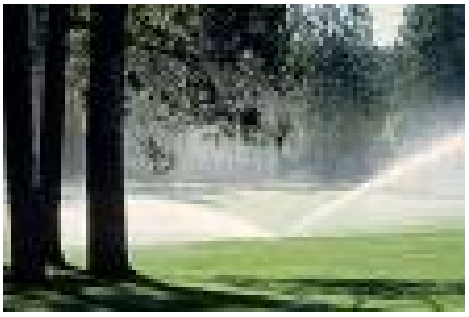
A NJDEP TECHNICAL MANUAL

Reuse It New Jersey !

RECLAIMED WATER FOR BENEFICIAL REUSE



NJDEP
Division of
Water Quality

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I. Introduction

This manual was developed to assist you in implementing a Reclaimed Water for Beneficial Reuse (RWBR) program for a wastewater treatment plant. RWBR programs may only be authorized by the Department under the authority of a NJPDES discharge permit.

The importance of RWBR programs first came to light during the drought of 1999 when we experienced firsthand the importance of protecting and conserving our potable water supplies. The subsequent drought of 2002 reinforced the concept of RWBR.

Reclaimed wastewater, which was once considered a waste for disposal, is now a resource desired by commercial entities, municipalities, county parks, and various recreation departments, and residential developments. N.J.A.C. 7:14A-2.1 established a responsibility for the Department to encourage and promote RWBR and water conservation. As a result, the Department's policy encourages applicants to evaluate alternative wastewater management techniques before submitting a permit application. These evaluations should include public health, economic, scientific, energy, engineering and environmental considerations. The ultimate goal is the development of environmental alternatives that provide the most economic and energy efficient RWBR methods.

This manual includes design, operation, and maintenance criteria for wastewater systems discharging reclaimed water for beneficial reuse as well as providing RWBR criteria for users of RWBR. Using this manual can help treatment plant owners establish flexible designs and sound engineering practices for managing wastewater in an environmentally sound manner. The manual is also intended to ensure wastewater discharges are free from substances that pose a serious threat to the public health, safety, and welfare.

The manual also includes:

- Effluent treatment level requirements for RWBR,
- Details on completing a Reuse Feasibility Study are found in Appendix RFS1 & RFS2,
- Details on the documents and reports needed to receive a "Reuse Site" approval from the Department,
- An explanation of the approval process, the operations protocol process, and the report review,
- How to implement a RWBR Program at your site, and
- A summary table (Appendix A) of the treatment requirements for various reuse applications.

II. RWBR Program Objective

To help preserve the highest quality water and reduce the export of freshwater out of basins in support of meeting water supply needs and natural resource protection.

III. What is Reclaimed Water for Beneficial Reuse?

Reclaimed Water for Beneficial Reuse ("RWBR") involves taking what was once considered waste product, giving it a specialized level of treatment and using the resulting high-quality reclaimed water for beneficial uses. In other words, the reclaimed water is used to replace or supplement a source of ground water or potable water consumption.

Depending upon the specifics of an application, extensive treatment and disinfection may be required to protect public health and environmental quality, while other applications involving limited public accessibility may not need a high level of treatment.

The following are just a few of the benefits of reuse:

- Reuse reduces demands on valuable ground water supplies, used for drinking water and irrigation.
- Reuse helps reduce pollutant loading to surface waters.
- Reuse may postpone costly investment for development of new water sources and supplies.
- Reuse allows multiple uses of land for agriculture and reuse of reclaimed water.
- Reuse can save money and can provide aesthetic value.

IV. Examples of Reuse Applications

Properly treated wastewater effluent has been used to augment potable water resources for decades and many states have highly successful reuse programs. There are many applications for RWBR. RWBR may not be utilized for activities associated with primary contact recreation. Primary contact recreation is defined as water-related recreational activities that involve significant ingestion risks including, but not limited to, wading, swimming, diving, surfing, and water skiing.

The following are some specific examples:

Landscape Irrigation — Reclaimed water can be distributed for irrigation of parks, golf courses, baseball/soccer/football fields, highway medians, cemeteries, and even residential lawns.

Agricultural Irrigation — Reclaimed water can safely be used to irrigate pasturelands and crops.

Industrial Uses — Industrial facilities and power plants can use reclaimed water for cooling equipment, parts washing and cleaning, equipment operation and various other manufacturing processes.

Fire Protection — Reclaimed water can be supplied to fire trucks, hydrants and sprinkler systems for fire fighting.

Aesthetic Fountains and Lagoons — Reclaimed water can be used in decorative ponds, fountains, and other landscaping features.

Construction Uses — For dust control, reclaimed water can be used at construction sites, landfills, and quarries. It can also be used for washing aggregate and making concrete.

Miscellaneous — Reuse water can be used as a water supply for commercial laundries, for vehicle washing, to flush sanitary sewers and reuse water lines, and to manufacture ice for ice rinks.

Other RWBR Applications

The Department may approve other uses of reclaimed water if the following requirements are met:

(1) All requirements of this manual are met; and

(2) The engineering report provides reasonable assurance that the intended use will meet applicable rules of the Department and will protect public health and the environment.

V. Planning Reclaimed Water for Beneficial Reuse Systems

According to the EPA's Manual, *Guidelines for Water Reuse* (document # EPA/625/R-04/108), planning is a fact-finding phase meant to rough out physical, economic, and legal bounds to a water reuse plan. The primary tasks are to:

1) locate potential sources of effluent for reclamation and reuse,
2) locate all potential markets for reclaimed water, and
3) develop good working relationships among wastewater managers, water supply agencies, and potential reuse water users.

There are many areas that need to be examined, such as institutional constraints, public perceptions and environmental impacts to list a few. EPA's manual identifies the following issues that should be addressed during the planning phase:

What local sources of effluent might be suitable for reuse?
What are the potential local markets for reuse water?
What public health considerations are associated with reuse, and how can these be addressed?
What are the potential environmental impacts of water reuse?
How would water reuse "fit in" with present uses of water resources in the area?
What are the present and projected user costs of freshwater in the area?
What existing or proposed laws and regulations effect reuse possibilities in the area?
What local, state or federal agencies must review and approve the implementation of a reuse program?

What are the legal liabilities of a purveyor or user of reclaimed water?
What sources of funding might be available to support the reuse program?
What reuse system would attract the public's interest and support?

After addressing the above issues, screening potential markets becomes essential. *Guidelines for Water Reuse* contains a wealth of information on screening potential markets and evaluating selected markets. It is highly recommended that you obtain a copy of this document as well as EPA's *Municipal Wastewater Reuse Document* (# 430/09-91-022). To obtain these documents, visit EPA's web site at www.epa.gov or contact your regional EPA office.

For water reuse planning, one must consider the intended purpose of the reuse water. This planning involves determining both effluent quality and quantity. For example, if golf courses were to be your major effluent re-users, the greatest demand for reclaimed water would most likely be in the summer months. Both diurnal and seasonal fluctuations in supply and demand must be taken into account as well as industrial contributions to the wastewater treatment facility. Wastewater treatment facilities that receive substantial amounts of high-strength industrial wastes may be limited in the number and types of suitable reuse applications.

For water reuse planning it is also critical to ensure that your plans are consistent with other regulating entities such as the Pinelands Commission or the Delaware River Basin Commission.

The concept of wastewater mining should also be considered for water reuse planning.
Wastewater mining is an alternative approach to provide RWBR for an end user when the cost of conveyance of the RWBR to the end user may be prohibitive. The Wastewater mining concept involves the construction of a satellite treatment system to treat mined raw influent at the end user location.

Finally, environmental impacts must be evaluated when planning reuse. Elimination or reduction of a surface water discharge by reclamation and reuse generally reduces adverse water quality impacts to a receiving stream. However, the implementation of reuse systems may have secondary environmental impacts that may need to be addressed as part of the planning and review process.

A. Minimum Effluent Treatment Requirements for RWBR

The planning process should include a close examination of your existing facility to determine what changes are necessary to meet the water quality and distribution requirements associated with your desired RWBR application. It is important to note that certain treatment requirements only apply when reclaimed water is distributed directly to the reuse location and only to that portion of the water that is to be reused. Additional effluent monitoring in many instances will be required when distributing effluent to reuse locations to ensure its safe and proper use. Monitoring results of the reclaimed water will appear on the facility's Discharge Monitoring Report (DMR) in the form of "Report Only" requirements rather than as effluent limitations on the DMR because RWBR effluent treatment requirements will be included in the narrative requirements of Part IV of the facility's operations permit. If a facility is unable to meet the treatment requirements of RWBR, it must divert its effluent to the existing, approved disposal system or reroute it through the wastewater treatment system.

One of the most critical objectives in a reuse program is assuring public health protection is not compromised through the use of reclaimed water. Other objectives, such as meeting user requirements, avoiding public nuisances and preventing environmental degradation, are equally important. However, the starting point remains the appropriate treatment of the reuse water.

The presence of toxic chemicals and pathogenic microorganisms in untreated wastewater creates the potential for adverse public health effects. Protection of a receiving stream and public health is achieved by reducing concentrations of pathogenic bacteria, parasites, enteric viruses and controlling the level of chemical pollutants.

Traditional wastewater treatment processes reduce the concentrations of wastewater pollutants to levels protective of a receiving water since the potential for human contact, inhalation and/or ingestion is minimal. When considering RWBR, an additional level of public health protection is necessary to further reduce pathogenic organisms. Advanced wastewater treatment processes are generally utilized for this purpose, particularly when high quality reclaimed water is necessary for the irrigation of recreational and urban landscaping, food crop irrigation, non-primary contact recreation applications and many industrial applications.

Chemical coagulation and filtration followed by chlorine disinfection to reduce bacteria to very low coliform levels and adequately inactivate pathogens. This form of disinfection has demonstrated the ability to remove or inactivate 5 logs (99.999 percent) of seeded poliovirus. Ultraviolet (UV) disinfection has been incorporated into surface water and ground water discharges and more recent studies have shown UV disinfection to be as effective as chlorination, especially with respect to pathogen inactivation. UV disinfection has also shown the ability to remove or inactivate 5 logs (99.999 percent) of seeded poliovirus. When used in conjunction with conventional treatment technologies, these systems can produce effluent essentially free of measurable levels of pathogens.

It is important to remember that it is not always necessary to treat your entire wastewater flow to RWBR standards. Only that portion of the flow that will be reused is required to meet the RWBR standards, although it may be easier or more practical to treat the entire flow in many circumstances. Some of the principal wastewater treatment processes to consider for water reclamation reuse are identified below.

Filtration is a common treatment process used to remove particulate matter. Filtration involves the passing of wastewater through a bed of granular media or membranes that retains solids. Removal efficiencies can be improved through the addition of certain polymers and coagulants. A filtration system prior to a disinfection system should be considered as part of the overall treatment process.

Nitrification is the term generally given to any wastewater treatment process that biologically converts ammonia nitrogen sequentially to nitrite nitrogen and nitrate nitrogen. Nitrification does not remove significant amounts of nitrogen from the effluent, it only converts it to another chemical form. Nitrification can be accomplished in many suspended and attached growth treatment processes when they are designed to foster the growth of nitrifying bacteria. A well-

designed and operated nitrification process will produce an effluent containing 1.0 mg/L or less ammonia-nitrogen. Ammonia- nitrogen can also be removed from effluent by several chemical and physical treatment methods such as air stripping, ion exchange, Reverse Osmosis, and breakpoint chlorination, although these methods tend to be uneconomical or difficult to operate in municipal applications. Ammonia removal should be examined closely, when considering reuse, especially since it is the first step for biological denitrification.

Denitrification is any wastewater treatment method that removes total nitrogen (NO_3+NH_3). Total nitrogen will be a limiting effluent parameter when reviewing most reuse applications, especially the land application of reuse water by spray irrigation. As with ammonia removal, denitrification is usually best done biologically for most municipal applications. Biological denitrification processes can be designed to achieve nitrogen concentrations between 2 mg/L and 12 mg/L total nitrogen (NO_3+NH_3). Denitrification may also be required when using effluent for agricultural irrigation of certain crops during specific times in the growing cycle (such as corn).

Nitrogen removal may have to be considered when planning a reuse program at your facility. Either chemical or biological methods or a combination of the two can remove nitrogen. The choice of methods will depend on site-specific conditions. A site evaluation and the engineering report submitted to the Department (as identified later in this manual) will help determine the extent of nitrogen removal required.

Other processes may also have to be examined, again dependent on the source of wastewater and the intended reuse application. Carbon adsorption treatment, for example, will remove several metal ions, particularly cadmium, hexavalent chromium, silver and selenium. Activated carbon has been used to remove unionized species such as arsenic and antimony from an acidic stream and it also decreases mercury to low pH values.

For all reuse applications, a requirement to meter the amount of RWBR supplied to each reuse application and location where the RWBR is utilized will be required.

The type of RWBR you intend to produce and supply will be dependent upon the findings in your planning phase as well as the capabilities of your wastewater treatment facility. NJDEP has identified four main categories of RWBR and the specific requirements for each. However, reuse is not limited to these four categories and other opportunities may exist that require additional or less treatment requirements. Those opportunities will be examined on a case-by-case basis. Following are the four primary categories identified by NJDEP:

1. Type I RWBR - Public Access Systems

Public Access RWBR involves the use of reclaimed water where public exposure is likely, thereby necessitating the highest degree of treatment. Typical examples of these applications include; spray irrigation of golf courses; baseball/soccer/football fields and parks; irrigation of landscaped areas; highway median strip irrigation and/or decorative outdoor fountains. In order to qualify for Public Access RWBR, the minimum design capacity of the wastewater treatment plant should be 0.1 million gallons per day (MGD).

In addition to the minimum treatment requirements for public access reuse identified below, RWBR must also meet all the treatment effluent standards specified in the permit, prior to distribution to the reuse location.

Disinfection

Where chlorine is utilized for disinfection, a total chlorine residual produced oxidant of at least 1.0 mg/L shall be maintained for a minimum contact time of 15 minutes at peak hourly flow. The treatment facility shall provide continuous on-line monitoring for chlorine residual/chlorine produced oxidant (CPO) at the compliance monitoring point. For spray irrigation, CPO levels for disinfection should be continually evaluated to ensure chlorine residual levels do not adversely impact vegetation at an application site.

Where ultraviolet disinfection is used, a design UV dose of 100 mJ/cm^2 under maximum daily flow must be used. This dose must also be based on continuous monitoring of lamp intensity, UV transmittance and flow rate. All aspects of the UV system must meet the requirements of the December 2000 National Water Research Institute's *Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse*.

The use of alternative methods of wastewater disinfection, such as ozone disinfection may satisfy the high-level treatment requirements of public access reuse water. However, the permittee shall submit the following information in support of a request to use an alternative method of disinfection for reuse:

1) The operating protocol as per the "Permitting Procedures and Requirements" section of this manual; and

2) Statistically significant monitoring data, indicating compliance with the 2.2 fecal coliforms per 100 ml requirement for reuse water.

Fecal Coliform

Fecal coliform concentrations shall not exceed 14 fecal coliforms per 100 mL at any given time (as an instantaneous maximum level). Fecal coliform concentrations must also meet a weekly (7 day) median value of 2.2 fecal coliforms per 100 mL.

Total Suspended Solids (TSS)

Total suspended solids (TSS) shall not exceed 5.0 mg/L before disinfection. Continuous monitoring for turbidity before disinfection will be required. A statistically significant correlation between turbidity and TSS shall be established prior to commencement of the RWBR program. This correlation should be done as part of a daily monitoring program for at least 30 days. As part of the operations protocol, to ensure continuous compliance with the 5.0 mg/L TSS limitation, turbidity must be monitored continuously and TSS at least weekly. The correlation established for the facility, between TSS and turbidity, must be updated at a minimum on an annual basis.

