Guidelines for Water Reclamation and Urban Water Reuse

State of Georgia
Department of Natural Resources
Environmental Protection Division
Water Protection Branch
Atlanta, Georgia 30334
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1.0 INTRODUCTION

Urban water reuse is a term generally applied to the use of reclaimed water for the beneficial irrigation of areas that are intended to be accessible to the public, such as golf courses, residential and commercial landscaping, parks, athletic fields, roadway medians, etc. Expanded uses for reclaimed water may also include fire protection, aesthetic purposes (landscape impoundments and fountains), industrial uses and some agricultural irrigation. Reclaimed water is domestic wastewater or a combination of domestic and industrial wastewater that has been treated to stringent effluent limitations such that the reclaimed water is suitable for use in areas of unrestricted public access. Since most areas where reclaimed water is to be used are designated for public access, protection of public health is the primary concern. Although utilization of reclaimed water will be beneficial, there is no guarantee that this source will provide all the water that is needed or desired.

Highly treated reclaimed water that meets the requirements of these guidelines is a valuable water resource. Wastewater treated to urban water reuse standards may be used in lieu of potable water for agricultural irrigation (feed crops), residential/commercial landscape irrigation, dust control, etc. The reclaimed water system is an integral part of the utility system and provides benefits to both the potable water and wastewater utilities. The Georgia Environmental Protection Division (EPD) encourages the use of reclaimed water as a substitute for potable water for the purposes identified.

The EPD, through its permitting program, allows permittees to provide reclaimed water to designated users. Prior to providing reuse water to a designated user, written notice must be provided to the EPD and a public notice must be provided to the community. The permit requires any designated user to enter into a written user agreement with the permittee. The Owner of any wastewater treatment system who desires to provide reclaimed water to designated users will be responsible for insuring that the reuse water meets the requirements of reclaimed water at the point and time of delivery to the designated user or reuse holding pond. The permittee must establish reasonable policies, regulations, resolutions, ordinances, or written agreements concerning the use of reclaimed water to ensure compliance with these requirements.

Since all reclaimed water treatment systems are different, early contact with EPD is advised to determine what requirements must be met. Specific information concerning Design Development Reports (DDR), Environmental Information Documents (EID), and permitting requirements should be addressed early in the project.

2.0 DEFINITIONS

a) **Agricultural irrigation** means the irrigation of crops not intended for direct human consumption.

b) **Customer** means designated user or user for the purposes of these guidelines.

c) **Designated user or user** means any site or facility, where reclaimed water is beneficially used under a contract with the permittee. User may also be defined as the customer to be supplied with reclaimed water who has a written user agreement with the permittee. In addition, a designated user may also be a purveyor that provides reclaimed water to other customers.

d) **Division** or EPD means the Georgia Environmental Protection Division of the Department of Natural Resources.

e) **Permittee** means the owner of the reclaimed water treatment system that has been issued a permit.

f) **Point of Delivery** means the point at which the reclaimed water is delivered to the designated user or the reuse water holding pond.

g) **Rain Event** means any event where precipitation could cause the water level in the holding pond, designed in accordance with Section 11.2 of these guidelines, to rise by no more than six (6) inches.

h) **Reclaimed Water** means wastewater that has received treatment to urban water reuse standards, meets the treatment criteria specified in these Guidelines, and is utilized at a reuse area or is sent to a designated user for reuse.

i) **Reclaimed Water Treatment System** means the treatment system for urban water reuse approved by the Division.

j) **Reject water** means wastewater that does not meet the 3 NTU criteria.

k) **Reuse** means the use of reclaimed water as a substitute for other water sources for the beneficial irrigation of areas that may be accessible to the public. This includes areas such as golf courses, residential and commercial landscaping, parks, athletic fields, roadway medians, and landscape impoundments.

l) **Reuse Area** is defined as the irrigated area of any designated user.

m) **Reuse Water Holding Pond** means an artificial impoundment that is designed and maintained to store a specific volume of reclaimed water. For the purposes of these guidelines, holding pond may also mean a storage tank constructed above, on, below, or partially below the ground surface.

n) **Runoff** is defined as reclaimed water, which has been applied to a reuse area in sufficient amounts to cause the water to leave the irrigation area in the form of surface flow during and shortly after irrigation application.

o) **State Act** means the Georgia Water Quality Control Act (Official Code of Georgia Annotated; Title 12, Chapter 5, Article 2).

p) **Storm Event** means any event in which precipitation exceeds the one-year 24-hour storm event for the geographical location.

q) **Urban Water Reuse** means the same as Reuse.

3.0 WASTEWATER TREATMENT

In planning for urban reuse there are two major issues that must be considered prior to developing such a system. The first of these is the issue of places to dispose of the reclaimed water when irrigation customers (golf courses, businesses, homeowners, etc.) cannot take additional water without harming their "cover crop". This situation will usually arise during wet weather periods. Since the wastewater will continue to come to the treatment facility, one or more of the following options must be in place:

- Sufficient storage can be established to handle the flows until irrigation can be resumed. This can be onsite or at the customer's location; and/or
- Additional land can be set aside that can be irrigated without causing harm to the "cover crop". For golf courses, extra rough areas and wooded areas can be set aside for this purpose; and/or

- Obtain a National Pollutant Discharge Elimination System (NPDES) discharge permit for all or part of the flow.

