment period is reopened.
- A revised draft permit and staff analysis are prepared, and the public comment period is reopened.

The permit writer should consult the State Reuse Permit Coordinator before responding to public comments. DEQ's official response to public comments is included in the Final Permit Transmittal Letter to the permittee. It is also recommended that DEQ provide a response to each individual who submitted a public comment.

6 Final Permit Issuance

6.1 Permit Issuance

The process for issuing a final permit is as follows:

1. Permit writer receives acceptance from the State Reuse Permit Coordinator to issue the permit.
2. Regional Office Administrator signs the final permit.
3. Permit writer completes the cover letter (EDMS 2010AFQ8 RUT12 Letter 7) addressed to the permittee.
4. Permit writer issues a PDF of the final permit, any response to public comments and list of changes made to the draft permit, and cover letter to the permittee and all individuals copied on the cover letter.
5. The State Reuse Program will ensure the final permit is posted on the DEQ website.

6.2 Permit Handoff Meeting

A permit handoff meeting should be offered to all facilities that are issued a new or renewed reuse permit, even if the renewed permit does not deviate from the prior permit. The Regional Reuse Permit Coordinator schedules the permit handoff meeting and informs the State Reuse Permit Coordinator that a handoff meeting was requested.

6.2.1 Participants

The responsible official, authorized representative, and system operator for the permitted facility should attend the permit handoff meeting. Other facility personnel or relevant parties (e.g., lab personnel, consultant) may be included at the invitation of the facility or DEQ.

From DEQ, the Regional Reuse Permit Coordinator and permit writer should attend the meeting. If the permittee intends to include legal representation during the permit handoff meeting, the Regional Reuse Permit Coordinator must notify the Attorney General's office to ensure a deputy attorney general is present during the meeting. A permit handoff meeting should not occur if only one party has legal representation present.

6.2.2 Time Frames

The invitation to schedule a permit handoff meeting can either be extended before the final permit is signed or included in the final permit transmittal letter. Schedule the permit handoff meeting on or within 30 days of the permit issuance.

6.2.3 Conducting the Meeting

When the meeting starts, the Regional Reuse Permit Coordinator should introduce all attendees and ensure all attendees are signed in (Appendix A). DEQ saves the reuse permit handoff meeting attendance sheet and any relevant documents generated at the meeting in DEQ's document management system. Provide a copy of the permit to each attendee.

The Regional Reuse Permit Coordinator reviews key elements in the permit that the permittee must be aware of to ensure compliance with the permit:

- If the permittee is new, DEQ reviews the permit in its entirety. This review is also appropriate for permit renewals if a permittee had substantial compliance issues during the previous permit cycle or has new staff or officials.
- If it is a permit renewal, DEQ reviews any changes in permit conditions, limits, and monitoring from the previous permit cycle.
- DEQ reviews reporting requirements with the permittee, including example calculations and expectations for interpretive discussions.

The Regional Reuse Permit Coordinator saves the reuse permit handoff meeting attendance sheet and any relevant documents generated at the meeting in DEQ's EDMS.

7 Permit Modification

Permit modifications are categorized as minor or major (IDAPA 58.01.17.700). The permittee must receive a permit modification before any planned physical alteration or addition to the permitted facility if the alteration or addition would result in a significant change in information submitted during the permit application process or would result in noncompliance with any permit condition or with IDAPA 58.01.17. The permit writer should discuss the modification with the appropriate Regional Engineering Manager and note that a modification is not required for replacing components with like parts.

If granted, minor modifications would not result in any increased hazard to the environment or public health. A minor modification is authorized through official correspondence with the permittee (EDMS 2016AGH385 RUT12 Letter 10c). Minor modifications are normally limited to the following:

- Correct typographical errors or formatting changes.
- Transfer ownership or operational control (DEQ must be notified before transfer occurs, see IDAPA 58.01.17.800 for requirements), or responsible official.
- Change in monitoring or reporting frequency requirements, or revision of a laboratory method.
- Change in compliance due date in a schedule of compliance, including extending a permit expiration date (extension cannot exceed 10 years total permit term).
- Change or add a sampling location.
- Change to a higher level of treatment without a change in end uses.
- Change in terminology.

- Remove an allowed use.
- Correct minor technical errors, such as citations of law, and citations of construction specifications.
- Change in a contingency plan resulting in equal or more efficient responsiveness.
- Remove acreage from irrigation without an increase in loadings.

For major modifications, the procedure is the same as applying for and issuing a new permit (section 3). The draft and final major modification is authorized through official correspondence with the permittee (EDMS 2016AGH383 RUT12 Letter 10a and EDMS 2016AGH384 RUT12 Letter 10b). Examples of major permit modifications include the following:

- Changes in the treatment system.
- Addition of an allowed use of recycled water.
- Changes to lower (less treated) class of recycled water.
- Addition of reuse site acreage.
- Changes to less stringent constituent and hydraulic limits.

Permit modifications require a substantial amount of time to complete, and the permit writer should ensure the initial permitting process is as comprehensive as possible to minimize the number of modifications during a permit cycle. The permit writer should consider if issuing a new permit instead of a major modification would be more efficient.

8 Permit Revocation

DEQ may revoke a permit if the permittee violates any permit condition or violates federal, state, or local rules (IDAPA 58.01.17.920). Except in emergencies, DEQ will issue a written notice of intent to revoke to the permittee before final revocation. Revocation becomes final within 35 days of receipt of the notice by the permittee, unless within that time the permittee requests an administrative hearing in writing. The hearing is conducted according to the "Rules of Administrative Procedure Before the Board of Environmental Quality" (IDAPA 58.01.23).

If DEQ finds public health, safety, or welfare requires emergency action, DEQ incorporates the findings that support action into a written notice of emergency revocation issued to the permittee. Emergency revocation is effective on receipt by the permittee. If the permittee requests a revocation hearing in writing, DEQ will notify the permittee and conduct the hearing according to IDAPA 58.01.23.

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Appendix A. Permit Handoff Meeting Attendance Form

Use this form to collect information and signatures for meeting attendees.

Table A-1. Permit handoff meeting attendance list.

Date -		Permit Handoff Meeting	
Facility -		Permit Number -	
Name (print)	Signature	Title	Email

Permit coordinator comments and notes—Briefly summarize topics discussed, questions from the facility personnel, and any issues identified during the meeting. Handwritten notes are acceptable.