TSS levels are also significant depending upon the method of disinfection used. In the case of chlorination, in no case shall the level of TSS exceed 5 mg/l. For UV disinfection, in no case shall the level of turbidity exceed 2 nepholemetric turbidity units (NTU) while still maintaining the 5 mg/l maximum level for TSS. RWBR limitations shall be met both before and after disinfection for TSS or turbidity and prior to discharge to a reuse location. Only RWBR meeting the conditions detailed in the approved "Operations Protocol" shall be released to the reuse location.

Total Nitrogen (NO_3+NH_3)
RWBR limitations shall not exceed a total nitrogen concentration of 10 mg/L. The Department may impose a total nitrogen concentration limitation greater than 10 mg/L if the permittee can demonstrate that a concentration greater than 10 mg/L is protective of the environment. To justify a greater than 10 mg/L total nitrogen concentration limitation, the permittee shall submit the additional specified information listed under the Engineering Report, Parts C through F.

Loading Rate
The Department requires that any surficial application of RWBR be done in a manner that prohibits sheet flow, runoff conditions or persistent ponded water on the ground surface. Without conducting a subsurface evaluation, the hydraulic loading rate for RWBR for surficial irrigation (spray, ridge and furrow, etc.) may not exceed a maximum of two (2) inches per week. The Department may authorize a higher hydraulic loading rate if a permittee can demonstrate that a higher rate is warranted. To justify an increase in hydraulic loading rates, the permittee shall submit the additional specified information listed under the Engineering Report, Parts C through F. For applications other than surficial irrigation, a loading or volumetric rate will be established on an individual application basis and should be thoroughly justified in your proposal to the Department.

Additional Limits for Constituents in RWBR for Irrigation
The minimum guidelines for treatment of metals and toxic chemicals established in the USEPA's *Guidelines for Water Reuse* (EPA/625/R-04/108) to protect human health and the environment are to be achieved by NJPDES permitted facilities that are authorized for RWBR applications. Copies of the past five years of priority pollutant scans completed by the facility are to be submitted as part of the RWBR approval process.

2. Type II RWBR - Restricted Access and Non Edible Crop Systems

Restricted access and non-edible crops RWBR involves the use of reclaimed water where public exposure is controlled; therefore, treatment requirements may not be as demanding as in a public access RWBR system. Examples of restricted access and non-edible crops RWBR may include activities such as spray irrigation of sod farms and pasturelands, or similar areas where public access to the application area is restricted. These systems do not include the irrigation of edible crops.

Total Nitrogen (NO_3+NH_3)
RWBR Restricted Access Spray Irrigation limitations shall not exceed a total nitrogen concentration of 10 mg/L. The Department may impose a total nitrogen concentration limitation

greater than 10 mg/L if the permittee can demonstrate that a higher concentration is protective of the environment. To justify a greater than 10 mg/L total nitrogen concentration limitation, the permittee shall submit the additional specified information listed under the Engineering Report, Parts C through F.

Hydraulic Loading

The hydraulic loading rate for RWBR restricted access spray irrigation shall not exceed a maximum of two (2) inches per week per site. The Department may authorize a higher hydraulic loading rate if the permittee can demonstrate a higher rate is protective of the environment. To justify an increase in hydraulic loading rates to the Department, the permittee shall submit the additional specified information listed under the Engineering Report, Parts C through F.

Additional Limits for Constituents in RWBR for Irrigation

The minimum guidelines for treatment of metals and toxic chemicals established in the USEPA's *Guidelines for Water Reuse* (EPA/625/R-04/108) to protect human health and the environment are to be achieved by NJPDES permitted facilities that are authorized for RWBR applications. Copies of the past five years of priority pollutant scans completed by the facility are to be submitted as part of the RWBR approval process.

Disinfection

The treatment facility shall establish a written standard operating procedure ("SOP") that ensures all effluent that is utilized for RWBR has satisfactorily met the disinfection requirements. The SOP required for RWBR shall be made available to the Department, upon request. CPO levels should be continually evaluated to ensure the RWBR will not adversely impact vegetation. For restricted access spray irrigation applications, the fecal coliform concentration shall not exceed a monthly geometric mean value of 200 fecal coliforms per 100 ml or a weekly geometric mean value of 400 fecal coliforms per 100 mL.

Where ultraviolet disinfection is used, a design UV dose of 75 mJ/cm^2 under maximum daily flow must be used. This dose must also be based on continuous monitoring of lamp intensity, UV transmittance and flow rate. All aspects of the UV system must meet the requirements of the December 2000 National Water Research Institute's *Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse*.

The distribution of RWBR shall not produce surface runoff or ponding for any significant amount of time. Land application sites shall not be frozen or saturated when applying RWBR. For a period of 15 days from the last application of reclaimed water, land application areas shall not be used for the grazing of cattle whose milk is intended for human consumption. There are no restrictions on the grazing of other cattle.

3. Type III RWBR - Agricultural Edible Crop Systems

This use of reclaimed water involves the irrigation of edible crops. The same high-level treatment requirements associated with public access uses also apply to reuse for edible crops. The following additional requirements also apply:

(1) Spray irrigation of edible crops is only allowed if those crops will be peeled, skinned, cooked or thermally processed before consumption.

(2) Using an application method that allows for direct contact of reuse water on edible crops that will not be peeled, skinned, cooked or thermally processed before consumption is prohibited. However, it is permitted to use an indirect method that precludes direct contact with the reclaimed water (such as ridge and furrow irrigation).

(3) The permittee shall submit to the Department, as part of the authorization request, a listing of the inventory of commercial agricultural operations using reclaimed water to irrigate edible crops. In addition, an inventory of edible crop irrigation shall be submitted annually to the Department with the annual report of reclaimed water utilization. The inventory of edible crop irrigation shall include the following:

a. Name of the agricultural operation.
b. Name and telephone number of the owner or operator of the agricultural operation.
c. Address of the agricultural operation.
d. Edible crops irrigated with reclaimed water.
e. Type of application (irrigation) method used.
f. Approximate area under irrigation on which edible crops are grown.

(4) If requested, the Department may authorize special demonstration projects to collect and present data related to the direct application of reuse water on crops which are not peeled, skinned, cooked, or thermally processed before consumption. Crops produced during such demonstration projects may be used as animal feeds or may be thermally processed or cooked for human consumption.

(5) The RWBR shall meet all treatment effluent standards in the permit, including the public access reuse high-level treatment standards prior to discharge to a reuse location. The spray irrigation of reclaimed water shall not produce surface runoff or ponding.

4. Type IV RWBR - Industrial Systems, Maintenance Operations and Construction

Industrial RWBR involves the use of reclaimed water in industrial applications such as cooling water and/or washing operations. The uniqueness of each industrial reuse application makes it impossible to establish specific treatment standards for this general category of reuse. Prior to implementation, all industrial reuse systems require a case-by-case review by the Department. Some applications, such as the reuse of effluent for non-contact cooling water, may require very little, if any changes to the level of treatment the wastewater is already receiving at the wastewater treatment plant.

Examples of construction uses can be dust control, washing of aggregate, and/or the use of RWBR for cement mixing. Public Works Maintenance Operations activities utilizing RWBR can include sewer jetting, washing of public works vehicles, and street cleaning to name a few. As with many industrial applications, construction and/or maintenance operations utilizing RWBR, the RWBR water may require very little if any changes to the treatment levels the effluent is already receiving at the wastewater treatment plant.

VI. IMPLEMENTING AN RWBR PLAN

A. Permitting Procedures and Requirements

A decision to implement a reuse program should be based on the results of your planning investigations. Implementation of a RWBR Plan can only occur under the authority of a NJPDES Permit for a wastewater treatment facility. Below are the steps a NJPDES-permitted facility must follow to obtain Department approval for instituting a reuse program along with the reports and documents needed. (Note: New facilities require the information listed in this manual and a complete NJPDES permit application consistent with the requirements at N.J.A.C.7:14A– 4.)

All RWBR locations must be approved by the Department prior to the distribution of reclaimed water to a RWBR location. This requires a modification of a NJPDES existing permit, significant changes during the renewal process or a request to have the conditions included in the issuance of a new permit. Modification of an existing NJPDES permit for inclusion of RWBR conditions shall be submitted on the "RWBR Authorization Request" form, which can be found in RFS Appendices of this manual. No permit fees are required for submittal of this request. The Department will then approve of individual reuse locations in the form of an administrative or minor modification to an existing NJPDES permit that is authorized for a type of reuse application. The regulation and management of individual users of reclaimed water will be administered by NJPDES permittees through the Reuse Supplier and User Agreements with individual users of reclaimed water or by local ordinance. NJPDES permittees shall not issue individual reuse water permits to individual property owners.

Changes to the current/existing Areawide Water Quality Management Plans (N.J.A.C. 7:15) for the area may be required if the facility discharges into a non-tidal receiving stream. All discharges to tidal receiving waters only require a minor revision to the current/existing Water Management Plan, typically a 30-day process.

For facilities that will be storing public access RWBR in basins prior to irrigating or other beneficial uses, no NJPDES permit will be required for those basins. This exemption only applies to basins receiving RWBR after acceptably meeting all public access monitoring criteria and where those basins do not have a direct discharge outlet to surface waters.

B. Engineering Report

An engineering report shall be submitted to the Department in support of reuse authorization requests for new or expanded RWBR projects.

The engineering report submission requirements for modifications to existing RWBR projects, Category IV RWBR (Industrial Reuse) and for those existing facilities which have had past violations of permit conditions or water quality standards shall be determined on a case-by-case basis by the Department. Such determinations shall be based on the frequency and severity of past violations, the potential for adverse affects on reuse water quality and on surface and ground water quality, and the scope of proposed modifications.

The **Engineering Report** for Categories I, II, and III RWBR shall include the following:

1. Land Use Requirements

(1) The exact boundaries of the reuse project, with setback distances shown (see "Setback Distances" in this manual), shall be depicted on the most recent USGS topographic maps. These maps shall show present land uses within 0.5 miles of the site boundaries;
(2) All potable and non-potable water supply wells and monitoring wells shall be located on USGS maps. The well depth, yield, and screen interval within 500 feet of the reuse application sites shall be provided along with the use (e.g., potable) and ownership (e.g., private);
(3) If expansion of an RWBR project is anticipated, the area likely to be used in the expansion shall be shown on the maps; and
(4) Surface water locations, within 0.5 miles of the RWBR project site, shall be provided on the maps and shall include classification, uses, and approximate distance from the site.

2. Project Evaluation

(1) An evaluation of the overall long-term effect of the proposed project on environmental resources in the area shall be provided. The evaluation shall include aspects such as changes in water table elevations due to natural fluctuations and the reuse project, prediction of the rate and direction of movement of applied reuse water, changes in water quality in the area associated with the project, and similar information.
(2) Justification and documentation for using setback distances, selection of hydraulic loading rates, and loading and resting cycles shall be provided.
(3) An evaluation of the proposed project with respect to public health, safety, and welfare shall be provided.
(4) Forecasts of flows and reuse water characteristics for the current and design year shall be provided, including:
a. Physical, chemical, and biological characteristics and concentrations, and
b. Reuse water flow patterns – total annual, monthly average, daily average, daily maximum, and seasonal peak one-hour flow during current and design years.
(5) A site plan showing existing and proposed operations and unit processes shall be provided.
(6) Technical information and design criteria for a reuse/spray irrigation system shall be provided, including:
a. Hydraulic, organic, and nutrient loadings – minimum, average, and maximum quantities;
b. Flow metering (at the wastewater treatment facility);
c. Monitoring points; and
d. Concentrations of reuse water percolated to ground water or being discharged to surface waters, with supporting data including design calculations.
(7) Operation and control strategies shall be provided.

3. Soils Information

(Required as a part of the Engineering Report, if a permittee is seeking approval for a greater than 2 inches per week hydraulic loading rate and/or greater than 10 mg/ L total nitrogen (NO_3+NH_3) concentration limitation)

(1) A soils map of the RWBR site shall be provided. The soils shall be named and described in accordance with the standard criteria (e.g. soil surveys) of the USDA, Unified or Burmeister Soil Classification System, and/or Rock Quality Description System unless advised by the soil scientist of the NRCS that soils present are not appropriate for such characterization.

(2) Physical characteristics of each significant soil, subsoil, or substratum layer to a depth of 10 feet below the average water table, or to a 20-foot depth (as measured below the lowest point on the site) if no water table is encountered, shall be provided. Representative soil profiles of the site shall be provided. Soil characteristics such as texture, hydraulic conductivity, available water capacity, organic matter content, pH, sodium adsorption ratio, and cation exchange capacity should also be investigated. Appropriate chemical characteristics shall be determined for soil profile horizons active in the chemical and biological renovation of reclaimed water or effluent.

Specific sites used for determining hydraulic conductivity shall be shown on the soils map, and data shall be submitted to substantiate that the proposed site is hydrologically capable of accommodating the design loading and application rate.

(3) For projects with an approved reuse location, where expansion of the existing site or the addition of a new similar reuse location (similar in soil, hydrogeologic and land management systems profiles), the Department may accept an abbreviated report of the soil characteristics at the proposed site (See Section “G”).

4. Hydrogeologic Survey

(Required as a part of the Engineering Report, if permittee is seeking approval for a greater than 2 inches per week hydraulic loading rate and/or greater than 10 mg/ L total nitrogen (NO_3+NH_3) concentration limitation)

(1) Hydrogeologic data necessary to evaluate the capability of the proposed project to perform successfully at the site on a long-term basis shall be provided. This information shall include, but not be limited to, geophysical information concerning known "solution openings" and sinkhole features within one mile of the site; the identification (with applicable geologic sections), extent or continuity, and hydrologic characterization of aquifers and confining zones underlying the site (i.e., horizontal and vertical hydraulic conductivity, porosity, thickness); head relationships between aquifer systems; and information on the annual range of ground water elevations at the proposed site.

(2) The velocity and direction of existing ground water movement, and the points of discharge, shall be shown on maps of the area. Similar information regarding environmental impact conditions anticipated as a result of the project shall be provided.

(3) Information on potable and non-potable water supply wells (and monitoring wells, as appropriate, including the depth, length of casing, cone of depression and, geophysical surveys of the wells (if available) shall be provided.

(4) Flood prone areas on the proposed site and within 0.5 mile of the site shall be located on a map. Flooding frequencies and magnitude shall be based upon New Jersey State Flood Plans.

(5) For projects with an approved Reuse location where expansion of the existing site or new similar (similar in soil, hydrogeologic and land management systems profiles) public access spray irrigation sites, the Department may accept an abbreviated report from the permittee covering the hydrogeologic characteristics at the proposed site. (See Section "G" below)

5. Land Management System

(Required as a part of the Engineering Report, if permittee is seeking approval for a greater than 2 inches per week hydraulic loading rate and/or greater than 10 mg/ L total nitrogen (NO_3+NH_3) concentration limitation)

(1) The present and intended soil-vegetation management program shall be discussed and the reuse location's vegetative covers identified. Reclaimed water to be applied shall be characterized in terms of its physical, chemical, and biological properties. Data and other documentation to verify the uptake of nutrients (such as nitrogen and phosphorus), moisture and salt tolerances, pollutant toxicity levels, yield of crops and similar information shall be provided. For projects requesting authorization for reuse, detailed water and nutrient budgets (balances) shall be included.

(2) Harvesting frequencies and the ultimate use of crops shall be indicated. Length of operating seasons, application periods and rates, and resting or drying periods shall also be described.

(3) The best available information (and technical assistance) from organizations or individuals qualified in the agricultural/agronomic aspects of reuse and spray irrigation shall be used in the preparation of the above report information.

(4) Plans for storage, reuse, or disposal of reuse during crop removal, wet weather, control of pests, equipment failures, or other problems precluding land application shall be described.

6. Pollutant and Hydraulic Loading Rates

(Required as a part of the Engineering Report, if permittee is seeking approval for a greater than 2 inches per week hydraulic loading rate and/or greater than 10 mg/ L total nitrogen (NO_3+NH_3) concentration limitation)

(1) Hydraulic loading rates shall be established after evaluating the soil-plant system's ability to remove pollutants from reclaimed water.