The second issue which must be considered is the constituents (e.g. salts) that may be present in the reclaimed water and what effect(s) they may have on the cover crops that will be irrigated. For specialized users such as golf courses, nurseries, etc., a detailed evaluation of the effluent constituents may be necessary in order to determine whether or not they are candidates for urban reuse irrigation. Appendix A contains information relevant to this issue.

3.1 General

Treating secondary plant effluent with chemical coagulation, filtration, and disinfection is effective in providing removal of pathogenic organisms. Therefore, the preapplication waste treatment shall, at minimum, result in a reclaimed water that meets secondary treatment as defined in 40 CFR 133.102, (30 mg/l BOD_5 and 30 mg/l SS) followed by coagulation, filtration and disinfection or equivalent treatment as defined in Section 3.1.1 below. The reclaimed water shall not exceed a turbidity of 3 Nephelometric Turbidity Units (NTU) prior to the application of the disinfectant. Water that does not meet the 3 NTU limit shall not be sent to a reuse water holding pond or designated user. Such reject water may be sent to a dedicated site, NPDES discharge, reject pond, or other appropriate use.

3.1.1 Equivalent Treatment

Other process trains such as physical-chemical treatment followed by membrane filtration may provide equivalent results. Treatment methods based on alternative technology may be acceptable when performance is proven to the satisfaction of the Division. If alternative treatment methods are considered, early contact with EPD is advised to minimize any delays which may occur while demonstrating equivalent performance.

3.2 Treatment Facilities

3.2.1 Process Control

- Turbidity $\leq$ 3 NTU

3.2.2 Treatment Criteria

- Biochemical Oxygen Demand (BOD_5) $\leq$ 5 mg/l

- Total Suspended Solids (TSS) $\leq$ 5 mg/l
- Fecal Coliform $\leq$ 23 per 100 ml monthly geometric mean, 100 per 100 ml maximum per sample.
- pH 6-9 standard units
- Turbidity $\leq$ 3 NTU
- Detectable disinfectant residual at the delivery point (strongly recommended)

4.0 MONITORING REQUIREMENTS

Turbidity shall be monitored continuously on the filtered water prior to disinfection. Turbidity shall not exceed 3 NTU and any water exceeding 3 NTU shall be automatically rejected. Monitoring includes the routine calibration of the turbidimeter and other on-line analyzers.

Sampling for TSS and BOD shall be weekly and may be increased if deemed necessary upon notification by the Division.

The frequency and monitoring for fecal coliform bacteria shall be daily and may be increased if deemed necessary upon notification by the Division. Fecal coliform in the reclaimed water shall not exceed 23 per 100 ml as a monthly average, as determined from the geometric mean of all valid test results that have been completed for each reporting period. Should any test result for an individual sample exceed 100 per 100 ml, then an investigation to determine the cause must be conducted and appropriate actions taken to prevent future occurrences. Testing may be reduced from daily for those systems which use multiple methods of disinfection.

The frequency for monitoring of pH shall be daily and may be increased if deemed necessary upon notification by the Division.

The monitoring requirement for detectable disinfection residual includes such measures as measuring chlorine residual or the inspection, calibration, and recording of ultraviolet (UV) output and transmittance.

Monitoring of groundwater and surface water is generally not required for reuse systems. However, the Division may determine that groundwater monitoring is required on a case-by-case basis at the time of permitting.

All sampling and analysis shall adhere to the requirements of 40 CFR 136 unless otherwise stated in the permit. The operations manual must address the routine equipment inspection and calibration schedule.

5.0 SYSTEM REQUIREMENTS AND RELIABILITY

Reliability is the ability of a component or system to perform its designated function without failure and is critical in maintaining continuous operation of any high quality operation. Multiple process units are recommended. The ability to isolate and bypass all process units must be included in the design. The system must be capable of treating peak flows with the largest unit out of service. Spare parts must be available so that repairs can be completed and the system placed back into operation within a maximum of three days or emergency storage provided. An inventory of critical spare parts shall be maintained at the facility. For those facilities which have no alternative method for disposal, multiple process units for critical units are required. In addition to providing multiple treatment units, for systems which have widely varying flows, equalization may be needed. Alternative reliability methods may be considered by EPD on a case-by-case basis (i.e., separate land application system (LAS) sprayfield, additional reject storage, etc.).

5.1 Biological Oxidation

All reuse facilities should employ a biological oxidation process (or equivalent) to reduce the biochemical oxygen demanding materials. Multiple oxidation basins are recommended. Standby aeration equipment is required so that the aeration requirement can be met with the largest unit out of service. All aeration equipment must be accessible for ease of repair.

5.2 Clarification

Multiple units will be required. The units must be designed so that loading rates (solids, hydraulic, and weir) are clearly within acceptable ranges (examples include various civil/environmental textbooks, manuals of practice, etc.) with the largest unit out of service. In lieu of providing clarification, some other treatment methods (i.e., membrane technology) may be acceptable if performance can be demonstrated to the satisfaction of the Division.

