Guidelines for Preparation of Reuse Feasibility Studies for Consumptive Use Permit Applicants

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Prepared by the

Reuse Coordinating Committee

INTRODUCTION

The purpose of this document is to provide guidelines for, water use permit applicants, who have been requested by their Water Management District to conduct an evaluation regarding the feasibility-of using reclaimed water. The following aspects of a reuse feasibility study are addressed:

- Environmental feasibility;
- Economic feasibility, including a present value cost analysis.

These guidelines apply only to applicants for consumptive use permits (CUP's), who are potential end users of reclaimed water. Public water supply utilities having wastewater management responsibility must follow the reuse feasibility study guidelines issued in 1991 by the Department of Environmental Protection (DEP). The public water supply applicants for CUP's should contact the applicable water management district to discuss the contents of the study.

REUSE IN FLORIDA

Sub-sections 373.250(1) and 403.064(1) Florida Statutes, establish the following state reuse objectives:

> The encouragement and promotion of water conservation and-reuse of reclaimed water, as defined by the department, are state objectives and are considered to be in the public interest.

In response to this objective, the DEP, the water management districts, and the Public Service Commission (PSC) have implemented a comprehensive reuse program designed to encourage and promote reuse of reclaimed water. Detailed technical rules governing reuse have been developed by the DEP and are contained in Chapter 62-610, Florida Administrative Code (F.A.C.), entitled <u>Reuse of Reclaimed Water and Land Application</u>. These rules are fully protective of public health and environmental quality, have been endorsed by the Florida Department of Health (DOH), and are consistent with national guidelines for water reuse (EPA, 1992)[1].

Reclaimed water can be used for a wide range of beneficial purposes, such as landscape and agricultural irrigation; cooling and industrial processes; ground water recharge; wetland creation, restoration, enhancement; fire protection; fountains and other aesthetic uses; and toilet flushing.

[1] US Environmental Protection Agency and US Agency for International Development, 1992. Guidelines for water use: EPA/625/r-92/.004; US EPA Technology Transfer, Cincinnati. Ohio.

Reuse of reclaimed water benefits end users of water, public water supply utilities, and the people of Florida in many ways:

- reclaimed water is a high quality. water source,
- conserves water by reducing the demands on ground water and surface water;
- reuse postpones costly investment for development of new water sources and supplies;
- reclaimed water can be a reliable source during droughts,
- reuse eliminates surface water discharges that may harm valuable surface waters;
- reuse often can recharge ground water aquifers,
- reclaimed water can have a fertilizer benefit, and
- reclaimed water can save money.

REUSE FEASIBILITY GUIDELINES

AVAILABILITY/GENERAL

1. Any projects which are not within five miles of an existing or proposed reclaimed water source (i.e.. pipeline or plant), are solely for potable use, or provide documentation from the nearest reclaimed water provider that reclaimed water will not be available within the permit duration, may not need to submit a reuse feasibility study.

2. Has a contract been signed with the reclaimed water supplier? If applicable, please provide a copy of the executed agreement or the current draft under negotiation. If a contract has been signed, please submit the executed agreement in lieu of a reuse feasibility study.

3. What is your current or proposed water source (e.g. ground water, stormwater, or surface water) and use(s) (e.g. irrigation, power generation, other)?

4. Are you within a Reuse Service Area permitted by DEP (Rule 62.610.490(l), F.A.C.)?

ENVIRONMENTAL FEASIBILITY

1. Does reclaimed water storage need to be provided on site? If yes, please provide an estimate of the available storage volume.

2. Is the storage area isolated or part of a surface water management system?

3. If reclaimed water will be stored in a surface water management system, does this system discharge off site? If so, what is the receiving water body?

4. Are there any wetlands on site? If so, will the use, or storage, of reclaimed water affect the seasonal water level fluctuations or water quality within the wetlands? Please provide supporting information.

5. Are there any public water supply wells within 500 feet of the area to be irrigated with reclaimed water or any proposed unlined reclaimed water storage areas?

6. Are there any other issues affecting he environmental feasibility of using reclaimed water at this project?

TECHNICAL FEASIBILITY

1. Is the reclaimed water quality acceptable 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 reclaimed water.

2. How much reclaimed water can be supplied and does this meet all of the demands of the project? What is the source of the backup supply and if necessary; the-supplemental supply needed to meet all demand?

3. Are there any other issues affecting the technological feasibility of using reclaimed water at the project?

ECONOMIC FEASIBILITY

1. What are the new design or retro-fit costs of converting to reclaimed water? Please provide a 20-year present value analysis comparing the cost of using reclaimed water to the cost of using the current source. Please refer to Appendices A and B for assistance.

2. Is a supplemental or back-up source proposed for use with the reclaimed water system? Please include these costs in the present value analysis described in question number 1.

3. Are there any other issues affecting the economic feasibility of utilizing reclaimed water at this project? For example, the cost of obtaining or altering surface water management permits, NPDES permits, etc. If so, these costs should be reflected in the present value analysis.