(2) Nitrogen loading shall promote both the use by vegetation and nitrification-denitrification reactions in the soil. If supplemental fertilizers are used, the effect of such fertilizer use on nitrogen concentrations in ground water shall be assessed.

(3) In establishing loading rates, the following additional factors shall be examined: the infiltration capacity and hydraulic conductivity of the geologic materials underlying the site, the resultant pollutant load's assimilative capacity within the soil-plant system, methods to eliminate surface runoff or ponding of the applied reclaimed water, and the quality and use of underlying ground water (which may dictate the loading rates to be used).

(4) A justification for loading rates shall be included. This justification shall be based on the renovating and hydraulic capacity of the soil-plant system, the existing quality and use of surface or ground water in the area, and other relevant hydrogeologic conditions.

Additional Design Information – Note: Additional information may be required in the Engineer's report pursuant to the "Design Considerations" section (later in this manual).

7. Abbreviated Reports

For projects involving only the expansion of existing reuse sites in public access areas, the Department may accept an abbreviated engineering report with the following conditions:

(1) The average annual hydraulic loading rate calculations shall be provided in the abbreviated report, and

(2) No percolation to ground water is used in the water balance calculations.

Please contact the your case manager in the Division of Water Quality for specific abbreviated report requirements.

C. Operation Protocols

An Operation Protocol is a document, describing how a wastewater treatment facility is operated to ensure that only reuse water meeting the applicable standards is released to a reuse system. It is a detailed set of instructions for the operators of facilities. An Operation Protocol shall be submitted to the Department in support of all reuse authorization requests for RWBR. The requirement for an Operation Protocol may be waived by the Department for certain types of industrial reuse, depending on the intended reuse application if wastewater quality is not an issue for any reason. An Operation Protocol shall be approved by the Department before a reuse system is operated. Only Operation Protocols providing reasonable assurances that treatment and disinfection requirements will be met will be approved.

1. Minimum Operation Protocol Requirements

(1) The criteria used to make continuous determinations of the acceptability of the reuse water being produced. This shall include the set points for parameters measured by continuous on-line monitoring equipment.

(2) The physical steps and procedures followed by the operator when substandard water is produced.

(3) The physical steps and procedures to be followed by the operator when the treatment facility returns to normal operation and acceptable quality reuse water is again being produced.

(4) Procedures to be followed during a period when an operator is not present at the treatment facility.

(5) The physical steps and procedures to be followed by the operator when the operator returns to the treatment facility, following an unattended period.

(6) A New Jersey Licensed Professional Engineer certification that the reuse limitations can be met.

(7) Any basin that requires draining or lowering and will discharge to a surface water body must not receive RWBR for at least 14 days prior to the draining event.

2. Operation Protocol Updates

The permittee shall periodically review and revise the Operation Protocol, as appropriate, to ensure satisfactory system performance. The Operation Protocol shall be updated when operational or benchmark changes are made at the facility providing RWBR. The Operation Protocol shall also be submitted for Department review with each permit renewal application. Renewal applications shall include the following:

(1) Current procedures and criteria addressing the requirements of reuse.

(2) Evaluation of the effectiveness of the procedures and criteria in ensuring that reuse requirements are met. This shall include an evaluation of any violations of permit requirements during the previous permit. This also shall include an analysis and correlation's of parameters monitored continuously against parameters regulated by the permit (for example, turbidity versus total suspended solids).

D. Reuse Supplier and User Agreement

A copy of all Reuse Supplier and User Agreements shall be submitted to the Department in support of reuse authorization requests. A Reuse Supplier and User Agreement is a binding agreement between the party (e.g., a wastewater treatment facility) who supplies reuse water and the user (e.g., privately owned & operated golf course or any other property owned by another party). The agreement is to ensure that construction, operation, maintenance, and monitoring for the reclaimed water meets the requirements of the NJPDES Rules and Regulations for reclaimed water. RWBR systems shall be operated and maintained to achieve applicable waste treatment requirements, before final release of reclaimed water to the user and the environment. The following requirements apply to Reuse Supplier and User Agreements:

(1) Where the treatment/reuse/disposal system is under the direct control of the permittee for the useful life of the facilities, the permittee shall maintain control over, and be

responsible for, all activities inherent to all reuse and reuse location application systems to ensure the entire reuse or waste treatment system operates as approved by the Department;

(2) Where the wastewater treatment plant permittee reuses water using property owned by another party, a binding agreement between the involved parties is required to ensure that construction, operation, maintenance, and monitoring meet the requirements of NJPDES Rules and Regulations. Such binding agreements are required for all reuse sites not owned by the permittee. The permittee shall retain primary responsibility for ensuring compliance with all requirements of the NJPDES Rules and Regulations;

(3) Reuse application systems using crops for the uptake of nutrients shall provide for removal of the crop at appropriate intervals as described in the engineering report and as approved by the Department; and

(4) The copy of the Reuse Supplier and User Agreement submitted to the Department shall detail how compliance with the reuse program requirements will be met.

E. Treatment Works Approval

Prior to construction and/or placing a reuse system into operation, a Treatment Works Approval (TWA) permit shall be required for:

(1) Process units that may be added in order to meet additional NJPDES permit limitations for reuse, such as filtration systems and/or additional chlorine contact chambers. Process units for the sole purpose of achieving a higher quality reclaimed water for beneficial reuse and not to meet NJPDES permit limitations are exempt from obtaining a TWA.

(2) All new conveyance lines and/or storage units used in delivering reuse water to reuse locations. Pond storage systems and distribution lines or equipment located at a reuse location site are exempt.

(3) TWAs shall comply with the requirements at N.J.A.C. 7:14A-22 and 23. You may contact the Bureau of Financing and Construction Permits at (609)984-6840 with any questions.

F. Cross-Connection Control

In support of reuse authorization requests, the permittee is required to comply with the New Jersey Safe Drinking Water Act, N.J.A.C. 7:10-10.l, Physical Connections and Cross Connections Control as well as the Plumbing Subcode of the New Jersey State Uniform Construction Code N.J.A.C. 5:23.

(1) If the reuse distribution system is located at a site with a public community water system, a Physical Connect Permit Application shall be submitted to the Department's Bureau of Safe Drinking Water. A copy of the New Jersey Safe Drinking Water Act and Application Form for Initial Physical Connection Permit can be obtained by contacting the Department's Bureau of Safe Drinking Water at 609-292-5550.

(2) If the reuse distribution system is located at a site with a non-community water or non-public water systems, a Physical Connect Permit Application is not required. Compliance with the Plumbing Subcode of the New Jersey State Uniform Construction Code N.J.A.C. 5:23 is still required.

(3) Questions pertaining to public community water systems should be directed to the Department's Bureau of Safe Drinking Water. Questions pertaining to non-community water or non-potable water systems should be directed to the local plumbing subcode official. State or federal sites should direct their questions to the Department of Community Affairs.

G. Design Considerations

1. Considerations for Cross-connection Control

(1) RWBR water shall not be in primary contact recreation applications.

(2) RWBR water may be used to irrigate landscaped areas with a tank truck only if the following requirements are met:

a. The truck used to transport and distribute reclaimed water is not used to transport potable water that is used for drinking water or any other fluids intended for human consumption.

b. The distribution of reclaimed water is in accordance with the requirements of this manual: and,

c. The truck used to transport and distribute reclaimed water is not used to transport waters or other fluids that do not meet, at a minimum, the treatment requirements for reuse water as specified in this manual, unless the tank has been evacuated and properly cleaned prior to the addition of the reclaimed water.

(3) Conversion of existing facilities.

a. Existing water lines, sewers, and wastewater transmission lines may be converted for use as reclaimed water transmission lines with Department approval.

b. Applicants wanting to convert these types of facilities to reuse water transmission lines shall comply with the TWA requirements in this manual as well as the requirements of Section 5 – "Cross Connection Control."

(4) No cross-connections to potable water systems shall be allowed.

(5) RWBR delivery pipes shall not be connected into any storm water conveyance or pipe that is not the final delivery point prior to final use. For example, RWBR may be delivered directly to a storm water basin prior to irrigating, but may not be interconnected with storm water pipelines prior to that basin for the purposes of minimizing RWBR delivery lines.

2. Setback Distances

The following setback guidelines are the minimum requirements for each category of reuse. The Department may require additional or alternative setbacks based upon individual specific

proposals for reuse. All minimum setback distances are calculated from the edge of the wetted perimeter of the particular RWBR application and should include considerations for aerosol transmission. Any category that does not require a setback means that RWBR may have a wetted perimeter up to the edge of that area, but may not contact or cross over the noted feature (i.e., buildings, roadways, property lines, public eating areas, bathing facilities, etc.) unless specifically authorized by the Department.

Type I and III Reclaimed Water for Beneficial Reuse for Public Access and Agricultural Edible Crops Systems

(1) There shall be a setback distance of 75 feet from the edge of a wetted public access land application area to potable water supply wells that are existing or have been approved for construction (but not yet constructed). The 75 feet setback distance can be reduced if conditions of N.J.A.C. 7:14A-23.6 (b) 5 are satisfied. A utility providing reuse water for residential irrigation may also adopt and enforce an ordinance prohibiting private drinking water supply wells in residential areas. This setback distance requirement does not apply to closed loop heating or air conditioning return wells.

(2) No setback distance is required to any non-potable water supply well.

(3) A 75-foot setback distance shall be provided from a reclaimed water transmission line or land applied area to all potable water supply wells. The 75 feet setback distance can be reduced if conditions of N.J.A.C. 7:14A-23.6 (b) 5 are satisfied.

(4) Setback distances for potable water supply wells shall be applied for new or expanded reuse projects.

(5) Setback distances are not required for surface waters, other than PL, FW1 and Category 1 surface waters, or other protected areas. Setback distances for PL, FW1 and Category 1 surface waters and other environmentally sensitive areas (Pinelands, shellfish beds, etc.) will be determined on a case by case basis.

(6) Low trajectory nozzles, or other means to minimize aerosol formation shall be used within 100 feet of outdoor public eating, drinking and bathing facilities.

(7) A setback distance of 100 feet shall be maintained from indoor aesthetic features (such as decorative pools or fountains) and adjacent indoor public eating and drinking facilities when the aesthetic features and eating and drinking facilities are within the same room or building space.

(8) The edge of the wetted perimeter of the RWBR application shall not cross into adjoining sites; properties or public roadways that are not part of the Department approved RWBR location.

(9) Direct spraying or aerosol transmission of RWBR onto any structure or across property lines is prohibited. Additional setbacks from the wetted perimeter may be required for privately owned occupied dwellings adjacent to commonly owned or leased land utilizing RWBR.

Type II RBRW for Restricted Access for Agricultural Use

(1) There shall be a setback distance of 500 feet from the edge of a wetted public access land application area to potable water supply wells that are existing or have been approved for construction (but not yet constructed).

(2) No setback distance is required to any non-potable water supply well.

(3) A 100-foot setback distance shall be provided from a reclaimed water conveyance or application location to a public water supply well. The 100 feet setback distance can be reduced if conditions of N.J.A.C. 7:14A-23.6 (b) 5 are satisfied

(4) Setback distances for potable water supply wells shall be applied for new or expanded reuse projects.

(5) Setback distances of 500 feet from FW1 surface waters, Pineland Waters and Category 1 Shellfish Waters. All other surface water and wetland setback distances shall be established on a case-by-case basis.

(6) Setback distances of 100 feet from any property line, outdoor public eating, drinking and bathing facilities.

(7) The edge of the wetted area of the RWBR shall not cross into adjoining sites that are not part of the Department approved RWBR location.

(8) Setback distances of 400 feet from any residence, dwelling or occupied structure.

3. Access Control and Advisory Signs

For RWBR for public access and agricultural edible crops, no access control provisions are needed. However, the public shall be notified of the use of RWBR. This shall be accomplished by posting advisory signs designating the nature of the reuse project area where reuse is practiced, notes on scorecards, or by other methods. International signage is also encouraged. Examples of some of the notification methods include posting of advisory signs at entrances to residential neighborhoods where reuse water is used for landscape irrigation, and posting advisory signs at golf course entrances and at the first and tenth tees. The use of purple as a prominent color on advisory signs and written notices related to a reuse project is recommended and encouraged, but is not required.

For RWBR for restricted access, access controls are needed and appropriate advisory signs designating the location as “Restricted Access” shall be posted around the site boundaries to designate the nature of the project area. For RWBR for restricted access and agricultural crops (edible or non-edible), all employees with access to the areas where RWBR is being applied must be notified in writing of the activity and must receive awareness instruction with respect to the exposure of RWBR which does not meet public access criteria. This awareness instruction must be specified in the RWBR Operation Protocol.

4. Storage Requirements

System storage shall not be required when another permitted reuse system or effluent disposal system is incorporated into the system design. If system storage is not required, flow equalization

or storage provisions should be evaluated in the engineering report to ensure reuse water flows will match the demand pattern during a diurnal cycle. If system storage ponds are utilized, they do not have to be lined. However, reject storage ponds shall be lined or sealed to prevent measurable seepage and minimize potential subsurface impacts.

Existing or proposed ponds (such as golf course ponds) are appropriate for storage of reuse water and stormwater management if all Department requirements are met. However, the use of ponds for reuse water storage shall not impair the ability of the ponds to function as otherwise intended, such as retention ponds, created as part of stormwater management systems. Any pond that has a direct connection to a surface water body may not be used for reuse water, such as detention ponds.

5. Fire Protection

Reclaimed water may be used for fire protection purposes. Accordingly, reclaimed water may be supplied to fire hydrants; however, there be shall no connection to potable water supplies. Reclaimed water may also be used to provide water for fire protection in sprinkler systems located in commercial or industrial facilities or buildings; and in motels, hotels, apartment buildings, and condominiums provided workers, guests, or residents do not have access to the plumbing system for repairs or modifications.

Fire protection systems using reclaimed water shall be designed and operated in accordance with local fire protection codes, regulations, or ordinances. If reclaimed water will be used only for fire protection, the Department may approve alternative levels of reliability, operation controls, and operator attendance. This type of reuse will require applicants to provide an affirmative demonstration in the engineering report that alternative controls will provide controls on reclaimed water production equivalent to the full requirements of this section. The engineering report shall include reasonable assurances that public health will be protected. The report shall also document cross-connection control measures and controls on facility operation sufficient to ensure reliable production of reclaimed water of acceptable quality.

H. Annual Reuse Report Requirements

After a facility has received an RWBR approval, a requirement to submit an annual report on the total reuse water flow shall be included in the facilities NJPDES permit as part of the reuse authorization. The following information shall be included in the annual reuse report, which is typically due in February of each year:

(1) The total flow reused with respect to the total flow treated by the wastewater treatment facility expressed in terms of the percentage flow reused, total flow accepted and total flow reused;

(2) The total annual flow to each approved reuse location (Name each reuse location.);

(3) The maximum monthly average flow over the past twelve months for each reuse site;

(4) An update to the correlation study for Turbidity and Total Suspended Solids (if required); and

(5) If no flow was sent to a reuse location, the report shall include an explanation as to why flow was not diverted to the particular reuse location.

I. DEP Approval

The Department shall issue an authorization letter for approval to place a Reuse System into operation once the it has determined that all the requirements, as referenced in this technical manual, have been satisfied. If you have any questions on RWBR, please contact the Division of Water Quality's Bureau of Point Source Permitting Region 1 at (609) 633-3869, Bureau of Point Source Permitting Region 2 at (609) 292-4860 or the Bureau of Nonpoint Pollution Control at (609) 292-0407.

VII. DEFINITIONS

Reclaimed Water for Beneficial Reuse ("RWBR")
RWBR involves taking what was once considered waste, giving it a specialized level of treatment, and using the resulting high-quality reclaimed water for new, beneficial uses. In other words, reclaimed water is used in place of, or as a supplement to, ground water or potable water uses.