5.3 Coagulation

Addition of chemical coagulants generally increases the effectiveness of pathogen removal. Chemical feed facilities for coagulant, such as coagulant aids, lime, polyelectrolytes, etc. shall be provided unless manufacturers information, pilot testing, or other rationale is provided to waive this requirement. Chemical feed systems may remain idle if after start-up of the system the 3 NTU

level can be maintained without chemical addition. Such chemical feed facilities must be operated (exercised) at a minimum of 2 times per month so that the complete chemical feed system is operational should it ever be needed.

5.4 Filtration

Filtration is an important component of a wastewater treatment facility that produces reclaimed water. By removing solids and turbidity prior to disinfection, filtration serves to increase the ability of the disinfection process to inactivate or remove pathogenic organisms. Filtration also serves as the primary barrier for the removal of protozoan pathogens (Cryptosporidium, Giardia, and others).

Filtration shall be provided for turbidity control. The maximum (peak) filtration rate shall not exceed the manufacturer's documented performance. Loading rates will be considered based on manufacturer's information, pilot testing, and actual records from operating treatment units.

5.5 Turbidity

A turbidity meter will be required on the combined filter effluent followed by an automatic diversion valve. The automatic diversion valve shall automatically divert treated wastewater which does not meet the 3 NTU requirement away from the reuse storage facilities to the reject pond, NPDES permitted discharge, reject LAS, etc. Once diversion has begun, it must continue until the 3 NTU requirement is met and the operator manually overrides the reject diversion.

5.6 Disinfection

Disinfection is required that will achieve a fecal coliform level of <23/100 ml (geometric mean) and a maximum of 100/100ml in any single sample. If a fecal coliform test yields results in excess of 100 per 100 ml, the cause must be determined and appropriate actions taken within the operation/maintenance scheme to prevent future occurrences. Provisions must be made for automatic diversion due to any failure of any component of the disinfection system. All disinfection systems must include provisions for continuous disinfection. Items which should be considered include:

- Automatic switchover feed system
- Standby disinfection source

- Standby reactor per train or a standby reactor train (in series)
- Uninterruptible power source

It is recommended that all disinfection systems provide a detectable disinfectant residual at the point of delivery. The design should consider multiple points of disinfection (before and after storage, prior to long transport lines, critical points within the distribution system, etc.), or have provisions to redirect the flow to an alternate permitted site.

5.7 Power Supply

Sufficient resources must be available to provide uninterrupted service to the reclaimed water treatment system. Options available to accomplish this are:

- Onsite generator as a standby power source or
- Uninterruptible power supply or
- Separate feed lines from different sub-stations

Automatic switchover is required to initiate the reserve power source. The switchover must disconnect the primary power source during standby operation.

5.8 Alarms

Alarms shall be installed to provide warnings of:

- Loss of normal power supply
- Failure of pumping systems
- Failure of disinfection system
- Turbidity ≥ 3 NTU

A telemetry system must be provided that will immediately notify the operator of any alarm warnings.

6.0 OPERATION REQUIREMENTS

The permittee shall at all times have total control of all reclaimed water up to the point of delivery to the designated user. The permittee shall have an established pretreatment program or an enforceable Sewer Use Ordinance/Agreement which contains provisions for monitoring all significant industrial users. For private development a written sewer agreement will be required in lieu of a Sewer Use Ordinance. The permittee shall have in place a public education program which has been approved by the Division prior to supplying reclaimed water to end users.

All persons using the reuse system shall be authorized by the permittee to do so in accordance with the permit, written user agreement, ordinances, and the established public educational program.

The facility's operator in responsible charge shall be Class I. Operation of reclaimed water systems requires on-site operation by a Class II or higher operator 8 hours per day, 7 days per week. If the operator can monitor from a remote location and receive immediate notification for alarms, a reduced schedule for on-site operation by a Class II or higher operator may be considered on a case-by-case basis.

An operations manual must be reviewed and approved by EPD prior to delivering any reuse water to any designated user.

7.0 STORAGE

Reclaimed water must meet the required turbidity criteria before it is transported to the designated user(s) or reuse storage pond. If for any reason the turbidity limit is not met, the water must be rejected. An off-line system for storage of reject water shall be provided for all dedicated reuse facilities relying on irrigation as the only means of effluent disposal. At a minimum, the capacity of this storage shall be equal to 3 days of flow at the average daily design flow of the treatment facility. Provisions for returning this reject water to the facility for further treatment or for sending the reject water to a separate disposal site shall be incorporated into the design. In all cases, the reject water stream must be isolated from the reuse stream.

7.1 Reclaimed Water

Reclaimed water that meets the required treatment criteria can be transported to a variety of designated users. It is anticipated that storage will be provided at the plant site or by the designated users. Unlike land treatment systems utilizing dedicated irrigation sites, the determination of storage capacity will depend on the actual needs of the designated users. Storage requirements will vary significantly with how the reclaimed water is utilized. Storage of reclaimed water will make it available for delivery when needed. Therefore, ponds must be constructed to minimize leakage. Covered storage should be considered to retard algal growth. Designers are encouraged to use information from experienced landscapers, golf course superintendents, county extension personnel, nurserymen, and others skilled in agronomy and water use data from existing and similar applications to determine the operational storage needs of the system. **The basis for**

establishing the storage requirement must be provided in the Design Development Report.