APPENDIX A

GLOSSARY

1. **Discount Rate** - the interest rate used to reduce future sums of money in order to facilitate the comparison of alternatives in current dollars.

2. **End User of Water** - **person** that is subject to consumptive use permitting, but does not provide for public wafer supply. Examples include agricultural establishments, nurseries, golf courses, mines, commercial and industrial facilities, and projects with landscape irrigation demands.

3. **Executed Agreement** - a legally binding contract.

4. **Future value** - the value of a monetary investment or a series of investments at some future point in time after the accumulation of additional value as a result of compounding at a given interest rate.

5. **Present Value** - the monetary value in current dollars that is equivalent to some future amount of money.

6. **Public Water Supply Utility** - a public or private utility which supplies potable water through a public water supply system.

7. **Reclaimed water** - **water** that has received at least secondary treatment and basic disinfection and is reused for a beneficial purpose after flowing out of a domestic wastewater treatment facility.

8. **Reuse** - the deliberate application of reclaimed water, **in** compliance with DEP and water management district rules, **for** a beneficial **purpose.**

9. **Surface Water Management System** - any combination of dams, impoundments, reservoirs, appurtenant works, or works, that provide drainage, water storage, conveyance, or other surface water management capabilities.

10. **Wastewater Management Responsibility** - providing collection, transmission, or treatment of domestic wastewater.

11. **Wetlands** - those areas that are inundated or saturated by surface water or ground water at a frequency and a duration sufficient **to** support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated **soil conditions.** Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above. These species, due to morphological, physiological, or reproductive adaptations, have the ability to grow, reproduce or persist in aquatic environments or anaerobic soil conditions. Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, hydric seepage **slopes, tidal marshes, mangrove swamps** and other similar areas. Florida wetlands generally do not include longleaf or slash pine flatwoods with an understory dominated by saw palmetto.

APPENDIX B

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 be applied to the project's cost of using the existing water source to allow a comparison of the two sources. 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) $P = pwf^n \times B^n \text{ (or } C^n)$

2) $pwf^n = \frac{1}{(1+i)^n}$

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

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:

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

Where

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

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 (X-30 year) loans. The USBR's discount rate is published in the Federal Register each December and is available from the Regulation Department of any of the Water Management Districts. 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 lime method of depreciation should be used in the present value analysis. The useful lives of certain equipment and facilities are provided as follows:

- Storage ponds/reservoir 50 Years
- Transmission / Distribution pipes 50 Years
- Steel and concrete structures 50 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 of 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 water management district 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 Florida holds a Consumptive Use Permit (CUP) for a total amount of 150 million gallons 'per year (MGD)[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 CUP 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 CUP 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 8inch 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 WWI'P 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 i,s 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'.

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 ($0.10/1,000gal)	$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 sal rage figures are shown as negative values.

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

$PV_{Initial}$ = $63,700 (already at present value)

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

$$PV_{Replace} = \$15{,}000 \times \frac{1}{(1+0.08)^{15}}$$

= $15,000 x 0.3152

= $4,800

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

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

= $4,000 x 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

$$PV_{SV} = \$23{,}400 \times \frac{1}{(1+0.08)^{20}}$$

= $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)

$$SV = \$15{,}000 \times \frac{15\ years}{20\ years}$$

= $11,300

$$PV_{SV} = \$11{,}300 \times \frac{1}{(1+0.08)^{20}}$$

= $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 (l-20 years)

$$PV_{O\&M} = \$24,200 \times \frac{1 - \frac{1}{(1+0.08)^{20}}}{0.08}$$

$$= \$24,200 \times 9.8181$$

$$= \$237,600$$

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 benefits of using reclaimed water is that it can be a more reliable and stable water supply since it is not subject to district water use restrictions.

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[1] The indicated useful lives in this document are consistent with requirements placed upon applicants for grant funding from state or federal money for construction of new wastewater treatment facilities (see Rule 62-501.310(2)(j)3d, F.A.C.

[2] The allocated amount of water is determined using AFSIRS model (version 5.5) and based primarily on the following parameters:

- Location - Brevard County
- Soil type- Eau Galliesand
- Irrigated acreage-150 acres
- Water table depth -3 feet
- Irrigation system -Multiple head sprinkler system

It should be noted that the water use allocation for this golf course may not be applicable to golf courses in other locations. Applicants should always cons:ltwith appropriate WMDsto determine their water use allocation prior to the completion of the present value analysis.

[3] The cost of pumping was estimated by a golf course located in SJRWMD.

[4] The 6C’percent’reduction was estimated based on the assumption that all pumping incurred by three pumps on existing wells will be eliminated and the pumping requirement for the irrigation system will be reduced due to the pressure from the reuse system.

[5] Final Report: Reclaimed Water User Cost Study. 1992. KPMG. Vienna, VA.

[6] Based on a number of engineering reports and reuse studies.