Public Access RWBR
Public Access RWBR involves the use of reclaimed water where public exposure is likely, thereby necessitating the highest degree of treatment.

Restricted Access and Non-Edible crops RWBR
Restricted access and non-edible crops RWBR involves the use of reclaimed water where public exposure is controlled; therefore, treatment requirements may not be as demanding as in a public access RWBR system.

RWBR - Agricultural Edible Crop Systems
This use of reclaimed water involves the irrigation of edible crops. The same high-level treatment requirements associated with public access uses also apply to reuse for edible crops.

Industrial RWBR
Industrial RWBR involves the use of reclaimed water in industrial applications such as sewer jetting, cooling water and/or washing operations. The uniqueness of each industrial reuse application makes it impossible to establish specific treatment standards.

Operation Protocol
An Operation Protocol is a document, describing how a wastewater treatment facility is operated to ensure that only reuse water meeting the applicable standards is released to a reuse system. It is a detailed set of instructions for the operators of facilities.

Reuse Supplier and User Agreement
A Reuse Supplier and User Agreement is a binding agreement between the party (e.g., a wastewater treatment facility) who supplies reuse water and the user (e.g., privately owned & operated golf course or any other property owned by another party). The agreement is to ensure that construction, operation, maintenance, and monitoring for the reclaimed water meets the requirements of the NJPDES Rules and Regulations for reclaimed water.

Annual Reuse Report
This is the requirement to submit an annual report on the total reuse water flow from a facility during a calendar year.

APPENDIX A: EFFLUENT REUSE TREATMENT GUIDELINE TABLE

TYPES of REUSE	TREATMENT & RWBR QUALITY	RWBR MONITORING	COMMENTS
RWBR Public Access Systems: Examples include golf course spray Irrigation, playground or park spray Irrigation, commercial car wash, hydroseeding	Fecal Coliform 2.2/100 ml, 7 day median, 14/100 ml maximum any one sample Minimum Chlorine Residual 1.0 mg/L after 15 Minute contact at peak hourly flow or Design UV dose of 100 mJ/cm2 under maximum daily flow 5 mg/L TSS maximum, 2 NTU maximum Turbidity in UV applications Total Nitrogen (NO_3+NH_3) 10 mg/L (1) Hydraulic Loading Rate 2 inches per week (2) Secondary (3) Filtration (4) Permit levels must be met	Continuous on-line monitoring of turbidity and CPO or UV criteria (5) Operation Protocol Required User/Supplier Agreement Annual usage report	A chlorine residual of 0.5 mg/L or greater in the distribution system is recommended to reduce odors, slime and bacterial re-growth. Chemical (coagulant and/or polymer) addition prior to filtration may be necessary Loading rates can be increased based on a site specific evaluation and Department approval Total Nitrogen (NO_3+NH_3) limitation can be less stringent if site evaluation submitted is approved by the NJDEP Additional requirements dependant on application
RWBR for Agricultural Edible Crops Systems: Examples include irrigation of any Edible crop that will be peeled, Skinned, cooked or thermally Processed before consumption/Commercially processed foods (8)	Fecal Coliform 2.2/100 ml, 7 day median, 14/100 ml maximum any one sample Minimum Chlorine Residual 1.0 mg/L after 15 Minute contact at peak hourly flow or Design UV dose of 100 mJ/cm2 under maximum daily flow 5 mg/L TSS maximum, 2 NTU maximum Turbidity in UV applications Total Nitrogen (NO_3+NH_3) 10 mg/L (1) Hydraulic Loading Rate 2 inches per week (2) Secondary (3) Filtration (4) Permit levels must be met	Continuous on-line monitoring of turbidity and CPO or UV criteria (5) Operation Protocol Required User/Supplier Agreement Annual usage report Annual inventory submittal on commercial operations using RWBR to irrigate edible crop	A chlorine residual of 0.5 mg/L or greater in the distribution system is recommended to reduce odors, slime and bacterial re-growth. Chemical (coagulant and/or polymer) addition prior to filtration may be necessary Loading rates can be increased based on a site specific evaluation and Department approval Total Nitrogen (NO_3+NH_3) limitation can be less stringent if site evaluation submitted is approved by the NJDEP Additional requirements dependant on application
RWBR Restricted Access Systems and Non Edible Crops: Examples include irrigation of fodder crops or sod farms or other areas where public access is limited, such as landscaped areas within a secured perimeter	Fecal Coliform 200/100 ml, monthly geometric mean, weekly geometric mean 400/100 ml Minimum Chlorine Residual 1.0 mg/L after 15 minute contact at peak hourly flow or Design UV dose of 75 mJ/cm2 under maximum daily flow TSS (6) Total Nitrogen (NO_3+NH_3) 10 mg/L (1) (9) Hydraulic Loading Rate 2 inches per week (2)(9) Secondary (3) Permit levels must be met	Submission of Standard Operations Procedure that ensures proper disinfection (7) User/Supplier Agreement Annual usage report	A chlorine residual of 0.5 mg/L or greater in the distribution system is recommended to reduce odors, slime and bacterial re-growth. Loading rates can be increased based on a site specific evaluation and Department approval Total Nitrogen (NO_3+NH_3) limitation can be less stringent if site evaluation submitted is approved by the NJDEP Additional requirements dependant on application
RWBR Industrial Systems: Includes closed loop systems. For example, sewer jetting, non-contact cooling water, boiler makeup water	Permit levels must be met	Submission of Standard Operations Procedure that ensures proper material handling User/Supplier Agreement Annual usage report	Worker contact with RWBR shall be limited to individuals who have received specialized training to deal with the RWBR systems. Additional requirements dependant on application
RWBR for Construction, and Maintenance Operations Systems: Examples may include street sweeping, dust control, fire protection and road milling	Fecal Coliform 200/100 ml, monthly geometric mean, weekly geometric mean 400/100 ml TSS (6) Secondary (3) Permit levels must be met	Submission of Standard Operations Procedure that ensures proper disinfection (7) User/Supplier Agreement Annual usage report	Worker contact with RWBR shall be minimized No windblown spray Additional requirements dependant on application

Appendix B: Notations

(1) The Total Nitrogen (NO_3+NH_3) Limit may be less stringent than 10 mg/L. See report/study requirements in Guidance Manual under Engineering Report Section.

(2) The Loading Rate may be greater than 2 inches per week. See report/study requirements in Guidance Manual under Engineering Report Section.

(3) Secondary treatment for the purpose of this manual, refers to the existing treatment requirements in the NJPDES permit, not including the additional RWBR treatment requirements.

(4) Filtration means the passing of wastewater through a filtration system in order to reduce TSS levels to below the 5 mg/L.

(5) The continuing monitoring for chlorine produced oxidant (CPO) or UV criteria & turbidity (in either case) is to ensure that all RWBR has been properly treated to the high-level disinfection requirements. The UV criteria include the continuous monitoring of lamp intensity, UV transmittance and flow rate.

(6) The TSS requirements in the application applies to the existing treatment requirements as specified in the NJPDES permit for the discharge.

(7) The Standard Operations Procedure is a written document on what methodology has been employed to ensure all the RWBR has been properly disinfected to the required RWBR treatment levels identified in this manual.

(8) Commercially processed food crops are those that, prior to final sale to the public or others, have undergone chemical or physical processing sufficient to destroy pathogens.

(9) Applicable limit for restricted spray irrigation applications.

Appendix C: Additional Technical Guidance Documents

The following publications are referenced as additional technical guidance to assist utilities and engineers in planning, design, construction, and implementation of reuse projects.

- U. S. Environmental Protection Agency, 1981. Land Treatment of Municipal Wastewater-Process Design Manual. EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

- U. S. Environmental Protection Agency, 1977. Wastewater Treatment Facilities for Sewered Small Municipalities-Process Design Manual. EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

- U. S. Environmental Protection Agency, 1974. Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability-MCD-05. Environmental Quality Instructional Resources Center, The Ohio State University, 200 Chambers Road, Room 310, Columbus, Ohio 43212.

- U. S. Environmental Protection Agency, 1980. Design Manual-Onsite Wastewater Treatment and Disposal Systems. EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

- U. S. Department of Agriculture, Soil Conservation Service, 1973. Drainage of Agricultural Land. Water Information Center, Inc., 125 East Bethpage Road, Plainview, New York 11803.

- U.S. Environmental Protection Agency. 1984. Land Treatment of Municipal Wastewater - Supplement on Rapid Infiltration and Overland Flow - Process Design Manual. EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

- Water Pollution Control Federation, 1989. Manual of Practice SM-3. Water Reuse. W.P.C.F., 601 Wythe Street, Alexandria, Virginia 22314-1994.

- American Water Works Association, 1983. Dual Water Systems. Manual M24. A.W.W.A., 6666 West Quincy Avenue, Denver, Colorado 80235.

- U.S. Environmental Protection Agency and the U.S. Agency for International Development. 2004. Guidelines for Water Reuse. Report EPA/625/R-04/108. EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

- Municipal Wastewater Reuse, Selected Readings on Water Reuse, EPA Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, Ohio 45268.

- Using Reclaimed Water to Augment Potable Water Resources, Water Environment Federation and American Water Works Association., 1998

- Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse, National Water Research Institute and American Water Works Association Research Foundation, 2000

Appendix D: RFS1 - Guidelines for Preparation of Reuse Feasibility Studies For Wastewater Treatment Facilities

Acknowledgement

This reuse feasibility study is based upon the Florida Department of Environmental Protection guidelines that have been in use since 1990. The New Jersey Department of Environmental Protection appreciates their dedication to the field of wastewater reuse and hard work in developing their guidelines and their willingness to enable NJDEP to use that work.

A. Purpose and Applicability

Purpose

The purpose of this appendix is to define the contents of reuse feasibility studies. The following aspects of reuse feasibility study preparation are addressed:

1. Identification of alternatives to be evaluated;
2. Evaluation of costs using present value analysis;
3. Assessment of environmental impacts;
4. Evaluation of resulting user charges and fees; and
5. Evaluation of technical feasibility.

Use by Other Entities Implementing Reuse

A municipality, governmental entity, or utility that has developed and is implementing a reuse as part of their activities may submit their water supply plan and documentation of implementation for consideration by the Department of Environmental Protection during the review of a reuse feasibility study.

Report Submittals

A minimum of three copies of reuse feasibility studies should be submitted to the Department of Environmental Protection. One copy must be submitted to the Bureau of Point Source Permitting, Region 1 of the Division of Water Quality and the other two to the appropriate regulatory office.

B. Background

The Reclaimed Water for Beneficial Reuse (RWBR) program in New Jersey, which began in 1999 in response to significant impacts due to severe drought conditions, has been developing steadily over the past few years. The Department's goal is to continue to expand this program to its full potential and establish New Jersey as a leader in the northeastern states in the field of RWBR. Accomplishment of this goal will provide NJDEP with a major tool in the management

of the state's water resources at a time when its population and demand for water supply are continuing to increase.

The Department of Environmental Protection has implemented a reuse program designed to meet the water supply protection objectives of the State.

Mandatory Reuse Program

The NJPDES permitting programs may be requiring the assessment of RWBR feasibility at all wastewater treatment and disposal facilities in the State with a design flow of 0.1 MGD or greater. The Water Allocation permitting program may be requiring similar reuse feasibility studies for all applicants proposing to use water for non-potable and consumptive uses. Reuse of reclaimed water from domestic wastewater treatment facilities could be required, unless such reuse is not economically, environmentally, or technically feasible as indicated by a Department approved study that conforms to the requirements of this guideline. Any other agency that desires to require a reuse feasibility study is encouraged to use this document.

Reuse Feasibility Studies

This appendix presents comprehensive guidelines for the preparation of reuse feasibility studies by applicants having responsibility for domestic wastewater management.

C. Reuse Feasibility Studies for Water Allocation Permittees

The reuse feasibility study identifies and evaluates the following information to determine the feasibility of implementing water reuse in lieu of potable water sources for the proposed or existing water supply.

Availability/General

1. Any projects which are not within three (3) miles of an existing or potential reclaimed water source (i.e.. pipeline or plant), are solely for potable use, or provide documentation from regional reclaimed water providers that reclaimed water will not be available within the project duration, may not need to submit a reuse feasibility study. Detailed documentation regarding these exceptions must be submitted to the NJDEP permitting bureau to review and approve such an exception.

2. A reuse feasibility study may not be required if a contract been signed with a reclaimed water supplier. If applicable, please provide a copy of the executed agreement or the current draft under negotiations. If a contract has been signed, please submit the executed agreement in lieu of a reuse feasibility study.

3. Applicants must identify all current or proposed water source(s) (e.g. ground water, stormwater, or surface water) and use(s) (e.g. potable, irrigation, power generation, other). An evaluation of each of the current or proposed uses must be completed to determine if reuse water could be used in lieu of an existing potable supply or creation of a new water source.

Environmental Feasibility

1. If RWBR storage needs to be provided on site, provide an estimate of the available storage volume at the proposed or existing site.

2. Identify if the storage area is to be isolated or part of a surface water/storm water management system.

3. If RWBR will be stored in a surface water management system, identify if that system discharges off site and what is the receiving water body.

4. Identify all wetlands on site and evaluate how the use, or storage, of reclaimed water will affect the seasonal water level fluctuations or water quality within the wetlands. Provide all supporting information.

5. Identify all public water supply wells within 500 feet of the area to be irrigated with RWBR or any proposed unlined reclaimed water storage areas. Also provide the location of any private water supply wells within 75 feet of an RWBR irrigated area.

6. If there any other issues negatively affecting the environmental feasibility of using RWBR at this project, those should be thoroughly documented and provided to the Department for review.

Technical Feasibility

1. Determine the RWBR quality available and identify if that RWBR is of an acceptable quality for use on your project. If not, please describe the proposed use of water and the specific limitations that you believe prevent the use of RWBR. Provide an evaluation of what measures would be required to provide additional treatment to the existing RWBR to improve the quality to acceptable levels.

2. Evaluate the quantity of RWBR that can be supplied to the project and if that quantity can meet all of the demands of the project. Identify the source of the backup supply and if necessary, the supplemental supply needed to meet all demand?

3. Identify all other issues negatively affecting the technological feasibility of using RWBR at the project and provide any documentation to support those issues.

4. The technological feasibility of wastewater mining shall also be evaluated as a part of the study.

5. The technological feasibility study shall include the evaluation of other potential users of the reclaimed water, including other water allocation permittees, within the surrounding area (minimum 3 mile radius from the water allocation permittee), including industrial, municipal, and commercial entities. This evaluation shall be incorporated into the economic feasibility analysis required below.

Economic Feasibility

1. Evaluate the new design or retrofit costs of converting to RWBR. Provide a 20-year present value analysis comparing the cost of using RWBR to the cost of using the current source. Please refer to Sections A and B for assistance.

2. If a supplemental or backup source proposed for use with the RWBR system, identify why these systems are required and include these costs in the present value analysis described in question number 1.

3. Identify any other issues that will negatively affect the economic feasibility of utilizing RWBR at this project. For example, the cost of obtaining or altering water allocation permits, NJPDES permits, etc. If so, these costs should be reflected in the present value analysis.

4. The study shall examine partial/blending existing water use with RWBR at the site at 50% and 75% ratios.

5. The study shall also include other potential users of the reclaimed water within the surrounding area (minimum 3 mile radius from the water allocation permittee), including

industrial, municipal, and commercial entities. The analysis shall examine these potential users that may potentially help in sharing costs for either distribution/conveyance of the RWBR and/or upgrades to the Wastewater Treatment Facility that may be required for treating the RWBR to the standards required for the existing/proposed RWBR project.