If a pumping pond is established it must be designated for reclaimed water only and all runoff should be directed away from this pond. The only water other than reclaimed water entering the pumping pond shall be limited to water that falls on the surface during a rain event or is transferred into the pond from other sources to supplement irrigation needs. Discharge of reuse water to waters of the state is prohibited unless done so in accordance with an NPDES permit. Overflow from ponds utilized as reuse storage ponds is considered an unpermitted discharge and may result in enforcement action if not covered under an NPDES permit in accordance with the section for *Design of Reuse Storage Ponds, Ponds with Intermittent Discharges* of these guidelines. Irrigation systems using reclaimed water shall be operated so that runoff of reclaimed water does not occur.

7.2 Reject Water

Ponds used for storage of reject water must be lined to prevent seepage from exceeding 1/8 inch per day. Either properly constructed clay or synthetic liners may be used. If a clay liner is used, provisions must be made to prevent drying, cracking, and erosion.

All flows must meet the required treatment levels or shall be diverted to the reject storage pond. Reject water is to be returned to the treatment works for further treatment or transported to a permitted alternate disposal location.

8.0 ACCESS CONTROL AND WARNING SIGNS

Buffer zones are not generally required for water reuse systems. EPD will evaluate the need for buffer zones for reuse systems on a case-by-case basis. Buffer requirements have been established and will be required for all pretreatment facilities and land used to treat reject water.

Low trajectory nozzles, or other means to minimize aerosol formation shall be used within 100 feet of outdoor public eating, drinking and bathing facilities. Irrigation systems should be designed so that spray does not go outside of the established irrigation boundaries.

The public shall be notified of the use of reclaimed water. This can be accomplished by the posting of advisory signs in areas where reuse is practiced, notes on golf course scorecards, mailings, or by other methods.

Advisories should be written in a positive manner emphasizing the water conservation importance of water reclamation. Anyone who is working with, around or may come in contact with the reclaimed water should be readily aware of its origin.

9.0 DISTRIBUTION SYSTEMS

This section identifies the requirements of the permittee for construction and operation of the reuse distribution system. The permittee is responsible for ensuring compliance with all portions of the permit including how the reclaimed water is reused.

9.1 PURPOSE

The review and enforcement responsibilities for all designated users which are tributary to the reclaimed water system service area should be identified in the written user agreement. Compliance with this written agreement is the responsibility of the permittee. The permittee shall terminate service to any customer for failure to comply with these provisions.

9.2 PROCEDURES

In order to fulfill the terms of the permit, the permittee must enact procedures which will accomplish the following:

a. Individual applicants for reclaimed water service shall apply to the permittee by completing and signing an application. All applications for reclaimed water service shall describe the non-potable water uses requested by the applicant. Use of master meters to tie-on multiple customers is not recommended but may occur when allowed by the permittee in the written agreement.

b. Maximum obtainable separation of reclaimed water lines and potable water lines shall be practiced. A minimum horizontal separation of three feet (outside of pipe to outside of pipe) shall be maintained between reclaimed water lines and either potable water mains or sewage collection lines. A minimum of 18 inches shall be provided between the bottom of any potable water supply line and the top of the reuse line.

c. All reclaimed water valves and outlets should be appropriately tagged or embossed to warn public and employees that the water is not intended for drinking.

d. All piping and pipelines shall be color-coded using Pantone Purple 522 using sunlight stable pigment. All valves, fire hydrants, and outlets shall be tagged and color-coded purple to differentiate reclaimed water from potable water. All reclaimed water valves and outlets shall be appropriately tagged or labeled “Do Not Drink” together with the equivalent standard international symbol to warn the public and employees that the water is not intended for drinking. Where hose bibs are present on reclaimed water lines, different sizes from those on potable water supply lines shall be established to preclude interchange of hoses. Cam Lock connection assemblies in small sizes (1/2 to 3/4 – inch) with lockable meter boxes will be required on all hose connections designated for reclaimed water. All distribution and application facilities located on private properties, including residential properties, shall be color-coded using Pantone Purple 522.

e. The customer shall have installed a permanent underground irrigation system.

f. A public information program is required to inform designated users and the public of what reclaimed water is and to answer questions about connecting to the system. All designated users wishing to connect to the system must participate in the public information program and have their participation documented. This public information program may be in the form of a seminar, video, multimedia electronic presentation, or other appropriate media.

g. As-built plans of the reclaimed water systems, showing valve locations, tap locations, and size of taps, shall be available to the permittee at all times.

h. The customer shall not allow the reclaimed water to enter the dwelling unit(s).

i. The customer shall sign a written user agreement with the permittee prior to being tied onto the reuse system. Irrigation shall occur only during periods approved in the written user agreement.

j. The customer shall not allow reclaimed water to be used for consumption (human or animal), interconnecting with another water source, sprinkling of edible crops (gardens), body contact recreation, filling of swimming pools, or sharing a common reclaimed service between properties.

k. Notification shall be provided to inform the public that reclaimed water is used for irrigation purposes and is not safe for drinking. Posting of signs and other prominent notification methods shall be used to ensure that any and all persons associated, employed, or otherwise connected with the property utilizing the reuse water are aware of the fact that reuse water is being utilized on the property and it is non-potable.