D. Present Value Analysis of Using Current Source and Reclaimed Water

Definition and Use of Present Value Analysis

The present value analysis is defined as the analysis of value obtained by discounting, separately for each year, the difference of all project related expenses (costs) and revenues (benefits) accruing throughout the period of analysis at a fixed, predetermined discount rate. For the purpose of these guidelines, the scope of a present value analysis is limited to the project's expenses to use reclaimed water. The present value analysis demonstrated here should also be applied to the project's cost of using the existing water source to allow a comparison of the two sources. Current costs of existing water source shall use a current assigned dollar cost of $4.00 per 1000 gallons, or the highest cost of existing water from the local purveyor, whichever is greater. It is important to note that a project that incurs a higher cost in water supply could be still feasible as long as the project is able to yield a desired rate of return on investment.

Calculation of Present Value

The present value (PV) is the discounted future value (either costs and benefits) at a fixed, predetermined discount rate. For a project, the PV is the sum of discounted future costs and benefits accruing throughout the life of the project. Thus:

1) $P = pwf" \times B^n$ (or C^n)

2) $pwf" = 1/(1 + i)^n$

3) $PV = (B_t - C_t) + [B_{t+1} - C_{t+1}/(1+i)^1] + [B_{t+2} - C_{t+2}/(1+i)^2] + \ldots + [B_{t+n} - C_{t+n}/(1+i)^n]$

Where:

P = Present value (at Year = 0)
pwf" = Present worth factor (single payment)
B = Benefits
C = Costs
i = Discount rate or interest rate
n = Number of years for which costs are incurred or benefits received
t = Year 0 or the beginning year of the project

It should be noted that the pwf" has two applications. Equation (2) is used when asking, "What is the present value of $1 (single payment) given to me *n* years in the future given the discount rate *i*?" The equation for pwf" may be modified when asking, "What is the present value of $1

(multiple payments in same amount) given to me each year for *n* years in the future given the discount rate *i*?" In such, cases, Equation (2) can be rewritten as:

$$4) \qquad pwf = \frac{1 - \frac{1}{(1+i)^n}}{i}$$

pwf = Present worth factor (multiple payments in same amount over *n* years)

The above formulas are provided for reference only. Applicants may find that actual calculations of PV are easy using spreadsheet programs such as Lotus123 or Microsoft Excel or some calculators with built in PV functions.

Period of Analysis

Applicants need to use a period of 20 years for a present value analysis. The first year of the analysis (Year 1) should correspond to the year when the project will be completed.

Suggested Discount Rate for Present Value Analysis

The applicant can use either the current discount rate developed annually by the U.S. Bureau of Reclamation (USBR) or the interest rate that would be paid by the applicant to a financial institution on long term (15-30 year) loans. The USBR's discount rate is published in the Federal Register each December. A quote on the interest rates of long term loans can be obtained from local commercial banks.

Costs to be Considered

All capital and operation and maintenance costs incurred by the applicant and associated with the withdrawal and transmission of water from its source to final delivery points will be considered. Capital costs include construction cost or contribution for internal connections/lines plus other related costs such as engineering, legal services, contingencies, etc. Operation and maintenance costs include user fees or quantity charges paid to a supplier and costs of labor, energy, and replacement and upgrade to operate and maintain withdrawal facilities and transmission lines.

Sunk Costs

Construction costs of facilities previously constructed or under construction shall be considered as sunk cost and shall not be included in the cost analysis. However, all operation and maintenance costs for all existing and future facilities shall be included.

Depreciation Methods and Salvage Values

The straight line method of depreciation should be used in the present value analysis. The useful lives[1] of certain equipment and facilities are provided as follows:

- Storage ponds/reservoir 50 years
- Transmission/Distribution pipes 50 years
- Steel and concrete structures 30 years
- Pumping equipment 15 years
- Auxiliary equipment 10 years

Example: The salvage value of 6" pipeline costing $50,000 in the first year. At the end of the 20 year period of analysis, 40 percent (20 yr/50 yr) of its useful life will have been utilized. Therefore, the applicant will have a $30,000 salvage value of his/her initial investment of $50,000. The $30,000 salvage value will then be discounted with an appropriate discount rate to reflect its present value.

Replacement

The applicant may need to consider to replace existing facilities or equipment during the period of analysis. The useful life presented in the preceding section shall be used to determine when facilities or equipment will require replacement, unless replacement is required earlier to comply with any applicable rules or permit conditions.

Basis of Costs

All costs should be expressed in current dollars. Inflation during the 20-year period of analysis should not be included in the present value analysis.

Documentation of Costs and Assumptions

The sources of all costs and assumptions used in preparing the present value analysis need to be documented and clearly presented as part of analysis.

An Example of Present Value Analysis for Reuse at a Golf Course

The following is a hypothetical and simplified example of a present value analysis for irrigation of a golf course. This example is provided for illustration purposes only. Therefore, actual item or unit cost and water use for a similar size golf course may be different from the case presented here. An actual present value analysis may be more complicated and may require more detailed documentation of costs and assumptions. The Department or the Board of Public Utilities may be able to provide a more representative present value analysis for your use and/or area.

Background

An 18 hole golf course located in Green County in New Jersey Water Allocation Permit for a total amount of 150 million gallons per year $(MGY)^2$ for the irrigation of 150 acres of turf area. The golf course has its own water supply system consisting of three deep wells equipped with

electrical pumps. Currently the permittee pumps the ground water directly into its irrigation system. It was estimated by the permittee the pumping cost has been about $0.15/1,000 gallons[3] and that the actual annual water use has been around 120 MGY over the last five years. Since the WAP is going to expire in January 1996, the permittee intends to renew the permit for a maximum use of 150 MGY and proposes to continue the use of its existing water supply system. As part of the permit renewal process, the WAP applicant is required to conduct a reuse feasibility study which includes a present value analysis of using the current source of water compared to the use of reclaimed water if it is available.

Possible Supply of Reclaimed Water

There is a 10 MGD wastewater treatment plant (WWTP) owned and operated by Green County. The WWTP is located approximately two miles from the golf course. The WWTP is upgrading its treatment facility and planning to provide the reclaimed water for landscape irrigation and other useful purposes. The WWTP proposes to construct an 8 inch diameter transmission pipe to deliver the reclaimed water from the WWTP to the golf course. The designed pressure of reclaimed water at the delivery point will be 50 psi. The WWTP will charge a $0.10 per 1,000 gallon fee for the reclaimed water to recover a portion of treatment and transmission costs.

The availability of reclaimed water is a benefit to the golf course since reclaimed water is considered to be a very reliable source of supply and is not subject to water use restrictions in the event of drought. In order to use the reclaimed water however, the golf course would incur certain capital costs. Based on the current irrigation system configuration, the golf course estimated that a portion of irrigation needs can be met by directly connecting the irrigation system with the reuse system. Considering its peak daily and seasonal water use requirement, some of the reclaimed water would be delivered to an onsite lake during low-use hours and then it would be used to meet peak demands. This would require a new pump station by the lake. For the purpose of this document, it is assumed that the on-site lake is an isolated lake without discharges. Overall, the golf course is expected to reduce its cost in electricity by 60 percent with the reuse option[4].

The golf course has been subject to restricted watering hours in recent years and the restrictions are likely to stay. Thus, the applicant wants to determine the present value using reclaimed water. For the purpose of this present value analysis, the following assumptions are used:

1. Discount rate = 8%
2. All costs are in 1995 dollars
3. Annual. water use = 120 million gallons

PV of the Reclaimed Water Option

Given the following cost items:

a. Capital cost

▪ 1,000 ft. of 8" PVC pipe ($15/ft)[5]	$15,000
▪ 2,000 ft. of 6" PVC pipe ($12/ft)[5]	$24,000
▪ Misc. valves and boxes (approx. 10% of piping cost)[5]	$3,900
▪ One irrigation pump (@ $15,000)[6]	$15,000
▪ Engineering & legal (approx. 10% of total)	$5,800
Total	**$63,700**

b. Annual O&M cost

▪ Electrical cost for pumping (40% of current costs)	$7,200
▪ Maintenance	$5,000
▪ Reuse quantity charge ($0.10/1,000 gal)	$12,000
Total	**$24,200**

Calculations of PV (rounded to nearest $100):

Note: For ease of example presentation, cost figures are shown as positive values and salvage figures are shown as negative values.

1. Initial capital cost (in Year 0) = $63,700

$$PV_{initial} = \$63,700 \text{ (already at present value)}$$

2. Replacement capital cost for irrigation pump (in Year 15) = $15,000

$$PV_{Replace} = \$15,000 \times 1/(1 + 0.08)^{15}$$
$$= \$15,000 \times 0.3152$$
$$= \$4,800$$

3. Replacement capital cost for valves/boxes (in Year 10) = $4,000

$$PV_{Replace} = \$4,000 \times 1/(1 + 0.08)^{10}$$
$$= \$4,000 \times 0.4632$$
$$= \$1,900$$

4. Salvage value (SV) for pipes (in Year 20)

$$SV = (\$15,000 + \$24,000) \times \frac{30\,years}{50\,years}$$
$$= \$23,400$$

PV_{sv} = \$23,400 x $1/(1+0.08)^{20}$

= \$23,400 x 0.2145

= \$5,000

5. Salvage value (SV) of the initial pump (in Year 20)

SV = 0 (installed at year 0 with a useful life = 15 years)

6. Salvage value (SV) for the replacement pump (in Year 20)

SV = \$15,000 x 15 years/20 years

= \$11,300

PV_{sv} = \$11,300 x $1/(1+ 0.08)^{20}$

= \$11,300 x 0.2145

= \$2,500

7. Salvage value (SV) for the replacement valves/boxes (in Year 20)

SV = 0 (installed at year 10 with a useful life = 10 years)

8. O&M costs (1-20 years)

$PV_{O\&M}$ = \$24,200 x $[1-(1/1+0.08)^{20}]/0.08$

= \$24,200 x 9.8181

= \$237,600

9. Total present value of the reclaimed water option

PV = $PV_{Initial} + PV_{Replace} – PV_{SV} + PV_{O\&M}$

= \$63,700 + \$4,800 +\$1,900 - \$5,000 - \$2,500 +\$237,600

= \$300,500

Conclusion

This present value analysis provides the cost of using reclaimed water at the golf course. The same methodology can also be used to evaluate the PV of using current sources, such as ground

or surface water. After the cost of the existing source and reclaimed water are known, an informed decision can be made about which source will be used. One of the many benefits of using reclaimed water is that it can be a more reliable and stable water supply since it is not subject to NJDEP water use restrictions during drought periods, reducing the costs associated with replacing or rehabilitating damaged turf grass or lost revenue from limiting golfers from certain areas or reduced patronage due to brown courses. Furthermore, since the actual volume of wastewater being discharged is lower, reduction in NJPDES permitting fees may be realized.

E. Reuse Studies for Wastewater Treatment Facilities

1. Alternatives

Normally, the reuse feasibility study shall identify and evaluate at least the following two alternatives:

1. The implementation of a restricted access reuse system only, and

2. Implementation of a public access reuse system in conjunction with restricted access reuse systems.

As described below, there are some circumstances in which one or more additional alternatives may need to be evaluated. In addition, the number of alternatives may be reduced in some cases (for existing reuse systems and for facilities that will be removed from service). All alternatives will be evaluated over a 20-year planning period.

a. Restricted Access Reuse Only Alternative

This alternative will involve provision of water supply and wastewater management without implementation of public access reuse. All facilities can meet the requirements to institute reuse for the purposes of sewer jetting sanitary sewerage lines. If the utility has already implemented reuse, the existing level of reuse will continue, but no future reuse construction will be considered. Population, wastewater flows, and demands for water supply are to be fully considered for the 20-year period.

b. Public Access Reuse Alternative

This alternative will involve implementation of public access as described in this reuse manual. Three subalternatives will be considered based on the percentage of the total annual average daily flow in the design year (20 years in the future) that will be reused. The applicant will evaluate the following reuse subalternatives:

1. Maximum Reuse: Over 75 percent of the average annual daily flow of domestic wastewater reused in the design year.

2. Medium Reuse: 40 - 75 percent reused.

3. Minimal Reuse: Less than 40 percent reused.

In evaluating this alternative and the three subalternatives, the objective is to identify the optimal level of reuse in the design year. Provisions for phasing implementation of reuse over the 20-year planning horizon should be considered.

Applicants may wish to evaluate the "Maximum Reuse" subalternative first. If this subalternative is found to be feasible and agreeable to the applicant, then the lesser levels of reuse utilization need not be evaluated.

The applicant shall identify major users of water that could possibly use reclaimed water early in the evaluation process. Alternatives should be structured toward providing reclaimed water to major users of water or possible concentrations of major users of water. Major users may include golf courses, other institutions using large quantities of water for landscape irrigation, agricultural irrigation (including irrigation of edible crops), industrial users, and others. Irrigation of residential properties should be considered, especially in areas along potential transmission lines running to the major users. Development of dual distribution systems within new residential developments may be more cost-effective than retrofitting existing development.

If technical constraints (such as high chloride concentrations for landscape irrigation) limit the potential for use in a public access irrigation system, additional alternatives must be evaluated. This will include evaluation of an alternative that includes provision of appropriate technology to overcome the constraint (such as partial desalinization or sewer system rehabilitation to control salinity). Other reuse options should be developed and evaluated. In addition, at least one other alternative, as described in the following section, should be evaluated.

c. Other Alternatives

The applicant may evaluate other reuse options if the applicant desires. As noted in the previous sections, there are some circumstances in which other alternatives may need to be evaluated. Other reuse options may include, but are not limited to,

1. Ground water recharge through slow-rate land application systems with restricted public access;

2. ground water recharge through rapid-rate land application systems;

3. underground injection to impede salt water intrusion;

4. wastewater mining;

5. slow-rate land application systems using subsurface application systems; or

6. other reuse activities meeting the "reuse" definition.

d. Small Wastewater Treatment Facilities (Less Than 0.1 mgd)

The minimum treatment system size requirements must be considered in the analysis. Domestic wastewater treatment plants having capacities less than 0.1 mgd are not required to evaluate

reuse for irrigation of public access areas. For these small systems, the reuse systems required to be evaluated must be restricted access systems or selected from the "Other Alternatives" section. Public access reuse systems may be investigated if desired by the facility.

The reuse feasibility study must evaluate the potential for regionalization of a small treatment facility with other facilities such that a regional facility having a capacity of at least 0.1 mgd would result. These small facilities should evaluate the feasibility of connecting to an existing or planned wastewater treatment facility that makes reclaimed water available for reuse.

If the wastewater treatment facility could be expanded to a capacity of at least 0.1 mgd during the 20-year period of analysis as identified in the facility's regional Water Quality Management Plan, evaluation of a public access must be completed.

e. Facilities That Will be Removed from Service

A wastewater treatment facility that plans to cease service and be connected to a regional treatment facility may-submit an abbreviated reuse feasibility study. The abbreviated study shall include a detailed schedule for the removal of the facility from service along with documentation from the owner of the facility who will provide future treatment service indicating concurrence with the plan to connect to his/her system. Additional reuse feasibility analysis will not be required if the treatment facility conclusively demonstrates that it will be removed from service within five years after submittal of the reuse feasibility report.

f. Existing Reuse Systems

A wastewater treatment facility that sends its entire flow to a reuse system meeting the definition of RWBR, may prepare an abbreviated report. The abbreviated report will contain all chapters that are needed for a full report; however, the scope may be limited to assessment of a single "alternative" (continued reliance on the existing reuse system). Chapter 2 of the abbreviated reuse feasibility study report (Existing Conditions) shall assess compliance of the existing system with applicable rules, permit conditions, and ground and surface water quality standards. The alternative, described in Chapter 4 and evaluated in Chapter 5, must address the full 20-year period of analysis. Cost estimates for future modifications, replacement, and expansions shall be included and the appropriate worksheet for evaluation of rates and fees shall be completed. Of course, the owner may choose to evaluate other alternatives.

If the Department of Environmental Protection concurs that the treatment facility has a reuse system and is in compliance with its permit and applicable rules, no further action will be needed by the wastewater treatment plant permittee. If the system is not a reuse system as defined in this manual, the evaluation of alternatives described in this guidance document must be completed. If the facility provides reclaimed water to a legitimate reuse system, but the treatment or reuse system is not in compliance with its permits or applicable rules, the reuse feasibility study shall provide a detailed assessment of needed corrective measures and shall include a schedule for bringing the facilities into full compliance.

g. Evaluation of Alternatives

As described in the following sections, the feasibility analysis will include evaluation of the net present value, rates and fees, technical feasibility, and environmental impacts of the alternatives.

At the outset, it must be noted that the evaluation of "feasibility" is not to be equated with simply selecting the least cost alternative. The dictionary defines "feasible" as follows:

1. Capable of being done or carried out.

2. Capable of being used or dealt with successfully.

Obviously, the primary definition has no reference to cost or cost effectiveness. In the secondary definition, some degree of cost consideration perhaps can be implied through the use of the word "successfully." As an example, the objective of placing a man on the moon was deemed to be feasible even though the costs associated with the space program were significantly greater than the cost of the no action alternative.

2. Present Value Analysis

a. Type of Analysis

Monetary costs and benefits will be identified and summarized as a net present value over the planning period. The analysis will be done for each alternative.

b. Present Value Calculations

Present value analysis is simply a method that can be used to compare alternatives that involve different cost components that are anticipated to occur at different times. Calculation of the present value for each alternative enables comparison of the costs of all alternatives using an equivalent basis (the present value). All costs anticipated during the planning period will be converted to an equivalent present value in Year 0. The sum of all component present value for an alternative yields the total present value of that alternative.

Table 1 lists the primary factors used in calculating present value. Factors for the interrelationships between uniform annual payments (R), future payments (S), and present value (P) are included. Figure 1 shows the basic relationship between these types of payments.

An example of present value calculations is included at the end of this chapter.

c. Period of Analysis

The period of analysis will be 20 years. The first year of the analysis (Year 1) should correspond to the year in which initial construction will be completed. This must be within five years of the date of submittal of the reuse feasibility study.

d. Discount Rate

The discount rate to be used in the analysis will be the current discount rate as developed annually by the federal government. The discount rate is published annually by the U.S. Environmental Protection Agency and by the American Consulting Engineers council and the U.S. Department of Agriculture through the National Resource Conservation Service. The discount rate also is published in the Federal Register each December. The discount rate for federal Fiscal Year 2003 was 5.875 percent. The current rate for federal Fiscal Year 2004 is 5.625 percent.

TABLE 1

FACTORS USED IN PRESENT VALUE ANALYSIS

Conversion Factor				
Name	Symbol	Calculated as	Given	To Find
compound amount factor (single payment)	caf'	$(1 - i)^n$	P	S
present worth factor (single payment)	pwf'	$\frac{1}{(1 + i)^n}$	S	P
compound amount factor	caf	$\frac{(1 + i)^n - 1}{i}$	R	S
sinking fund factor	sff	$\frac{i}{(1 + i)^n - 1}$	S	R
present worth factor	pwf	$\frac{(1 + i)^n - 1}{i(1 + i)^n}$	R	P
capital recovery factor	crf	$\frac{i(1 + i)^n}{(1 + i)^n - 1}$	P	R

Notes: P = Present value (at Year = 0)

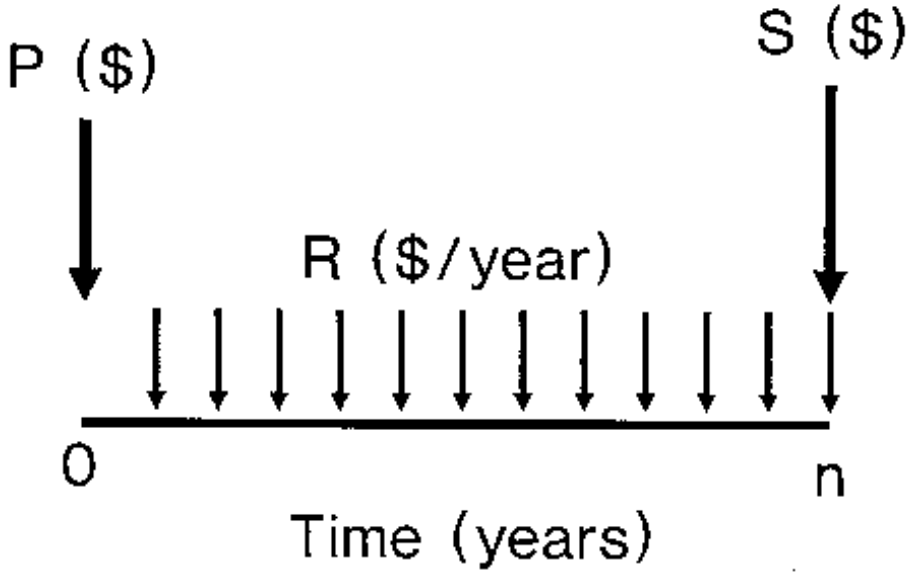
R = Uniform annual payment made in Years 1 through n

S = Future value (at end of year n)

i = Discount rate, as a decimal (for example, use 0.10 for 10%)

n = Number of years considered

Figure 1
Present Value Concepts



P = Present value in Year 0

R = Uniform annual payments in Years 1 through n

S = Future value at end of year n

e. Costs to be Considered

All costs associated with wastewater management will be considered. Capital construction costs will include the costs of wastewater collection and treatment and reclaimed water transmission to the point of delivery for the end users. Capital construction costs include the actual construction costs plus reasonable levels of other related costs (engineering, legal services, interest during construction, contingencies, etc.). Percentages used for these other related costs shall be identified and justified in the report and shall be consistently applied to all alternatives evaluated. Costs of initial construction and future expansions, replacements, and needed upgrades of levels of treatment shall be included.

Reasonable assumptions are to be incorporated into the development and evaluation of alternatives. Levels of wastewater treatment during the 20-year planning period must be reasonable. Assumption of secondary wastewater treatment with surface water discharge as part of the no action alternative probably, is not appropriate in most of the state. The analysis must account for needed expansions and upgrades of levels of service over the entire 20-year planning period.

All wastewater and reclaimed water operation and maintenance costs will be considered.

f. Utilities Responsible for Water Supply and Wastewater Management

Applicants under the same ownership/control as a public water system may find it advantageous to consider evaluating combined water supply and wastewater management elements if an alternative chosen for evaluation displaces demand on the potable water supply system. The Department may require such combined evaluations in designated critical water supply problem areas when considering reuse feasibility evaluations related to consumptive use permit applications. Specifically, the evaluation should address the effect of reduced overall and peak demands on the need to upgrade or construct new water supply facilities during the evaluation period.

Wastewater applicants also evaluating potable water supply costs must include the costs of water withdrawal, treatment, and transmission to the point where the potable water leaves the water treatment plant. Of course, all costs associated with wastewater management and provision of reclaimed water must be included in the analysis.

g. Sunk Costs

Construction costs of facilities previously constructed or under construction shall be considered as sunk costs and shall not be included in the cost analysis. Of course, all operation and maintenance costs for all existing and future facilities shall be included.

h. Revenues

Revenues received by the utility to be included in the present value analysis are limited to the following:

1. Estimated revenues from the sale of reclaimed water produced;

2. Revenues from the sale of crops produced;

3. Revenues from the lease of lands; and

4. Revenues from connection fees for reclaimed water service (including any front-end fees directly related to initiation of reclaimed water service).

Revenues from normal user charges, impact fees, and connection fees not specifically associated with reclaimed water service will not be included in the present value analysis.

i. Salvage Values

The following useful lives will be used for facilities being considered in the present value analysis:

1. Piping - 50 years,

2. structures and concrete/steel tankage - 30 years,

3. process equipment and pumps - 15 years,

4. auxiliary equipment - 10 years, and

5. land - permanent.

The straight line method of depreciation will be used throughout the analysis.

For example, consider a pipeline costing one million dollars in the first year of the analysis. At the end of the 20-year period of analysis, 40 percent of its useful life will have been utilized. The salvage value is 60 percent of the initial capital investment ($600,000). The salvage value (a revenue) would be shown in the 20th year of the analysis.

All land purchased during the period of analysis will have a salvage value in Year 20 equal to the estimated purchase price.

j. Replacement

The need to replace existing facilities or facilities anticipated to be constructed as part of the alternative being evaluated shall be considered in the analysis. The useful lives presented in the preceding section shall be used to determine when facilities will require replacement, unless replacement is required earlier to comply with any applicable rules or permit conditions.

k. Basis of Costs

All costs and revenues should be expressed in current dollars. The basis of costs used shall be clearly stated in the report.

Inflation during the 20-year period of analysis will not be included in the present value analysis.

l. Documentation of Costs, Revenues, and Assumptions

The basis for all costs, revenues, and assumptions used in developing, describing, and evaluating the alternatives shall be clearly presented. This could be accomplished using a detailed appendix to the reuse feasibility study report.

m. Water Savings

The analysis will include an evaluation of water saved by implementing the reuse alternatives. This analysis will include estimates of water used by customers of the water utility during each year of the planning period. Estimates of annual water use (other than reclaimed water) by other water users that could be served by reclaimed water, also will be prepared. Projections of total annual water use (other than reclaimed water) under the no action and reuse alternatives will be made. Subtracting the annual water use (other than reclaimed water) associated with a reuse alternative from the water use (other than reclaimed water) for the no action alternative, yields the annual water savings. This water savings will be valued at the average residential rate for potable water charged by the predominant water supply utility within the reuse service area. The highest rate charged by any single water service utility within the sewer service area, or $4.00 per 1,000 gallons (whichever is greater) shall be required in the report. The value of this water savings will be included in the analysis as a revenue (benefit) for the reuse alternative.

This method of valuing water savings is proposed solely for preparation of reuse feasibility studies.

n. Reporting of Present Values

Two present values will be calculated for each alternative and subalternative that is evaluated. First, the total net present value will be calculated for all costs and revenues with the exception of the estimated value of water saved.

Second, an adjusted present value will be calculated that includes the present value of water saved. An example of the calculation of total present value and adjusted present value is included in the next section.

Example Calculation

The following is a hypothetical example that is designed to demonstrate the basic application of present value analysis.

Given: Initial Capita1Investment: $3 Million in Year 0
Useful life = 20 years

Expand facilities: $2 Million in Year 10
Useful life = 20 years

Average annual operation and maintenance (O&M) costs:

Years 1-10 = $500,000/year
Years 11-20 = $750,000/year

Planning Parameters:

Planning period = 20 years
Discount Rate = 10%
All costs are in 1991 dollars.

Water Savings:

Years 1-10: Reuse will save 0.5 mgd of potable water
Years 11-20: Reuse will save 1.0 mgd of potable water
BPU highest residential water cost = $10.00/1,000 gal.

Figure 2 graphically depicts the time sequence of estimated costs.

Determine: Present value of this alternative in 1991 dollars without consideration of the benefit of potable water saved. Repeat the analysis including consideration of the benefit associated with the water savings.

Calculations:

1. Initial capital construction cost = $3,000,000

Present Value (PV) = $3,000,000 (already at present value)

2. Capital construction cost of the expansion/upgrade

   Cost = $2,000,000 in Year 10

   PV = ($2,000,000)(pwf'-10 yr.-10%)

   = ($2,000,000)(0.3855)

   = $771,000

3. Salvage Value (SV) of initial construction (at end of 20 year period of analysis)

   SV = 0 (useful life = 20 years)

4. Salvage Value (SV) of the expansion

   SV = (Useful life remaining)(capital construction cost)/(useful life)

   = (10 years)($2,000,000)/(20 years)

   = $1,000,000 (at the end of year 20)

   PV = ($1,000,000)(pwf'-20 yr.-10%)

   = ($1,000,000)(0.1486)

   = $149,000 (note: rounded to nearest $1,000)

5. O & M Costs (years 1-10)

   PV = ($500,000)(pwf-10 yr.-10%)

   = ($500,000)(6.144)

   = $3,072,000

6. O & M Costs (years 11-20)

   PV = ($750,000)(pwf-10 yr.-10%) (pwf'-10 yr.-10%)

   = ($750,000)(6.144)(0.3855)

   = $1,776,000 (note: rounded to nearest $1,000)

7. Total Present Value

PV (total) = PVconstruction + PVo&m - PVsalvage

= $3,000,000 + $771,000 + $3,072,000

+ $1,776,000 - $149,000

PV (total) = $8,470,000

8. Benefit of water savings (years 1-10)

Water saved/yr. = (0.5 mgd)(365 days/yr.)(10^6 gal/mg)

= 182,500,000 gallons/yr.

Value = 182,500,000 gal/yr. @ $4.00/1000 gal

= $730,000/yr.

PV = ($730,000)(6.144)

= $4,485,000 (note: rounded to nearest $1,000)

9. Benefit of water savings (years 11-20)

Water saved/yr. = (1.0 mgd)(365 days/yr)(10^6 gal/mg)

= 365,000,000 gal/yr.

Value = 365,000,000 gal/yr. @ $4.00/1,000 gal

= $1,460,000/yr.

PV = ($1,460,000)(pwf-10 yr.-10%)(pwf'-10 yr.-10%)

= ($1,460,000)(6.144)(0.3855)

= $3,458,000 (note: rounded to nearest $1,000)

10. Total benefit of water savings (at present value)

PV (water saved) = $4,485,000 + $3,458,000

= $7,943,000

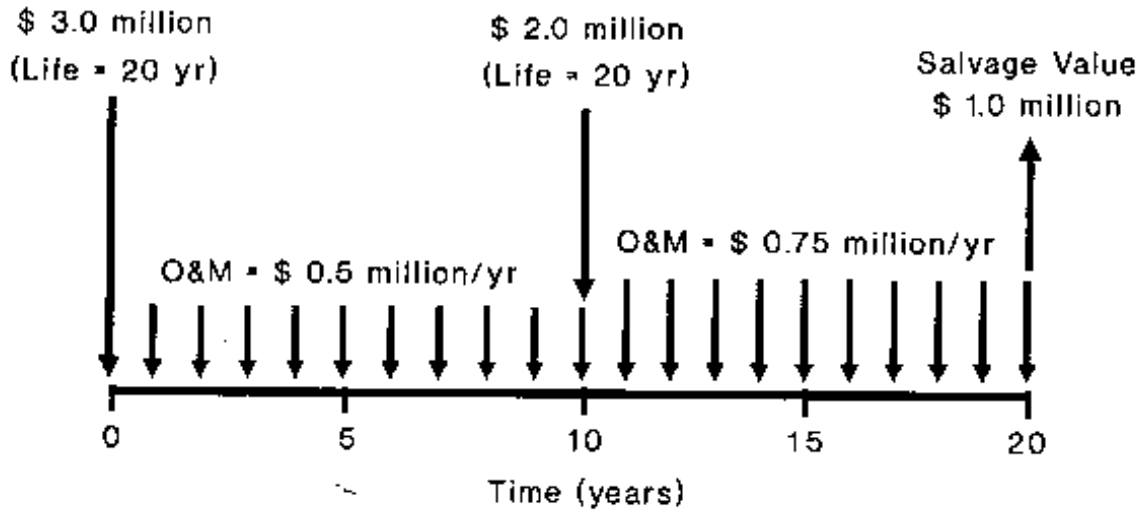
11. Adjusted Present Value

PV (adjusted) = PV (total) - PV (water saved)

= $8,470,000 - $7,943,000

PV (adjusted) = $527,000

Figure 2
Present Value Example



n = 20 years

i = 10 %

F. Evaluation of Rates and Fees

As part of the feasibility analysis, the applicant shall evaluate the effects of the alternatives considered on rates, fees, and user charges. The worksheet to be used for publicly owned utilities is included in Appendix A. The worksheet for privately owned utilities is in Appendix B. The appropriate worksheet should be completed for each alternative and subalternative evaluated. The completed worksheets should be included in an appendix to the reuse feasibility study report. The results showing user charges, connection/impact fees, and charges for sale of reclaimed water should be summarized in the feasibility study report for all alternatives considered, including the no action alternative.