l. Operation and maintenance of the reclaimed water system including valves, outlets, couplers, and sprinkler heads shall be performed by personnel who have completed the public information educational program(s).

m. Precautions shall be taken to ensure that reclaimed water will not be sprayed on any facility or area not designated for application. Low trajectory nozzles, or other means to minimize aerosol formation shall be used within 100 feet of public eating, drinking, and bathing facilities.

n. Malfunctioning irrigation systems and line breaks shall be repaired immediately. Improper operation allowing runoff during irrigation may be grounds to shut off service to the customer.

o. Tank trucks and other portable equipment that is used to distribute reclaimed water shall be clearly identified with reclaimed or non-potable water signs. The truck used to transport and distribute reclaimed water may not be used to transport potable water that is used for drinking water purposes.

p. Use through hose bibbs or faucets may be allowed on a case-by-case basis. If allowed, hoses and hose bibbs shall be through cam-lock connection assemblies to be provided by the permittee at the location specified by the permittee. Specific provisions must be made in any reuse written user agreements to ensure that reclaimed water is used strictly for irrigation purposes and will not

be utilized for any of the restricted items identified in these guidelines. Runoff of reclaimed water into ditches or streams should be avoided.

q. Application of reclaimed water for agricultural irrigation of crops not intended for direct human consumption will be considered by EPD on a case-by-case basis.

r. The permittee must coordinate with the purveyor of potable water to advise them of the use of reclaimed water in the area.

10.0 RECORDS

EPD may at anytime verify compliance with a reuse permit by reviewing the records kept by the permittee. The permittee is responsible for conducting inspections within the reclaimed water service area to verify proper connections, monitor proper use of reclaimed water, and minimize the potential for cross connections. Inspections are required when customers first connect to the reclaimed water distribution system. Therefore, the Permittee shall at minimum ensure the following:

a) A permanent record that the users of reclaimed water have been advised of the quality of the reclaimed water and the conditions of use shall be maintained. This record shall include the conditions of use and evidence that the user has agreed to abide by these conditions. Whenever the ownership/tenancy of the property changes, a new application shall be required.

b) The permittee shall maintain in a responsible manner, records, documentation, and enforcement actions associated with their reuse program for EPD review.

c) The permittee, through periodic inspections, shall be responsible for ensuring that all customers are in compliance with the conditions of their written user agreement. Records of the inspections with violation notices and follow-up corrective actions shall be included.

d) The permittee shall review the customer's notification system to ensure that signs are posted and other notification methods are utilized to advise those likely to come in contact with the water that reuse water is being utilized.

e) The permittee shall report to the Division annually the volume and quantity of reclaimed water used in the service area.

All new developments proposing to utilize reclaimed water shall provide a reclaimed water distribution system in accordance with these guidelines. The permittee shall perform all tie-ins on the reuse system or shall maintain a listing of acceptable licensed contractors who are authorized to perform the installation.

11.0 DESIGN OF REUSE STORAGE PONDS

Reuse offers significant advantages for both wastewater management and water resource management. As a result, reuse is considered an important part of water management in Georgia. It is anticipated that storage of reclaimed water will occur at the treatment facilities or the reuse site. Storage requirements will vary significantly with how the reclaimed water is utilized and will depend on the actual needs of the reuse area. Of particular interest is the use of ponds at golf courses and other large landscaped areas for the storage of reclaimed water. Many of these ponds were designed as part of the stormwater management system and may discharge intermittently to waters of the state. Systems that desire to supplement reclaimed water with potable water must provide an air gap between the potable water source and the reclaimed water system.

11.1 Isolated Ponds

Storage requirements will vary significantly with how the reclaimed water is utilized and with the original design and purpose when retrofitting an existing storage pond. Storage of the reclaimed water on-site will allow it to be available for delivery to the irrigation area when needed.

The use of isolated, non-discharging ponds, which are not waters of the state, to store reclaimed water does not require any form of NPDES permitting. It is recognized that any pond may be subject to overflow during extreme hydrologic conditions (extreme flooding, hurricane, other infrequent conditions). An overflow from isolated, non-discharging ponds used for reuse storage is considered a spill or an unpermitted discharge and may result in enforcement action.

11.2 Ponds With Intermittent Discharges

This section deals with storage ponds located at the treatment site, golf courses, or other large landscaped areas, which are not waters of the state, but may discharge intermittently. This may be allowed through an NPDES permit if the outfall structures are designed as described herein. These ponds may be part of the stormwater management system. Discharges from these ponds to waters of

the state may occur in response to storm events. Use of these ponds to store reclaimed water must be identified in the written user agreement, Design Development Report (DDR), and Notice of Intent (NOI) for permit application for the reuse system. For ponds designed as retention basins, coordination with the local stormwater management and permitting authority (city or county government) may also be needed. If the pond that will receive reclaimed water is part of the stormwater management system, it is essential that the pond have sufficient capacity to accommodate both uses. The permittee must provide documentation of the stormwater storage capacity, reclaimed water storage needs, or any other uses that affect pond storage with the submittal.