Expenses and revenues are to be estimated for Years 1, 5, 10, 15 and 20 of the 20-year planning period established for the present value analysis. All costs and revenues considered in the present value analysis should be reflected in the evaluation of rates and fees. Salvage values and the value of water saved will not be included in the evaluation of rates and fees.

Debt Service Calculations for Public Utilities

The previous chapter described the requirements for the present value analysis. This included use of a specified discount rate and the 20-year planning horizon for calculating present value.

In estimating annual expenses for debt service as part of the evaluation of rates and fees, the applicant must use the anticipated borrowing period (term of the loan) and interest rate that would be charged on a loan or bond issue. Total capital construction costs should be reduced by the amount of any grants or other front-end funds (such as property tax revenues, prepaid connection fees and betterment assessments, local funds/reserves available for the project, etc.) that can reasonably be expected to be available to reduce the amount to be financed.

Rates and Fees

The worksheets in the Appendices request information on anticipated expenses and revenues. Estimates of projected revenues from sales of reclaimed water, and from user fees and connection/impact fees are needed. Estimates of future unit rates and fees in terms of dollars/month/household, dollars/new connection, or dollars/1000 gallons are needed. Establishment of these unit rates and fees is an iterative process designed to ensure that projected total revenues equal or exceed total expenses. Costs should be allocated equitably and reasonably between wastewater customers and users of reclaimed water.

G. Reuse Benefits

Benefits associated with implementation of reuse projects shall be fully discussed in the report. The discussion of benefits associated with reuse shall include, but not be limited to the following:

1. The public "good" associated with reuse (i.e., meeting a state objective).

2. The ability to conserve potable quality water. Sources of water saved should be discussed. This discussion should include identification of aquifers or surface waters from which withdrawals will be reduced and evaluations of stress impacts that may be mitigated by these reductions in withdrawals.

3. Conservation of water may postpone future expansions of water supply facilities and development of new sources of water.

4. The ability to recharge aquifers.

5. Provision of a water supply that will not be subject to restrictions during future droughts.

6. Improvement in surface water quality resulting from elimination of effluent discharge.

7. Fertilizer savings recognizing the nutrient content of reclaimed water used for landscape or agricultural irrigation.

8. Other benefits associated with reuse.

Discussion of benefits should be detailed and as quantitative as possible.

H. Technical Feasibility

Each alternative must be evaluated in terms of its technical feasibility. A detailed discussion is to be included in the reuse feasibility study report. Technical problems or constraints that could render an alternative as being "technically infeasible" must be identified, evaluated, and discussed. Technical solutions must be included in the analysis. For examples a high chloride concentration in the reclaimed water may make landscape or agricultural irrigation using reclaimed water infeasible. However, chlorides could be controlled by partial desalination of the reclaimed water, or by rehabilitation of the sewer system to reduce infiltration of high-chloride ground water in coastal areas. Provisions of technical solutions should be evaluated and incorporated into the alternatives considered (including the associated costs).

Also, where technical problems or constraints exist, other alternatives should be developed and evaluated. A wide range of public access reuse activities can be developed and permitted. In addition, other types of reuse systems described in this manual may not be subject to the technical constraints identified and may be implementable.

Technical problems or constraints typically can be overcome. Of course, additional costs may be incurred. Such costs should be estimated and included in the analysis. Generalizations about technical infeasibility should be avoided. General claims, such as the following, should be avoided:

1. "High chloride concentrations makes reuse infeasible."

2. "There is no guarantee that any one will want to irrigate using reclaimed water."

3. "Reuse is prohibitively expensive."

4. "The ground water table is too high."

5. "Guidelines on allocation of costs are not available."

6. "The liability and risk associated with reuse are too large."

The 2003 Reuse Inventory identified about 80 treatment facilities that provide reclaimed water for one or more reuse activities. Obviously, reuse is an implementable and popular alternative to discharge and disposal of a valuable water resource.

I. Report Outline

Table 2 presents the outline to be used for preparing the reuse feasibility study report. The following sections discuss the contents of the report.

Chapter 1 - Introduction

The introduction should include a detailed statement of the purpose of the reuse feasibility evaluation. If applicable, the statutory or rule requirement for preparation of the reuse feasibility study should be identified.

Chapter 2 - Existing conditions

This chapter will be a detailed assessment of the current situation. The geographic area to be covered should include the existing service area as well as areas that are anticipated to be served by wastewater management facilities and reuse facilities in the alternatives that will be evaluated. This chapter will be divided into four subsections discussing general characteristics, existing wastewater management facilities, water supply and distribution facilities, and existing reuse facilities.

General Conditions - This section will provide a discussion of the existing environment within areas included in the current and future service areas. This will include current land use, identification of applicable flood plains, wetlands, and high recharge areas. Surface and ground waters; which are affected by water withdrawals, effluent discharge, or by reuse activities; should be fully described and characterized. Historical population trends should be presented.

Wastewater Management - The existing service areas for wastewater management should be delineated. Existing domestic wastewater facilities should be located and described. The description should include physical condition, age, levels of treatment, capacities, and effluent quality. This should include assessment of collection systems, treatment facilities, transmission facilities, discharge facilities, and residuals management facilities. Historical trends for wastewater flow should be included.

Water Supply - The service areas for provision of potable water supply should be identified. Historical trends for demand for water should be provided. Existing well fields, treatment, and storage facilities should be identified. Sources of water used should be discussed. Major users of water, including, but not limited to, golf courses, industrial installations, and power plants should be located. The average rate (user charges) for provision of potable water to residential customers within the service area must be identified. Information provided should be consistent with the Department’s published guidance.

Reuse Facilities - If reuse projects have been implemented, the reuse service areas shall be identified and facilities described. Facilities' descriptions shall include location, age, capacity, current flows and demands, and reclaimed water quality. Historical trends for use and demand for reclaimed water shall be presented. Current users of reclaimed water should be identified and flows presented. Current fees for use of reclaimed water shall be shown.

Chapter 3 - Future Conditions

This chapter will present the basic constraints on planning for wastewater management and reuse in the area. Projections are needed for the entire 20-year planning period and must be consistent with the local comprehensive plan. This chapter will be subdivided into the same four sections used to describe existing conditions in Chapter 2.

General Conditions - This section will contain population and land use projections for the existing and projected service area throughout the 20-year planning period.

Wastewater Management - This section will include detailed flow projections for domestic wastewater within the projected service area. Projections are to be included as to when existing facilities will need expansion or upgrade. Constraints on wastewater management, particularly surface water discharge, should be clearly identified in consultation with the Department of Environmental Regulation. Limitations on quantities that can be discharged to surface streams as well as effluent quality limitations should be assessed.

Water Supply - This section shall include projections of demand for water supply and the sources of water anticipated to be used.

Reuse Facilities - Possible future users of reclaimed water should be identified and projections of potential water use should be made. This should be done in concert with local water purveyors. Current plans for expansion of existing reuse systems or implementation of new reuse systems should be identified.

Chapter 4 - Description of Alternatives Considered

The alternatives evaluated shall be presented and described. Guidance for development of alternatives was presented in a previous section of this guidance document dealing with alternatives. For the no action and reuse alternatives considered, maps showing service areas and locations of major reclaimed water distribution lines shall be provided. New wastewater management facilities should be located. Major users of reclaimed water as well as areas where residential irrigation will be practiced should be identified.

Chapter 5 - Evaluation of Alternatives

This chapter will contain a detailed evaluation of all alternatives considered (including no action and various reuse alternatives). The chapter will be subdivided into four subsections as described below. Each alternative will be discussed in detail within each of these sections.

Present Value Analysis - A detailed present value analysis will be completed and presented for each alternative. All data and assumptions used in the analysis shall be clearly presented. Detailed data may be included as an appendix. A listing of all costs and revenues, and the time when experienced shall be included. The initial present value will be calculated with no

consideration given to the benefit associated with water savings related to reuse projects. An adjusted present value will then be calculated that also considers the value of water saved.

Evaluation of Rates and Fees - An evaluation of impact on rates and fees will be completed for each alternative evaluated (including the no action alternative). Worksheets will be completed for each alternative and should be included as an appendix to the reuse feasibility study report.

Technical Feasibility - A detailed evaluation of the technical feasibility of each alternative will be included in this section. Technical problems and constraints and proposed methods to overcome problems and constraints will be identified and discussed.

Environmental Assessment - This section will contain an assessment of the environmental impacts associated with the implementation of each alternative. This will address impacts on the physical, biological, and socioeconomic environments within the study area. Both the construction phase as well as project implementation shall be addressed. Detailed narratives discussing the benefits associated with reuse will be presented. Each alternative considered will be discussed in detail.

Chapter 6 - Summary and Conclusions

The pros and cons of each alternative considered will be summarized. Summary tables of the results of the present value analysis (with and without consideration of the value of water saved) and the results of the evaluation of rates and fees shall be presented. Narrative discussion should be provided for each alternative considered.

List of References

A detailed bibliographical listing of the sources and information used throughout the document should be presented. Throughout the text of the report, references to this list must be made so the reviewer can identify the sources of costs and other information used in the analysis.

Appendices

All information needed to support all costs, revenues, capacities, calculations, constraints, etc., should be incorporated as one or more appendix to the report. The worksheets for evaluation of rates and fees for each alternative should be included as an appendix. Other appendices may be included, as appropriate.

Utilities should include an appendix that provides support for proposed capital improvement costs and increases (or decreases) in revenues and expenses. An explanation of the system of accounts used should be included for private utilities.

Abbreviated Report

There are some circumstances under which a complete reuse feasibility study report is not required. Owners of treatment facilities that currently make reclaimed water available for reuse may prepare an abbreviated report. Owners of treatment facilities that will be removed from service also may prepare an abbreviated report. The following sections provide details on when an abbreviated report is acceptable, and on the content and format of the abbreviated report.

Existing Reuse Systems

A wastewater treatment facility that sends its entire flow to a reuse system meeting the definition of "reuse", may prepare an abbreviated report. The abbreviated report will contain all chapters that are needed for a complete report; however, the scope may be limited to assessment of a single "alternative" (continued reliance on the existing reuse system). Chapter 2 (Existing Conditions) shall assess compliance of the existing system with applicable rules, permit conditions, and ground and surface water quality standards. The alternative, described in Chapter 4 and evaluated in Chapter 5, must address the full 20-year period of analysis. Cost estimates for future modifications, replacements, and expansions shall be included and the appropriated worksheet for evaluation of rates and fees shall be completed. Of course, the owner may choose to evaluate other alternatives.

If the Department of Environmental Protection concurs that the treatment facility has a reuse system and is in compliance with its permit and applicable rules, no further action will be needed by the wastewater treatment plant permittee. If the system is not a reuse system as defined in the guidance manual, the evaluation of alternatives described in this guidance document must be completed. If the facility provides reclaimed water to a legitimate reuse system, but the treatment or reuse system is not in compliance with its permits, applicable rules, or ground and surface water quality standards, the reuse feasibility study shall provide a detailed assessment of needed corrective measures and shall include a schedule for bringing the facilities into full compliance.

Facilities That Will be Removed from Service

The owner of a wastewater treatment facility who plans to cease service and have his/her facility connected to a regional treatment facility may submit an abbreviated reuse feasibility study. The abbreviated study shall include a detailed schedule for the removal of the facility from service, along with documentation from the owner of the facility who will provide future treatment service indicating concurrence with the plan to connect to his/her wastewater treatment facility. Additional reuse feasibility analysis will not be required if the owner of the treatment facility to be removed from service conclusively demonstrates that the facility will be removed from service within five years of the date of permit issuance requiring the feasibility study.

TABLE 2

REUSE FEASIBILITY STUDY REPORT OUTLINE

A. Chapter 1 - Introduction

    1. Purpose

B. Chapter 2 - Existing Conditions

    1. General Description

    2. Wastewater Management

    3. Water Supply

    4. Reuse Facilities

C. Chapter 3 - Future Conditions

    1. General Description

    2. Wastewater Management

    3. Water Supply

    4. Reuse Facilities

D. Chapter 4 - Description of Alternatives Considered

    1. No Action

    2. Public Access Reuse Systems

        a. Maximum Reuse

        b. Medium Reuse

        c. Minimal Reuse

    3. Other Reuse Alternatives (as needed)

E. Chapter 5 - Evaluation of Alternatives

    1. Present Value Analysis

a. No Action Alternative

b. Public Access Reuse Alternatives

(1) Maximum Reuse
(2) Medium Reuse
(3) Minimal Reuse

c. Other Reuse Alternatives (as needed)

2. Evaluation of Rates and Fees

a. No Action Alternative

b. Public Access Reuse Alternatives

(1) Maximum Reuse
(2) Medium Reuse
(3) Minimal.Reuse

c. Other Reuse Alternatives (as needed)

3. Technical Feasibility

a. No Action Alternative

b. Public Access Reuse Alternative

(1) Maximum Reuse
(2) Medium Reuse
(3) Minimal Reuse

c. Other Reuse Alternatives (as needed)

4. Environmental Assessment

a. No Action Alternative

b. Public Access Alternatives

(1) Maximum Reuse
(2) Medium Reuse
(3) Minimal Reuse

c. Other Reuse Alternative (as needed)

d. Include construction-related and operation-related impacts on physical, biological, and socioeconomic environment.

e. Detailed discussion of the benefits of reuse.

F. Chapter 6 - Summary and Conclusions

G. References

1. Listing of sources of information used

2. Throughout text, references to this list of sources must be made such that the reviewer can identify where costs and other information used in the analysis were drawn from

H. Appendices

1. Narrative and detailed tables to support all projected capital construction costs, revenues, expenses, capacities,
calculations, constraints, etc.

2. Evaluation of Rates and Fees Worksheets for all alternatives.

3. Description of system of accounts used (for private utilities).

ATTACHMENT A - Worksheet for Evaluation of Rates and Fees for Public Utilities

Worksheet for Evaluation of Rates and Fees for Public Utilities

Applicant: _____
Date: _____
Alternative: _____

This form provides for complete evaluation of costs to be incurred and revenues generated by the wastewater management system. This form is to be completed for each alternative and subalternative evaluated.

A. Household Median Annual Income, Average Household Size, Number in the Service Area, and Population to be Served.

Population to be served is determined by the number of households multiplied by the household size. This data should be consistent with local comprehensive plan projections.

	Year 1	Year 5	Year 10	Year 15	Year 20
1. Enter calendar year that corresponds with Years 1, 5, 10, 15, and 20 of the analysis	( )	( )	( )	( )	( )
2. Median household income ($/year)					
3. Average household size (people/household)					
4. Number of households served by the sewerage system					
5. Serviced population (people) [multiply Line 3 by Line 4]					
6. Total number of homes served by reclaimed water					

B. Capital Construction Costs and Amounts to be Financed

In this block list all capital construction costs to be incurred by the wastewater system/utility. This should correspond directly to the costs included in the net present value analysis as described in another section of this document. List anticipated grants and other front-end sources of funds (property tax revenues, prepaid connection fees an betterment assessments, local funds/reserves available for the project, etc.) to be used to reduce the amount to be borrowed.

Year	Project Description	Total Capital Construction Costs ($)	Anticipated Grants and other front-end funds ($)	Describe sources of grants and other front-end funds	Capital Construction costs ($) to be Financed
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
Totals:					

C. Financing of Capital Construction Costs

In this block, indicate what type of financing will be used (revenue bonds, general obligation bonds, etc). Lines in this table should correspond to the lines in Block B and the costs to be financed are to agree with the information in Block B. The interest rate and term (bonding period or loan period) should reflect the type of financing to be used.