Figures 1 and 2 illustrate the basic concepts involved in the use of a stormwater management pond for storage of reclaimed water. The ponds typically are constructed with a control structure (weir, standpipe, or other device). Two outlets are required. The invert of the highest overflow defines the “full pool level”. The “full pool level” (Level A in Figures 1 & 2) corresponds to the condition where the pond is at that invert elevation of the peak discharge or rate control device (the weir invert in Figures 1 & 2). If the pond is at full pool level, any additional input of water into the pond will result in rapid discharge from the outlet structure. The “control elevation” (Level B in Figures 1 & 2) represents the maximum water level that will ensure availability of sufficient volume for the storage of stormwater. Typically, the volume between Level B and Level A represents the volume needed for storage of runoff from the target storm event in the tributary watershed. Normally, the peak discharge or rate control device level (the weir invert in Figures 1 & 2) is set to release all flow which exceeds a predetermined design storm for flood control purposes. This storm event is based on available data for a 24-hour rainfall with a recurrence of one year. (For the Atlanta area, a target storm event has been established as a 3.25-inch rainfall occurrence). The pond will not discharge through the designated control device except during these occasional storms.

Following a storm event in excess of design storm, the water level in the pond will fall to Level A as discharges over the weir diminish. At Level A, there is no available volume in the pond for storage of stormwater. As a result, the ponds must have some type of a bleed-down device located below Level A. This normally will be a small orifice or V-notch weir, an underdrain in the berm or bank, or other device in the control structure. This bleed-down device will enable recovery of the storm water storage volume (between Level B and Level A). As a result, a minor discharge will occur for a

period of time after the end of the rainstorm (3 to 4 days are typical). This frees up storage volume for the next rain event. Any rain event below the design storm event should bleed down within 2 to 3 days. The bleed down device must be designed to allow the pond to regain the available storage volume within a maximum of five (5) days.

The bleed down device is normally located at the control structure (as shown in Figures 1 & 2). A staff gauge should be located at the control structure to allow for visual monitoring of the stage of the storage pond.

The permittee must ensure that reclaimed water is only delivered to the storage pond when the actual pool elevation is below level B. Automatic float controls or valves should be provided at the pond to preclude reclaimed water delivery to the pond when the pool elevation is at or above level B. The design should allow 6 to 8 inches of freeboard below the bleed down structure. Some ponds may have ”on demand” type delivery systems. Automatic shutoff controls are required to ensure that once the pond reaches the “control elevation”, the delivery of reclaimed water ceases.

11.3 Design Requirements

When constructing a new storage pond or retrofitting an existing pond, some basic hydrologic information is required. The permittee is responsible for obtaining the design basis for each pond and overflow structure from the designated user to determine if it is adequate for its intended use. The permittee must verify that there is sufficient volume for the reclaimed water storage and any stormwater storage needed for the drainage area of the designated holding pond. Therefore, information on the size of the drainage area, runoff coefficients, time travel, and other factors affecting runoff must be provided. This information must accompany the written user agreement, DDR, and NOI for permit application. Sketches of the discharge control structure and the stormwater/reclaimed water storage pond are needed. Elevations must be shown for full pool, control elevation, and freeboard. The watershed which drains into the pond must be identified and the drainage area determined. The submittal must include the following:

- The dimensions of the storage pond and the reclaimed water storage requirements.

- A map showing the proposed receiving stream and the proposed point of discharge

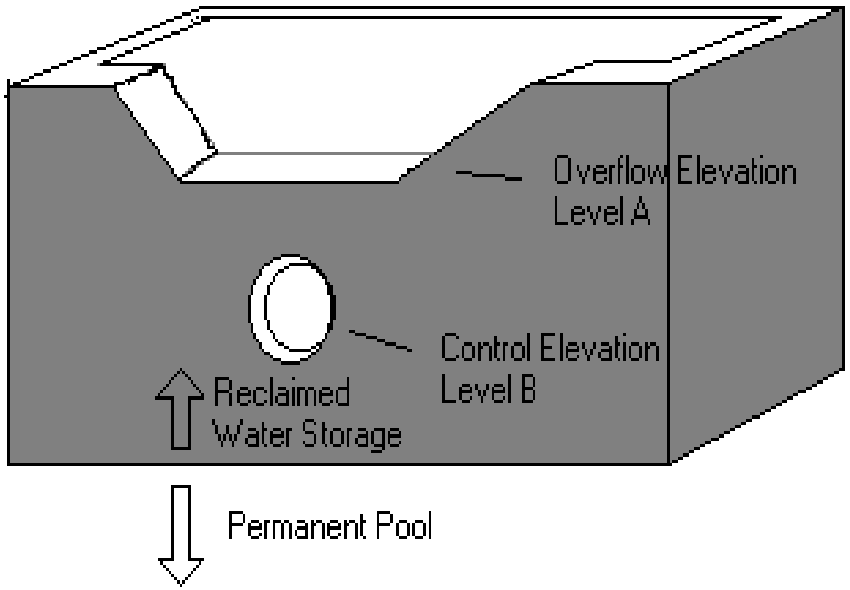
- Locations of sensitive downstream uses such as recreation areas, beaches or drinking water intakes.

- An analysis of historic records for daily rainfall for a period covering at least the past 20 years, using climatic data that are available from, or representative of, the area involved.