			Financing			
Year	Description	Capital Construction Costs ($) to be Financed	Type	Annual Interest Rate (%)	Term (years)	Annual Debt Service ($/yr)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
Total ($):						

D. Debt Service Schedule

The annual debt service shown in Block C should be distributed across the 20-year planning period. Lines in this table should correspond to lines B and C. Be sure to show the debt service for each project (from Block C) only in the appropriate years. For example, facilities to be constructed in the Year 12 of the analysis and financed over 20 years, would have the debt service would be shown only for years 15 and 20.

	Debt Service ($/yr)				
Description	Year 1	Year 5	Year 10	Year 15	Year 20
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
Totals ($):					

E. Other Anticipated Debt which will be Repaid from Operations fo the Wastewater System/Utility.

Please show the debt service associated with other anticipated debt only in appropriate years (those within the term of the loan or bond issue).

			Annual Debt Service ($/yr)				
Description	Debt Amount ($)	Annual Interest Rate (%)	Year 1	Year 5	Year 10	Year 15	Year 20
1.							
2.							
3.							
4.							
Totals ($):							

F. Existing Debt for the Wastewater System/Utility

Please show the debt service associated with outstanding loans or bond issues only in appropriate years (those within the term of the loan or bond issue).

			Annual Debt Service ($/yr)				
Description	Current Debt Amount ($)	Annual Interest Rate (%)	Year 1	Year 5	Year 10	Year 15	Year 20
1.							
2.							
3.							
4.							
Totals ($):							

G. Annual Expenses for the Wastewater System/Utility.

Please enter annual expenses for operation and maintenance, depreciation and amortization, and taxes (other than income). Do not include debt service or expenses that are reported elsewhere in Blocks D, E, F, and H.

1. Existing facilities

	Expenses ($/yr)				
Expense Category	Year 1	Year 5	Year 10	Year 15	Year 20
Operating and Maintenance					
Depreciation and Amortization					
Taxes Other Than Income					
Totals ($):					

2. Proposed facilities associated with this alternative

	Expenses ($/yr)				
Expense Category	Year 1	Year 5	Year 10	Year 15	Year 20
Operating and Maintenance					
Depreciation and Amortization					
Taxes Other Than Income					
Totals ($):					

3. All Existing and planned facilities (Total of 1 and 2 above)

	Expenses ($/yr)				
Expense Category	Year 1	Year 5	Year 10	Year 15	Year 20
Operating and Maintenance					
Depreciation and Amortization					
Taxes Other Than Income					
Totals ($):					

H. Other Expenses

Please list and describe any other expenses to be incurred by the wastewater system/utility during this 20-year period.

	Expenses ($/yr)				
Description	Year 1	Year 5	Year 10	Year 15	Year 20
1.					
2.					
3.					
4.					
5.					
Totals ($):					

I. Total Expenses

Total expenses shown in Blocks D, E, F, G, and H.

	Year 1	Year 5	Year 10	Year 15	Year 20
Total Expenses ($):					

J. Reclaimed Water Connection Fees

Include in this block connection fees or impact fees to be obtained as major users and residential customers are added to the reclaimed water system. Do not include contributions from major users that were previously used to offset capital construction costs.

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Number of new residential connections (connections/yr)					
2. Residential connection/impact fees ($/connection)					
3. Revenue from residential connections ($/yr) [multiply Line 1 by Line 2]					
4. Number of new major users (connections/yr)					
5. Revenues from connection fees from major users ($/yr)					
6. Average major user connection fee ($/connection) [divide Line 5 by Line 4]					
7. Total revenues from connection fees ($/yr) [add Line 3 and Line 5]					

K. Revenues From Sale of Reclaimed Water

Included are anticipated revenues from the sale of reclaimed water in this block. Estimates should be realistic and conservative.

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Sales to major users (1,000 gal/yr)					
2. Revenue from sales to major users ($/yr)					
3. Average sale price to major users ($/1,000 gal) [divide Line 2 by Line 1]					
4. Sales to residential customers (1,000 gal/yr)					
5. Revenue from sale to residential customers ($/yr)					
6. Average price for residential service ($/1,000 gal) [divide Line 5 by Line 4]					
7. Total revenues from sale of reclaimed water ($/yr) [add Line 2 and Line 5]					

L. Wastewater Connection Fees

Include connection fees, impact fees, and related one-time assessments associated with provision of wastewater management services.

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Total connection/impact fee for non-residential customers to be collected ($/yr)					
2. Number of new non-residential connections (connections/yr)					
3. Average connection/impact fees for non-residential customers ($/connection) [divide Line 1 by Line 2]					
4. Number of new residential connections (connections/yr)					
5. Residential connection/impact fee ($/connection)					
6. Residential conection fees collected ($/yr) [multiply Line 4 by Line 5]					
7. Total revenues from connection fees [add Line 1 and Line 6]					

M. Wastewater User Fees

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Revenue from wastewater user/service charges for non-residential customers ($/yr)					
2. Wastewater from non-residential customers that is treated (1,000 gal/yr.)					
3. Average user charge for non-residential customers ($/1,000 gal) [divide Line 1 by Line 2]					
4. Number of households served [must agree with Line A4]					
5. Revenue from residential user/service charges ($/yr)					
6. Average monthly residential user/service charge ($/month/household) [divide Line 5 by Line 4 by 12]					
7. Total revenues from wastewater user/service charges ($/yr) [add Line 1 and Line 5]					

N. Other Revenues

Please list other sources of revenues anticipated to be received by the wastewater system/utility.

	Other Revenue ($/yr)				
Description	Year 1	Year 5	Year 10	Year 15	Year 20
1.					
2.					
3.					
4.					
5.					
Totals ($/yr):					

O. Total Revenues

Please add the totals from Blocks J, K, L, M, and N to obtain total revenue to be received by the system.

	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues ($/yr):					

P. Total Surplus or Deficit

The total costs shown in Block I are to be subtracted from the total revenues shown in Block O. The results for Years 1, 5, 10, 15, and 20 should be entered on Line 1 if a surplus is indicated (revenues exceed expenses) or Line 2 if a deficit is indicated (expenses exceed revenues).

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Surplus ($/yr)					
2. Deficit ($/yr)					

Q. Existing Fees and Charges

Please identify existing fees and charges for connection and sale of reclaimed water, as well as user charges for wastewater services.

1. Wastewater user charges
   a. Residential user charge $_____/month/household

   b. Average residential connection fee $_____

   c. Average residential impact fee $_____

   d. Average user charge for non-residential customers $_____/1,000 gallons

   e. Non-residential customers connection/impact fees $_____

2. Sale of reclaimed water
   a. Residential users $_____/month/household or $_____/1,000 gallons

   b. Initial connection fees for residential users $_____

   c. User charges for non-residential customers $_____/1,000 gallons

   d. Connection fees for non-residential customers $_____

R. Summary of proposed fees and charges

1. Wastewater user charges

	Year 1	Year 5	Year 10	Year 15	Year 20
a. Residential user charge ($/month/household) [from Line M6]					
b. Average residential connection/impact fees ($) [from Line L5]					
c. Average user charge for non-residential customers ($/1,000 gallons) [from Line M3]					
d. Non-residential customers connection/impact fees ($) [from Line L3]					

2. Sale of reclaimed water

	Year 1	Year 5	Year 10	Year 15	Year 20
a. Residential user charge ($/1,000 gallons) [from Line K6]					
b. Initial connection fees for residential users ($) [from Line J2]					
c. User charges for non-residential customers ($/1,000 gallons) [from Line K3]					
d. Connection fees for non-residential customers ($) [from Line J6]					

ATTACHMENT B - Worksheet for Evaluation of Rates and Fees for Private Utilities

Worksheet for Evaluation of Rates and Fees For Private Utilities

Applicant: _____
Date: _____
Alternative: _____

This form provides for complete evaluation of costs to be incurred and revenues generated by the wastewater management system. This form is to be completed for each alternative and subalternative evaluated.

A. Household Median Annual Income, Average Household Size, Number in the Service Area, and Population to be Served.

Population to be served is determined by the number of households multiplied by the household size. This data should be consistent with local comprehensive plan projections.

	Year 1	Year 5	Year 10	Year 15	Year 20
1. Enter calendar year that corresponds with Years 1, 5, 10, 15, and 20 of the analysis	( )	( )	( )	( )	( )
2. Median household income ($/year)					
3. Average household size (people/household)					
4. Number of households served by the sewerage system					
5. Serviced population (people) [multiply Line 3 by Line 4]					
6. Total number of homes served by reclaimed water					

B. Existing Assets and Accumulated Depreciation

Identify all existing assets and the associated accumulated depreciation. Assets may be grouped by account type. An explanation of the system of accounts should be included in the appendix.

Description	Amount ($)	Accumulated Depreciation ($)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
Total ($):		

C. Existing Contributions in Aid of Construction (CIAC) and Accumulated Amortization

1. What is the current balance of CIAC? $_____

2. What is the current accumulated amortization? $_____

D. Existing Debt and Equity

1. Provide current balances of all existing long and short term debt, the year the debt was incurred, the interest rate, and the maturity date.

Debt	Amount ($)	Origination Date	Maturity Date	Annual Interest Rate (%)
a.				
b.				
c.				
d.				
e.				
Total ($):				

2. Provide current balances of equity, the last authorized rate of return on equity (if available), and the source of the authorization.

Equity	Amount ($)	Authorized Return on Equity (%)	Source of Authorization
1.			
2.			
3.			
Total ($):			

E. Proposed Capital Construction Costs and Financing

In this block list all capital construction costs to be incurred by the wastewater system/utility. This should correspond directly to the costs included in the net present value analysis as described in another section of this document. Indicate what type of financing will be used (revenue bonds, general obligation bonds, etc.). The interest rate and term (bonding period or loan period) should reflect the type of financing to be used.

				Financing		
Year	Description	Total Capital Construction Costs ($)	Capital Construction Costs ($) to be Financed	Type	Annual Interest Rate (%)	Term (yrs)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
Totals:						

F. Other Anticipated Debt which will be Repaid from Operations of the Wastewater System/Utility.

Description	Debt Amount ($)	Annual Interest Rate (%)	Term (yrs)
1.			
2.			
3.			
4.			
Totals ($):			

G. Identify the projected annual expenses for the wastewater system/utility. All increases (or decreases) should be described in a narrative and attached as an appendix.

1. Existing facilities

	Expenses ($/yr)				
Expense Category	Year 1	Year 5	Year 10	Year 15	Year 20
Operating and Maintenance					
Depreciation and Amortization					
Taxes Other Than Income					
Income Taxes					
Totals ($):					

2. Proposed facilities associated with this alternative

	Expenses ($/yr)				
Expense Category	Year 1	Year 5	Year 10	Year 15	Year 20
Operating and Maintenance					
Depreciation and Amortization					
Taxes Other Than Income					
Income Taxes					
Totals ($):					

3. All Existing and planned facilities (Total of 1 and 2 above)

	Expenses ($/yr)				
Expense Category	Year 1	Year 5	Year 10	Year 15	Year 20
Operating and Maintenance					
Depreciation and Amortization					
Taxes Other Than Income					
Income Taxes					
Totals ($):					

H. Other Expenses

Please list any other expenses to be incurred by the wastewater system/utility during this 20-year period.

	Expenses ($/yr)				
Description	Year 1	Year 5	Year 10	Year 15	Year 20
1.					
2.					
3.					
4.					
5.					
Totals ($):					

I. Total Expenses

Total expenses shown in Blocks G and H.

	Year 1	Year 5	Year 10	Year 15	Year 20
Total Expenses ($):					

J. Reclaimed Water Connection Fees and Property Contributions

Include in this block connection fees or impact fees and property contributions to be obtained as major users and residential customers are added to the reclaimed water system.

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Number of new equivalent residential connections (ERCs/yr)					
2. Residential connection/impact fees and property contributions ($/ERC)					
3. Total residential connection fees and property contributions ($/yr) [multiply Line 1 by Line 2]					
4. Number of new major users (ERCs/yr)					
5. Total connection fees and property contributions from major users ($/yr)					
6. Average major user connection fee and property contributions ($/ERC) [divide Line 5 by Line 4]					
7. Total connection fees and property contributions ($/yr) [add Line 3 and Line 5]					

K. Revenues From Sale of Reclaimed Water

Included are anticipated revenues from the sale of reclaimed water in this block. Estimates should be realistic and conservative.

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Sales to major users (1,000 gal/yr)					
2. Revenue from sales to major users ($/yr)					
3. Average sale price to major users ($/1,000 gal) [divide Line 2 by Line 1]					
4. Sales to residential customers (1,000 gal/yr)					
5. Revenue from sale to residential customers ($/yr)					
6. Average price for residential service ($/1,000 gal) [divide Line 5 by Line 4]					
7. Total revenues from sale of reclaimed water ($/yr) [add Line 2 and Line 5]					

L. Wastewater Connection Fees and Property Contributions

Include connection fees, impact fees, and property contributions associated with provision of wastewater management services.

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Total connection/impact fee and property contributions for non-residential customers to be collected ($/yr)					
2. Number of new non-residential connections (ERCs/yr)					
3. Average connection/impact fees and property contributions for non-residential customers ($/ERC) [divide Line 1 by Line 2]					
4. Number of new equivalent residential connections (ERCs/yr)					
5. Connection/impact fee and property contributions for residential customers ($/ERC)					
6. Residential connection fees and property contributions collected ($/yr)[multiply Line 4 by Line 5]					
7. Total collections from connection fees and property contributions [add Lines 1 and 6]					

M. Wastewater Revenues

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Revenue from wastewater user/service charges for non-residential customers ($/yr)					
2. Wastewater from non-residential customers that is treated (1,000 gal/yr.)					
3. Average user charge for non-residential customers ($/1,000 gal) [divide Line 1 by Line 2]					
4. Number of households served [must agree with Line A4]					
5. Revenue from residential user/service charges ($/yr)					
6. Average monthly residential user/service charge ($/month/household) [divide Line 5 by Line 4 by 12]					
7. Total revenues from wastewater user/service charges ($/yr) [add Line 1 and Line 5]					

N. Total Revenues

Please add the totals from Blocks K and M to obtain total revenue to be received by the system.

	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenue ($/yr):					

O. Total Surplus or Deficit

The total costs shown in Block I are to be subtracted from the total revenues shown in Block N. The results for Years 1, 5, 10, 15, and 20 should be entered on Line 1 if a surplus is indicated (revenues exceed expenses) or Line 2 if a deficit is indicated (expenses exceed revenues).

Description	Year 1	Year 5	Year 10	Year 15	Year 20
1. Surplus ($/yr)					
2. Deficit ($/yr)					

P. Existing Fees and Charges

Please identify existing fees and charges for connection and sale of reclaimed water, and user charges for wastewater services.

1. Wastewater user charges
    a. Residential user charge $_____/month/household
    b. Average residential connection fee $_____
    c. Average residential impact fee $_____
    d. Average user charge for non-residential customers $_____/1,000 gallons
    e. Non-residential customers connection/impact fees $_____
2. Sale of reclaimed water
    a. Residential users $_____/month/household or $_____/1,000 gallons
    b. Initial connection fees for residential users $_____
    c. User charges for non-residential customers $_____/1,000 gallons
    d. Connection fees for non-residential customers $_____

Q. Summary of proposed fees and charges

1. Wastewater user charges

	Year 1	Year 5	Year 10	Year 15	Year 20
a. Residential user charge ($/month/household) [from Line M6]					
b. Average residential connection/impact fees ($) [from Line L5]					
c. Average user charge for non-residential customers ($/1,000 gallons) [from Line M3]					
d. Non-residential customers connection/impact fees ($) [from Line L3]					

2. Sale of reclaimed water

	Year 1	Year 5	Year 10	Year 15	Year 20
a. Residential user charge ($/1,000 gallons) [from Line K6]					
b. Initial connection fees for residential users ($/ERC) [from Line J2]					
c. User charges for non-residential customers ($/1,000 gallons) [from Line K3]					
d. Connection fees for non-residential customers ($/ERC) [from Line J6]					