- An analysis of the historic records for steam flow in the proposed receiving stream. Because this information is sometimes not available, it may be necessary for the permittee to contact the United States Geologic Survey (USGS) to obtain flow estimates based on records of nearby/similar streams.

Some storage ponds are constructed and operated such that the pond is always (or almost always) full. In this case, any discharge of reclaimed water into the pond normally will result in a discharge out of the outlet structure. This situation must be handled as a continuously discharging system and a NPDES permit obtained as such. The provisions of these guidelines for intermittently discharging ponds are not appropriate for aesthetic ponds that are or almost always kept full.

Figure 1. Discharge Control Structure



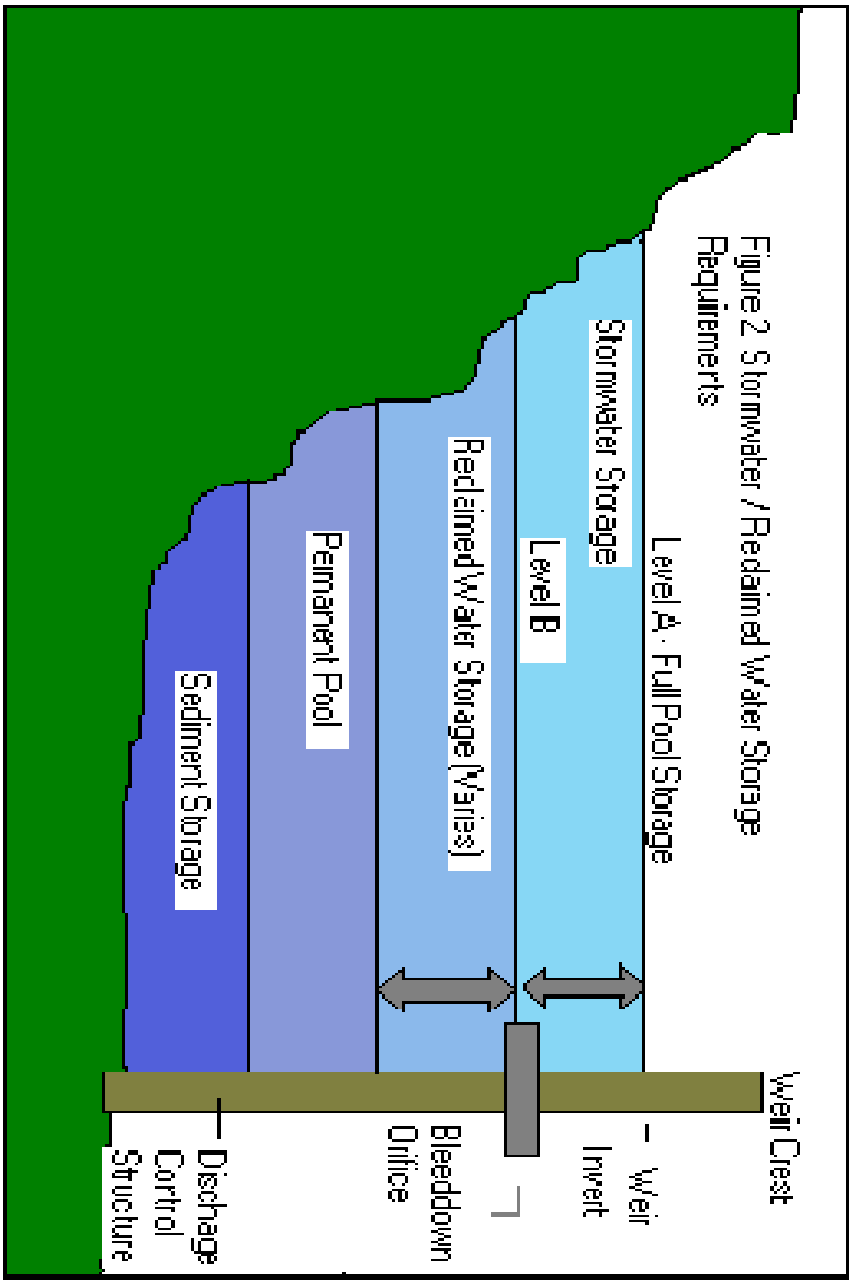


Figure 2 Stormwater / Reclaimed Water Storage Requirements
Level A - Full Pool Storage
Stormwater Storage
Level B
Reclaimed Water Storage (Varies)
Permanent Pool
Sediment Storage
Weir Crest
Weir Invert
Bleeddown Orifice
Discharge Control Structure

Appendix A

INORGANIC CONSTITUENTS

The use of reclaimed water for irrigation purposes requires periodic assessment of the inorganic constituents of the reclaimed water to evaluate its suitability to irrigate certain crops. The chemical and biological constituents of reclaimed water can vary considerably. Regular sampling of reclaimed water for these constituents is needed. The effects of the concentrations of specific water quality constituents can be seen in Table 1. The concentrations and problems caused with the overabundance of trace elements can be found in Table 2. These tables along with additional information can be found in Chapter 3 of the United States Golf Association (USGA) book: *Water Reuse for Golf Course Irrigation* (1997). We recommend contacting the local extension service or golf course association for a determination of the impacts of the dissolved salts on the local grasses/ornamentals. We appreciate the USGA allowing us to use these tables in this Appendix.

Table 1. Guidelines for Interpretations of Water Quality for Irrigation

		Degree of Restriction on Use		
Potential Irrigation Problem	Units	None	Slight to Moderate	Severe
Salinity[a]				
EC_w TDS	dS/m	<0.7	0.7 – 3.0	>3.0
	mg/L	<450	450 – 2000	>2000
Infilitration[c]				
SAR[b] = 0 – 3 and EC_w =		>0.7	0.7 – 0.2	<0.2
SAR = 3 – 6 and EC_w =		>1.2	1.2 – 0.3	<0.3
SAR = 6 – 12 and EC_w =		>1.9	1.9 – 0.5	<0.5
SAR = 12 – 20 and EC_w =		>2.9	2.9 – 1.3	<1.3
SAR = 20 – 40 and EC_w =		>5.0	5.0 – 2.9	<2.9
Specific Ion Toxicity				
Sodium (Na)				
Root adsorption	SAR	<3	3 – 9	>9
Foliar adsorption	Meq/L	<3	>3	
	Mg/L	<70	>70	
Chloride (Cl)				
Root adsorption	Meq/L	<2	2 – 10	>10
	Mg/L	<70	70 – 355	>355
Foliar adsorption	Meq/L	<3	>3	
	Mg/L	<100	>100	
Boron	Meq/L	<1.0	1.0 – 2.0	>2.0
Miscellaneous Effects				
Bicarbonate (HCO_3)	Meq/L	<1.5	1.5 – 8.5	>8.5
Unsightly foliar deposits	Mg/L	<90	90 – 500	>500
Residual chlorine	Mg/L	<1.0	1 – 5	>5

[a] EC_w = total salinity of the water

[b] SAR, Sodium Adsorption Ratio, $SAR = \frac{Na^{+1}}{\sqrt{\frac{Ca^{+2} + Mg^{+2}}{2}}}$, Cations in meq/L

[c] Infiltration is affected by both SAR and EC_w. The infiltration rate generally increases when the water is saltier and decreases with higher SAR values.

Adopted from Westcot and Ayers 1984; Farnham, et al, 1985

Table 2. Recommended Maximum Concentrations of Trace Elements in Irrigation Water

	Element	Recommended Maximum Concentration (mg/L)	Remarks
Al	Aluminum	5.0	Can cause non-productivity in acid soils (pH < 5.5), but more alkaline soils at pH > 7.0 will precipitate the ion and eliminate any toxicity
As	Arsenic	0.10	Toxicity to plants varies widely, ranging from 12 mg/L for Sudangrass to less than 0.05 mg/L for rice
Be	Beryllium	0.10	Toxicity to plants varies widely, ranging from 5 mg/L for Kale to 0.5 mg/L for bush beans
Cd	Cadmium	0.01	Toxic to beans, beets and turnips at concentrations as low as 0.1 mg/L in nutrient solutions. Conservative limits recommended due to its potential for accumulation in plants and soils to concentrations that may be harmful to humans.
Co	Cobalt	0.05	Toxic to tomato plants at 0.1 mg/L in nutrient solutions. Tends to be inactivated by neutral alkaline soils.
Cr	Chromium	0.10	Not generally recognized as an essential growth element. Conservative limits recommended due to lack of knowledge on its toxicity.
Cu	Copper	0.20	Toxic to a number of plants at 0.1 to 1.0 mg/L in nutrient solutions.
F	Fluoride	1.0	Inactivated by neutral and alkaline soils
Fe	Iron	5.0	Not toxic to plants in aerated soils, but can contribute to soil acidification and loss in availability of essential phosphorus and molybdenum. Overhead sprinkling may result in unsightly deposits on plants, equipment and buildings.
Li	Lithium	2.5	Tolerated by most crops up to 5 mg/L; mobile in soil. Toxic to citrus at low concentrations (<0.075 mg/L). Acts similarly to boron.
Mn	Manganese	0.20	Toxic to a number of plants at a few tenths to a few mg/L, but usually only in acid solution.
Mo	Molybdenum	0.01	Not toxic to plants at normal concentrations in soil and water. Can be toxic to livestock if forage is grown in soils with high concentrations of available molybdenum.
Ni	Nickel	0.20	Toxic to a number of plants at 0.5 mg/L to 1.0 mg/L; reduced toxicity at neutral or alkaline pH.
Pb	Lead	5.0	Can inhibit plant cell growth at very high concentrations.
Se	Selenium	0.02	Toxic to plants at concentrations as low as 0.025 mg/L and toxic to livestock if forage is grown in soils with relatively high levels of added selenium. An essential element to animals, but in very low concentrations.
Sn	Tin		Effectively excluded by plants; specific tolerance unknown
Ti	Titanium		(see remarks for tin)
W	Tungsten		(see remarks for tin)
V	Vanadium	0.10	Toxic to many plants at relatively low concentrations
Zn	Zinc	2.0	Toxic to many plants in widely varying concentrations; reduced toxicity at pH>6.0 and in fine textured or organic soils.

Adapted from Wescot and Ayers 1984